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town PLANNING

RANGWALA

TOWN PLANNING

[A TEXT-BOOK FOR ENGINEERING STUDENTS]

By

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PREFACE

Town planning is gaining increasing importance in the planned economy of our country. The number of Technical Institutions where the subject of Town Planning is being taught, either as compulsory or optional in the overcrowded syllabii, has increased enormously in the last few years. There are hardly a few text-books on this subject written in a simple language and covering the syllabus for the students of the Indian Universities.

This treatise is different from other books published on Town Planning in the sense that the treatment of the subject matter is step-by-step and systematic, and written in lucid style. An attempt has been made to explain briefly the general principles of the subject. The unique feature of the book is that it is completely written in Metric Units. It contains self-explanatory and neatly drawn sketches. Typical questions follow each chapter.

I take this opportunity to express my sincere thanks to all good friends who have helped me in writing this book. I am highly grateful to Shri. R. C. Patel of Charotar Book Stall – Anand, who took keen interest in all the aspects of publishing this book. I am also obliged to Anand Press for such decent printing and finishing of the book.

Suggestions to improve the utility of the book will be gracefully received and incorporated in the subsequent editions.

Ahmedabad 380 001
February 24, 1974

S. C. RANGWALA

THIRD EDITION

The author has privilege to bring out the Third edition of this treatise within five years only, which also proves the popularity of the book. The text-matter of the second edition has been thoroughly revised and updated by adding plenty of new material.

It is hoped that this revised edition will prove more useful to the teachers and the taught by the new additions, it now contains.

All the same, I look forward to receive useful suggestions so as to improve the utility of the book.

Ahmedabad
August 22, 1979

S. C. RANGWALA

NINETEENTH EDITION

At the outset, we would like to mention that the response of earlier editions of this standard text-book of Town Planning have been extremely favourable. This is evident from the fact that as many as eighteen editions have been brought out since its first publication in 1974. Despite such a favourable response, we felt that the utility of the text could be further enhanced by widening its coverage and updating its contents. As a result, this nineteenth edition is now published by adding few drawings and with the revised, and updated text matter.

In spite of all the pains taken, it is possible that some errors may have escaped our attention. We shall be grateful if they are brought to our notice by sending e-mail at charotar@cphbooks.com, so that they can be corrected in subsequent edition. We strongly urge the readers to send their comments, suggestions and opinions to enhance the utility of the book.

Ahmedabad 380015
May 05, 2005

S. C. R.
K. S. R.
P. S. R.

TWENTY-SEVENTH EDITION

It is indeed a privilege to present the Twenty-seventh Edition of this highly acclaimed text-book. Its first edition was originally published in 1974 and now has gone in its Twenty-seventh Edition – which proves its popularity and utility among the teachers and the students.

We express our hearty appreciation and sincere thanks to the teachers and also the students for their magnificent response to the book.

We strongly urge the readers to send their comments, suggestions and opinions to enhance the utility of the book.

Ahmedabad 380 015
January 1, 2014

KETKI B. DALAL
(Alias K. S. Rangwala)

TWENTY-EIGHTH EDITION

It is indeed a great pleasure to present the *Twenty Eighth Revised and Enlarged edition* of this popular and highly acclaimed book mostly referred by professors and professional people in their practice.

This revised edition preserves most of the text and style of the previous one including a number of significant changes and additions. In this revised and enlarged edition, all the chapters are thoroughly revised and updated with the latest information. Chapter 4, Housing; Chapter 10, Building Bye-laws and Appendix 2, Gandhinagar are thoroughly revised and updated with the latest information.

The newly added Appendix 3 '*Recent Planned Cities of India*' providing latest information of following cities:

Lavasa – a planned hill station near Pune, Maharashtra;
GIFT city – a global financial and IT services hub near Gandhinagar, Gujarat;
Dholera Special Investment Region (DSIR) – a global manufacturing and trading hub, near Dholka, Gujarat.

I am very much thankful to Mr. Pradipkumar R. Patel and Mr. Parth P. Patel of Charotar Publishing House Pvt. Ltd., Anand for their continuous guidance and suggestions. I heartily appreciate their hard work and sincere efforts in publishing this book.

We hope that this new edition of the book will be more popular among the students and professionals. We shall feel obliged to receive comments, suggestions and opinions from the readers and students to boost the utility of the book.

Ahmedabad 380015
25th December 2014

KETKI B. DALAL
(Alias K. S. Rangwala)

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Chapter 1 INTRODUCTION

1-1. GENERAL

The term *town planning* is used to indicate the arrangement of various components or units of a town in such a way that the town as such attains the significance of a living organism. It also includes ways and means to be adopted for the improvement of the existing towns or for the extension of towns. Thus, the knowledge of town planning helps in achieving the best possible advantages of the situation of town with respect to its land and the surrounding environments. In a sense, it will be quite proper to say that God made the country and man made the town.

The town planning demands active imagination and sharp common sense of the understanding of various needs of the society occupying or likely to occupy the town. A town planner has to prepare the layout plans or to carry out the researches in such a way that the final results are appreciated by all the sectors of public. The success of a town planner lies in converting the town from an inert and lifeless object to a complex organic body that pulses with life. A well-planned town carries out its activities in a normal way like a living organism. The urban growth or development is the man's most civilized creation.

The town planning is a science as well as an art too. The science consists in collecting, correlating and analysing the facts about a town. The art lies in arranging the components of a town in such a way that the final result is in the form of a beautiful, convenient, economical and efficient unit. Thus, science and art must not and cannot sit apart when a new town is being designed or when an existing town is being remodelled. The science and art must join their hands and work as co-partners in the difficult task of bringing out a well-arranged town.

The town planning, however, is not an exact science and precise forecasts of future possibilities are not attainable. But the gap between guesswork and prediction can be brought down to a minimum by the co-operation of various agencies involved in the use and development of land.

The difference between town planning and architecture should be noted. The town planning expresses the life of an era. The architecture reveals its spirit. In this chapter, the general topics related with the subject will be described.

1-2. EVOLUTION OF PLANNING

The works of an archaeologist show how the ancient cities were planned. The primitive men used to stay in tribes and they formed groups for mutual protection for carrying out business activities and for maintaining a social life. The location of towns was also selected by giving some consideration such as ease of defence, climatic conditions, business facilities, etc.

As such, cities are as old as civilization as seen from the verbal connection between the words '*city*' and '*civilization*'. These two words have emerged together with city furnishing the structural framework through which civilization functions. By 'civilization', we basically mean an urban civilization. There were obviously human groups before that period. But they were initially nomadic, then agricultural and finally evolved into an urban society.

The towns of the modern time have to be designed for problems which were not existing in the ancient times. Such conditions may be enumerated as air pollution, water pollution, telephones, motors, electricity, etc. The study of ancient towns, however, helps considerably in solving the complicated problems of town planning even of today.

The two illustrations of ancient towns are worth mentioning. *Kahun* in Egypt was conceived and built for a specific purpose before 2500 B.C. It was designed to accommodate workmen and officials engaged in the construction of the pyramid at *Illahun*.

The other notable example is from ancient India in the valley of the river Indus in Sind, now in Pakistan and located 480 km north-west of Karachi. A brief note on the *Indus Valley Civilization (IVC)* is given later in this chapter.

In the year 1922, the ruins of the city of Mohanjo-Daro were discovered by a British archaeologist Sir John Marshall when he observed the villagers digging up heads of pottery fragments from their fields.

The name *Mohanjo-Daro* means the mound of the dead and it is regarded as the cradle on Buddhism of the subcontinent. It is understood that it was the most planned and developed city with an important trading centre in the Indus Valley around 2600 B.C. Its population is estimated as 40000 to 60000 living off an agricultural economy. The arrangements for houses, water supply and drainage systems in this ancient town were supposed to be of very high standard. The rooms were large and well ventilated and baths were attached to the rooms.

As the city stands today, it is divided into two mounds, one measuring 1183 m × 546 m and the other measuring 364 m × 273 m. The city also contained a huge public bath which in excellence and solidity of construction cannot be improved upon by any modern builder. It provided a social centre exhibiting the precision, craftsmanship and imagination of the ancient builder.

There is nothing on record to show the demise of this outstanding and unparalleled ancient city. There are indications to show that it was gradually abandoned possibly because of a changing climate or as per another prevalent theory, the people of town fled to escape the hordes of Aryan nomads who launched an invasion of the subcontinent from central Asia in about 1700.

1-3. OBJECTS OF TOWN PLANNING

The four essential objects or ideals of any town planning scheme are:

(1) Object of beauty
(2) Object of convenience
(3) Object of environment
(4) Object of health.

(1) Object of beauty: The object of beauty is achieved by taking the most possible advantages of the natural conditions surrounding the town and also by

giving architectural finishes to the various components of the town. It also includes the preservation of trees, natural greenery, architectural control on public as well as semi-public buildings, ancient architectural buildings, temples, churches, mosques, buildings of cultural and historical significance, etc.

(2) Object of convenience: The object of convenience is understood in the form of various economic, social and recreational amenities to be given to the public. These amenities include cheap power and electricity, proper sites for industrial units, transport facilities, adequate water supply, easy disposal of sewage and industrial wastes, facilities to commercial units, etc. The recreational amenities include open spaces, parks, town halls, playgrounds, cinema houses, community centres, stadiums, etc.

(3) Object of environment: The object of environment is important in the sense that environment should be moulded in such a way that man can go about his normal activities with the least amount of strain. The complex problems of the modern society such as tiresome travel to work, long hours of work, limited time spent within the community, etc. have gradually led towards serious mal-adjustments between the human being and the type of life he had to live. These mal-adjustments have tended to destroy the vitality of urban living and the town planning is mainly concerned with bringing about a better relation between man and his environment.

(4) Object of health: The object of health is accommodated in a town planning scheme by making right use of land for right purpose, by providing parks and playgrounds for the public, by maintaining the pollution of various forms to the lowest possible degree, etc. It is achieved by dividing the land into zones such as residential, commercial, etc. and by avoiding the encroachment of one zone upon the smooth and orderly development of the town in future.

It is, however, necessary for the town planner to maintain a proper balance between the four objects mentioned above and not to give emphasis on any one of them at a disadvantage of the others.

1-4. ECONOMIC JUSTIFICATION FOR TOWN PLANNING

The town planning can be studied from many different angles such as legal, historical, sociological, architectural, economic, etc. Each category will study the subject from certain points of view and the conclusions arrived at by each study will certainly have influence on the fields of other categories. It is thus not possible to study town planning from a solitary angle. Hence, if town planning is not to be frustrated, it should be studied from the economic angle along with other factors.

In the economic sense, the town planning is desired if its adoption leads to better utilization of the resources of the community than would otherwise be achieved. The town planning mainly deals with the utilization of available lands. Hence, for any given size, the best planned town is one where the aggregate land values are at a maximum. Thus, economically, the best town plan will lead to the highest aggregate land values.

While adopting the land values criterion, the following factors are to be considered for assessing the economic worth of the town planning:

(1) Change in quantity of resources: There should be no change in the quantity of resources. If the quantity of resources change, there are chances for the land values to fall.

(2) Demand for goods and services: The demand for goods and services should not change. If the demand for goods and services falls, naturally the demand for resources will also fall and it may cause the land values to come down.

(3) Production techniques: The techniques of production should remain more or less the same. Otherwise more efficient use will be made of the resources and it may have adverse effects on the land values.

(4) Redistribution of land values: If town planning has merely resulted in the redistribution of land values and as such there is no net increase in land values, the town planning in economic sense, is not justified. Thus, the town planning should not lead to increase in the land values at certain places and corresponding decrease in the land values at some other places.

The economic advantages offered by the urban way of life are enormous. But at the same time, it should be remembered that the path of urban growth is not very smooth and there are many mal-adjustments which accompany this process preventing the city from making the maximum contribution to the national economy. Some of the economic disadvantages can be mentioned as difficulties in securing housing accommodation, inequalities of incomes between urban inhabitants, congestion of facilities, etc. In a similar way, the drawbacks of the rapid urban growth from various other disciplines can be enumerated as follows:

(i) The local government is concerned with the expansion of urban area, its administration, etc.

(ii) The medical officer is concerned with the effects of dirt, smoke, etc. on the health of urbanities.

(iii) The psychologist is concerned with the effects of noise and strain leading to greater insanity and more suicides.

(iv) The sociologist is concerned with the formation of slums, inadequate recreational facilities, increase in crimes, etc.

It is thus seen that there are certain disadvantages of urbanization from different view points. But the advantages offered by urbanization out-weigh its disadvantages. An urban dweller comes into contact with a variety of people and he can develop his career, if he uses the opportunity. The characteristic of city life is that all sorts of people meet and the social relationships in such a society will naturally be different than the folk community. An urban man cannot know all people and he is always making new acquaintances and forgetting the old ones for achieving his personal benefits. Hence, it has become more popular at present and efforts are made to overcome its disadvantages. The society cannot obtain the greatest possible benefit from cities unless and until the disadvantages of urbanization are totally removed.

At this stage, it will be worthwhile to understand the meaning of the term *urban area*. This term is used to mean a limited area in which a large number of people are permanently residing and they are separated from other centres by a much greater area of thinly populated land. It is also understood that the residents of an urban area are normally, although not wholly, engaged in non-agricultural activities or occupations. Thus, the urban areas are very much a human invention and their primary function is to carry out service activities from centralized locations for the benefit of the surrounding agricultural area.

1-5. PRINCIPLES OF TOWN PLANNING

The subject of town planning demands knowledge of various professions, especially those of engineering, architecture and surveying. The town should not be designed only to satisfy the needs of the future generation. But the probable growth and development of the town should be suitably conceived by the town planner and it should be seen that the town does not develop in any haphazard fashion. Some of the guiding principles of town planning are as follows:

(1) Green belt
(2) Housing
(3) Public buildings
(4) Recreation centres
(5) Road systems
(6) Transport facilities
(7) Zoning.

Each of the above principle of town planning will now be briefly described.

(1) Green belt: The provision of a green belt on the periphery of town results in the limitation of its size and hence, the final size of the town can well be anticipated.

(2) Housing: Extreme care should be taken to provide housing accommodation to various categories of people. It should be observed that there is no development of slums and further, if slums are existing, they are cleared by the provision of some alternative arrangement.

(3) Public buildings: There should be a well-balanced grouping and distribution of various public buildings throughout the town. The unnecessary concentration of public buildings at certain spots of the town should be avoided.

(4) Recreation centres: Depending upon the size of town, enough space should be reserved for the development as recreation centres for the general public.

(5) Road systems: The efficiency of any town is measured by the layout of its roads. A nicely designed road system puts a great impression in the minds of people, especially the visitors to the town. The provision of a faulty road system in the initial stages of town formation proves to be too difficult and costly to repair or to re-arrange in future.

(6) Transport facilities: The town should be provided with suitable transport facilities so that there is minimum loss of time from place of work to the place of residence.

(7) Zoning: The town should be divided into suitable zones such as commercial zone, industrial zone, residential zone, etc. and suitable rules and regulations should be formed for the development of each zone.

1-6. NECESSITY OF TOWN PLANNING

It is evident that a small house, if well arranged and planned, looks far more better than a disordered big palace. In a similar way, a town which is properly planned affords more comforts and conveniences to the public. The necessity of town planning can very well be appreciated by mentioning the evil situations which a town has to face in the absence of town planning. They are as follows:

(1) defective road system resulting in the formation of narrow streets and lanes;
(2) development of slums and squatter settlements;
(3) haphazard location of industries;

(4) heavy traffic congestion during the working hours of the day;
(5) inadequate open spaces for parks and playgrounds resulting in unhealthy living conditions;
(6) lack of essential amenities like electricity, water supply and drainage;
(7) noisy atmosphere disturbing the peace of city dwellers;
(8) uncontrolled development of the town;
(9) unhealthy living conditions; etc.

1-7. ORIGIN OF TOWNS

If a survey is carried out regarding the origin of some of the important existing towns and cities of the world, it can be easily established that any town or city has originated because of certain specific cause. The contributing forces for the origin of towns and cities can be broadly divided into two categories, namely, topographical and functional.

(1) Topographical features: The *topographical features* contributing to the origin of towns are as follows:

(i) conditions favourable for industrial units,
(ii) hilly areas to achieve the object of defence,
(iii) plain areas useful for business activities,
(iv) river banks, and
(v) sea or ocean fronts.

(2) Functional aspects: The *functional aspects* responsible for the origin of towns are as follows:

(i) education,
(ii) health resorts,
(iii) political, and
(iv) religious.

1-8. GROWTH OF TOWNS

The towns grow during passage of time in a number of ways and various forces which contribute to the overall development of a town are transport facilities, installation of industries, expansion of factories, provisions for defence or security, proximity of agricultural lands, availability of electric power, political importance, etc.

It should, however, be remembered that towns and cities are not solely products of industrialization because they existed many centuries before the Industrial Revolution.

However, the preindustrial towns and cities have limited opportunities for producing goods and rendering services and as such, they have less relative importance.

It is quite evident that the degree of urbanization increases sharply as industrialization increases and the aspect of urban growth has occurred practically throughout the world indicating the terrible attraction of urban way of life inspite of certain imperfections in the urban mechanism.

Reasons to stay close to urban areas:

Some of the reasons why the people would like to stay close together in urban areas can be enumerated as follows:

(i) It is also quite likely that man has been often found to stay in groups to facilitate defence against attack from hostile outsiders. Of course, as time passes, the defensive element may go in the background.

(ii) The man by nature is a social animal and he gets much of the satisfaction of living a life in the company of his fellows.

(iii) The size of urban aggregate exhibits considerable heterogeneity. An urban man can develop contacts and friendships with like-minded persons having common interest and at the same time, the urban dweller can retain a very high degree of privacy.

(iv) The urban area may provide a reliable water supply or a meeting place for exchange of goods or a place of assembly for religious, political or administrative purposes, etc.

The need of a man for employment and opportunities regarding education, recreation, business, marriage, etc. will add to the additional functions of town growth and ultimately, a town provides a platform for a variety of persons to perform specialized activities on different scales.

The growth of town, to a large extent, will depend on the economic forces because it is found that an urban area is usually a centre of specialized activities and hence, the size of a town will depend on the amount of goods and services supplied to outsiders i.e., its exports. The economic base theory suggests that if there is an increase in the demand of goods and services exported by the town, the growth of town takes place and the rate of growth will naturally depend on the rate at which demand for its exportable products increases. Moreover, the money earned by the export activities would provide a fund for supporting the production of goods and services required by the population of town.

The facilities of transport or communication increase the population and such a tendency leads to the growth of towns. The means of transport may take up the following forms:

(i) *Aerial ports:* In some cases, the airports also play an important role in the growth of a town.

(ii) *Railways:* If town is connected with railways, there will be increase of passengers and goods traffic even from long distances.

(iii) *Roadways:* The neighbourhood area is connected with the town and it leads to overall expansion of trade and industry.

(iv) *Waterways:* If facilities of waterways are available, the town can grow as a harbour with possibility of foreign trade and business.

The above-mentioned means of transport have led to the horizontal growth of town. But the availability of mechanical lifts, escalators and elevators has made it possible to have vertical growth of town in the form of skyscrapers.

The growth of towns and cities can be studied in the following two ways:

I. Growth of towns according to origin

II. Growth of towns according to direction.

1-8-1. GROWTH OF TOWNS ACCORDING TO ORIGIN

The growth of towns and cities according to the origin can be divided in two categories:

(1) Natural growth

(2) Planned growth.

(1) Natural growth: Most of the towns in the past have grown in a natural way, that is, the development of the town as such has taken place without any future planning. The men on the spot and the interested parties took decisions regarding the growth of the town for immediate comfort and convenience of the residents. The provisions of various essential amenities such as road system, parks, playgrounds, schools, industrial units, commercial centres, hospitals, cinemas, etc. are made in an irregular way without any consideration for future expansion of the town. The natural growth of a town may be in the form of the following four types:

(i) Concentric spread

(ii) Ribbon development

(iii) Satellite growth

(iv) Scattered growth.

(i) ***Concentric spread:*** It is the natural tendency of the people to be as near as possible to the town or city and as a result of this tendency, the town develops in the form of concentric rings with nucleus as town. Such a growth creates many complicated problems such as traffic congestion, narrow streets, concentration of population, improper houses, etc.

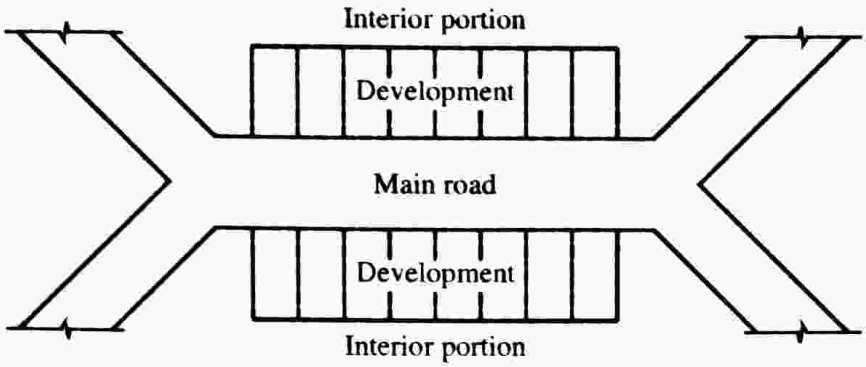
The town growth is represented by a series of concentric circles or rings. The first zone embodies the central business district and it is the focal point of commercial, social and civic life of the town area. It represents the area of original settlement and land use in this zone takes the form of shops, offices, hotels, theatres, etc. As the town grows, the persons who can afford more transport time and charges go away from the central zone and thus low-income housing, better-class residences and high-class residences are subsequently formed away from the central business district respectively.

The idea of concentric spread is based on the fact that similar or functionally related activities will be located at the same distance from the centre of an urban area. Thus, the town grows radially from the centre whereby each inner zone extends its area by invading the adjoining zone towards the periphery of the town area.

(ii) ***Ribbon development:*** It has been observed that because of improvement of road surface and growth of motor traffic, it is the natural tendency of everyone to build as near as possible to the main road.

The building activity therefore expands in a natural way along the sides of main road and long fingers or ribbons of houses, factories, shops, etc. develop as shown in fig. 1-1.

If ribbon development is allowed without the enforcement of certain rules and regulations, it leads to the following disadvantages:



Ribbon development

FIG. 1-1

(a) As the houses extend in a long strip, there is increase in cost of various basic utility services such as water supply, electricity, postal deliveries, telephone, etc. It thus results into wastage of available resources.

(b) The development of ribbons causes to loose and to scatter the community so that there is lack of social life.

(c) The future improvement becomes costly and difficult, if not impossible.

(d) The houses face heavy traffic associated with noise, dust and undesirable smells.

(e) The interior portion is left undeveloped which results in the wastage of valuable land.

(f) There are chances of traffic accidents and traffic delays because of the presence of pedestrians on the main road.

(g) The ribbon development is purely an urban formation which is thrust into the naturalness of a country and hence, it is aesthetically faulty.

(h) The ribbon development spoils the countryside and if it is carried to the extreme, it would make it non-visible at least to the road user.

(i) The through traffic of main road is considerably affected by the local traffic.

(j) The traffic capacity and efficiency of main road are reduced.

Depending upon the number of main transport routes, especially the fastest ones, the growth of town may even be in the form of a star-shaped pattern and each arm of the star will correspond to the main route leading to the town.

The problem of ribbon development is very complex involving socio-economic, political, technical and legal measures for its solution. It requires a co-operative effort by legislators, town planners, traffic department, judiciary, adjacent land owners and last but not the least, the road-users themselves.

Considering the various causes of ribbon development and the resulting ill-effects, the requirements for legislation exist in respect of the following:

(a) control of advertisements and obstructions to view;

(b) control of unfettered access to the highways;

(c) creation of a competent authority to enforce the various legislative measures;

(d) land-use zoning to check undesirable building activity in the vicinity of highways;

(e) regulation and control of traffic using the highways;

(f) removal of encroachments from the road right-of-way; etc.

The engineering measures to discourage ribbon development include expressway facility with completely controlled accesses, grade separated crossings, controlling the access points, planning the roadside amenities, etc.

(iii) ***Satellite growth:*** When a town reaches a certain size, some sort of satellite growth is bound to take place. The development of a satellite town is mainly due to the metropolis and the term *satellite* is used to indicate a body under the influence of a more powerful body but possessing its own identity. Fig. 1-2 shows the development of satellite towns around the parent city.

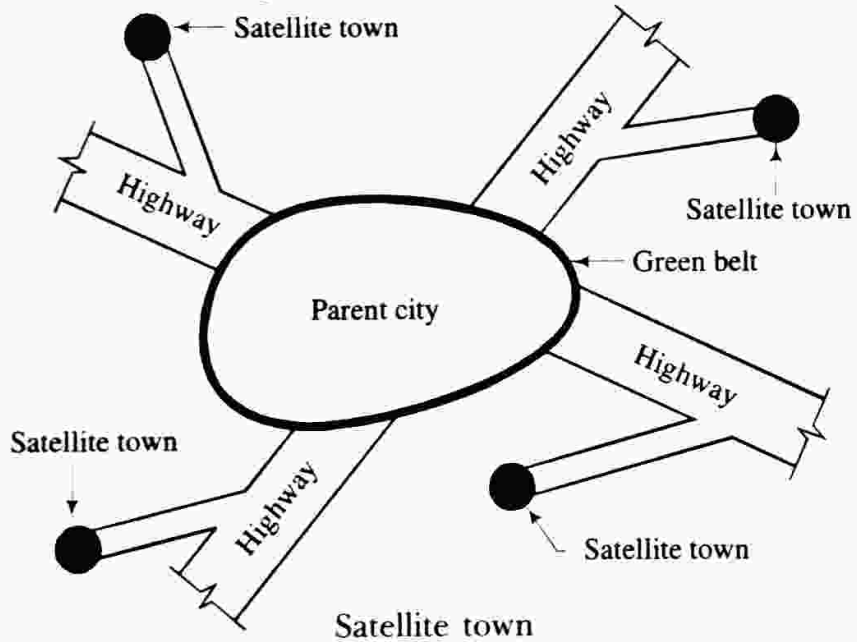


FIG. 1-2

The features of a satellite town are as follows:

(a) It has its own local government and corporate life.

(b) It is a town in the full sense of the word except that it depends to a certain extent upon a nearby large town or city.

(c) It is connected to the parent city by local trains, buses, etc. in such a way that men can reach to the parent city without any difficulty.

(d) It is free to decide its economic, social and cultural activities.

(e) It is generally situated beyond the green belt of the parent city.

(f) It is mainly a residential area having only local shops, schools for children, etc. As no industries are permitted, the people will have to depend on the parent city for employment opportunities.

(g) It is neither a village nor a suburb. A village has not to perform the functions of a town and a suburb is absorbed or is likely to be absorbed into another community.

(h) It need not have zoning regulations.

(i) Its size and development are controlled in such a way that it does not become a rival to the parent town or city in future.

(j) The satellite may even be considered to be the part of the market for some of the goods and services being produced in the parent city.

(k) The workers living in a particular satellite may belong to the labour force of a certain industry and in that case, it will give a wider choice to the employers of such industries for finding the best man for the job.

The main *disadvantage* of satellite growth is the necessity of the long journey to work. However, this fact is sometimes over-stated or over-estimated. It may be that a long journey in distance does not necessarily mean a long journey in time and further, a long journey is not invariably more uncomfortable than a short one. However, this drawback of satellite growth has to be accessed by considering the efficiency of the different modes of transport.

It is also sometimes pointed out that the satellite may be deprived of entertainment and cultural activity and this factor may be responsible for preventing the development of a community spirit. This drawback also seems to be over-emphasized because the absence of community activities may be due to certain other reasons such as absence of community centres and halls.

(iv) ***Scattered growth:*** In this case, the growth of a town takes place in a very irregular way. It results into traffic congestion, encroachment of industries on residential areas, slums, lack of parks and various other problems which prove to be too difficult to be solved in future.

(2) Planned growth: In case of a planned growth, a town develops in a predetermined line as conceived by the town planner. The overall growth of the town is controlled by the enforcement of suitable rules and regulations. Such an orderly growth avoids the clashing of manifold activities to which a normal town has to undergo. There is rational distribution of various blocks such as residential, industrial, commercial, etc.

The provision of various amenities such as widths of streets, drainage lines, water supply lines, parks, playgrounds, etc. is made to meet with the future requirements. The modern concepts of town planning can very well be seen and appreciated in some of the recent new towns in many parts of the world.

1-8-2 GROWTH OF TOWNS ACCORDING TO DIRECTION

With respect to direction, the growth of towns and cities can take place in the following two ways:

(1) Horizontal growth

(2) Vertical growth.

Each of the above type of growth will now be briefly described.

(1) Horizontal growth: In case of horizontal growth, the town expands and develops horizontally in all directions. It is clear that such a growth will be possible at places where land is available in plenty at nominal cost.

(i) ***Advantages:*** The advantages of horizontal growth are as follows:

(a) In general, there will be saving in cost as the buildings will usually consist of two or three storeys.

(b) It does not require the services of high technical personnel.

(c) It is possible to make the maximum possible use of the natural light.

(d) The density of population can be restricted.

(e) There is economy of floor space as the provision of columns, lifts, etc. will not be required.

(f) The surrounding marginal space can be utilized for developing garden.

(ii) ***Disdvantages:*** The disadvantages of horizontal growth are as follows:

(a) It requires the use of more land and hence, it will prove to be uneconomical where land values are very high.

(b) The foundation cost per unit area will be more.

(c) There will be absence of group living.

(2) Vertical growth: In case of vertical growth, the buildings of the town are designed and developed as multi-storeyed flats. It is quite evident that such a growth will be possible at places where land is costly.

(i) ***Advantages:*** The advantages of vertical growth are as follows:

(a) As many people will be staying and using the common amenities of the same building, a sense of group living will develop.

(b) As the foundation cost will be distributed between all the floors, the foundation cost per unit area will be in the reasonable limit.

(c) For floor above certain height, the natural sceneries such as sea view, river view, etc. can be enjoyed in a better way.

(d) It will be possible to make the maximum use of the modern construction techniques such as fire-proofing, sound-proofing, heat insulation, air-conditioning, high speed lifts, etc.

(e) There is considerable saving in land and hence, it will prove to be economical where land values are very high.

(f) There will be economy in construction cost as the buildings will be designed as framed structures with repetition of a typical floor plan at each floor level.

(ii) ***Disadvantages:*** The disadvantages of vertical growth are as follows:

(a) In case of natural calamities such as earthquake or fire, it will be difficult for the inhabitants of the upper floors to escape safely.

(b) The density of population will be more.

(c) The design of flats will be stereo-typed and there is no scope for personal likes or dislikes.

(d) The evils of group living will have to be tolerated.

(e) The failure of lift, pump to raise water, etc. will cause great inconvenience.

(f) The people staying at upper floors will be deprived of natural living near the ground level.

(g) There will be some wastage of floor space as lifts, supporting columns, etc. will have to be provided.

1-9. STAGES IN TOWN DEVELOPMENT

A town undergoes different stages of development and accordingly, the towns are classified into various categories.

Sir Patrick Geddes (1854-1932) classified the towns broadly into *three* categories, namely, *primary*, *secondary* and *tertiary*. The *primary towns* produce mainly human necessities e.g. agricultural village. The *secondary towns* act as centres of exchange e.g. marketing town.

The *tertiary towns* provide residential, recreational and educational facilities. It is, however, very clear that no single town can be placed in one category only. There is always bound to be some admixture.

Lewis Mumford an outstanding thinker of our generation and he has suggested six stages in town development as shown in table 1-1. He has classified the towns in social order rather than physical items.

TABLE 1-1
STAGES IN TOWN DEVELOPMENT

No.	Stage	Remarks
1.	Eopolis	It indicates the village community having economy based on agriculture.
2.	Polis	It indicates an association of population with some sort of specialization and mechanization.
3.	Metropolis	It indicates the town serving as capital of state or region.
4.	Megalopolis	It indicates the first stage of decline. The originality of town shows signs of decline.
5.	Tyrannopolis	The town further deteriorates and situations such as trade depressions, military power, exploitation of colonies, etc. occur.
6.	Necropolis	The town is in the worst stage. The inhabitants prefer to shift to the nearby villages for various reasons such as disease, famine, war, economic breakdown, etc. The town may recover or re-establish after an interval of time.

According to Griffith Taylor, a town passes through the following four stages:

(1) Infantile: The town is not divided into separate distinct zones.

(2) Juvenile: In this stage, shops are separated from houses and there are few factories.

(3) Mature: In this stage, the town is distinctly divided into residential zone, commercial zone and industrial zone.

(4) Senile: This stage indicates the physical decay of most of the portions of the town.

It may, however, be noted that a change from one stage to the other does not necessarily mean an improvement. For instance, a town in juvenile stage may be quite comfortable. But when it reaches the stage of maturity, it may become hopelessly crowded and very inconvenient in functioning.

Depending upon the size, population, pattern of land ownership, distance from urban area, etc., the settlement patterns of the Indian villages can be grouped under the following four categories:

(1) Basic village
(2) Rural town
(3) Service town
(4) Town.

(1) Basic village: The population of basic village is of about 400 to 500 souls and primary occupation is agriculture. The stability of this settlement can be increased by providing a primary school, open well for potable water, murum roads, mobile dispensary, live stock breeding centre, etc.

(2) Rural town: The population of rural town is of about 2000 to 3000 souls and it groups the surrounding 10 to 15 basic villages. It serves as a cultural, commercial and administrative centre and its stability can be increased by taking various steps such as tube well, open drains, secondary school, mobile library, community hall, murum roads, agricultural seeds research and development centre, etc.

(3) Service town: The population of service town is of about 5000 to 7000 souls and it accommodates adequate level of amenities, services and economic activities to cater about 25 to 30 basic villages. The service town grants employment in small scale industries over and above the agricultural employment. The service town contains cinema, community halls, industrial estate, electricity, macadam roads, piped water supply, health centre, etc.

(4) Town: This is the last level of settlement and depending upon its location, its size will be decided. It may even ultimately convert into a big city possessing all the modern amenities and services. Thus, the town indicates the smallest urban community and it represents greater impact of rural character.

The urban place is commonly understood through cities and the cities differ extensively on the basis of extent of population, psychological attitude, civic amenities, etc. On the basis of population, the cities can be classified as shown in table 1-2.

TABLE 1-2
CLASSIFICATION OF CITIES ON THE BASIS OF POPULATION

Name	Population
City	50000 to 100000
Great-city	100000 and over
Super-city	More than 300000
Metropolis	1000000 and above
Megalopolis	5000000 and above.

1-10. PERSONALITY OF TOWN

Every town has its own personality, character or individuality. For instance, a hill station or an industrial town possesses individuality of its own. A small town is not a miniature replica of a big town. The conveniences and amenities which a big city can afford may not be available in a small town. Further, the personality of a town is influenced by its geographical, economic and other conditions. These changing factors greatly influence the growth of a town. However, all the towns do not grow indefinitely and the trend of development will depend on the character of town.

The unforgettable beauty of a town can be achieved by taking the maximum advantage of its natural features and the overall landscape pattern of the locality. The personality of a town lies in the harmony achieved between the elements of a town and its natural landscape features.

Every town or city, like a human being, has its own identity which persists even if not a single stone of its original buildings can be found. It is not merely an organism.

Its citizens are not cells, but they are free agents and every part of its physical body is a product of conscious action and not of unconscious organic growth.

The *three* important factors which grant character or personality to a town are pattern, site and situation. The *patterns of streets* and of characteristically different districts give some identity of the town. The *selection of site* is the most decisive act in the history of a city or a town and some strong natural features such as hill-tops, islands, rivers, bays, etc. tend to remain and to give permanent identity to their cities or towns. The *situation of a city* or a *town* may be such that it dominates and serves the region for a particular job and takes up the identity as the centre of that region.

1-11. DISTRIBUTION OF LAND USES

Any town possesses the following five distinct parts:

(1) Town centre
(2) Industrial area
(3) Residential area
(4) Open space
(5) Town periphery.

The above five parts are well defined in case of a planned town. They are, however, not very clear in case of an unplanned town. The brief description of each part will now be given.

(1) Town centre: It indicates the central area containing commercial and administrative blocks, theatres, big temples, principal library, museum, etc.

(2) Industrial area: In this part, the manufacturing industries of different goods are located.

(3) Residential area: This part is mainly used for providing residential accommodation to the inhabitants of the town. But it also contains small shops, primary schools, gardens, small service industries, etc.

(4) Open space: This part of town is allotted to network of roads, parks and playgrounds and in fact, it indicates land which is substantially left in its natural state for the benefit of people.

(5) Town periphery: The term *town periphery* is used to indicate the land which is located on the boundary of town and which is directly influenced by the town. It, however, cannot be considered as part of the town. The town periphery includes market, gardens, nurseries, golf courses, etc.

1-12. FORMS OF PLANNING

To maintain the continuity in the planning process, the following five forms of planning are to be considered:

(1) Local planning
(2) Country planning
(3) Regional planning
(4) National planning
(5) International planning.

(1) Local planning: The development plan of a city or a town is prepared by keeping in view the local conditions. It aims at proper distribution of population densities, regulation of traffic, location of shopping and recreation centres, provision

of green belts, suitable division of the area in various zones, etc. It is quite evident that local planning will be greatly influenced by economic conditions and finances available for the development of the town.

(2) Country planning: The area surrounding a town cannot be allowed to develop in a haphazard way. Generally, a town is surrounded by villages and rural planning becomes necessary for the proper functioning of the town. For this purpose, the surrounding villages should be linked up with suitable transport facilities and wherever possible, the encouragement should be given for the growth of various village industries such as dairy, poultry farming, basket and rope making, weaving on manually operated looms, etc. If possible, the rural industries may even be supplemented by mechanical aids.

A proper balance between the agriculture and industry should be maintained without disturbing the character of rural area. It should be remembered that country planning and town planning are complementary to each other and they cannot be treated as two independent separate entities.

(3) Regional planning: The term *regional planning* is used to include proposals in a region for the distribution of population and industry, transport facilities, rural services, village industries, etc. A town or a city cannot be isolated from its surrounding region. Hence, the regional planning helps in controlling and reshaping the growth of major towns in the region. The term *region* is generally used to define areas separated not merely or exclusively by natural boundaries, but equally by political or administrative boundaries.

In general, a region may be defined as an area within which interaction is more intense than its interaction with other areas and the modern practice is to embrace the following in regional planning:

(i) agricultural regions;
(ii) industrial areas;
(iii) large hydro-electric power stations;
(iv) resort and recreational areas; and
(v) suburban zones of large cities.

The regional planning is necessary for the following reasons:

(a) It avoids the wasteful duplication of facilities. For instance, the local planning cannot take care of highways and trunk routes.
(b) It ensures the most profitable utilization of the resources at minimum expense for the maximum benefit of both the individuals and the communities in the region.
(c) It gives the information regarding the economic functions which are to be performed by the surrounding areas.
(d) It grants mutual control over the areas in the region. It gives the local planners knowledge of relationship between the areas of the region and they can thus base their plans on this information.
(e) It grants planned and harmonious development of the national economy especially in case of the developing countries.
(f) It involves planning in terms of regional dimensions because man's mobility and his normal activities are spread over a much larger area than what he used to cover in the days of bullock carts.

(g) It reveals new town planning and building principles and makes it possible to reject to a certain extent a static character of new towns and to adopt a more flexible and dynamic structure. It thus helps considerably for providing the requirements for the development of a modern town.

(h) It serves as a link of co-operation and co-ordination between the areas of the region.

The main argument advanced against regional planning is that the regional planner may not have the requisite knowledge of local needs and requirements and in that case, he would concentrate only at regional requirements. It is possible to remove this defect of regional planning by furnishing the regional planner with the necessary information of local requirements.

(4) National planning: The term *national planning* suggests the setting up of the planning procedure on a national level and it takes into consideration the potentialities in various fields of a nation as a whole. By proper and careful national planning, the resources of national importance like railways, irrigation projects, heavy industries, hydro-electric works, etc. can be utilized in the best possible manner. Our various five-year plans serve as an illustration of the national planning.

The national planning can be visualized in different ways as follows:

(i) development of nation in terms of its administrative or political system;

(ii) developments at various levels in an hierarchic order either from top level to bottom level or vice-versa i.e., from international level to local level or from local level to national level;

(iii) developments in terms of various economic sectors such as agriculture, fishing, forestry, mining, quarrying, etc.,

(iv) developments in terms of various social sectors such as clothing, housing, food, education, health, employment, recreation, etc.

(5) International planning: With the establishment of United Nations Organization or UNO, the international planning has come into existence and efforts are made at international level to promote goodwill and co-operation between different countries of the world. The various agencies appointed by UNO conduct surveys in various fields of human life such as education, health, housing, food, etc. The study of such surveys helps in finding out remedies and solutions of complicated problems at an international level.

1-13. SITE FOR AN IDEAL TOWN

The physical characteristics of site play an important role in determining the position of a proposed town and the important features to be considered with respect to the site of a town are as follows:

(1) availability of the natural advantages,

(2) availability of the electric power,

(3) available means of communication,

(4) climatic conditions,

(5) contours of the area,

(6) development of the surrounding area,

(7) drainage of the area,

(8) facility available for the sewage disposal,

(9) fertility of the soils,
(10) frequency of the floods,
(11) growth of the trees,
(12) nature of the soil,
(13) position of the streams and lakes,
(14) water resources, etc.

In general, the national and regional development plans would decide the need of a town in a particular area and the purpose which the town has to serve. Considering the physical features of the area, the final selection of the site is made in such a way that the town will be able to discharge its function efficiently and at the same time, the costs of various amenities and services will be brought down to the minimum possible extent.

1-14. REQUIREMENTS OF NEW TOWNS

The two important facts which are to be carefully examined before deciding the requirements of new towns are as follows:

(1) Function of the town
(2) Welfare of the people.

The brief descriptions of the items to be studied with respect to these two facts will now be given.

(1) Function of the town: A new town is generally formed or developed for a specific purpose or it may be designed as a small multi-purpose town which serves a particular area and acts as a local centre of that area.

The purposes for which the towns may be designed are commerce, industry, culture, education, defence, health, recreation, government administration, etc. Thus, the purpose may be economic, social or political. Once the function of new town is known, the size of population to be accommodated in the town can be worked out and accordingly, the requirements of the new town can be framed.

(2) Welfare of the people: A new town should be designed for the welfare of the people. The welfare of the people is measured by three factors, namely, amenity, convenience and health.

The requirements of the new town are framed in such a way that the people of the town will be able to maintain their health together with reasonable amenities and conveniences.

With the above two facts in mind, the various requirements of a new town can be listed as follows:

(i) amenities such as sewer lines, water supply, electric power, etc.;
(ii) educational institutions;
(iii) effective network of the roads;
(iv) encouragement of planned growth and prohibition of disorderly growth;
(v) enough provision for future expansion;
(vi) parks and playgrounds;
(vii) proper location of the public buildings;
(viii) provision of suitable building bye-laws for the town;
(ix) recreation centres;
(x) zoning of the town into suitable zones; etc.

1-15. PLANNING OF THE MODERN TOWN

The procedure for preparing an outline plan of a modern town depends on skill, training and imagination of the town planner. It is absolutely necessary to correlate the function or functions of town with the physical characteristics of site. A proper combination of function and site would result in the formation of a successful modern town.

The usual features which are to be embodied in the plan of any modern town are as follows:

(1) space for residence, commerce and industry,
(2) communication system,
(3) parks and playgrounds,
(4) public utility services,
(5) neighbourhood structure, and
(6) public buildings.

The spaces to be allotted for various features can be estimated from the study of existing towns or they can be suitably judged from the experience of the town planner. In the beginning, the town planner prepares an outline plan accommodating the above features and if necessary, one or more alternatives are also prepared and then, by trial and error, a combination giving maximum benefit of site with the function or functions of town is adopted.

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

(1) The provisions for various public utilities should be liberal to meet with the future requirements.
(2) The road system should be well designed after careful considerations and it should be able to develop a good bond between different zones of the town.
(3) Enough provision should be made in the outline plan for parks, playgrounds and recreation centres.
(4) The industrial area should be properly located and provision of facilities required for the same should be made.
(5) Extreme care should be taken for the planning of residential area and amenities such as schools, local shops, etc., should be accommodated in the outline plan.
(6) The public building should be located in such a way that favourable impression is developed on the visitors.
(7) The study of existing railway line will help in finalizing the location of the main railway station for the town.
(8) The natural features of the site should be preserved and maximum advantage should be taken of such features for public enjoyment.

After this outline plan of the town is finalized, the detailed planning of various areas of the town is carried out.

At this stage, it is worthwhile to mention that some of the city planners have started to predict the future forms of towns. It is understood that the urban population is growing much faster than the world population.

The urban planners at present are faced with the problem of designing new towns and cities to meet rapidly changing life styles of society. The various novel ideas regarding the future towns are predicted by the leading architects of the world.

1-16. PLANNING OF MILITARY TOWNS

The term *cantonment* or *military station* is used to mean a township for a defence establishment. After independence, especially after the 1962 war with China, a large number of new military stations have been planned and developed throughout the country to achieve improved functional efficiency, economy and compact development. They are planned to suit the changed social, cultural and training requirements of the defence forces.

A military township differs from a civil town in a number of ways because of its peculiar functional requirements.

Following are the important differences between a civil town and a military town:

(1) Density of development: In the military township, the density of development is comparatively low due to the training needs of troops and safety considerations.

(2) Employment: The military population is already employed. For a city town, the planner has to make provisions for job opportunities of the occupants.

(3) Function: A civil town could be a commercial centre, industrial base, a seat of administration or a combination of all such aspects. Hence, the planner has to anticipate future population to achieve the growth of town in a planned and orderly fashion. The military town caters for a certain number of troops only and its size can be decided accordingly.

(4) Housing: The construction activity for a civil town depends on the public as well as the private sectors. For a military town, the houses and other accommodation are provided by the government.

(5) Social grouping: The civil population consists of the very rich to the very poor. For military population, there does not exist major social and economic disparity. For instance, the residential areas of a military town are planned for three social groups, namely, officers, junior commissioned officers and sepoys.

(6) Status of individual: Nearly 80 per cent of the military population live alone in hostel type buildings.

(7) Work places: In a civil town, one may have to travel long distances to reach the work place. For a military town, the units and training areas form the work places for the troops.

1-17. POWERS REQUIRED TO ENFORCE T.P. SCHEMES

To implement the proposed town planning schemes, the authorities will require various powers with legal force. These powers can be enumerated as follows:

(1) power for fixing up the value of the property arbitrarily according to some fixed procedure;
(2) power to acquire slums and demolish them with a view to improve the town.
(3) power to acquire the land;
(4) power to compel proper use of lands and buildings i.e., power to introduce zoning;
(5) power to finance the city planning projects; and
(6) power to prevent the fragmentation of land beyond a certain limit.

1-18. COST OF TOWN PLANNING

The implementation of town planning schemes will require the use of resources of the community and as such, optimum cost of town planning can ideally be worked out by relating cost of planning to the benefits derived from planning. It is possible in specific cases such as expansions to existing towns and planning of new towns to relate costs of benefits by measuring land values.

In actual practice, the usual position is that the amount to be spent on planning is decided by the governing bodies or agencies and the town planner is asked to work out the planning schemes within given limitations. The factors included in such limitations may be:

(1) amount of money which the community is willing to spend on roads, hospitals, parks, etc.;
(2) law relating to town planning;
(3) present pattern of land use; etc.

Thus, the ideal cost of planning will be the adoption of town plan which will maximise land values within the given limitations.

1-19. TOWN PLANNING IN ANCIENT INDIA

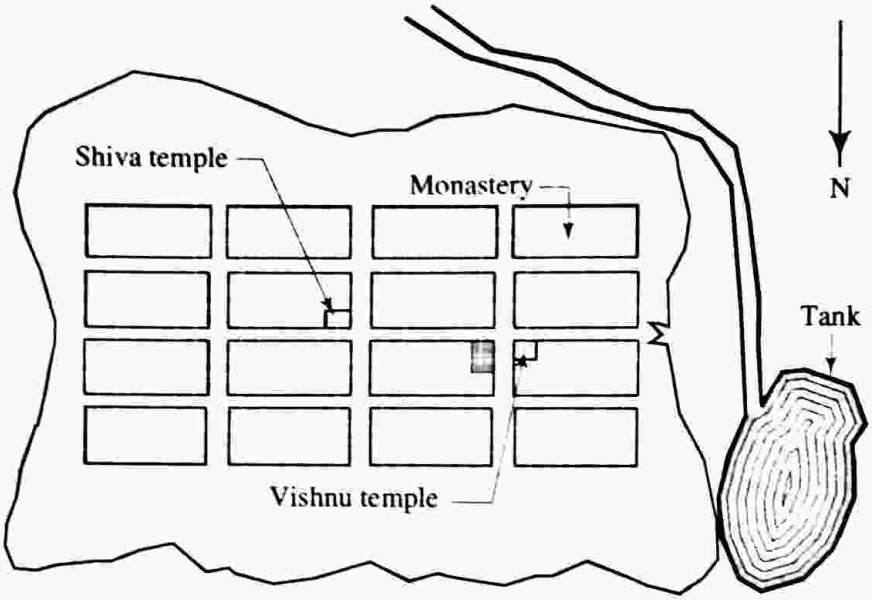
The planning of towns, cities and villages was done on a scientific footing in India even in Vedic times. Some of the principles and theories of town planning are contained in the literature of ancient times such as Rig Veda, Atharva Veda, Yajur Veda, Puranas, Samhitas, Shilpa-shastras, Niti-shastras, Smriti-shastras, etc. It is quite clear that the principles underlying the planning of an ancient Indian village more or less resembled those of the modern garden cities.

The profession of a town planner possessed a high social status in the ancient times. An intensive training was given to the Sthapati (i.e., an architect or town planner) and thus the architects and the town planners were chosen from the upper strata of society. *Vishvakarma* is traditionally known as the *divine architect* and he is credited to have spread the knowledge of shilpa-shastras. Even today, Vishvakarma is worshipped by the artisans.

The nature and growth of towns and cities were governed by the site conditions. The towns were generally situated on river banks, by the sea shore or by the side of a big lake. A flowing stream was always preferred for sanitary requirements. The towns on river banks usually were of oblong shape to take the maximum advantage of the river. It is significant to note that Indians have always loved, glorified and worshipped their rivers since the dawn of civilization and in a sense, it can be said that they are real witnesses of the origin, growth and even decline of the many cities of the Indo-Aryan civilization.

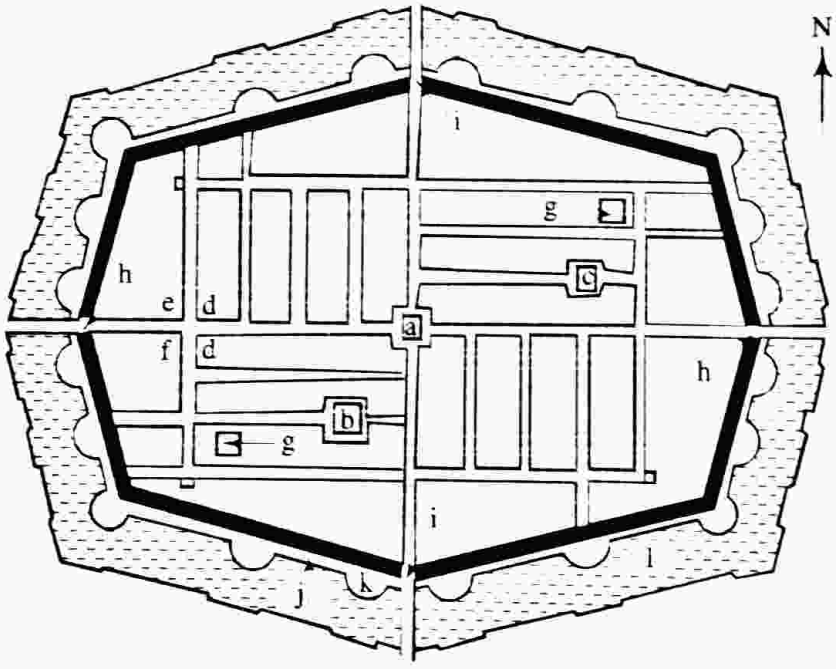
In Vedic period i.e., upto 400 B.C.,the scientifical town planning was done. The principles of town planning are mentioned in some of our sacred books. It is written in '*Vishwakarmaprakash*' that '*First lay out the towns and then plan out the houses.*' This principle is adopted even today, in the period of modern technology.

In '*Mansara Shilpa-shastra*' some of the aspects of town planning like study of soil, climatic condition, wind direction, orientation of building to get maximum advantage of sun, topography, etc. are mentioned. Also various types of town plans like '*dandaka*', '*swastika*', '*padmaka*' (lotus shaped), '*nandyavarta*' (flower shaped), '*prastara*', '*chaturmukha*' and '*karmukha*' (bow shaped) are described in the said book.



Dandaka type town plan
FIG. 1-3

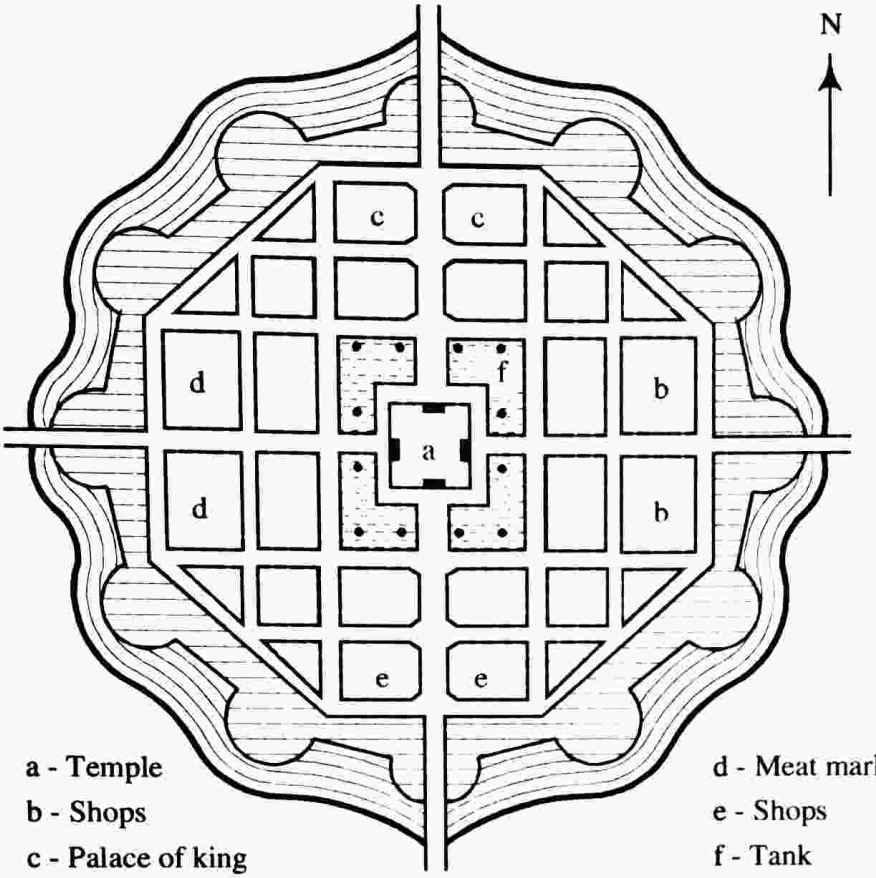
In all the above mentioned types of town plans, the main streets i.e., 'Rajmarga' were oriented East-West with the idea that roads get purified by the sun rays. All the sub-lanes were kept North-South. One road was kept running around the town for the use of priests only. This road was known as *mangal vithi*. Figs. 1-3, 1-4, 1-5, 1-6, 1-7, 1-8 and 1-9 show layout plans of various town plans.



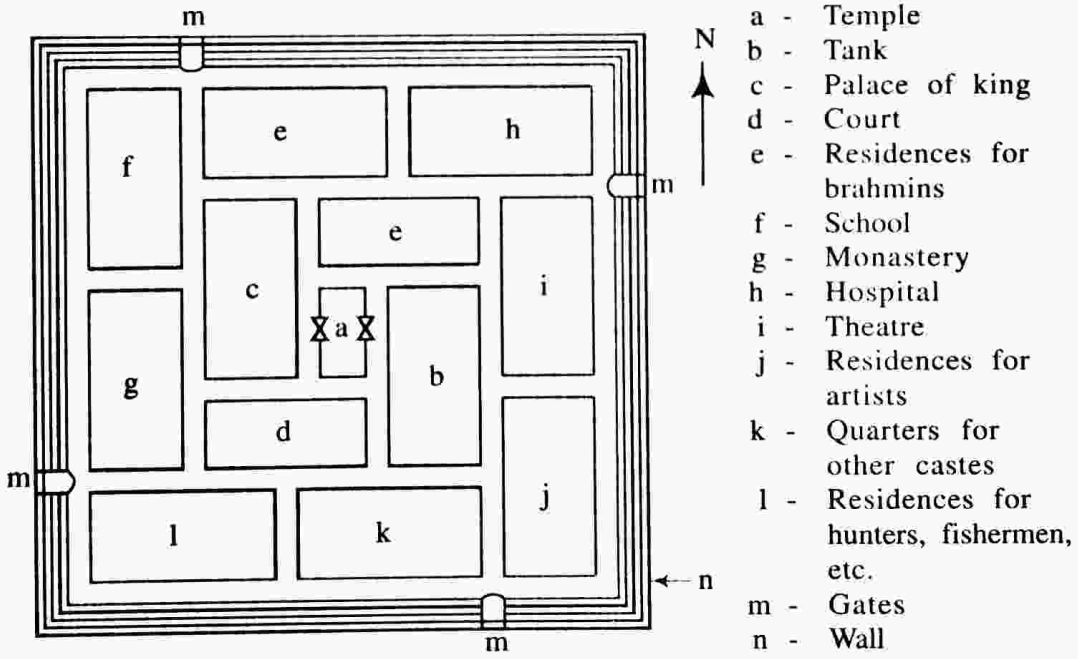
a - Shiva temple
b - Jain temple
c - Buddha temple
d - Office and court
e - Palace of King
f - Palace of prince
g - Tank and garden
h - Ganesh temple
i - Kali temple
j - Wall
k - Bastion with armoury
l - Moat filled with water

Swastika type town plan
FIG. 1-4

The authentic descriptions of ancient Indian cities and towns can also be obtained from the writings and records of great foreign travellers and historians, namely, Magasthenese, Huen Tsang, Fahein, Iban-i-Batuta, etc. who visited India in the ancient period.



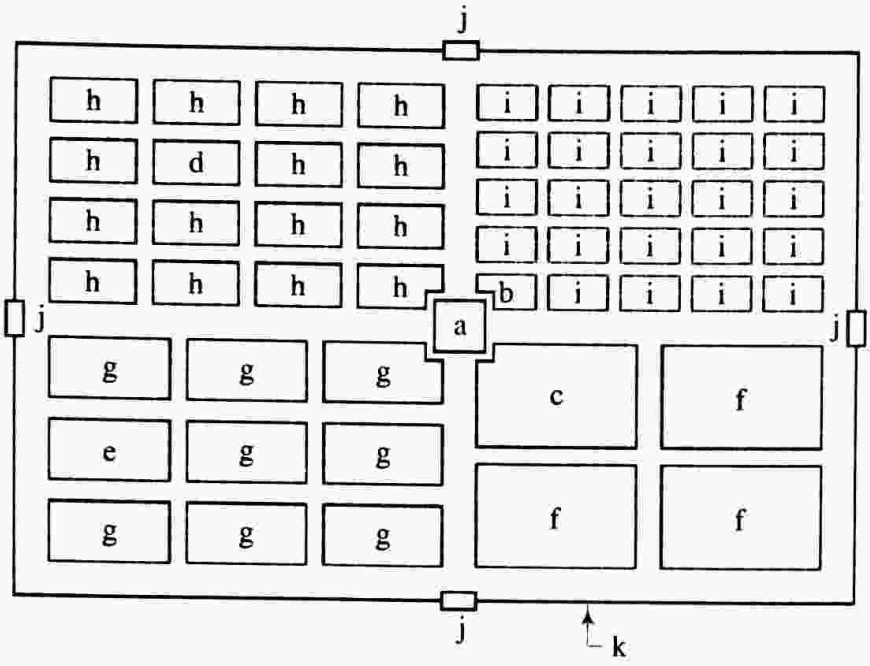
Padmaka type town plan
FIG. 1-5



Nandyavarta type town plan
FIG. 1-6

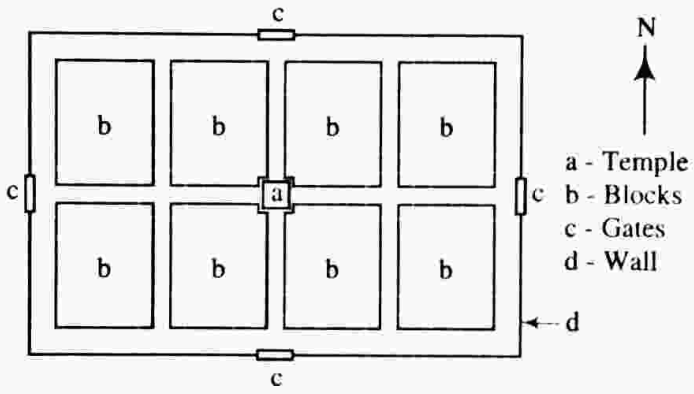
A typical Indian town consisted of market, streets, public buildings, residences for citizens, temples, royal palace, recreation centres, ditches, sheds for drinking water, pleasure gardens, tanks, reservoirs, underground passages, city forts, etc.

The towns were provided with amenities required for a normal town life. Some of the towns worth mentioning are Ayodhya, Mohanjo-Daro, Patliputra, Takshasila, Nalanda, etc.



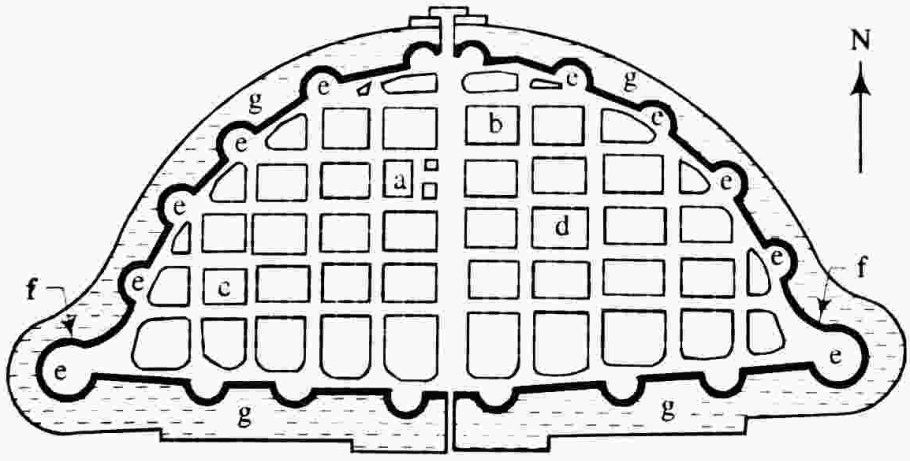
Prastara type town plan

FIG. 1-7



Chaturmukha type town plan

FIG. 1-8



Karmukha type town plan

FIG. 1-9

(i) *Ayodhya* is said to have fine and wide streets which were arranged symmetrically and which were planned in such a way that there were practically no chances for traffic congestion. The city of Ayodhya is stated to have been 5484 m long and 1371 m broad. The sweet drinking water was provided and the street facades exhibited harmony in their design and symmetry. The town contained many theatres and town halls and there were special apartments for ladies. Ayodhya has been known to the Hindus from the epic period of Ramayana. It remained obscure for a considerably long period and enjoyed the status of the capital of Oudh in the 18th century. Saadat Khan was the last ruler of Oudh who had his capital at Ayodhya and after his death, the capital was shifted to Faizabad. At present, Ayodhya has no separate identity and it is located at a distance of about 6.50 km north-east of the city of Faizabad.

The study of Mohanjo-Daro has revealed that it contained wide roads with drainage line on either side. Every house contained an open place and one or more decent bathrooms.

(ii) *Patliputra* (Patna of present time) was the capital of Mourya Empire. Its length and breadth were about 15 km and 3 km respectively. It was protected by a strong wooden compound wall containing 64 gates and 570 towers. The four main gates were located to the cardinal points of the cardinal points of the compass and were wide enough for the elephants to pass through easily. For defence purpose, it was surrounded on all sides by 180 mm wide and deep valleys. Most of the houses were of timber.

The royal palace was located at the centre of town and it was surrounded by parks and fountains with water-pools. Megasthenese, the ambassador of seleucus visited India during the reign of Chandragupta Maurya and he has written elaborate and excellent description of Patliputra and its people

Layout plan of Takshashila
FIG. 1-10

(iii) *Takshasila* was located in north-west side of India and it developed as a famous education centre. Nalanda was a Buddhist monastery to start with under the revered sage Sariputra, the renowned personality for his learning.Its length and width were about 487 m and 244 m respectively. It had about 300 halls to accommodate more than 10000 students. There were nine storeyed high libraries. Both the universities at Takshasila and Nalanda had free hostels for students and they contained various departments

for studying different subjects. Nalanda has also royal observatory and it is said that its water-clock indicated the standard time for all Magadha area.

Thus, Takshasila and Nalanda provide excellent examples of the early university towns in India and they followed a systematic growth according to the norms laid down by Shilpa-shastras. Layout plan of Takshashila is shown in fig. 1-10.

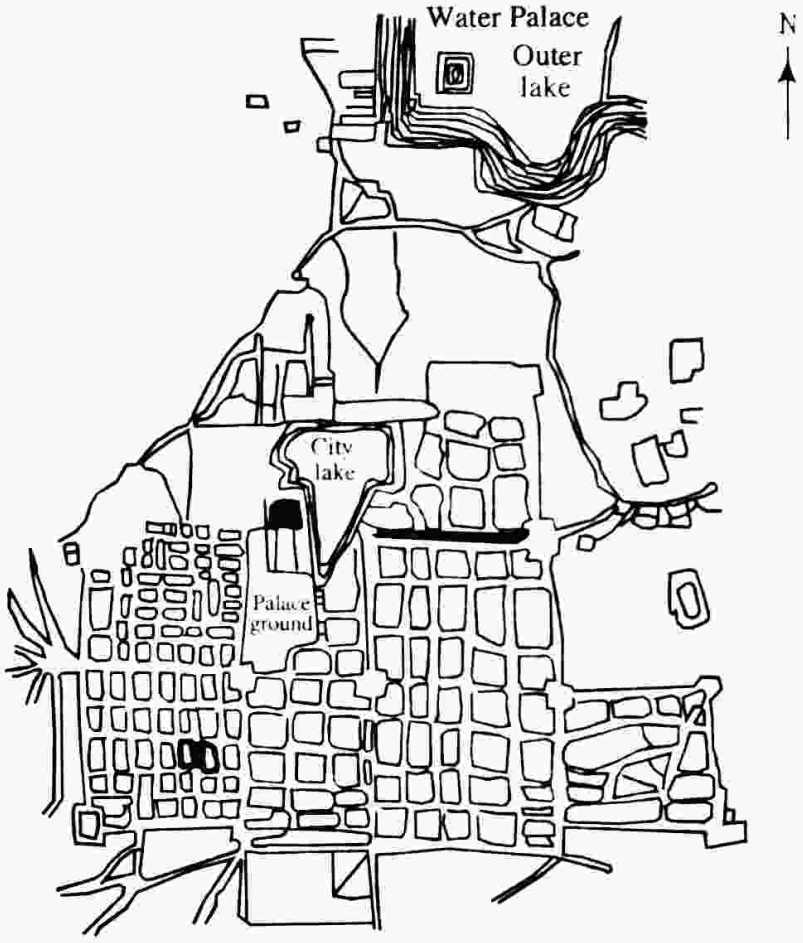
During the pre-Moghul and Moghul periods, the rulers established few more towns. Most of these towns were more or less traditional and as such no further contribution was made to the science of town planning during these periods.

The towns such as Delhi, Lucknow, Lahore, Agra, Jaipur, Fatehpur Sikri, Ajmer, Ujjain, Bharatpur, Shamadabad, Banaras (Varanasi), Mathura, etc. developed during Moghul period and they clearly bear the influence of muslim architecture and culture. The layout plan of Jaipur city with its lakes and palaces is shown in fig. 1-11.

From the study of history, it is evident that a separate department existed for the construction and development work. The emperor himself headed the department and it included eminent architects, engineers and ministers as its members.

In the regime of great emperor Akbar, a Public Works Department was established for the planning and development of construction work and Akbar's ideas about architecture were carried out by his able staff of architects and engineers.

Subsequently, all the other muslem rulers or emperors also maintained a separate urban planning and development section and they pushed ahead the process of town planning according to their own whims and desires to fulfil the requirements of public.



Layout plan of Jaipur
FIG. 1-11

India has maintained a fairly stable settlement pattern for hundreds and even thousands of years. The Indian society has roots which are deeply spread into the remote past. Varanasi was a principal urban centre in the time of Buddha and it is said to be the oldest city of the world. Patna, capital of Bihar State, is located on the site of Patliputra, the capital of Magadha empire. Delhi, the national capital of India, was once Indraprastha, one of the legendary capitals of Mahabharata.

1-20. INDUS VALLEY CIVILIZATION (IVC)

The Indus valley civilization (IVC) was definitely a pre-vedic phenomena and in fact, it is referred to as the *Harappan Civilization* by the archaeologists because Harappa was the first site to be discovered and by convention, the archaeologists use the name of the first site discovered to refer to the entire civilization. The IVC was spread over an area of 13 lakh km^2 i.e., nearly the size of Egypt and Mesopotamia put together. It had a long coast with five ports — Lothal and Kuntasi in India and Bagalkot, Sutka-Gendor and Sutkoh in Pakistan. It has been fairly well established that the IVC originated in the sub-continent near the Indus and not in West Asia.

In all likelihood, the IVC was a political State because a vast civilization like that could not have survived without some central administration. The archaeological evidence suggests that it consisted of four provinces. The central province has Mohanjo-Daro and Harappa as its principal and secondary capitals respectively. In this country of distance, the need for a secondary capital was recognised as far back as the IVC. The eastern, western and southern provinces had their capitals at Kalibangan (now in Punjab), Dabarkot (now in Pakistan) and Lothal (now in Gujarat) respectively. The IVC was perhaps the largest political entity before the advent of the Roman empire.

The IVC originated in the bronze age i.e., when there was no iron. It was also an urban civilization and for an urban civilization to flourish, there needs to be a surplus agricultural production. To create this surplus, it is necessary to have effective agricultural instruments. Without iron, only a wooden plough can be used and a wooden plough can only be effective in soil present in semi-arid conditions. Hence, the site of the IVC near the Indus was eminently appropriate.

The IVC can be identified by what the archaeologists call its *material culture*. It is an assemblage of certain characteristic material objects which constitute a technology and also speak about the minds of their creators. The characteristic objects include clay bangles, bone figurines of women and animals, seals with inscriptions, copper tools, bath tubs, pottery and weights. One very distinctive object is the standardized kiln-burned brick with dimensions in the proportion 1:2:4. This assemblage uniquely identifies the culture of the IVC. On an analysis of the sites and these objects, it becomes clear that other more complex characteristics of the IVC included the capacity for town planning and large scale production.

1-21. MOHANJO-DARO

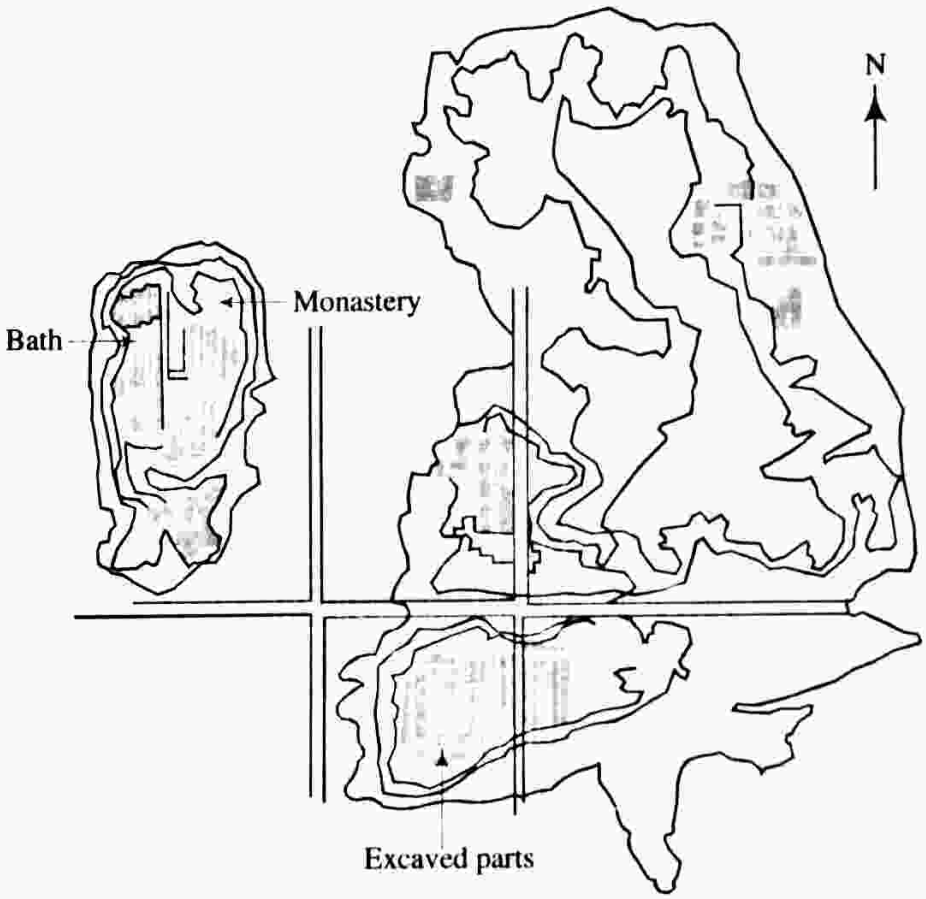
The city Mohanjo-Daro, shown in fig. 1-12, was located in two mounds, one was 1183 m × 546 m and other was 364 m × 273 m.

Its population is estimated as 40000 to 60000. The city was divided in 12 blocks by 9 m wide street. The length and width of each block was 365 m and 244 m respectively. The streets were located as per 'grid iron' plan. All the houses were constructed with brick walls and of varying sizes and storeys. Every house contained central open space, which was surrounded by series of rooms.

There was no direct entry in the houses from main street and there were no windows towards the internal lane. Sufficient roof ventilation was provided for air and light. Every house had one or more decent bathrooms. A common well was provided between the blocks. An effective and sound drainage system was provided on either side of the roads with sufficient numbers of manholes.

The roads were wide. Market halls, granaries, offices, etc., were systematically planned. 7 m wide, 12 m long and 2.4 m deep huge public bath was provided with remarkable system of filling and emptying water. It was made watertight with layers of bitumen and was surrounded by toilets and private baths.

There is nothing on record to show the demise of this outstanding and unparalleled ancient city. There are indications to show that it was gradually abandoned possibly because of a changing climate or as per another prevalent theory, the people of town fled to escape the hordes of Aryan nomads who launched an invasion of the subcontinent from Central Asia in about 1700.



Layout plan of the city Mohanjo-Daro
FIG. 1-12

A number of cultural symbols, practices and even artefacts of the IVC exist today. The worship of the mother-goddess, trees and animals were all adapted by Hinduism. The wearing of bangles, fire altars, the Punjabi tandoor, the bullock cart, etc. are all the objects and traditions of the IVC that even exist in modern age.

1-22. LOTHAL

As a result of an intensive survey in the year between 1953 to 1956, as many as thirty Harappa and post-Harappa sites have been discovered, the earliest among which is at Lothal in Ahmedabad district, near Dholka, Gujarat State. Lothal is the name of a mound in Saragwala village of Dholka district and it is connected by State Transport bus routes and metre gauge railway line. The river Bhogavo flows at a distance of about 3 km from Lothal. The discovery of a full-fledged Harappa settlement at Lothal has made good to India loss of Harappa and Mohanjo-Daro subsequent to partition in 1947.

The discovery of a dock yard measuring about 216 m × 35 m suggests that Lothal must be a very important and flourishing port and as such, this dock is supposed to be the earliest in the world. Several stone anchors used by the sailors are also found in the dock.

A large number of seals and sealings have been recovered at Lothal suggesting that it must have been an important commercial centre. The majority of seals and sealings bear the Indus script and unicorn. From the various structural remains and tools discovered at Lothal, it is inferred that the people of Lothal must have been a peace loving people with the main occupation of agriculture, fishing and trade.

Lothal like any other Harappan settlement is a well-planned township with an elaborate arrangement of public and private drains for carrying sullage water. It contains streets and lanes which connect various blocks, each block having a group of houses built on platforms. There seems to be nine streets, one of which must have been a market lane with shops of bead makers, copper-smiths, etc. The traces of 12 houses with bathrooms standing in straight row have also been found. The intricate system of surface and underground drains reveals a well-planned sewage system with arrangements for easy flow of water in cesspools through small control holes and manholes.

With the above brief description of town planning in ancient India, it is quite clear that efforts were made in ancient India to develop principles and theories of town planning. As times passed, these principles and theories of town planning were modified and re-adjusted to suit the new requirements. In a similar sense, it can be said that the modern town planning is an outcome of ancient town planning with its approach suited to the modern requirements.

1-23. PRESENT POSITION OF PLANNING IN INDIA

It is significant to note that the well-known town planner Sir Patrick Geddes (1854-1932) visited India in 1915 to advise the Governor of Madras, Lord Pentland, on the replanning and redevelopment of some of the old towns. It was owing to his efforts and series of lectures delivered by him in different cities of India that planning was interpreted as not only planning of streets and good houses, but also planning for the people who lived in them, for their economic and social ways and for their ambitions and aspirations. He gave his expert advice for the improvement of about 18 major towns in India. He insisted that a correct diagnosis should be made of evil effects from which the town suffers and then to prescribe the remedies to improve such town. He had successfully overcome the horrors of Edinburgh slums before coming to India.

In India, the various States have passed Town Planning Acts to enforce town planning actions. The main source of all these T.P. Acts is the English Town Planning Act of 1909. The main provision of the English Town Planning Act of 1909 is that local authorities are given power to prepare and to enforce town planning schemes on open lands in the city and on its fringe.

In England, subsequent to T.P. Act of 1909, various amendments and new Acts have been passed, the important one being T.P. Act of 1947. In India, regional and local planning is not practised on a comprehensive basis and as such, town planning process results into acquisition of properties, their valuation for compensation, betterment charges, etc. It is because of such approach of town planning that we have few cities such as New Delhi, Chandigarh (Punjab), Gandhinagar (Gujarat),

Durgapur (West Bengal), Ulhasnagar (Maharastra), etc. which may be called as *planned cities*.

For the purpose of looking after the planning and execution of new cities or new parts within metro-centres, various organizations such as DDA (Delhi Development Authority), CIDCO (City and Industrial Development Corporation), CMPO (Calcutta Metropolitan Planning Organization), HUDCO (Housing and Urban Development Corporation), etc. are set up by the government.

In Gujarat, the Bombay Town Planning Act, 1954 has been replaced by The Gujarat Town Planning and Urban Development Act, 1976. It received the President's assent on 19-6-1976. The former Act was controlling town planning activities within the areas having the jurisdiction of local authorities only. It was felt that if planning activities are undertaken on a more rational and scientific basis with reference to the development of areas within the peripheral limits of cities and towns, it was possible to create better environmental conditions. The present Act seeks to achieve this object in the State of Gujarat.

In addition to local authorities, the State Government is empowered to declare urban development areas and to constitute urban development authorities for such areas. Such authorities are given the following powers as per section 23 of the Act:

(1) To prepare development plans for the urban development area.

(2) To prepare town planning schemes.

(3) To carry out surveys in the urban development area for preparing development plans or town planning schemes.

(4) To guide, direct and assist the local authority or authorities and other statutory authorities functioning in the urban development area in matters pertaining to the planning, development and use of urban land.

(5) To control the development activities in accordance with the development plan in the urban development area.

(6) To execute works in connection with supply of water, disposal of sewage and provision of other services and amenities.

(7) To acquire, hold, manage and dispose off property movable or immovable.

(8) To enter into contracts, agreements or arrangements with any local authority, persons or organizations.

(9) To carry out any development work in the urban development area as may be assigned to it by the State Government from time to time.

(10) To exercise such other powers and perform such other functions as are supplemental, incidental or consequential to any of the foregoing powers and functions as may be directed by the State Government.

We have yet to go a long way in this field of town planning. The State Governments as well as the Central Government will have to take serious steps to make the science of town planning more significant and important to the ordinary layman.

QUESTIONS 1

1. What is meant by the term town planning?
2. Discuss the evolution of planning.
3. What are the objects of town planning?

4. Describe the guiding principles of town planning.
5. Why is town planning necessary?
6. What are the contributing forces for the origin of towns and cities?
7. Discuss the growth of towns according to origin.
8. What is ribbon development? What are its disadvantages?
9. Mention the features of a satellite town.
10. Describe the growth of towns according to direction.
11. What are the advantages and disadvantages of horizontal growth?
12. What are the advantages and disadvantages of vertical growth?
13. Mention the six stages in town development as suggested by Lewis Mumford.
14. Write short notes on:
    (1) Concentric spread
    (2) Primary towns
    (3) Personality of town
    (4) Necropolis
    (5) Country planning
    (6) Cost of town planning
    (7) National planning
    (8) Mohanjo-Daro
    (9) Ribbon development
    (10) Satellite town
    (11) Regional planning
    (12) Lothal
    (13) Requirements of a new town.
15. Mention the four stages through which a town passes as suggested by Griffith Taylor.
16. What are the distinct parts of a town?
17. What are the forms of planning?
18. What are the important features to be considered in the selection of site for an ideal town?
19. What are the requirements of new towns?
20. Discuss how a modern town is planned.
21. Discuss the important differences between a civil town and a military town.
22. Mention the powers required to enforce T.P. schemes.
23. Describe town planning in ancient India with illustrations.
24. Which aspects of town planning are mentioned in 'Mansara Shilpa-shastra'?
25. Mention various types of town plans with neat sketches described in the book 'Mansara Shilpa-shastra'.
26. What were the peculiarities of various town plans mentioned in 'Mansara Shilpa-shastra'?
27. Describe the town planning of Ayodhya and Mohanjo-Daro.
28. Write brief note on Takshashila and Nalanda.
29. Write a critical note on the Indus valley civilization.
30. What is the present position of planning in India?
31. How is growth of town related to means of transport?
32. Explain economic justification of town planning.
33. Why is regional planning necessary?
34. Why would the people like to stay together in urban areas?
35. What are the settlement patterns of the Indian villages?

36. What are the powers given to the urban development authorities?
37. Explain with neat sketch different types of town plans mentioned in 'Mansara Shilpa-shastra'.
38. Differentiate between the following:
    (1) Town planning and architecture
    (2) Green belt and zoning
    (3) Natural growth and planned growth
    (4) Horizontal growth and vertical growth
    (5) Secondary towns and tertiary towns
    (6) Regional planning and national planning
    (7) Topographical features and functional aspects
    (8) Satellite town and parent city
    (9) Megalopolis and tyrannopolis
    (10) Country planning and town planning
    (11) Basic village and town
    (12) Rural town and service town
    (13) Urban area and agricultural area
    (14) Great-city and super-city.
39. Give reasons for the following:
    (1) The town planning is a science as well as an art too.
    (2) A town which is properly planned affords more comforts and conveniences to the public.
    (3) In case of ribbon development, there is lack of social life.
    (4) The problem of ribbon development is very complex.
    (5) A satellite town is neither a village nor a suburb.
    (6) The town planning should be studied from the economic angle with other factors.
    (7) The ribbon development results into a wastage of available resources.
    (8) The ribbon development should not be allowed without the enforcement of certain rules and regulations.
    (9) The horizontal growth will prove to be uneconomical where land values are very high.
    (10) The path of urban growth is not very smooth.
    (11) The growth of town, to a large extent, will depend on the economic forces.
    (12) The towns and cities are not solely products of industrialization.
    (13) The selection of site is the most decisive act in the history of a city or a town.
    (14) The various novel ideas regarding the future towns are predicted by leading architects of the world.
    (15) The three important factors which grant character or personality to a town are pattern, site and situation.
    (16) It is inferred that the people of Lothal must have been a peace loving people with the main occupation of agriculture, fishing and trade.
    (17) In all likelihood, the Indus Valley Civilization (IVC) was a political State.
    (18) Takshashila and Nalanda provide excellent examples of the early university towns in India.

Chapter 2

TOWN PLANNING SURVEYS

2-1. GENERAL

The surveys are carried out by looking for facts already recorded by other investigators and authorities and by original field works on the spot. The latter may be necessary because an item has never been studied before or because facts and figures need to be brought up-to-date. The surveys establish ultimately the present state of the town and indicate the measures for its improvements.

It may be mentioned that the surveys do not necessarily mean the work carried out usually by a land surveyor, namely, measurement of distances, levels and topography. The chief subjects of surveys for the town planning are as follows:

(i) the people, their interests and occupations and how they follow them;

(ii) the land and buildings and how they serve their interests.

The data collected in surveys are properly analysed in relation to the area under consideration and they are recorded on maps, charts, schedules and sometimes on models. The term *civil survey* is sometimes used to refer the planning surveys carried out for re-planning of an existing town.

The pioneering work with respect to the civic survey was carried out by Patrick Geddes (1854-1932). He carried out the civic survey of Edinburgh and prepared reports on Indian towns and villages.

It is said that statistics is an invaluable tool in the hands of a town planner. It is defined as the collection, tabulation and presentation of quantitative data. The town planner, of course, is not expected to be an expert in statistics. But at the same time, he must have an elementary knowledge of statistics so that he is able to find out when the data will be useful, their scope and limitations. The town planner, as such, is very much concerned with prediction i.e., obtaining the desired results or preventing the undesirable ones and the data supplied by statistics help him in a great way to achieve the main aim of town planning.

It must be remembered that a planning survey does not start just of its own accord. It has to be organized with meticulous care from beginning to end and various processes concerned with such a survey are to be suitably collected, processed, arranged and interpreted without bias and with integrity, honestly and objectively. Thus, the essential ingredient of a purposeful planning survey is to arrange the facts of investigation in the best possible scientific manner.

In this chapter, the important aspects connected with the town planning surveys will be discussed.

2-2. NECESSITY OF SURVEY

The two main advantages of a fully documented and vividly illustrated survey are as follows:

(1) The survey draws attention to the inter-relation between various complicated activities of a town life.

(2) The survey stresses the local requirements and appropriate treatment to be given socially, conveniently and artistically. It works as diagnosis before treatment of the disease.

Thus, the role played by survey in the science of town planning is as follows:

(1) to evaluate the effects of development;

(2) to present detailed reasoned reports;

(3) to provide the necessary understanding before decisions for development are made; and

(4) to study the situation objectively and factually.

2-3. COLLECTION OF DATA

Following four surveys are carried out to collect data and other relevant information, required in the process of town planning:

(1) Functional survey

(2) Social survey

(3) Territorial survey

(4) Vital survey.

The type of information collected in each of the above survey will now be briefly described.

(1) Functional survey: The functional aspects of a town life are studied under this survey. The items which are to be included consist of means of communication, conditions of industries and commerce, implementation of the plan and financial aspects of the scheme. The type of information collected in the functional survey can be enlisted as follows:

(i) roads including history of roads, traffic survey, details of width of roads and tree planting;

(ii) railways with positions of level-crossings, passenger stations and goods sheds;

(iii) airports and seaports;

(iv) waterways and canals;

(v) routes of services by bus, tram, ferry and suburban railway;

(vi) facilities provided for access to the town;

(vii) local industries, their classification and location, avai- lability of raw materials and type of labour employed;

(viii) mines and their location;

(ix) conditions of commercial activity; and

(x) probable cost of planning scheme, sources of raising funds, preparing schedule of taxes and chalking out a line of implementation of the scheme,

(2) Social survey: The social aspects of a town life are studied under this survey. The items which are to be included consist of community structure, history, architecture, health conditions, housing and public services.

The type of information collected in the social survey can be enlisted as shown below:

(i) ancient ruins;

(ii) architectural character of the locality including local usages;

(iii) history of growth from the study of old maps;

(iv) conditions favourable for preservation of wild life and spots of natural beauty;

(v) birth rates, death rates and charts of diseases;

(vi) residential areas including historical studies, types of buildings, slums and suburban development;

(vii) historical buildings and public buildings, their location and classification;

(viii) parks and playgrounds, their size and number in relation to the residential areas; and

(ix) public services comprising of water supply, sewerage, drainage, electricity, telephone, street lighting, cemeteries and fire protection.

(3) Territorial survey: The physical aspects of a territory are studied under this survey. The items which are to be included consist of physical features, agricultural soil, forests, climatic conditions and types of soil.

The type of information collected in the territorial survey can be enlisted as follows:

(i) geology showing arrangements of underlying rocks and method responsible for formation of topography;

(ii) contours of the land surface showing both the actual heights and variations of surface;

(iii) rivers, oceans, streams and lakes;

(iv) climatic conditions including temperature range, rainfall and direction and intensity of winds;

(v) types of soil including areas of first class agricultural soil;

(vi) forests and other natural vegetation; and

(vii) areas which are low-lying and are likely to submerge.

(4) Vital survey: The population aspects of the town under consideration are studied under this survey. The items which are to be included consist of actual population, future population, growth of town, density of population and occupations of people.

The type of information collected in the vital survey can be enlisted as follows:

(i) history of the past growth of population;

(ii) characteristics of the present population;

(iii) factors which may influence the future rate of growth of the town such as migration, decentralization, development of new local industries, etc.;

(iv) density of population.

2-4. TYPES OF SURVEYS

The various surveys conducted for town planning schemes can broadly be divided into the following four types:

(1) Preliminary survey
(2) National survey
(3) Regional survey
(4) Civic survey.

Each type of the above survey will now be briefly described.

(1) Preliminary survey: The preliminary survey is in the form of restricted inquiries made for the town planning schemes. The data collected in the preliminary survey are of a fairly general nature and it is the usual practice to conduct the preliminary survey prior to national, regional or civic surveys.

The main object of the preliminary survey is to decide approximately the boundary of area to be planned and to find out the problems requiring further attention. The preliminary survey ascertains the features to be emphasized in planning so as to promote economic stability. The topics which are usually covered in the *preliminary survey* are as follows:

(i) ***Electric power:*** It includes the study of the sources and distribution of power and location of power supply units.

(ii) ***General amenities:*** It includes the study of civic art, parks, playgrounds, etc.

(iii) ***Highways:*** The conditions of the existing roads with respect to their construction and maintenance problems are studied.

(iv) ***Housing:*** It includes the study of the existing housing conditions with respect to lighting, ventilation, sanitation, conveniences and amenities.

(v) ***Industries:*** The industrial development including the arrangement and classification of various industries, location and distribution of the manufacturing units, etc. are considered.

(vi) ***Land use:*** The density and character of structures, divisions and uses of land, etc. are studied.

(vii) ***Railways:*** The existing routes and volume of goods traffic together with the future requirements with the growth of town are considered.

(viii) ***Water supply and sewerage:*** The existing facilities as well as the future requirements are studied.

(ix) ***Waterways:*** It includes the study of the highest water level, yearly and seasonal variations, navigation possibilities, etc.

(2) National survey: A study of national resources and potentialities gives a broad vision for the requirements of town planning schemes. The policies and procedures adopted by nation as a whole affect considerably the proposals of town planning schemes. For instance, if it is decided on a national level that industries should be decentralized, it should be seen while re-planning big cities that there are no additional industries developing in the town. The topics which are usually covered in the *national survey* are as follows:

(i) ***Administration:*** The aspects of land ownership and general administration of the country are considered.

(ii) ***Agriculture:*** It includes the study of type of agricultural soil, the crop patterns and number of crops per year.

(iii) ***Communication facilities:*** The existing modes of transport such as roads, railways, waterways and air routes are studied.

(iv) ***Economic development:*** The overall situation of economic conditions of the nation including availability of raw materials and labour force, types and location of industries, etc. are considered.

(v) ***Geography:*** The geological conditions, the extent of sea coast, etc. are considered.

(vi) ***Natural resources:*** The availability of natural resources in the form of oil, minerals, gas, water, etc. are studied.

(vii) ***Urban settlement:*** It includes the study of distribution and density of population.

(3) Regional survey: The regional survey is conducted on a slightly bigger scale as compared to the civic survey. The purpose of regional survey and civic survey is the same, namely, to investigate the economical, physical and social conditions of the area to be covered up under the town planning schemes.

The investigations made under the regional survey are of general nature. It is quite evident that the town to be planned should fit into the conditions prevailing in the region. The topics to be covered in the regional survey are more or less the same as those of the civic survey.

(4) Civic survey: The civic or town survey is conducted with special reference to the conditions prevailing in and around the town to be planned. The topics which are usually covered in the civic survey are as follows:

(i) ***Communication amenities:*** The means of communication such as roads, railways, airways and waterways are studied together with their inter-relationship. A study of the characteristics of traffic and its density is also made. The study of amount of money and time spent in journey to work is utilized for segregation of traffic, resort to decentralization and recentralization, provision of other means of communication, etc.

(ii) ***Contour:*** The study of contours of the area helps in deciding the gradients of roads, location of waterworks and sewage plants, etc. The information regarding contours of the area is also utilized in the location of public buildings which require commanding sites and of airports which require a levelled ground.

(iii) ***Existing land uses and land values:*** It includes the study of agricultural lands, residential and commercial areas, parks, open spaces, location of airports, etc. The study of land values is useful to get an idea of the compensation required to be paid to private owners for the acquisition of land for public purposes. It also helps in deciding the amount of betterment charges and in getting an overall picture of the financial implications or liabilities in planning a town.

(iv) ***Historical background:*** It includes the study of general historical development of town, present policy of administration, physical and social aspects of the area, etc.

(v) ***Housing:*** The characteristics of houses, distribution and relation of people to houses, etc. are studied.

(vi) ***Industries:*** The character, distribution, types and special requirements of the local industries are studied.

(vii) ***Population:*** It includes the study of the present and future population to be served by the town planning scheme, family structure, density of population, migration tendencies, etc.

(viii) ***Preservation of natural features:*** The buildings, open spaces and spots of natural beauty, which are to be preserved, are considered.

(ix) ***Public buildings:*** It includes the study of buildings to be used by the common people.

(x) ***Public health:*** A study is made of the general health of inhabitants, death rate, causes of special diseases, etc.

(xi) ***Public services:*** A study of the public services such as water supply, sewerage, telephone, gas, electricity, etc. is made.

(xii) ***Topography:*** The topography of the area is studied with reference to climatic conditions, locations of rivers and streams, etc.

2-5. USES OF SURVEYS

The data and information collected during the survey work are useful in the following respects:

(1) To give the town planner some basis for his thinking and working.

(2) To provide the relevant information regarding the community to be served by the town planning scheme.

(3) To suggest the means for developing public opinion and appreciation in favour of the town planning scheme.

2-6. METHODS ADOPTED TO COLLECT DATA

The data and information of various surveys are collected partly by the field work and partly by analysing the reports prepared by other bodies. For this purpose, the youth organizations, social workers, service organizations and similar other voluntary bodies can be contacted with advantage to collect the statistical data of the surveys.

The methods adopted to collect data for the surveys can be summarized as follows:

(1) Collect the data through questionnaire form: A questionnaire form may be prepared and information may be collected by house to house investigation. Alternatively, the questionnaire may be inserted in a local newspaper or journal of any organization or it may be sent out to interested parties and returned by post.

The survey is speedier and cheap and it is possible to have an extensive coverage at a low total cost. The questions should be simple and self-explanatory and as far as possible, ambiguity should be avoided.

The element of non-response should be reduced to a minimum by taking suitable measures. For instance, a forwarding letter indicating the purpose of survey accompanied by a stamped addressed envelop will encourage the respondent to reply immediately. The questionnaire should be standardized and it should be short, presented in a pleasing manner and avoid the duplication of questions. If there is too much non-response, second, third and fourth copies of the questionnaire can be despatched in the form of reminders.

(2) Collect the data through interviews: The interviews may be arranged with individuals or organizations having special knowledge in specific fields. The interviews will vary substantially according to the type of person or organization

being interviewed. The most frequent form of conducting an interview is by personal contact. But in advanced countries, it can be conducted over telephones. The personal contact enables the purpose of the survey to be explained fully and questions can be framed to suit the knowledge of the person being interviewed. However, the interviews are costly because of time and travelling expenses involved in the process.

(3) Collect the data through specialists: The specialists may be employed in some cases to supply the information on topics relating to their work.

(4) Collect the data through various records: The records and reports maintained by the government offices, police department, municipal offices, revenue department, etc. can be studied and analysed.

(5) Collect the data through town planner: The town planner himself carries out surveys and collects the necessary information on spot examination with the help of his staff. The observation can be carried out for many subjects such as physical potential of land for building purposes, generation of traffic, etc. The observation and recording of data in a field note-book are carefully carried out by the town planner. It is not merely a casual inspection, but the objects are viewed critically and accurately and all the details are fully recorded without leaving any aspect to memory.

2-7. DRAWINGS

The data and information collected in survey work are assembled and illustrated on maps, drawings, charts and diagrams. The preparation of drawings helps in the following two ways:

(1) The task of the town planner of designing the future town becomes easier.

(2) The final proposals of the town planner are to be accepted by people in general and by the authorities in particular. The representation of such proposals on drawings assists in easy understanding of the ideas of the town planner.

The maps and drawings may be prepared in convenient sizes and standard scales, colours and symbols may be framed to have uniformity in the work. The number and type of drawings to be prepared will depend upon the nature of work and data collected. In general, the following drawings are prepared:

(i) Contour map showing contours at suitable vertical intervals of say 2 m to 3 m.

(ii) Land use map showing the existing uses of land and broad features of the town such as parks, built-up areas, open spaces, etc.

(iii) Net population density map showing density of population per hectare.

(iv) Programme map of town showing development in first five years and also subsequent developments.

(v) Town map showing proposals of different zones.

2-8. REPORT

The drawings are accompanied by a detailed report on the proposed town planning scheme and if necessary, the models of some specific proposals included in the scheme are prepared to express the ideas of the town planner. The report contains the arguments in favour of the proposed scheme and it mentions the advantages and results of the proposed scheme.

The contents of the report prove useful to the authorities to give their approval and also to develop public opinion in favour of the proposed scheme. The implementation of the scheme starts after the report is accepted by the concerned authorities.

QUESTIONS 2

1. Why are surveys carried out? What are the chief subjects of surveys?
2. Describe the surveys which are carried out to collect data.
3. What is the type of information collected in functional survey?
4. Mention the information collected in social survey.
5. What is a preliminary survey? What are the usual topics covered in it?
6. Why is a national survey necessary? Mention the topics which are usually covered in it.
7. What is a town survey? What are the usual topics covered in it?
8. Write short notes on:
   (1) Territorial survey
   (2) Uses of surveys
   (3) Report on survey work
   (4) Regional survey
   (5) Civic survey
   (6) Social survey
   (7) Preliminary survey
   (8) Vital survey
   (9) National survey
   (10) Functional survey.
9. What are the methods adopted for the collection of data in surveys?
10. Why are drawings to be prepared? What are the usual drawings prepared?
11. Differentiate between the following:
   (1) Social survey and vital survey
   (2) Regional survey and civic survey
   (3) National survey and preliminary survey
   (4) Functional survey and territorial survey
   (5) Questionnaire form and personal interview.
12. Give reasons for the following:
   (1) The contours of the area are to be studied.
   (2) It is necessary to study the land values of the area.
   (3) A study of national resources and potentialities gives a broad vision for the requirements of town planning schemes.
   (4) The surveys are carried out by original field works on the spot.
   (5) It is necessary to carry out a fully documented and vividly illustrated survey for the purpose of any town planning scheme.
   (6) The preliminary survey is in the form of restricted inquiries made for the town planning schemes.
   (7) The data and information collected in survey work are assembled and illustrated on maps, drawings, charts and diagrams.
   (8) A detailed report and models of some of the specific proposals in the proposed scheme usually accompany the proposed town planning scheme when it is sent for approval of the concerned authorities.
   (9) It is said that statistics is an invaluable tool in the hands of a town planner.
   (10) A planning survey does not start just of its own accord.

Chapter 3

ZONING

3-1. MEANING OF THE TERM

The term *zoning*, as understood in town planning sense, is used to include two aspects of planning, namely,

(i) allocation of land for specific purposes and

(ii) control of the use, height and construction of the buildings.

The latter aspect automatically leads to the regulation of density of population.

Thus, the zoning is defined as the regulation by law of the use of land and (or) buildings and of the height and density of buildings in specific areas for the purpose of securing convenience, health, safety and general welfare of the community.

According to G. K. Hiraskar the zoning is defined as process of making sections or division of city areas in different zones, to control the incompatible land uses and prevent the misuse of land and buildings heights and densities of population at the initial stages.

According to Mr. Trevor Whitley who describes zoning in the Encyclopedia of Urban Planning as the division of community into zones/districts as per present and potential use of properties for controlling and directing their land use and development of the city.

According to W. PAUL Farmer and Julie A. Gibb, the Zoning is the division of land according to building Design and use.

The distinction between zoning and reservation should be clearly understood. The zoning is applied to certain types of general uses. The term *reservation* is confined to the uses of specific nature such as reservation for gardens, schools, markets, police stations, fire-brigade stations, parks, playgrounds, etc.

In a similar way, the distinction between zoning regulations and structural regulations should also be noted. The zoning regulations are meant for the use of character, height and density of buildings and they prescribe how each parcel of land in a community may be put to use. The structural regulations impose restrictions on the building materials and workmanship in the form of specifications of the work.

The zoning has been adopted by most of the countries of the world such as West Germany, England, America, Russia, Japan, Sweden, France, etc. In India also, some of the local authorities enjoy the zoning powers.

In this chapter, the topic of zoning as related to the town planning will be discussed.

3-2 HISTORY OF ZONING

The first modern zoning ordinance was developed in New York City in 1916. It was legally enforced in 1962 when U.S. Supreme Court considered the legality of comprehensive zoning controls. By the year 1930, several hundred localities had established their own zoning ordinances throughout USA.

3-3. USES OF LAND

The uses of land in town planning can broadly be classified into the following two categories:

(1) Profit-making uses of land

(2) Non-profit-making uses of land.

(1) Profit-making uses of land: The land which is developed with profit-making motive is said to be used for profit-making and the sites developed for offices, residences, industries, etc. are the examples of profit-making uses of land.

(2) Non-profit-making uses of land: The land which is developed without any motive of profit-making is said to be used for non-profit-making and it includes roads, parks, playgrounds, educational buildings, government offices, etc. The main non-profit-making use in urban area will naturally be the roads.

The relationship between profit-making use of land and non-profit-making use of land should be noted. The profitable uses of land are highly dependent on the non-profit uses of land. Alter the latter and the former will also be altered. One cannot take the profit uses as given and plan the non-profit uses, especially road system, accordingly because the alteration of the road system will react on the pattern of profit uses and alter it. Thus, the land used for shops, offices, industries, residences, etc. is dependent on land being used for schools, parks, hospitals, roads, etc. Without these non-profit uses of land, the return on the profit-making uses would be greatly reduced.

Usually, the non-profit-making uses of land pass into public control and profit-making uses are controlled by the private agencies. Hence, the non-profit-making land and profit-making land roughly correspond to the public and private uses of the urban land respectively.

One another distinction can be made between profit-making use of land and non-profit-making use of land. In the former case, it is possible to work out the return on investment by estimating the profitability of the use. In the latter case, it is not possible to estimate the return on investment with reference to the criteria of profit and hence, with non-profit uses, the return is to be calculated in relation to the benefits received by members of the community.

3-4. OBJECTS OF ZONING

The *objects* or *purposes* of zoning are as follows:

(1) The town planner gets ample opportunities for designing the future growth and development of the town. The zoning serves as a main tool to the town planner to achieve his goal.

(2) The zoning affords proper co-ordination of various public amenities such as transport facilities, water supply, drainage, electric power, etc.

(3) The zoning proves to be an effective instrument in the hands of the town planner for making any town planning scheme effective and successful.

Following are four major objectives of zoning :

(i) To conserve the value of its properties.

(ii) To assure orderly community growth.

(iii) To safeguard general public welfare.

(iv) To establish regulations which provides locations for all essential uses of land and buildings and to ensure that each use is located at most appropriate place.

3-5. PRINCIPLES OF ZONING

The main principles of zoning can be briefly summarized as follows:

(1) Arrangement of zones: The usual pattern of zones is in the form of concentric bands. The central area of the town is followed by sub-central area, intermediate area and undeveloped area. The other pattern of zones would be to provide blocks or units for various uses in different parts of the town.

(2) Boundaries: The design of boundaries for different zones should be carefully made. A street or a road usually does not provide a suitable boundary. A railway line or a park or an open green space may prove to be satisfactory boundary.

(3) Existing towns: When zoning is to be applied to an existing town, the information regarding the existing use of land is gathered and as far as possible, the town is divided into zones by considering the pre-dominant use in particular areas. However, the existing use of land can only be altered, if there are substantial grounds to justify such alteration.

(4) Flexibility: The principles of zoning may be rigidly enforced. But at the same time, care should be taken to observe flexibility in working out the details for zoning. For instance, homes should be very near to places of work to reduce time and cost of travel. But at the same time, they should not be too near to be disliked by the inhabitants for residence. Similarly, the small shopping centres for day-to-day requirements should be allowed in residential zone.

(5) New towns: For designing a new town of known population, the areas required for residence, industry and business are worked out with the help of suitable methods. The town is then divided into suitable zones.

3-6. ADVANTAGES OF ZONING

Following are the advantages of zoning:

(1) Danger from fire: The zoning results into minimum chances of fire occurrence and consequently, the damages due to fire are brought down to the minimum level.

(2) Future development: If zoning is adopted, it results into controlled future development of the town with proper regard to the community welfare as main criteria.

(3) General amenities: The zoning provides for general amenities such as parks, playgrounds, cinemas, shopping centres, schools, etc. in their proper surroundings and it avoids undue wastage of time, money and space.

(4) Health of community: If zoning is properly done, it results in considerable improvement of health of the community as a whole. The zoning prevents the invasion of undesirable industries on the residential areas. Thus, the harmful gases and odours are prevented from entering or attacking the residential area by the force of wind.

(5) Population distribution: The zoning regulates the density of population and there is no undue concentration of population in any part of the town.

(6) Public utility services: The zoning permits the economic use of various public utility services such as water supply, drainage lines, telephones, etc.

In general, it may be stated that the zoning promotes health, safety, prosperity, orderly development and overall welfare of the community.

3-7. IMPORTANCE OF ZONING

The importance of zoning has been recognized during the last century as a major measure to control and to regulate uses of land. The zoning proves to be essential and fundamental to evolve comprehensive town planning and because of this fact, it is accommodated in present times in the planning legislation of most of the countries of the world.

It should be remembered that the results of zoning are not immediate and it cannot immediately cure the disease of an area which has been developed in a disorderly way with the whims and ideas of individual owners. But if provisions made in zoning are sincerely implemented, it can certainly arrest the future decay of the area and can avoid further future complications in respect of town life. The zoning guarantees that the future development of the town will be in accordance with the zoning plan which has been devised to serve the welfare of the community in the best possible manner.

Some of the illustrations showing the undesirable situations which might develop in the absence of zoning are as follows:

(1) The big apartment flats of considerable height may be constructed very near to small cottages or houses and thereby, they considerably cause loss of light and air for the surrounding structures.

(2) The development of centres of public interest may take place at random without any considerations of their surroundings and hence, their functioning results into wastage of time, money and space.

(3) The public amenities may be provided as the need arises and ultimately, a time may come when it becomes either too costly or practically impossible to alter or to modify such amenities.

(4) The unsightly factories giving obnoxious gases and untimely noises invade the residential area of the town and by the way of their working, they make the residential area unfit for living.

3-8. ASPECTS OF ZONING

The zoning is related to the following three important aspects:

(1) Density zoning

(2) Height zoning

(3) Use zoning.

Each of the above aspect of zoning will now be briefly described.

(1) Density zoning: In density zoning, the density of population in the residential areas is controlled by means of suitable rules and regulations. It is quite evident that it is not practicable to restrict the number of persons from occupying any residential unit.

Hence, the following indirect measures are adopted to have effective density zoning:

(i) The front, side and rear margins from the boundaries are specified.

(ii) The maximum height of the building is specified.

(iii) The minimum size of allotment for each house is specified.

(iv) The number of houses per unit area is limited.

(v) The ratio of total site area to the total built-up floor area is specified.

The density of population per unit area may either be expressed as gross density or net density. The gross density is defined as the average density of population per unit area of the whole residential zone. The net density is defined as the average density of population per unit of the housing area including local roads only and excluding open spaces, public institutions, shopping centres, etc.

The advantages of density zoning are as follows:

(i) In general, it facilitates the proper layout and designing of various public amenities and services.

(ii) It ensures enough light and ventilation to the residences and hence, healthy conditions are established for the inhabitants.

(iii) It results into absence of over-crowding.

(iv) The land values are stabilized.

(2) Height zoning: The height zoning aims at controlling the height of buildings with due consideration of the following two factors:

(i) bulk or cubical contents of the buildings; and

(ii) street width and other adjacent marginal open spaces from the point of view of provision for light and ventilation.

In the first 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 i.e., $\left(\frac{1}{3} \times \text{area} \times \text{height}\right)$. The concept of floor space index (F.S.I.) is adopted at present to control the total built-up area of the building in relation to the open plot area.

In the second case, the height of building is limited by drawing a light plane at an angle of 45° or 63.50° to the horizontal, the latter being very common as it gives the ratio of height to width of road as 2:1.

The restriction on height of buildings will depend on nature of building, type of zone and climatic conditions.

The height zoning affords the following advantages:

(i) It controls the development of central business area of the cities and it thereby assists in solving the problems associated with such heavy concentration e.g. traffic congestion, etc.

(ii) It is found that if buildings with uniform height are constructed on important streets or roads, it gives pleasing aesthetic appearance.

(iii) It prevents an undue monopoly of light and ventilation by some tall buildings at the expense of adjacent units of small heights.

(iv) The land values are not allowed to go up very high in certain favoured areas only.

The main objects of height zoning are two, namely, to supply enough daylight to the buildings and to cause reasonable traffic movement. To achieve these objects, the town planner has two options, namely, either to allow buildings of moderate heights or to maintain more space between the buildings. The latter arrangement was advocated by the great architect Le Corbusier and such an arrangement would result into a city of towers.

Both the alternatives would prove effective in controlling density of population. The former arrangement would result in streets with normal widths and buildings of relatively low heights. The latter arrangement would result in tower-like structures with wide roads. The choice then is to be made by the authorities concerned.

(3) Use zoning: This is rather the most important aspect of zoning and it defines the uses to which various parts of the town will be put. The zones are usually classified into the following six categories with suitable sub-divisions in each zone:

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

The usual percentage of each zone in a normal town varies as follows:

Residential zone ..... 40% to 50%
Commercial zone..... 2% to 5%
Industrial zone ..... 2% to 25%
Recreational zone ..... 15% to 20%
Institutional zone ..... 1% to 2%
Civic zone ..... 2% to 3%.

Each of the above zone will now be briefly described.

(i) **Residential zone:** The character and location of this zone will depend on various factors such as nearness to the markets; freedom from nuisance, noise and smoke; nearness to parks and playgrounds; etc.

The buildings may be classified as detached houses, semi-detached houses, row of houses, flats and skyscrapers and accordingly, the residential zone may suitably be sub-divided. In fact, this is the largest zone in size and it includes all types of housing and a system of urban streets which provide residents the easy and convenient access to places of work, cultural centres, service establishments, etc.

The residential zone should be located windward and upstream with respect to the industrial zone. The territory of residential zone should provide good healthy site from the view point of hygienic and sanitary requirements.

(ii) ***Commercial zone:*** This zone should be near the centres of traffic and preferably it should abut the roads. It includes the uses of land for banks, offices, godowns, shops, etc.

(iii) ***Industrial zone:*** Great care should be exercised in providing units of industrial zone in various parts of the town. The light industries and factories running on electric power and causing no nuisance to nearby areas may be allowed to be set close to residential zone. On the other hand, the heavy industries giving out obnoxious gases and fumes and developing noisy atmosphere may be placed on the outskirts of the town. In a similar way, the minor industries such as laundries, bakeries, dairies, etc. should be grouped and placed in such a way that they are able to serve the surrounding areas in the best possible manner. The special industries producing undesirable trade wastes and by-products may be located far away from town in spacious grounds.

It should also be seen that the industrial enterprises having a large freight turnover are located in such a way that they have easy access to railway main lines or ports.

(iv) ***Recreational zone:*** This zone includes mainly parks and playgrounds and in a broad sense, it may be considered to include various recreational centres such as cinemas, theatres, town halls, clubs, libraries, restaurants, stadium and other community needs. The various units of recreational zone are scattered throughout the plan of town.

(v) ***Institutional zone:*** This zone contains schools, college, university and other research institutes etc. It is located in a quite zone.

(vi) ***Civic zone:*** This zone contains all public building i.e. town hall, courts, libraries, post office, museum, auditoriums, banks etc. and housing for employees working there. These buildings should be located in such a way that public access could be easier.

For the purpose of achieving use zoning, a schedule is prepared giving names of zones and various names of structures which might be permitted in any particular zone. The location of zones is shown on the plan in different colours. The purposes for which buildings or works are to be constructed or are to be prohibited are well-defined in the various columns of the schedule.

The *advantages* of use zoning are as follows:

(i) Each zone permits the best use of land for which it is reserved. For instance, the location of industrial zone would be such that it will result in assisting to bring down the cost of production.

(ii) It enables the proper selection of sites for various community needs such as schools, parks, playgrounds, hospitals, colleges, etc.

(iii) It is possible to accurately determine in advance the required size of transport facilities and other public amenities.

(iv) It results into the stabilization of land values.

(v) The unnecessary intrusion of factories and industries on the residential areas is avoided and thus, the residential areas remain free from traffic congestion, untimely noises and obnoxious smells.

3-9. ZONAL PLAN FOR MILITARY TOWNS

The acquisition of adequate land is made to accommodate the number and types of units to be located in a military town. A zonal plan is then evolved to select most suitable places for:

(1) to learn and train;

(2) to live and work; and

(3) to play and relax.

The detailed zoning for a military town takes into consideration the following factors:

(i) conservation of environment,

(ii) functional grouping of major and other allied sub-units,

(iii) location of units generating noise, smoke, smell, etc. to minimize environmental ill effects,

(iv) minimum distance between the place of work, residential zones and central amenities,

(v) road circulation pattern,

(vi) store holding units along peripherial roads,

(vii) zones for the bulk external services, etc.

3-10. TRANSITION ZONE

In order to have a smooth change from one zone to another, a transition zone is sometimes accommodated in zoning. The transition zone links up the adjoining zones and forms a boundary where one zone ends and the other starts.

The two important facts to be remembered in case of transition zone are as shown below:

(1) As far as possible, the type of development which may either be residential. commercial or industrial on the opposite side of the street should be similar and the zones should be bounded by boundary line of plots and not by streets.

(2) The zoning transition is always thought of as progressing from completely occupied and dense areas towards the more open area of the outer portions or from higher buildings to buildings of low heights.

3-11. ECONOMY OF ZONING

One of the virtues of zoning is that great improvements could be done without serious financial liabilities on the part of tax-payers, if zones are pre-planned. Of course, considerable amount of money will be required for land acquisition. road improvements and various other aspects of the implementation of town planning schemes.

But the same can be minimized and the extra costs which might result due to changes, additions, alterations and modifications after the town has been developed without zoning, can certainly be avoided.

It may further be noted that zoning indirectly helps in reducing costs because the use of land is known definitely and hence, sewer lines, water lines and various other public services required for the town life can be designed and laid in the best efficient way.

The zoning is essential also as the basis for economy in carrying out all site planning work and local development schemes.

3-12. ZONING POWERS

To enforce the rules and regulations contained in zone plan of the town, the local authorities will have to be given the required powers. Such powers may include acquisition of privately owned lands, approval of plans of the proposed structures, supervision of the activities of the occupants of structures, prohibiting the undesirable use of land, etc.

In general, it can be stated that zoning regulations are meant to improve health, welfare and convenience of the community as a whole. In India, some of the local authorities enjoy certain restricted powers with respect to enforcement of the zoning regulations. If better results from zoning are to be expected, these powers are to be revised and elevated on liberal scale.

3-13. MAPS FOR ZONING

Before zoning is undertaken, the town planner should be supplied with necessary comprehensive survey maps which include:

(1) The map showing the existing use of land marked in different colours such as residential, commercial, industrial, etc. should be prepared. The map should also show the portions of detached houses, semi-detached houses, flats and apartment houses and commercial-cum-residential buildings, etc. It should be also marked on the map the position of all manufacturing plants, public properties, parks, playgrounds, institutions, etc.

(2) The map showing density of population in different areas of the town and expressed either as houses per unit area or number of persons per unit area or number of families per unit area should be prepared.

(3) The map showing land values in the different sections of the town should be prepared.

(4) The map showing the details gathered from traffic survey should be prepared.

QUESTIONS 3

1. What is meant by the term zoning?
2. What are the objects of zoning?
3. Mention the main principles of zoning.
4. What are the advantages of zoning?
5. Explain the importance of zoning with illustrations.
6. What is density zoning? What are its advantages?
7. What are the advantages and objects of height zoning?

8. Discuss in detail use zoning.
9. What are the factors to be considered for the detailed zoning for a military town?
10. Write short notes on:
    (1) Aspects of zoning
    (2) Industrial zone
    (3) Recreational zone
    (4) Zonal plan for military towns
    (5) Transition zone
    (6) Economy of zoning
    (7) Zoning powers.
11. What are the maps required for zoning?
12. Differentiate between the following:
    (1) Zoning and reservation
    (2) Zoning regulations and structural regulations
    (3) Density zoning and height zoning
    (4) Residential zone and commercial zone
    (5) Gross density of population and net density of population
    (6) Profit-making and non-profit-making uses of land.
13. Give reasons for the following:
    (1) Care should be taken to observe flexibility in working out the details for zoning.
    (2) The zoning is accommodated in present times in planning legislation of most of the countries.
    (3) If zoning is properly done, it results in considerable improvement of health of the community as a whole.
    (4) Great care should be exercised in providing units of industrial zone in various parts of the town.
    (5) The zoning indirectly helps in reducing costs.
    (6) The zoning serves as a main tool to the town planner to achieve his goal.
    (7) The results of zoning are not immediate.
    (8) When zoning is adopted, the residential area remains free from traffic congestion, untimely noises and obnoxious smells.
    (9) A transition zone is sometimes accommodated in zoning.
    (10) The local authorities will have to be given the zoning powers.
    (11) The profitable uses of land are highly dependent on the non-profit uses of land.
    (12) The non-profit-making land and profit-making land roughly correspond to public and private uses of urban land respectively.

Chapter 4 HOUSING

4-1. GENERAL

The provision of good housing in any town planning scheme is desirable and it is to be accomplished by various means and measures. It has been well established that the Industrial Revolution of the last century is not the only factor in developing slums. As a matter of fact, the poor class of people is not allowed the benefit of good housing from time immemorial. Such unhealthy and ugly scenes of houses for the unfortunate led to the awakening of public opinion in the nineteenth century and in the twentieth century and because of the pressure of public opinion, the authorities concerned have started to accept the responsibility of providing good housing to those who are economically unable to provide for themselves.

It is not enough to provide structurally stable structures as houses. But they must be so located and designed that they afford convenience, amenity, health and social life to the community. A house in a general sense represents the smallest unit from where the town planning scheme emerges. The success or failure of all the town planning schemes rests on effective provision of housing for the population to be served by the town planning schemes.

It is said quite often that the town planner is concerned with the housing problem of the poor class or low paid workers. In general sense, this may be true. But at the same time, it should be remembered that town planning also aims to have some control for houses of moderate and rich people. The good housing reflects the general welfare of the community. The bad housing, on the other hand, leads to serious consequences such as diseases, immorality and juvenile delinquency.

In this chapter, the relevant aspects of the housing will be discussed.

4-2. IMPORTANCE OF HOUSING

A house is defined by the National Building Organization as a pucca or semi-pucca unit of dwelling that can accommodate an average household. The houses are useful in various ways. It is a place where one can take rest, sleep and cook food. It can also be used as shop or working place or for conducting business of any kind. The executives or officers of big concerns bring their routine work at home and can get it done at night. A significant fraction of recreational activities is being brought into the house in modern time by television, recorded music, radio, etc. As a matter of fact, a house is part and parcel of man's life and substantial part of man's life-time is spent in his house.

The economic importance of housing is also very significant. It contributes to national income, national wealth and national employment. It also serves as a good source of revenue for Central, State and Local Governments.

In general, it can be stated that the housing has potentiality to a great extent in promoting human welfare, social life, economic growth, health of community and various other related aspects of human life.

4-3. DEMAND FOR HOUSES

The house is the first unit of society and it is the primary unit of human habitation. The house is built to grant protection against wind and weather and to give insurance against physical insecurity of all kinds. As a matter of fact, the house has come to occupy an increasing role as a framework of family and social life. The housing, next to food and clothing, satisfies one of the basic needs of man. However, the following are the three peculiar constraints to the housing commodity:

(1) Immobility: Unlike food and clothing, the housing is immobile. With the more development of transport and trade and improved methods of cultivation and production, the problems of food and clothing can be easily tackled. Such is not the case with housing problem. As a matter of fact, the development of transport and trade has little impact on the housing problem.

(2) Initial investment: As compared to food and clothing, the housing requires heavy initial investment and because of this factor, the housing becomes an empty dream for many persons.

(3) Other problems: The housing problem also attracts the solution of several other factors such as transport, finance, taxation, building industry, population, land policy, etc.

The housing activity is doubly blessed, namely, it gives somebody a roof to live under and it serves as a source of income to the labour used in its construction. The special feature of the demand for housing consists in its unique nature and the demand for houses depends on the following factors:

(i) availability of cheap finance;
(ii) availability of skilled labour;
(iii) available transport facilities;
(iv) cost of labour and materials of construction;
(v) predictions of future demand;
(vi) rate of interest on investment e.g. low rates of interest with facilities of long term repayment may facilitate investment in housing;
(vii) rate of population growth and urbanization;
(viii) supply of developed plots at reasonable prices;
(ix) taxation policy on real estates;
(x) town planning and environmental conditions; etc.

4-4. BUILDING SITE

In most of the cases, a number of building sites will be available. It is extremely necessary to select a proper site for the proposed housing scheme. The relative merits and demerits of all the available building sites should be studied and then

only a final choice on building site affording the maximum advantages should be made. The factors to be considered while selecting the building site are as follows:

(1) access to parks and playgrounds;
(2) agricultural potentiality of the land;
(3) availability of public utility services, especially water, electricity and sewage disposal;
(4) contour of land in relation to the building costs;
(5) cost of land;
(6) distance from places of work;
(7) ease of drainage;
(8) location with respect to schools, colleges and public buildings;
(9) nature of use of adjacent areas;
(10) transport facilities;
(11) wind, velocity and direction; etc.

4-5. REQUIREMENTS OF RESIDENTIAL BUILDINGS

A good residential building satisfies the requirements of its inhabitants in the best possible manner. The requirements of residential buildings can briefly be summarized as follows:

(1) Height: It is desirable that the height of the building should be in proportion with the width of road or street.

(2) Location: The residential buildings should be located in such a way that freedom from nuisances such as dust, noise, smoke and smell is guaranteed. Further, the location of the building should be near to means of transport, markets, schools, hospitals, etc.

(3) Orientation: The building should be suitably oriented with respect to rain, sun and wind.

(4) Parks: The buildings should be located near to parks and playgrounds and it should be possible for the children to reach to the parks without crossing main roads.

(5) Privacy: The overall design of the building should be such that it affords maximum privacy to its users. It is desirable to provide the feature of privacy in the design of a building even at the sacrifice of some architectural need.

(6) Security: The construction of the building should be such that it affords safety and security against theft and fire. If possible, it should contain a strong room for the storage of valuables.

(7) Space: The floor space as well as the total cubical contents of the building should be in proportion with the number of persons likely to use the building. According to one standard, the floor area and cubical contents per member should respectively be at least 4.65 m^2 and 8.50 m^3.

(8) Utility services: The building should be provided with electricity, water and drainage facilities at reasonable costs.

(9) Ventilation: The rooms of the buildings should be fully ventilated. Each room should get enough air and light.

4-6. CLASSIFICATION OF RESIDENTIAL BUILDINGS

The residential buildings may broadly be classified in five categories as follows:

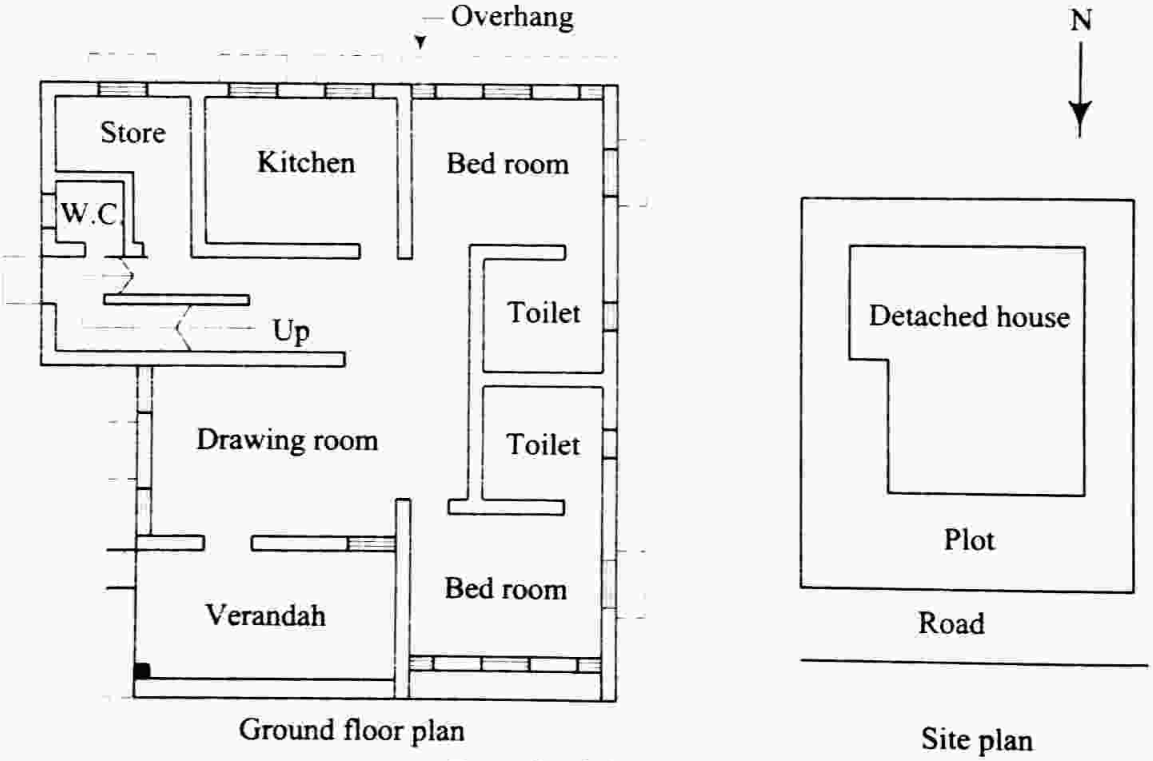
(1) Detached houses (4) Apartments or flats

(2) Semi-detached houses (5) Skyscrapers.

(3) Row of houses

The house may consist of a single tenement or a number of tenements. It should be noted that in housing parlance, a tenement means a family unit. Each category of residential building will now be briefly described.

(1) Detached houses: It is the usual tendency of any family to have a house surrounded by its own land. This has led to the formation of detached houses. The design of a detached house can be made by considering the individual requirements of the family to be accommodated in that house. Sufficient margins are left on sides, front and rear. It may also include amenities such as private garden, swimming pool, etc. A detached house permits the highest form of residence and it is applicable at places where land prices are comparatively low. Refer to fig. 4-1.

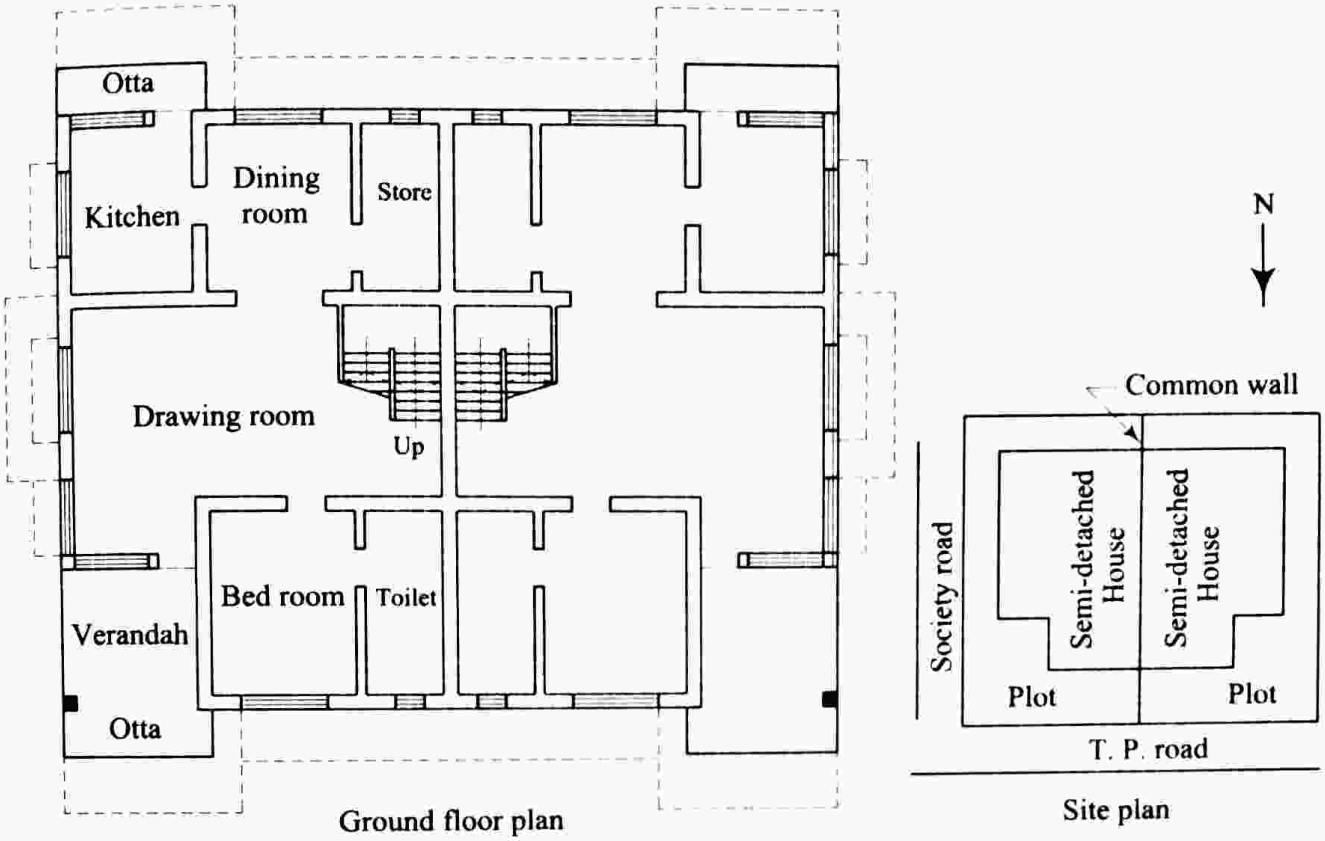


Detached house

FIG. 4-1

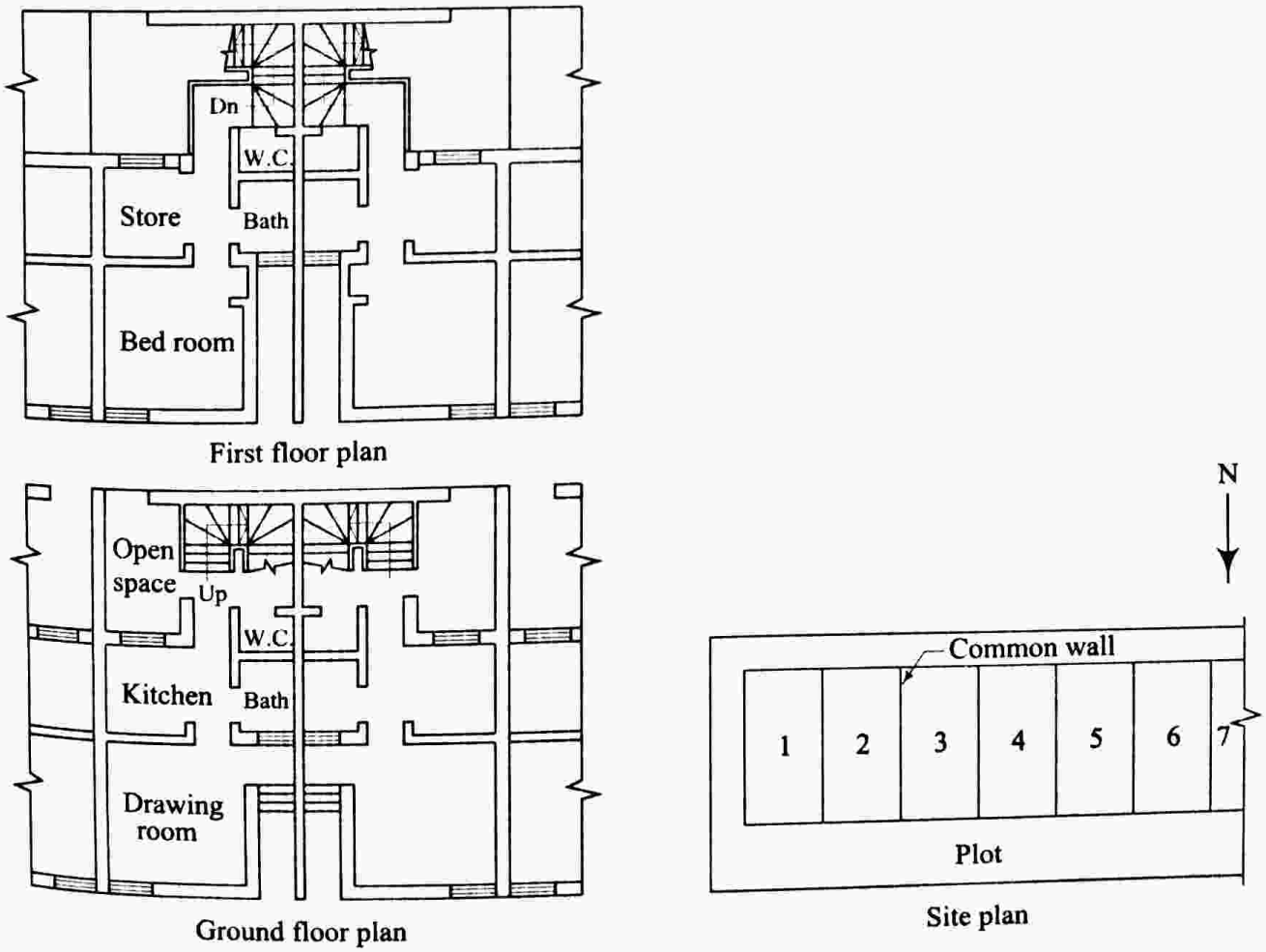
(2) Semi-detached houses: A common boundary wall in the form of structural barrier divides an independent plot into two units. Such a construction helps in securing many advantages of the detached type of houses and in addition, economy may be achieved by sharing expenses of common amenities such as water lines, drainage lines, electric cables, etc. Refer to fig. 4-2.

(3) Row of houses: For providing reasonable accommodation to the labourers or workers, a row of houses with minimum requirements such as living room and kitchen, may be constructed. It may be single-storeyed or two-storeyed. The row-housing yields more net residential density and it is preferred for the low-income group of families. Refer to fig. 4-3.



Semi-detached house

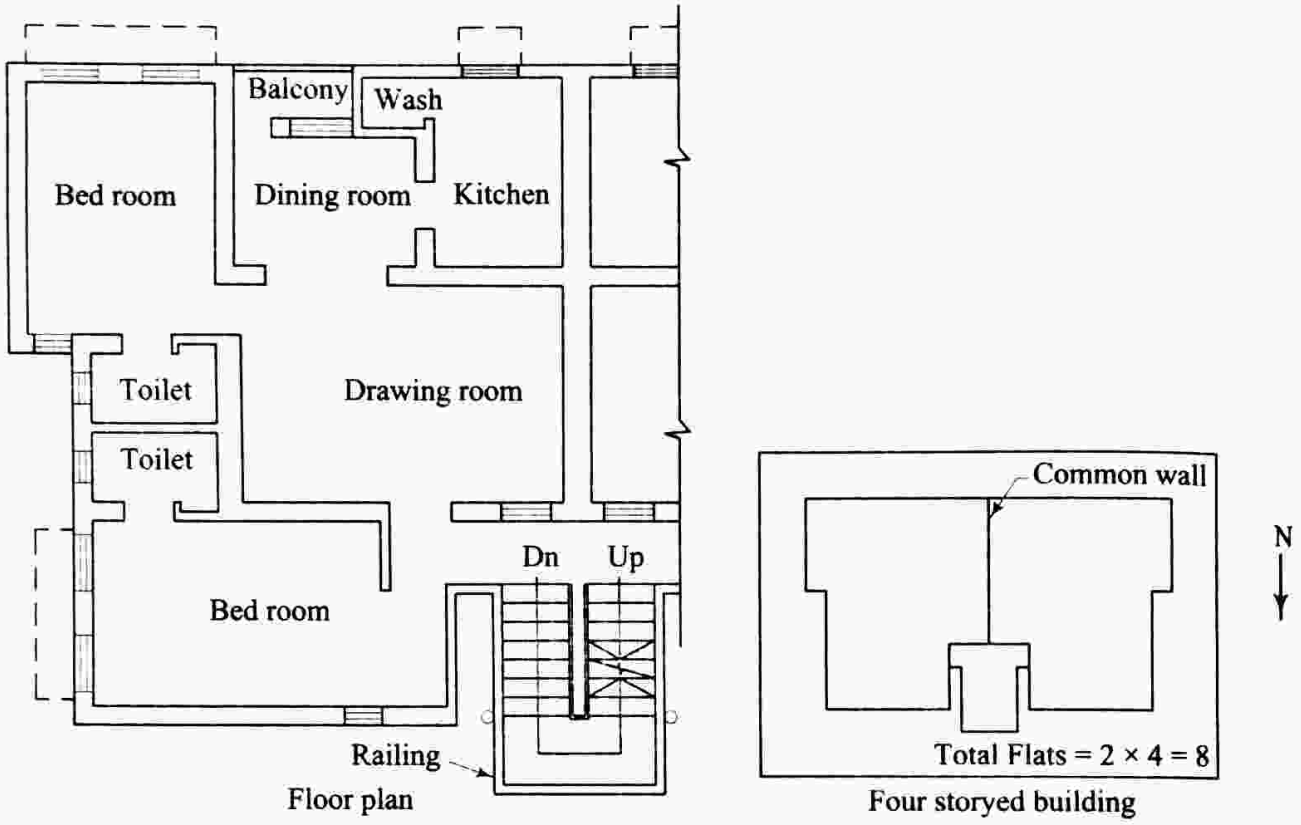
FIG. 4-2



Row houses

FIG. 4-3

(4) Apartments or flats: Due to tendency of migration by village population to cities, there is considerable rise in the price of city land and hence, it has become practically impossible even for the higher class of the society to have a detached house in a thickly populated city area. This has led to the conception of apartments or flats.



Apartment or flat

FIG. 4-4

An apartment or a flat consists of three to ten storeys and each floor or storey may accommodate two to four tenements. The idea of ownership flats is becoming popular day by day in big cities. The land and other common amenities appurtenant to flat are shared by all the occupants. The individual flat owner has no future scope either of vertical or horizontal expansion.

(5) Skyscrapers: The growing need of land and consequently sudden shooting rise in price of land in big cities further led to the conception of multi-storeyed buildings or as they are popularly known as *skyscraperes*. As it always happens, the subject of skyscrapers is also divided between two schools of thoughts. Some town planners favour the idea of skyscrapers while others do not agree on this point. Many seminars and discussions have been arranged on this topic and experts from various fields of community life have participated in such debates.

The arguments for and against the skyscrapers may briefly be mentioned as follows:

Arguments for:

(i) It gives sunlight and pure air to the residents and gives them relief against noise nuisance.

(ii) It is a remunerative or paying proposition.

(iii) It permits more open space around the building and this open space can be used for various purposes such as tennis court, swimming pool, badminton court, recreation area, etc.

(iv) It reduces the distance to be travelled by the occupants, thereby saving their time and energy.

(v) It results in curtailment of costs of various services such as water supply, transport, electrification, drainage, etc.

(vi) It saves precious land which can be utilized for agricultural purposes or developed for industrial units.

(vii) The conveniences such as offices, markets and also other amenities can be had in the same building.

(viii) The staying on upper floors grants the pleasure of scenic views of near and distant objects such as roads, green farms, hills, mountains, trees, rivers, lakes, etc.

(ix) They could be seen to symbolize the economic growth of town and their location could enhance the skyline as well as bear an expressive form of the urban imagery.

Arguments against:

(i) It becomes difficult for old people to undertake vertical travel when the lift or elevator of the building fails.

(ii) The benefit of enjoying the charm of a private garden cannot be obtained by the residents.

(iii) If located improperly and without any planning with respect to the surrounding features of the area, a skyscraper may spoil the skyline of a city. They should therefore be permitted only in specific zones reserving most waterfronts, hills and such other natural elements for other types of structures.

(iv) It deprives the sunlight and air of others.

(v) It is quite likely that a skyscraper may cause an obstruction to air traffic and micro-wave transmission.

(vi) The costs of construction and maintenance are high for skyscrapers because of the instalment of services such as lifts, fire fighting devices, etc. and design of structural elements for wind, earthquake, etc.

(vii) It may create psychological problems for children as they have no open space to play.

(viii) There is considerable increase in the land value due to the construction of skyscrapers and it ultimately necessiates into the construction of more skyscrapers.

(ix) There is fear of panic in case of emergency such as fire or earthquake.

4-7. TRENDS IN MULTI-STOREYED BUILDINGS

The credit of designing the first true skyscraper goes to Major William L. Jenney — an architect of Chicago, U.S.A. It may be noted that before the invention of the elevator, the practical limit of the commercial building was six storeys and even though it was possible to have more height, the builders were reluctant to do so mainly because of the following two facts:

(1) the business tenants were not accepting to climbing of more storeys than that; and

(2) the thickness of walls on ground floor became prohibitive as it was directly proportional to the height of building.

The tallest load-bearing masonry-wall structure is the 17-storey Monadmock Building in Chicago, U.S.A. having the thickness of walls on ground floor as 1830 mm. The tallest masonry structure in the world is the 808117 kN Washington Monument of U.S.A. It has a total height of 169 m and its construction required 40 years from 1848 to 1888. An elevator ride of just 70 seconds, gives a thrilling experience of viewing from the top of Monument the White House, Jefferson Memorial, Lincoln Memorial, etc.

In 1883, the Home Insurance Co. of Chicago, U.S.A. held a competition for the design of its office building and Jenney was entrusted with the work of the first skyscraper of the world. The Home Insurance Building had 10 storeys and later 2 more storeys were added. Jenney's building had an iron skeleton of columns and beams which carried the entire weight of the building — floors, roof and walls. The exterior walls were designed to serve merely as skin walls; to grant protection against fire; to accommodate the window frame; and to produce the desired architectural effects. It is said that Jenney got the idea of skyscraper when his wife placed a book on top of a bird cage one evening and he noticed how evenly the weight was distributed among the bars.

The city of Chicago was young, bold and free from any rigid building bye-laws and because of these facts only, it was possible to erect the first skyscraper of the world in Chicago. On the other hand, it took nearly 6 years more for New York to adopt the regulations relating to the design of skyscrapers. It is indeed difficult to appreciate today how a daring thing Jenney, the father of skyscraper, did when he designed a 12-storey building supported on an iron and steel skeleton resting on experimental foundations and on empirical calculations which predicted that the building ought to stand.

In 1929, the tallest Opera House at 20 North Wacker Drive in Chicago, was opened for public. It is 45 storeys skyscraper made from limestone and its capacity is of 3563 people.

The coming up of new materials and techniques of construction from the last half of the 19th century onwards accelerated the activity of construction of multi-storeyed buildings. America, especially the cities of Chicago and New York, took the lead in this direction and of all the skyscrapers in the world, almost 50% are located in America.

The world's tallest steel framed office building is the 'Sears Tower' in Chicago and its height is 443 m with 110 storeys. It is encased in black aluminium and bronze-tinted glass. It is the largest private office building in the world belonging to Sears, Roebuck and Co.

The Petronas Tower in Kuala Lumpur, Malaysia, constructed in 1996, overtook the Sear's Tower's record as the world's tallest office building. There are 88 storeys with 73.5 m high stainless steel pinnacles at the top of the 88 storeys. The total height of the building is 451.9 m

The tallest structure of New York, America was the World Trade Centre. It was built by The Port Authority of New York and New Jersey in 1972 in order to provide the port with new headquarters for the transaction of international business. It was an amazing complex of 2 huge twin towers with 110 storeys each. The towers were standing 411.5 m high and 21.33 m below the ground surface. The Centre was home for more than 1100 trading firms and organizations.

On an average, 50000 people were working in the World Trade Centre and more than 80000 visitors were coming to the Centre daily. Both the towers were attacked and destroyed by the terrorists on the black day of September 11, 2001.

The Empire State Building of New York is also a very famous steel framed skyscraper constructed during 1929-1931. It is in the form of a giant pencil standing on end and it contains a hollow tower at its top. It contains 102 storeys in an effective height of 381 m and total height of 449 m.

The idea of increasing the height of building is still developing in America and Europe and we may have buildings in future of height of about 2 km to 3 km.

The Trump World Tower in New York city, is the world's tallest purely residential building. It has 72 storeys and its height is 262.5 m. The luxuriously lofty ceilings make it taller than most other buildings with a similar number of floors.

The emergence of the highly complex skyscrapers has in practice diminished the traditional role of an architect. In fact, an architect has to rely on a team composed of structural engineer, plumbing engineer, mechanical engineer, electrical engineer and above all the elevator engineer.

The world's tallest monument is the stainless-steel Gateway of West Arch in st. Louis, Missouri, U.S.A. which was completed on 28-10-1965. The monument was erected to mark the westward expansion in the U.S.A. The gateway is a sweeping arch spanning 192 m and arising to the same height. It was designed by the American architect Eero Saarien. It cost about $ 29 million at that time.

It may be mentioned that previously upto 1995, the world's tallest free-standing structure was situated in Toronto, Canada. The structure is known as *CN Tower* and its height from ground is 553.34 m. The tower rises out of a parkland setting near the shore of Lake Ontario. The excavation work for the erection of 130000 tonne reinforced, post-tensioned concrete tower began on 12th February, 1973 and it was opened for public on 2nd April, 1975. The elevator climb takes only one minute to reach skypod situated at a level of 351 m. The 416 seat restaurant revolves in the tower's skypod and visibility can extend to hills 120 km away. The space deck is located at a height of 447 m and it is the highest public observation deck in the world.

It is in the form of a needle-tipped spire and it contains three basic components:

(1) The concrete column that provides support of and access to the public observation facilities and restaurants.

(2) The seven level skypod containing the public and broadcasting facilities.

(3) The steel antenna mast that accommodates communication, transmission and data-gathering facilities and instrumentation. The antenna is pentagonal to within 7.6 m of the top, where it changes to a four-sided box configuration.

The CN Tower serves the following three purposes:

(1) It facilitates commercial, educational and government broadcasting.

(2) It offers the public both open and closed observation platforms and a revolving restaurant with a capacity of about 416 persons.

(3) It provides facilities for gathering weather and atmospheric data.

Nearly after eighteen years, the Moscow's Ostankino TV Tower with height of about 560 m has surpassed the record held by CN Tower. An extension of 20 m

height was added to get the title back and it dominates the Moscow's skyline from the northern point of the city. At present the world's tallest free-standing structure is the Petronius oil and gas drilling platform. It stands 570 m above the ocean floor in the Gulf of Maxico. It is operated by Texaco and begun production on 21 July, 2000. The highest point on the platform is its vent boom, which is about 610 m above the ocean floor. It is more than 50 m taller than CN Tower of Torrento.

The all time height record for any structure is the guyed Warszawa Radio mast at Konstantynow, which is 96 km North-West from the capital of Poland. The mast was designed by Jan Polak and prior to its fall during renovation work on 10 August, 1991, it stood 646.38 m tall weighed 550 tonnes. It was completed on 18 July, 1974 and put into operation on 22 July, 1974.

The tallest structure in the world today is a stayed Television Transmitting Tower, which is 629 m tall. It is located between Frago and Blanchard, North Dakota, U.S.A. It was built for channel II of KTHI-TV in 30 days (from 2-10-1963 to 1-11-1963) by 11 men from Hamilton Erection Inc., U.S.A. From that time until the completion of the Warszawa Radio mast, this TV Tower was the tallest structure of world, a title that it regained following the collapse of the Warszawa mast.

4-8. TOP 10 UNDER CONSTRUCTION HIGH RISE BUILDINGS IN INDIA DURING 2014

(1) World One: It is located at upper Worli, Mumbai. It is 442 m high and has 117 floors. It spreads over 17.5 acres. This tower will be the tallest residential tower in the world once completed. The project includes three residential towers having 3 and 4 BHK luxurious apartments, villas and limited number of luxurious duplex, a high-end shopping avenue and an office building. Architect is Pei Cobb Freed and Partners and is developed by Lodha Gropu. It is expected to compete in 2015.

(2) Oberoi Oasis tower B: It is located at Annie Basant Road, Mumbai. It has 82 storey and total height 372 m. The project is mixed use development comprising of residential tower, commercial office space and a luxury hotel. This is a slum rehabilitation project. Architect is Kohn Pedersen Fox Associates and contractor is Samsung C and T corporation who has constructed many of the world's tallest landmark buildings like Burj Khalifa in UAE and the Patronas Tower in Malaysia. The project is expected to complete in 2016.

(3) Orchid Crown towers: It is located at Mumbai. It offers 3, 4 and 5 BHK apartments. It comprises of three high rise towers, two towers of 70 floors and one of 60 floors. It has three levels of basements, eight levels podium, two levels amenities like gardens and two levels of lobby. The 13th floor is the service floor and residences start from 14th floor. Architect is Hafeez contractor and main contractor is Larsen and Tourbo. It is expected to complete in 2016.

(4) Palais Royale: It is constructed at Lower Parel in Mumbai. Height of building is 310 m and total number of floors are 88. The building has 100 luxury apartments with areas of 8000 sq.ft. and 14000 sq.ft. and a floor plate of area 50000 sq.ft. The construction area of the building is over 3 million sq.ft. with 88 slabs. It is the first residential building in a country to have undergone site-specific seismic studies with the help of IIT Roorkee. Architect is Talati Panthaky Associates and main contractor is Raghuveer Urban Construction Co. Pvt. Ltd. It is expected to complete in 2014.

(5) Lokhandwala Minerva: It is located at Mahalaxmi in Mumbai. It will have 307 m high two towers of 82 floors. 2nd to 16th floors are kept for parking. At 17th floor podium garden is to be provided. 26th to 79th floors are for luxurious residential apartments. 80th floor is a service floor and penthouse at 81st, 82nd and terrace floor.

Architect is Hafeez Contractor and main contractor is Larson and Toubro. It is expected to complete in 2015.

(6) Supernova Spira: The supernova is a residential township developed by Supertech Limited. It will be the tallest buildings in North India, located at sector 94, Noida, Uttar Pradesh. Tallest tower in Supernova is Spira, with an height of 300 m and 80 floors, which is not just one of India's tallest buildings but is one of the world's greatest superstructure. Nova residences and Spira residences are two luxury towers of Supernova. It is expected to complete in 2015.

(7) Namaste tower: It is a 63 storey and 300 m high commercial tower located at Mahalaxmi in Mumbai. This tower will include hotel, offices and retail space. The building has two wings that join together like a palm of two hands to form the gesture of the Indian greeting Namaste. The tower will be clad in fritted glazing, creating a sense of transparency and depth to the building, maintaining the required thermal qualities. It is expected to complete in 2015.

(8) One avighna park: One Avighna Park is located in the heart of Lower Parell (E), Mumbai. It is 64 storey high with total 267 m height. It is with close proximity to central business areas like BKC, Nariman Point, etc. and has an excellent connectivity to entertainment and leisure avenues like Palladium, Atria, ITC Grand, Shangri-La, etc.

(9) Trump tower: It is about 263 m high with 77 floors. It is located at Worli in Mumbai with Lodha group. The construction is expected to be completed by 2018. Trump Tower will be one of the country's most luxurious residences having 3 BHK, 4 BHK and 5 BHK apartments.. This tower will offer the Indian consumer the very best in exclusive living, in the heart of south Mumbai developed by Lodha Group.

(10) India tower: India Tower Mumbai is the tallest building in India with 126 floors. situated in Mumbai, The super tall skyscraper has a height of 700 meters. It is a hotel cum residential tower located at marine lines, Mumbai and developed by Dynamix Balwas Realtors.

Raheja Revanta at Gurgaon (196 m high), Urbana at Kolkata (167.7 m high), Mantri Pinnacle at Bangalore (153 m high) are also other sky scrapers of the country under construction.

4-9. DESIGN OF RESIDENTIAL AREAS

The residential areas are to be carefully designed with respect to the following six aspects:

(1)	Aesthetics	(4)	Layout
(2)	Basic materials	(5)	Size and shape
(3)	Housing unit	(6)	Street system.

Each of the above aspect will now be briefly described.

(1) Aesthetics: It should be remembered that the residential buildings are not meant only to enclose spaces. A good aesthetic appearance may be obtained by the provision of a variety of designs and novel architectural ideas in the dwellings of a housing unit.

(2) Basic materials: The basic materials to be considered in the design of residential areas are as follows:

(i) buildings;

(ii) lands on which buildings are erected; and

(iii) roads and paths giving access to the buildings.

The design of a residential area includes the arts of landscape design of architecture and of road design. The successful design can only be achieved when the form of building is related to a particular environment.

(3) Housing unit: It is desirable to make a housing unit as small as possible, say of 300 to 1000 persons. A series of housing units may then be arranged in the residential area.

(4) Layout: The purpose of the layout of a residential area is to lay down a broad pattern or framework. In relation to layout, the design of each housing unit or individual building can then be subsequently worked out in detail. It should be an organic layout as against rigid plan. The layout should show only areas reserved for residential purposes, recreation places, schools, community centres and street system.

(5) Size and shape: The size and shape of a residential area will have to be decided from the population to be served and the availability of land. It is desirable to limit the population of a residential unit to about 3000 to 12000.

(6) Street system: The roads shown in the layout of a residential area should be limited to those which link the housing units to one another, to the public centres and to the main town roads. Since every residential area will have unique building groups, it will also have a unique street pattern. As the lines of the roads or streets will be adjusted to the topography, they are likely to take smooth and easy curves. Even if the site is quite flat, it will be desirable to introduce some curvature to contrast with the rectangular houses and to make more interesting view points.

4-10. RURAL HOUSING

According to the Census of India, 1971, a settlement is defined as an urban settlement only if the following conditions are satisfied:

(1) the estimated population of 1971 is at least 5000 persons;

(2) the density of population per km^2 is below 400;

(3) 75% of the male working population is non-agricultural pursuits; and

(4) any other place where urban characteristics were found which may be defined by the Director of Census Operation.

Broadly speaking, all settlements having population less than 5000 souls can be considered as the rural settlements.

The housing problems in urban and rural areas are different because of the following facts:

(1) availability of land;
(2) availability of materials;
(3) availability of technical supervision;
(4) economic conditions;
(5) living habits; and
(6) social obligations.

India is a developing country with nearly 700 thousand villages with the main activity of the people as agriculture. It is therefore necessary to give serious thought to the overall development of villages also. The design of rural housing should be based on characteristics of typical Indian village life and at the same time, the constructional features should correspond to the available men and materials.

The Central Building Research Institute, Roorkee has developed various techniques to make the rural housing schemes as economical as possible. These techniques include the production of building materials by using locally available raw materials and the building procedures can also be easily carried out by the locally available labour commensurate with the structural stability and durability aspects of the project.

The important aspects of the rural housing may briefly be mentioned as follows:

(1) Accommodation: The design of a rural house should provide enough light and ventilation to all the rooms. The provision should also be made for the accommodation of cattle and grains.

(2) Drainage: The waste water from bath rooms, kitchen, etc. may be taken to cesspools or soak pits. The rural house should also contain latrines such as aqua privy, bore hole privy, tub privy or pit privy, which do not require water carriage system to dispose off human excreta. For comparatively big villages, the septic tanks of suitable capacities may also be recommended.

(3) Drinking water: The village should be provided with drinking water wells and great care should be exercised while selecting site for these wells. If possible, the overhead storage water tanks may also be provided to serve the village community.

(4) Housing activity: The housing activity in the rural areas should be so organized as to generate employment direct as well as indirect. The housing alone otherwise would prove to be a burden on the people, if they have to repay the loan without earning anything extra. Such a situation will lead to negative consequences and unless the villager reaches a stage where he can afford the house, not only economically but as needy thing of cultural value, the rural housing would remain an unwanted imposition.

(5) Institutional activities: The major institutional activities on the housing in the rural areas would be as follows:

(i) advice in planning, building and construction;
(ii) encouragement of production and use of the local materials;
(iii) financing;
(iv) land development; and
(v) use of local techniques and skilled labour.

(6) Other amenities: The rural housing scheme should also include the provision of primary schools or secondary schools, panchayat hall, dispensary, small parks, etc. The roads inside the village need not be designed for heavy fast traffic. The village should be linked up with the highways or state roads through well-designed approach roads. The small industrial units which do not cause any nuisance to village life can also be accommodated in the plan of a rural housing area.

The rural housing is yet to be tackled seriously in India and it will take sufficiently long time to make village life as pleasant as town life so that migration tendency from villages to cities is discouraged. It should be noted that the housing in urban areas may become a definite need and an end in itself. Such is not the case with rural areas.

In the rural context, the housing will be a means to an end which is to improve the quality of rural life in all its aspects. The various measures which can be taken to give rural populations a chance to exist where they are without running to cities in search of livelihood are as follows:

(i) clean and hygienic water supply, paved streets and disposal of storm water and sewage;
(ii) educational facilities to suit the rural requirements;
(iii) efficient system of good roads linking villages and work places;
(iv) electricity for street light and industry;
(v) granting of all concessions for small industry in rural areas;
(vi) policy of industrial planning with equitable distribution of work opportunity;
(vii) simple entertainment like cinema, drama and folk festivals, cattle and agricultural shows;
(viii) system of marketing facilities for rural products such as milk, grains, vegetables, etc. without the system of middle man; etc.

It should not be forgotten that ours is a country of villages. Hence, it is utmost necessary to save cities from rural invasion and at the same time, to preserve the cultural heritage of villages by saving them from disintegration.

Typical rural house:

A typical rural house has three important provisions in its design:

(1) Courtyard: It is an open space which may be partly covered to accommodate a cattle shed or some such other purpose. The private courtyard is found in the house of well-to-do villagers and for poorer class, the street just abutting the frontage is used as courtyard.

(2) Rooms: The enclosed space is divided into suitable rooms to be used as sitting rooms, kitchen, store, etc. The rooms contain cupboards, pegs on walls and continuous shelves on which are displayed the shining vessels of many shapes and sizes in brass, copper and stainless steel. In addition, religious pictures, family portraits, articles of embroidery, etc. are also suitably exhibited to decorate the rooms. The size and number of rooms will be decided by their utility, status of occupant, etc.

(3) Verandah: This is a covered space near entrance and it rather forms the nucleus of family activities where the family as a whole lives, entertains and rests. It is often a long space and opens to the courtyard or street on one side.

The design of a typical rural house is such that it embodies the daily cycle of village life smoothly and it ultimately adjusts to the calibre, caste and class of the occupant. The modern schemes of rural housing are derived from westernised concept of suburban houses and as a result, even big clusters cannot generate village life. It therefore has happened that the poor people who have been rehabilitated in the past from flood affected areas, have returned to their original house units in the village proper. Surely, the work of rehabilitation has been completed, but the concept of rehabilitation is not realised.

It is, therefore, absolutely necessary to see that the existing rural houses should be modified to improve the living conditions and at the same time, the new rural housing schemes should be framed in such a way that the spirit of village life is not at all disturbed.

4-11. LOW COST HOUSING

Use of alternative materials and techniques of construction in rural housing: Technology for using locally available materials assumes a greater importance in low cost rural housing. Brick and tile house is a typical example of a currently accepted technology but not a feasible solution when a very large number of houses have to be built from the point of view of energy conservation. The most important criteria in deciding alternative technologies are:

(i) conservation of fuel energy;

(ii) reduction of transportation costs.

(1) Pressed soil block: Soil has been used extensively as a material for wall construction in traditional houses in India and elsewhere. Its abundant availability everywhere and low cost have lend to its wide spread use. Direct use of soil in various forms such as puddled soil construction, unburned bricks and bamboo reinforced mud walls, random rubble stone masonry walls are inexpensive. They have certain disadvantages as the performance of these walls is not very satisfactory.

Pressed soil blocks can be used for wall construction as an alternative to mud walls. They are prepared systematically. First the soil is cleaned with removal of roots and large pieces of stone. Then, lime, cement or any other stabilizing agent in required quantity is added in this soil and mixed thoroughly. The soil mixture is then moulded into blocks by using the soil block machines. These blocks are an alternative to conventional material used in construction.

(2) Techniques for cost reduction in low cost housing: Following are the various techniques for reducing cost of rural houses:

(i) ***Cost of rural houses can be reduced by***

(a) optimizing foundation dimensions;

(b) eliminating non-load bearing foundation;

(c) balancing volume of single storeyed building; and

(d) ingenuous use of structural components.

(ii) ***Use of costly and scarce materials can be eliminated by***

(a) replacing cement concrete with lime concrete and bricks in plinth and sill of buildings;

(b) extensive use of lime for masonry work;

(c) using structurally efficient roofing systems such as ferrocement rafters, thin R.C.C. ribbed slab, steel in structural members; and

(d) using precast R.C.C. frame for doors and windows.

(iii) ***New material saving techniques for construction can be used by applying***

(a) precast roofing systems;

(b) new method of masonry construction; and

(c) small width of windows to reduce lintel dimensions.

4-12. RURAL HOUSING BOARDS

With a view to solve the rural housing problems, the States have established Rural Housing Boards and such boards build houses to cover generally the rural requirements with particular attention to the needs of scheduled castes, scheduled tribes and other weaker sections of the society.

The rural housing policy should be based on the following three principles:

(1) Economic development: It should be seen that there is all round economic development of the rural areas which will help the villagers to maintain their houses and to repay the loans taken by them without much hardship. If possible, the efforts should be made to obtain subsidies either from government or other voluntary organizations to reduce the burden of the poor class people of villages.

(2) Improvement: The existing unfit rural houses should either be improved or reconstructed and for this purpose, the improvement scheme should be spread over a long period, say 10 to 15 years.

(3) Self-help: The element of self-help should be added to bring down the cost of housing unit. However, adequate technical guidance should be made available.

Following points should be considered at the time of selection of villages for the housing project:

(i) The villages having population of backward class with bad living conditions should be given first chance.

(ii) The villages which are flood affected and which are proposed to be rebuilt on sites free from damage of floods should be given preference.

(iii) The villages which have become congested due to over-population should be selected.

For selecting villages under the improvement programme, the following factors should be considered:

(i) The majority of residents should be willing to improve or rebuild their houses on self-help basis and in accordance with the master plan prepared by the authority taking due care of existing trees, wells, pucca houses, monuments, etc.

(ii) The village should offer voluntarily the sites for setting up co-operative brick kilns, tiles preparation, joinery, lime manufacture, etc.

To solve the rural housing problems and to make such projects more appealing, it is desirable to have an integrated Rural Housing Board, instead of an isolated, exclusively housing oriented Rural Housing Board, which would tend to look at housing as an end in itself. It is necessary for the rural housing problem to be

looked upon as an integral part of a comprehensive scheme designed to bring about socioeconomic changes in the rural life. If a decentralized development structure is adopted, the people would be involved in decision making, planning, construction and many other related matters.

4-13. GRUH

The Gujarat Rural Housing Finance Corporation Ltd. (GRUH) was incorporated under the Companies Act in July 1986 and has been promoted by Housing Development Finance Corporation Ltd. (HDFC) and Aga Khan Fund for Economic Development (AKFED), Switzerland. It is also recognized by the National Housing Bank (NHB) as an eligible housing finance company.

The GRUH provides housing finance to individuals for constructing or acquiring or upgrading dwelling units in towns and villages of Gujarat. It also provides financial assistance to corporate bodies for construction of staff quarters and employee owned houses. It has evolved its own mortgage underwriting standards which are compatible with the nature of the rural economy. It had enabled the creation of over 15000 dwelling units by March, 1996 in nearly 25000 villages and towns of Gujarat. The average loan amount was about Rs. 45000/- per unit and 70 per cent of these units were located in villages with a population less than 15000. Over 50 per cent of the cumulative loan approvals of the GRUH had been extended to the individuals with monthly family income lower than Rs. 2500/-. The company had planned to dispurse Rs. 200 crore in 2001-2002, Rs. 325 crore in 2002-2003 and Rs. 425 crore in 2003-2004. At present, the GRUH has retail network of 33 branches and planning to extend it upto 49. The company wants to strengthen its network in Maharashtra and intends to enter the border area of Rajasthan and Madhya Pradesh.

4-14. LAURIE BAKER

In connection with rural housing, the contribution of English architect settled in India, Laurie Baker, is substantial. He has proved to be one of the few architects who has worked consistently for creating beautiful homes with a real understanding of the needs of the rural poor. Laurie Baker has moulded materials into forms and spaces which combine economy, efficiency and beauty.

Laurie Baker was born in England in 1917. After studying at the Birmingham School of Architecture, he became an Associate of the Royal Institute of British Architects. He was greatly influenced by Gandhiji to return to live and work in India. In 1948 he married Elizabeth Jacob a like minded doctor from Kerala. Until the mid-nineteen sixties they lived and worked in a remote Himalayan region where they built their own home, hospital and schools and brought up their children. During this period, he acquired his insight into the problems and actual conditions of rural India, together with his deep appreciation of indigenous architecture. After the death of his father in England, Laurie's mother, at the age of 84, also came out to India to share her life with the family in Himalayas and remained there till her death ten years later.

Meanwhile with the advent of "development" into the Himalaya area, the Baker decided to move Kerala. Here also they chose remote mountain area among the neglected tribal and settlers to build another home and hospital. By 1970, they settled in Trivendrum.

In all Laurie Baker's works, whether house, school or church, there is an uncompromising adherence to local conditions, traditional building techniques and sensitive handling. He has been closely associated with Kerala Government in its low cost housing programmes. He has been also associated with allied government and quasi-government work including work with the Planning Commission and as a member of governing bodies of HUDCO and the National Institute of Design, the Scientific Advisory Counsil of C.B.R.I. etc. But there has been spontaneous response from thousands of individual home builders from all over the country wanting to build their own Laurie Baker Homes.

In Laurie Baker's work, the concrete is used very sparingly, often in a folded-slab design with broken and discarded tiles used as fillers, thereby making the roof light and inexpensive. The glass windows and frames are usually eliminated and the small openings in brick, like the traditional jali, are used frequently. For large openings, the doors are directly secured to the wall surface by brick corbelling.

Baker also extended his work into the industrial field and was for many years architectural consultant to a large industrial firm. At the same time and with these industrialists, his work on alternative energy systems relating to building grew.

The life-long pre-occupation of Laurie Baker with the idea of providing shelter for the homeless millions brought him international recognition and numerous awards. In 1987, HUDCO instituted a National Habitat Award and considered it an honour to confer the first award on Laurie Baker during the International Conference on mud architecture in Trivandrum. Laurie Baker's works will continue to inspire young architects and home builders.

4-15. AGENCIES FOR HOUSING

Following are the three agencies which may be considered responsible for the construction of houses:

(1) Government

(2) Co-operative housing societies

(3) Individuals.

(1) Government: To provide housing on a large scale and even at subsidized rates, the supreme agency would naturally be government and semi-government bodies or departments. It thus includes State government, Central government, postal department, income-tax department, railways, local authorities, etc. It is to be confessed that the principle of State assistance for housing, though unsound in nature, is unavoidable under the present condition. It is for this reason that such assistance is given official recognition in the housing legislation of most of the progressive countries of the world. It is also possible to give protection to tenants at government level by introducing various effective measures in the form of Rent Restriction Act, Standard Rent Act, etc.

The government action as such is the only effective measure for securing adequate supply of housing because of the very nature of the housing market on the supply side. The house cannot float in air and hence, they are geographically immobile, once they are built. The housing schemes demand high initial capital cost and because of the long durability of many houses, the net addition proves to be of marginal nature.

The government has introduced The Urban Land (Ceiling and Regulation) Act, 1976 which mainly aims at securing excess urban vacant lands in private hands for the development of houses of acceptable standards for the weaker sections of the society.

(2) Co-operative housing societies: The history of the co-operative housing movement in India can be traced to 1912 when the co-operative act was framed. Bombay was the first to take initiative in this movement and the first Co-operative Housing Society, known as Saraswat Co-operative Housing Society, was registered on co-partnership system in Bombay in 1915. Later on, the other States adopted the idea of housing societies.

The number of housing societies is the largest in Maharashtra followed by Gujarat and these two States account for more than half of the total number of societies in the country. The progress of formation of housing societies in other States is not satisfactory.

At present, this agency has become very popular because of encouragement at government level with respect to two main aspects of housing, namely,

(i) acquisition of land at reasonable price; and

(ii) financial help in the form of loans to be paid in instalments at low rates of interest.

A group of house-seeking persons combine and form a legal body, known as the *housing society*. The society works within the rules and regulations imposed and framed by its members and its working is examined and supervised by government department. The houses constructed through this agency are generally good, decent and within the financial reach of their members. The services and facilities provided in the houses are also far better and it leads to indirect benefits such as improved hygiene, health, education, etc. The housing societies have proved to be of paramount importance to the needy people of low income group.

Some of the suggestions to improve the working of housing co-operative can be made as follows:

(i) The Govt. should give priority for the allotment of lands and building materials to the housing co-operatives.

(ii) The housing societies should construct such houses whose cost is within the reach of their members.

(iii) The poor and the most poor should be brought under the scheme and the entry of rich people should be discouraged in housing co-operatives.

(iv) The working of the co-operatives should be supervised by a machinery equipped with adequate power and it should be seen that the co-operative housing society does not turn up into nonco-operative housing society.

In brief, if an atmosphere of mutual understanding and co-operation prevails among the members, the scheme of housing society will certainly prove to be a success.

(3) Individuals: The acute shortage of housing has also encouraged private enterprise to enter this field. The houses and flats are constructed by the individual with his own investment and later on, they are sold or converted into society form. In a similar way, big employers can provide housing accommodation to their employees and workers. However, the employers in our country are not so

enthusiastic and active in giving housing facilities to their employees. The challenge of housing is so grave that this agency can give only a limited share in solving this problem.

4-16. INVESTMENT IN HOUSING

The construction industry has to play a great role in housing schemes. The construction sector plays a major role in increasing the employment opportunities for the people. As a matter of fact, the construction sector practically does not require an imported material and it mainly employs unskilled labour. The labour force required in housing schemes in India consumes about 30 to 40 per cent of the total cost of scheme.

In addition to the direct employment to the skilled and unskilled workers or labourers, the investment in housing provides indirect employment also to the persons engaged in industries manufacturing building materials, transport of such materials, merchants dealing in such materials, etc. It is estimated that the housing project worth Rs. 1 crore per year will provide jobs to about 8000 men and women directly and indirectly.

The investment in housing results in over-all increase in productivity of economy in the following three ways:

(1) It increases the mobility of manpower.

(2) It promotes social development.

(3) It provides an incentive to productive labour.

A massive investment in the housing may be taken up in the following order:

(1) Slum improvement scheme

(2) Urban housing

(3) Rural housing.

The reasons of adopting the above sequence are as follows:

(1) Considering the excess demands for jobs and houses, the housing activities would certainly prove as proper path leading to social equilibrium.

(2) The employment generated by housing sector far exceeds than any other sector.

(3) The housing and employment are the elements of social development and they must form the basis of any socialistic pattern.

(4) The housing schemes also lead to the investment in roads, electricity, etc. and the whole area as such may come up as a satellite to the big urban complex.

(5) The housing schemes for slum areas give adequate shelter to the slum dwellers who are unable to pay the market rents.

(6) The investment in housing at present is regarded as an effective anti-inflationary measure. A well organized system under which small savings can accumulate and make an investment in housing possible will be an effective anti-inflationary force.

(7) The investment in housing generates employment for the large number of skilled and unskilled labourers in urban and rural areas.

With respect to the investment in housing by the individuals or private agencies, there are certain advantages and disadvantages. The advantages are as follows:

(1) A house can be protected by insurance and if it is burnt or destroyed otherwise, it can be replaced by the insurance company. Thus, the investment in housing is safe.

(2) It has a steady demand and in case of an emergency, it can be sold out at good price.

(3) It is a real and tangible investment in the sense that a house has some value and inherent stability.

(4) It can be made a source of income by allowing it to be used by a tenant.

(5) It is found to be an inflation-proof investment.

(6) It is not dependent on patents, trade secrets or manufacturing methods.

(7) The housing property rights are protected by our Constitution.

There are certain disadvantages also in the housing investment such as requirement of high capital, absence of centralized market, lack of liquidity, Govt. laws, assistance from experts, etc. But in general, it can be stated that the advantages of investment in housing outweigh the disadvantages and it serves as an excellent source of investment opportunity for most of the agencies in private sector.

4-17. HUDCO

The Housing and Urban Development Corporation, popularly known as *HUDCO*, was set up in 1970 and started functioning effectively from the middle of 1971 and its main aim is to promote housing and urban development programmes in the country. The HUDCO serves as the Apex Control Agency for mobilisation of financial resources for housing and urban development programmes. The HUDCO has launched a variety of instruments like Shelter Bonds, Capital Gains Bonds, Urban Bonds, etc. for mobilising the resources for enlarging its operations.

The HUDCO has launched a new deposit scheme as per directions of the National Housing Board to suit the requirements of individuals, corporate bodies, trusts and banks. Following are the four categories under this deposit scheme:

(1) certificate with face value showing maturity value including the interest in advance;

(2) cumulative income;

(3) doubling the principal amount in 60 months; and

(4) regular income on monthly or half-yearly basis.

The funds so generated are used by HUDCO for housing schemes of better quality houses for sale to the public on liberal terms and conditions.

The important borrowers from HUDCO are housing boards, development authorities, improvement trusts, municipal corporations, public sector undertakings, private sector bodies, semi-government and government agencies, private builders, etc. However, half of the total loan advanced by HUDCO is generally consumed by the housing boards. The HUDCO has identified more housing agencies and as a result of this policy, the number of housing agencies which was only 12 in 1971-72 has gone substantially high. The schemes financed by HUDCO are now spread over 1500 cities and hundreds of villages in 2004 as against only 14 towns

in 1970-71. The HUDCO has sanctioned a total of over 15265 projects with a loan commitment of over Rs. 1,11,614 crores upto May 2004. Out of which 15265 projects are completed.

The lending rate of interest charged by HUDCO varies with the nature of scheme for which loan is to be advanced. It looks with sympathy for the schemes which are floated for the economically weaker sections of the society and it thus helps the under-privileged people substantially. The differential rates of interest charged by HUDCO depends on the financial status of the borrowing party.

One of the main objectives of HUDCO is also to finance or undertake the setting up of building material industries because of the fact that building materials constitute about 70% of the total cost of construction. It is therefore necessary to ensure a steady flow of essential building materials at reasonable prices especially to build houses for people of economically weaker sections and low income group (EWS and LIG) categories.

Hence, to encourage the establishment of building material industrial units, HUDCO advances loan on liberal grounds with low rate of interest.

The HUDCO also promotes and provides consultancy services to help housing agencies to design low cost housing schemes, commercial projects, townships and various other projects connected with housing and urban development programmes. The HUDCO also gives priority to finance the water supply projects for the problematic areas where per capita water supply does not even meet with the basic requirements. Thus, the HUDCO extends benefits to the people through a variety of programmes like housing, rural housing, social infrastructure, land acquisition, skill development, environmental improvement of slums, basic sanitation, staff housing, etc.

The resources of HUDCO are limited and it has compelled HUDCO to review its policies. The HUDCO has taken various measures to prevent the entry of relatively better class people to the housing schemes sponsored by HUDCO. The main aim of HUDCO is to encourage the schemes which are really meant for the poor class people. Majority of the schemes sanctioned by HUDCO are committed for poor class families.

Among the major beneficiaries of HUDCO sanctioned schemes are people belonging to scheduled castes and scheduled tribes. The HUDCO terms are fully loaded in favour of weaker sections of the society. During 1996, the HUDCO has assisted the construction of nearly six lakh dwelling units out of which nearly 5.0 lakh units are for the EWS and LIG categories.

It is estimated that HUDCO has facilitated grants worth over Rs. 62600 crores and has enforced nearly 11000 projects under various plans and rural schemes for slum upgradation, sanitation, land acquisition, building materials and social infrastructure.

The people requiring houses have been classified in the following four categories by HUDCO:

(1) Economically Weaker Section (EWS) with a household income of Rs. 350/- per month or less.

(2) Low Income Group (LIG) with a household income above the EWS but not more than Rs. 600/- per month.

(3) Middle Income Group (MIG) with a household income above the LIG but not more than Rs. 1500/- per month.

(4) High Income Group (HIG) with a household income above the MIG i.e., Rs. 1500/- per month.

The cost ceilings of houses including costs of land and services, rates of interest and repaying periods of loan under various categories of income groups.

The loan disbursements by HUDCO to different categories of income groups is roughly in the following proportions:

EWS 30%

LIG 25%

MIG 25%

HIG 20%

4-18. HDFC

The Housing Development Finance Corporation (HDFC) is another notable and premier housing finance organization of government carrying on appreciable work in the area of housing finance. It was established in 1976 and has today become a major channelling institution which directs the public savings and capital finance into house building. It has turned the concept of housing finance into a profitable, professionally managed, world class enterprise. This is achieved by HDFC through lending schemes and generation of money by borrowing from the public through issues, insurance premiums, bank interests and so on.

The HDFC has enabled more and more people to purchase houses by offering them financial and institutional support.

The HDFC provides loans for resale of properties in a good condition, land purchase, home and non-residential premises loans for professionals, home improvement, home extension, home equality, etc.

The recovery percentage of 99 of the HDFC is very impressive. It lays emphasis on credit quality, credit appraisal and reorganization of the repaying capacity of the borrowers. The major emphasis is also laid on the consumer services. It has computerized its loan transactions.

The HDFC assists the clients in finding properties which match their budgets and location preferences. It has also established a network of collection centres at various banks.

The HDFC has also designed schemes for corporate bodies and limited companies under which, it gives loans for constructing housing colonies for their employees. It offers construction finance to the builders and promoters and approved project facilities to help the individuals. It has tried to tailor its schemes for every financing need that may be faced while buying or constructing a house.

The HDFC has assisted over 1.9 million families to own a home through loans over Rs. 370 billions upto the end of year 2003. This was supported by its strong distribution network of over 178 offices across the country securing customers in over 2400 cities or towns. It has over 46000 deposit agents with a deposit over Rs. 85 billion from over 1.2 million depositors. It has earned profit

of Rs. 204.62 crore after deducting tax upto June 2004, which is about 22% more than the previous year.

The procedure for getting loan from the HDFC can be briefly described as follows:

(1) First either download the application form from HDFC loan web site or get it by email or normal mail or collect it from any of the nearest HDFC offices.

(2) Fill up the application form and submit it along with the following supporting documents.
   (i) Allotment letter of co-operative society or association of apartment owners.
   (ii) Copy of approved drawings of proposed construction or purchase.
   (iii) Agreement for sale or sale deed or detailed cost estimate from architect or engineer for the property under consideration.
   (iv) The latest salary slip or salary certificate showing all deductions for a salaried employee.
   (v) The balance sheets and profit and loss account of the business or profession along with the copies of individual Income-tax returns for the last 3 years certified by a chartered accountant for self-employed person.
   (vi) Application processing fees which is 0.5% of the loan amount.
   (vii) A passport size photograph.

(3) The application will be considered and scrutinized by HDFC.

(4) On the approval of loan, a loan offer will be made.

(5) On the acceptance of the offer, an administrative fee for the approval of loan is to be paid to HDFC.

The two primary financial institutions, HUDCO and HDFC, have helped to solve the resources problem in the housing sector. They have also paved the way for other such local organisations and development authorities to take up the housing programmes and thus assist the Government in this sphere.

4-19. LIC HOUSING FINANCE LIMITED

The LIC (Life Insurance Corporation) Housing Finance Limited was established in 1989 with a network of 67 branches around the country and 35 per cent market share. The company has disbursed more than Rs. 10000 crore in housing loans and has aided the construction of more than 65 lakh houses.

The company has also built housing complexes for its policy holders in Mumbai, Chennai, Banglore, Ahmedabad, and many other cities.

The LIC gives loans to the individuals for the construction of houses or flats, for resale of residential premises and for extension of houses.

The amount of loan varies from Rs. 25000/- to Rs. 20 lakh and the rate of interest varies depending on the loan amount or the scheme selected.

The procedure of the loan has been simplified so that the amount is disbursed within one month of the application.

It is also arranged that the State and the Central Government employees could take additional loan on second mortgage of the property. The loans are also given to the builders, corporate bodies and housing boards for mass housing.

The special feature of the LIC loan facility is that insurance polices are taken as collateral security. In case of the unfortunate death of the client, the insurance money would be available to repay the loan and thus, his family will be relieved from the burden of the outstanding loan.

4-20. CIDCO

Mumbai, once the queen of Indian cities, is losing its lustre and the statement that the city is dying is made by a host of planners, public speakers and politicians. Mumbai is a city devoted to the wealth and because of this reason, it has increasingly attracted artists, musicians, architects, film makers, job seekers, etc. on one hand and undesirable elements of various categories on the other hand. As a matter of fact, it is estimated that more than half of the city's inhabitants live in slums where, on an average, each person has living area of about 1500 mm × 1200 mm, space not more than that of a grave.

Due to phenomenal rate of urban growth of city of Mumbai, it was decided to have a twin city across the harbour to accommodate a population of about 2 million. The project is named as the Navi Mumbai Project and it will serve as a counter-magnet to the office concentration taking place at the southern tip of Mumbai. The Govt. of Maharashtra accepted the proposal of the Navi Mumbai Project and accordingly formed City and Industrial Development Corporation (CIDCO) under the Indian Companies Act in March 1970. Thus, CIDCO is a limited company wholly controlled by the Govt. of Maharashtra. The development plan for Navi Mumbai was prepared by CIDCO and sanctioned by the State Government in August 1979.

The functions of CIDCO are planning, implementation, administration and maintenance of the Navi Mumbai and other areas which may be entrusted to it by the government. The new project is based on the formation of a series of nodal settlements strung along a Mass Rapid Transit (MRT) line. The plan provides for MRT system which have been planned through the centroids of various residential and employment nodes. Each nodal settlement spread over 400 to 600 hectares of land, further subdivided into sectors will have about 1 to 1.5 lakh population.

In the ultimate stage, Navi Mumbai is expected to have about 14 such nodes with a total population of about 2 million and 7.8 lakh jobs.

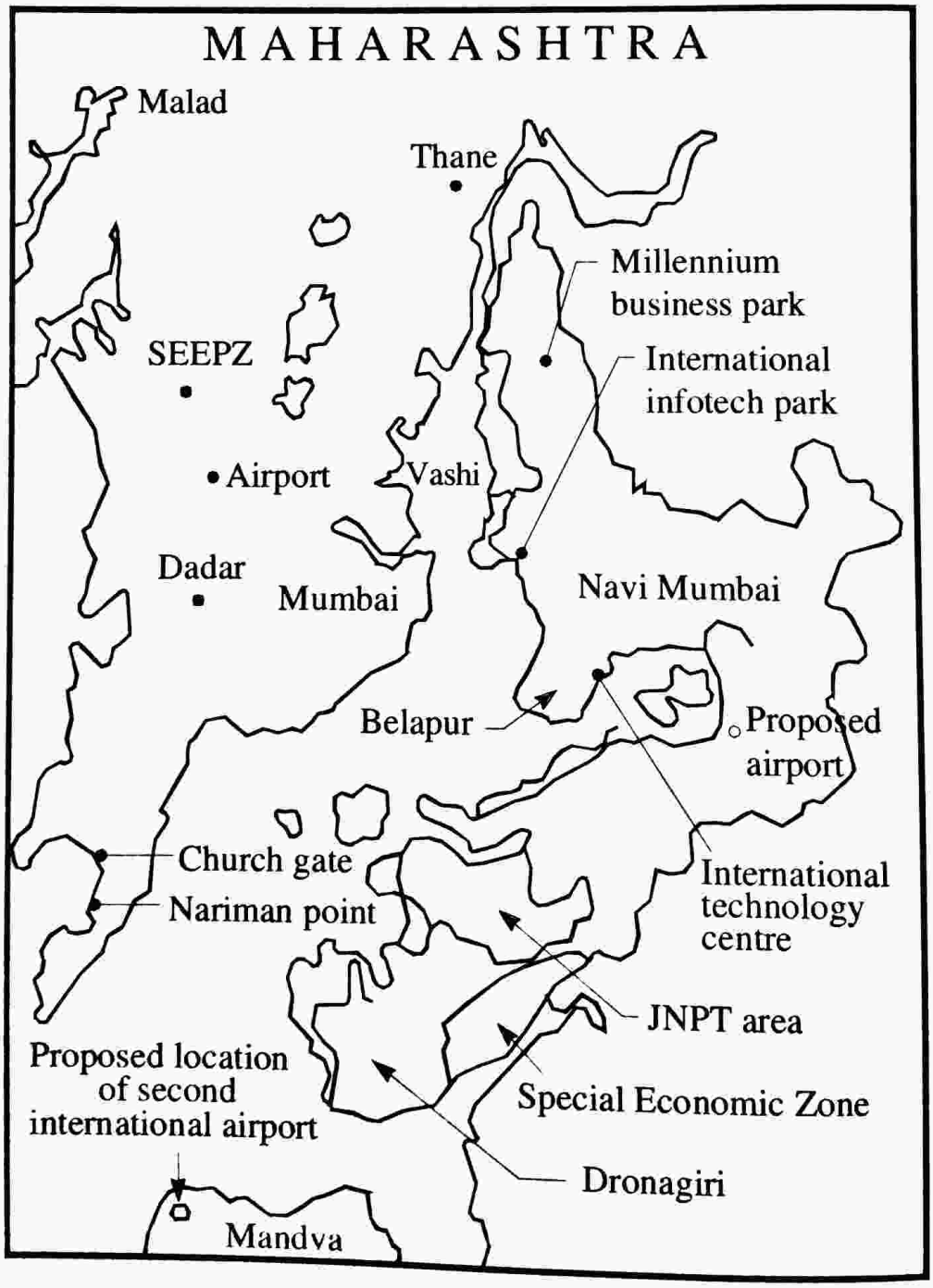
Each residential node is self-supporting and the pedestrian environment is achieved by linking various social elements like schools, hospitals, primary health centres, shopping, parks and playgrounds by pedestrian spines segregated from roads serving the vehicular traffic. Since the inception of the Navi Mumbai Project, significant progress has been made at various levels and CIDCO is actively engaged in the successful implementation of the project entrusted to it.

So far, CIDCO has constructed and allotted more than 74000 tenements in Navi Mumbai out of which two-third of houses are financed by HUDCO, providing an opportunity to the people of common means to own tenements on long-term hire purchase terms at rates of interest varying from 7% to 12.5% depending on the income group to which they belong.

The project of Navi Mumbai extends over 344 sq. km of marshy land between village Dighe in Thane district and Kalundre village of Raigad district.

It consisted of 150 km creek line of 720 km Konkan Coast. Navi Mumbai has Thane creek on west side, Dharmtar creek on south side, Karanja creek toward south-east and Parsik Hill Ranges on East side. Panvel creek with east-west direction flows centrally through the area.

The hill slopes are very steep. Out of total area about 20 % is low lying area. Thus, the area available for development is in the form of narrow strip. CIDCO carved out 14 nodes of this land with a view to facilitate comprehensive development and to give an identity of new city. These nodes are named Airoli, Ghansoli, Kopar Khairane, Vashi, Sanpada, Nerul, CBD Belapur, Kharghar, Kalamboli, Jui Kamothe, New Panvel, Ulwe, Pushpak and Dronagiri.



Plan of Navi Mumbai
FIG. 4-5

Navi Mumbai is expected to have a population of 2 million by 2005. It is 20 times larger than Nariman Point of South Mumbai. The 'New millennium city' of Navi Mumbai is becoming very popular. The jewel of Navi Mumbai's I.T. Sector is Reliance Infocom's Dhirubhai Ambani knowledge city at Kopar Khairane.

The broad objectives set before CIDCO by State Government for the development of Navi Mumbai are as follows:

(1) To absorb immigrants from other states.

(2) To provide an environment which permits the citizens of Navi Mumbai to live further and richer lives free from physical and social tensions associated with the urban living.

(3) To provide physical and social services, raise the living standards and reduce the disparities in the amenities available to the different sections of the population.

(4) To provide training and other facilities to the existing local population to enable them to adjust to the new urban setting of the new city.

(5) To reduce the growth of population in Greater Bombay by creating an attractive urban centre on the main land across the harbour.

(6) To support the industrial location policy which will eventually lead to an efficient and rational distribution of industries over the State.

With the above objectives, the principal activities of CIDCO can be enumerated as shown below:

(1) To build as many houses and community infrastructure such as schools, colleges, hospitals, shopping centres, parks, banks, bus stations, post offices, etc. to meet the day-to-day needs of the population.

(2) To develop land and provide the required physical infrastructure such as roads, drainage, water supply, sewerage, street lighting, landscaping, etc.

(3) To involve agencies in the development of public transport, both road and rail and telecommunication.

(4) To make available developed plots at reasonable prices for people to construct.

(5) To promote activities which will evolve a sound economic base for a self-sustained growth.

4-21. MEGA PROJECTS OF CIDCO

Following are the mega projects of CIDCO:

(1) Administrative city centre: It would be located in sector 50, 52 of Nerul and sector 15A of CBD Belapur, consisting of exhibition centre, town hall, city museum, CIDCO and NMMC (Navi Mumbai Municipal Corporation) and other administrative offices, habitat centre, etc. It also consists of commercial area in and around Sagar Sangam railway station.

(2) Amusement park: It is located near airport and railway stations would be easily accessible by road from all parts of Navi Mumbai. The amusement park will emerge not only as leisure spots but also as powerful vehicles for

generating revenue. The various other activities like adventure sports, theme parks, trekking, resort hotels, restaurants, etc. provide excellent franchisable opportunities.

(3) City centre: It is developed along Palm Beach Marg connecting Vashi railway station, I.T. park and Belapur railway station. City centre comprises Palm Beach Marg, commercial city centre, administrative city centre, recreational areas and international sports complex at Ghonsoli. Palm Marg would form the main spine with fibre optic connectivity for the city centre. Commercial centre would consists of Vashi railway station, I.T. parks and the proposed commercial centre on sanpada housing pond along creek. Recreational area would mainly consists of Golf course, recreational area and open space around holding pond of Nerul. International sports complex is developed at Ghansoli in about 27 hactor area. It is enclosed between the creek front on its western side and Palm Beach Marg on the east.

(4) Commuter rail projects: At Navi Mumbai CIDCO is developing three railway projects:

(i) From Thane to Vashi via Turbhe.

(ii) From Nerul to Uran via Belapur.

(iii) From Belapur to Panvel double line.

(5) Golf course: CIDCO has selected two excellent sites for setting up a Golf course of international class at Nerul and Kharghar. Their development is offered for the private sector's participation. The international class 18 hole and 27 hole course respectively at Nerul and Kharghar will be designed by renowned architect.

(6) International convention centre: It is located at Nerul. It will be the first of its kind and size in India with highly sophisticated, ultra modern communication facilities, luxurious hotels and entertainment venues.

(7) International technology park: CIDCO has already set up high tech I.T. park at Vashi and planned second I.T. park at Belapur node which is known as *Central Business District*. It is accessible from all parts of country by an expressway and efficient commuter transport nodes of rail, road as well as water. It is also provided with stable power supply, residential facilities in close proximity, health club, well-designed conference facilities, parks and gardens with plenty of parking space. I.T. park at Belapur is ideal for companies offering I.T. enabled services. WIPRO has already put its footmark here by acquiring almost 16% of the available space.

(8) Navi Mumbai Special Economic Zone (NMSEZ): SEZ is a special duty free enclave designed to promote for foreign investments in a comprehensive range of economic activities from manufacturing at one end to trading and financial services on the other in an infettered business environment. The SEZ will provide high quality and world class infrastructure designed to render costs of products, delivery, logistics and transactions competetive on global basis.

(i) ***Salient features of SEZ:*** Following are the salient features of SEZ:

(a) All the units of SEZ are able to import capital goods and raw materials duty free from abroad and also from DTA without paying any exise duty.

(b) No routine examination by the customers of export and import cargo.

(c) No extra documents required for customs and exim policy.

(d) No licence required for imports.

(e) 100% tax break upto 2010 u/s 10-A of the Income-tax act.

(f) Reimbursement of central sales tax laid on domestic purchase.

(ii) ***Advantages of Navi Mumbai SEZ (NMSEZ):*** NMSEZ is located in the heart of Navi Mumbai and is comprised of four zones, called *Dronagiri, Kalamboli, Ulwe* and *JNPT* area. Following are the advantages of NMSEZ:

(a) It has easy access to Mumbai for many products.

(b) The huge urban markets of Mumbai, Navi Mumbai and Pune are within the catchment area of NMSEZ.

(c) The skilled and capable manpower is easily available at considerably lower cost.

(d) The residential areas in Navi Mumbai and Belapur region developed by CIDCO are easily accessible.

(e) The commercial centre and financial capital of the country will provide unlimited access to capital, to the units located in NMSEZ.

(f) International and domestic transportation is easily available as Jawaharlal Nehru port, Chhatrapati Shivaji International airport, national highways, railways and water transport are nearby.

(9) Second international airport: A second international airport in the Mumbai region has become imperative, as the existing airport at Mumbai, is fast reaching saturation level. CIDCO is going to develop a new airport at Navi Mumbai to meet the growing demand of air travel.

The site of airport is located in an area of 950 hectares accommodating two parallel runways for simultaneous and segregated parallel operations with provision of full length taxi ways on either side of the runways.

Navi Mumbai international airport will support the rapidly growing air travel needs of Mumbai metropolitan region. It is expected to absorb anually 4.5 million passengers in its first operational year 2007, doubling to 8.2 million by 2010 to 13.7 million by 2020 and 30 million by 2030.

Over the past three decades CIDCO has expanded its horizons beyond Navi Mumbai. It has taken up similar projects elsewhere in Maharashtra at New Aurangabad, New Nanded, New Nashik, Walaj Mahanagar, Meghdoot-New Nagpir Oras and Vasai-Virar. Having become a premier infrastructure development agency, CIDCO has also undertaken consultancy in infrastructure development and planning in Kerala, Jharkhand and Chhattisgarh.

4-22. HOUSING PROBLEM IN INDIA

The provision and estimation of housing requirements in various five-year plans of our country have proved to be obsolete and inadequate because of considerable increase in population and construction costs. The country is facing economic crisis in other important fields of community welfare and yet, efforts are sincerely made to construct as many houses as possible with the available resources.

The concept of town planning is accepted by our country and accordingly, haphazard development of lands is restricted to a certain extent. The subsidized housing schemes are prepared by government and advantage of such schemes is

given to the poor class people or low-income group persons. The magnitude of housing problem in our country is so heavy that it will require considerable passage of time for the country to offer a sweet home to every family of our nation.

It is understood that with the present rate of growth of population, our country's population by 2010 year would be about more than 1200 millions and it is estimated that the housing shortage would be of the order of about 65 million dwelling units by the turn of century out of which the rural areas will account for 40 million dwelling units and the urban areas 25 million dwelling units. Thus, a massive housing programme will have to be launched by our country involving huge capital cost.

It is further estimated that by year 2010, the urban population of our country would be about 380 millions or nearly 30% of the total estimated population. Those connected with the overall development of the nation should evolve and frame sound policies so that our country can meet the future challenge of accelerated urban growth in both respects, confidently and successfully.

If the figures regarding the houses required for landless labourers or homeless people are gathered and viewed in proper perspective, it may even look that this huge problem cannot be solved for ages to come. It should, however, be realised that housing is an integral part of public welfare and it is not something which should be left to the financial ability of an individual. It is not merely a problem of finances or of developing cheap houses or of reducing the cost of building materials. The problem is also a social one. A permanent house means a great deal more to a villager than just a shelter for his family. It gives him new sense of self-respect and acts as a catalyst for a social change.

The main hurdles of the problem of rural housing can be enumerated as follows:

(1) lack of sense of social and moral obligation of rural people in solving the problem;

(2) lack of sufficient allocations to the rural housing in our plans;

(3) prohibitive cost of building materials as well as rising prices of land; and

(4) reluctance of financial agencies to finance the rural housing schemes for the landless villagers.

It is, therefore, submitted that a modest but well planned utility house consisting of a room, a kitchen and a verandah should be designed and to reduce its cost, the whole emphasis should be laid on the use of indigenously available raw materials. No rigid specifications should be enforced and no model design should be adopted. As a matter of fact, the house may vary from district to district, village to village or even from house to house.

The financial agencies such as nationalized banks, etc. should come forward to help the landless villagers to build their own houses on reasonable terms. The legalities governing the provident fund, pension fund, etc., should be made more flexible with a view to enable the housing finance seekers to put their own money to a good use of their own choice.

If sincere efforts are made from the public as well as government, it will be possible to solve the giant problem of housing in general and of rural housing in particular.

With a view to focus the attention on housing problem, the General Assembly of the United Nations declared the year 1987 as the International Year of Shelter for Homeless (IYSH). It was pointed out that a society was judged not so much by the standards attained by its affluent and privileged sections as by the quality of life which it is able to ensure for its common citizens. During the year, the sub-standard housing conditions prevalent in most of the countries in the world were highlighted and suggestions were made to devise ways and means to improve the housing conditions of such people by 2010 A.D.

4-23. NATIONAL HOUSING POLICY

(1) General: In the year following the IYSH, the Indian Government came out with a National Housing Policy (NHP) to declare its political will to intensify the housing activity in the country. The preliminary draft was presented in August, 1986 and the final policy was announced on 12-5-1988. Thus, the IYSH provided the necessary push for NHP so that the engineers, architects, town planners and housing finance corporations can evolve viable strategies on issues relating to the housing.

(2) Objectives of NHP: The NHP is comprehensive in nature and has the following four main objectives:

(i) To create an environment for achieving the maximum housing efforts.

(ii) To encourage investment in housing.

(iii) To motivate and help houseless and inadequately housed people to secure for themselves affordable shelter.

(iv) To promote vernacular architecture i.e., pertaining to the style of architecture and decoration peculiar to a specific culture or locality.

The NHP hopes to achieve the goal of eliminating houselessness by the year 2010. It envisages towards this end not only the construction of additional dwelling units, but also a substantial step in maintenance, upgradation and improvement of the existing housing stock.

(3) Important features of NHP: Following are the important features of NHP:

(i) ***Design aspects:*** It focuses on the design aspects of the houses with regard to their location. The architecture as well as the building materials would necessarily have to differ according to the type of region — whether it be hilly, desert land or coastal.

(ii) ***Fiscal incentives:*** The fiscal incentives under the laws relating to taxation of income, wealth and gifts will be rationalised to channelise savings into housing finance institutions. The concept of luxury housing is to be discouraged through ceiling on institutional finance assistance. The co-operative and group housing societies are to be treated on a priority basis.

(iii) ***Housing schemes:*** The housing schemes should take into consideration the mentally and physically disabled, the aged, widows and incorporate dwelling units of appropriate design.

(iv) ***National housing bank:*** An apex body, to build up a housing finance superstructure envisaged by the NHP, a national housing bank, has been set up. It will lead to easy accessibility of institutional finance at affordable rates of interest to the houseless and disadvantaged groups.

(v) ***Rationalised laws:*** The entire gamut of legal provisions contained in different Acts is to be reviewed and wherever necessary, amendment to the laws relating to land tenure, acquisition and ceiling are to be made. The municipal regulations relating to the house building, apartment ownership and other connected laws will also be initiated and new legislations enacted, wherever necessary.

(vi) ***Role of government:*** The role of Govt. will be that of a promoter and enabler rather than that of a builder. The government has thought it fit to assume the role of a facilitator and let people build houses for themselves. At the same time, it has to discharge the vital role of sustaining a regular supply of serviced land, a steady flow of finance, an easy availability of newer and cheaper building materials, creating a conducive legal environment, etc. It has also to provide essential services like potable water, sanitation, drainage, street lighting, paved pathways, etc.

(4) Criticism of NHP: The presentation of NHP document has generated some lively criticism on various grounds, the important ones being as follows:

(i) ***Ambitious goal:*** The NHP aims at too ambitious goal of abolishing houselessness by 2010 A.D. This huge task cannot be accomplished in a matter of few years in a country where people do not have even enough to eat and survive.

(ii) ***Course of action:*** The NHP sets out commendable goals. But it fails to outline the action plan required to achieve them.

(iii) ***Housing finance:*** The authorised capital of the national housing bank is too small to meet the huge investment of about Rs. 325000 crore which is estimated to be required till 2010.

(iv) ***Pro-urban attitude:*** The NHP seems to be pro-urban. It is mainly oriented towards rich developers and private contractors.

(5) Conclusion: To frame the NHP, the impressions were gathered from housing policies of various countries. But it was felt that no one-country method would be applicable in our case because of our staggering numbers, vast area, wide range of climatic conditions and multifarious income groups.

It is satisfying to note that nearly six decades after independence, India is finally in possession of a national housing policy. The NHP is certainly a positive step taken towards providing the people with one of their basic rights and it definitely stands out like a ray of hope for nearly half of the population for whom the quest for dwelling unit is an eternal struggle.

QUESTIONS 4

1. Write a critical note on good housing.
2. What are the factors to be considered while selecting the building site?
3. What are the requirements of residential buildings?
4. How are residential buildings classified?
5. What are skyscrapers? Are they desirable?
6. Write a brief note on the development of skyscrapers.
7. Mention the aspects to be considered in the design of residential areas.

8. Write short notes on:
   (1) Flats
   (2) Importance of housing
   (3) Housing problem in India
   (4) Rural housing
   (5) Row of houses
   (6) Investment in housing
   (7) Demand for houses
   (8) Building site for housing schemes
   (9) Skyscrapers
   (10) Co-operative housing societies
   (11) Government as an agency for housing
   (12) LIC Housing Finance Limited
   (13) Rural housing boards
   (14) World Trade Centre
   (15) CN Tower
   (16) Sears Tower
   (17) Low cost housing.
9. What are the important aspects of rural housing?
10. Give suggestions to improve the working of housing co-operatives.
11. What are the advantages and disadvantages of investment in housing by the individuals or private agencies?
12. Describe briefly a typical rural house.
13. What are the factors to be considered at the time of selecting villages for housing project and for improvement programme?
14. Explain the function of GRUH.
15. Describe the contribution of Laurie Baker in the rural housing.
16. Describe the agencies for housing.
17. What are the factors on which demand for houses depend?
18. In what order, a massive investment in housing should be taken up? Why?
19. Give a brief outline and functions of HUDCO.
20. Write a critical note on HDFC.
21. Why was CIDCO formed? Give an idea about its functions and achievements.
22. Mention the broad objectives and principle activities of CIDCO.
23. Discuss the national housing policy announced by the government in 1988.
24. Differentiate between the following:
   (1) Detached houses and semi-detached houses
   (2) Apartments and skyscrapers
   (3) Rural planning and city planning
   (4) Row of houses and flats
   (5) Housing unit and tenement
   (6) EWS, LIG, MIG and HIG.

25. What are the techniques for cost reduction in low cost housing?
26. What is SEZ?
27. Write salient features of SEZ.
28. Write advantages of Navi Mumbai SEZ.
29. Give reasons for the following:
    (1) The subject of skyscrapers is divided between two schools of thoughts.
    (2) It is extremely necessary to select a proper site for the proposed housing scheme.
    (3) It is not enough to provide structurally stable structures as houses.
    (4) Even if the site is quite flat, it will be desirable to introduce some curvature to the street system.
    (5) The provision of good housing in any town planning scheme is desirable.
    (6) It is necessary to give serious thought to the overall development of villages also.
    (7) The principle of State assistance for housing is given official recognition in the housing legislation of most of the progressive countries of the world.
    (8) At present, the co-operative housing societies have become very popular.
    (9) The individuals can give only a limited share in solving the problem of housing.
    (10) The provision and estimation of housing requirements in various five-year plans of our country have proved to be obsolete and inadequate.
    (11) The housing activity is doubly blessed.
    (12) The government action as such is the only effective measure for securing adequate supply of housing.
    (13) The construction industry has to play a great role in housing schemes.
    (14) The investment in housing is economically desirable.
    (15) The new rural housing schemes should be framed in such a way that the spirit of village life is not at all disturbed.
    (16) The idea of ownership flats is becoming popular day-by-day in big cities.
    (17) The costs of construction and maintenance are high for skyscrapers.
    (18) It was possible to erect the first skyscraper of the world in Chicago.
    (19) A massive housing programme will have to be launched by our country.
    (20) The HUDCO also promotes and provides consultancy services.
    (21) A house is part and parcel of man's life.
    (22) The housing becomes an empty dream for many persons.
    (23) The national housing policy should encompass a proper land use policy.
    (24) The investment in housing is safe.
    (25) No one-country method would be applicable to solve the housing problem of our country.
    (26) The NHP definitely stands out like a ray of hope for many people.

Chapter 5

SLUMS

5-1. GENERAL

There is no general agreement on the definition of term *slum* because there are varieties of slums. However, the prime characteristic of a slum is substandard housing. But a slum is always an area. A single neglected building, even in the worst stage of deterioration, does not make a slum. Thus, the areas characterized by substandard housing conditions within a city are known as the *slums*. The term '*substandard housing conditions*' should be taken in a relative social sense referring to actual living conditions with reference to a given time in a specific country.

The Central Government in its Slum Areas Improvement and Clearance Act, 1956 has adopted the definition of slum as any predominantly residential area where the dwellings which by reason of dilapidation, overcrowding, faulty arrangement of design, lack of ventilation, light or sanitary facilities or any combination of these factors are detrimental to safety, health and morals.

In general, a slum is an overcrowded poverty-stricken area having lack of open spaces and presence of unhealthy residential structures. The formation of slum converts the land into a place of vices and miseries and more or less it results into the state of hell on the surface of earth. The slum dwellers live under conditions impairing their health and happiness and they live there because they cannot afford better housing. A scholar has rightly observed that "God made the world, man made the town but devil made the slum".

The movement towards town planning as we know it today was born only after widespread realization of the intolerable conditions which life in industrial and commercial towns imposed on the poorer inhabitants. In India also, the Central and State Governments have realized the evils of slums on the town life and hence, the slum clearance authorities are being appointed to look after the slum clearance programmes. The various towns affected by slums are being covered up under the slum clearance schemes.

It is rather unfortunate to note that almost a quarter of our population lives in slums and further that the slum population in some of our cities constitutes about 30% to 50% of the population. The slums are famously known as '*Ahatas*' in U.P., '*Bustees*' in Bengal, '*Cherries*' in Madras and '*Chawls* or *Jhopadis*' in Mumbai.

In this chapter, the topic of slums with its implications on the town planning will be discussed.

5-2. CAUSES OF SLUMS

The formation or development of slum area in any town is due to various reasons. Following are the main causes which are considered to have contributed to the formation of slums:

(1) Decentralization: When decentralization takes place, the rich and middle class people move out to the extended portions of the town and thus, the poor people are left unattended in the overcrowded central area of the town.

(2) Economic conditions: The unemployment and growth of population may force the affected persons to stay even in unhealthy atmosphere. In fact, the most important and universal characteristic of slums is poverty. This is due to the fact that people live in slums because they cannot afford to pay the rent set up by the market conditions.

(3) Education: If the inhabitants are lacking in education, they may be easily dragged into social evils without any attention to improvement of the living conditions.

(4) Improper use of land: If lands fit for residence are used for industries or vice-versa, the slums may be formed.

(5) Industrialization: The slums may be said to be the direct evil result from industrialization which in the early stages never took care of planning houses for labourers. Those that were built near the factories were cheap structures with rent as the only motive.

(6) Lack of zoning: If the town is not divided into suitable zones and development is allowed to take place at random, the slums may be created.

(7) Migrants: The persons migrating from the surrounding areas may occupy, usually illegally, the vacant or empty places in or outside the city. The term *squatter* is used to mean a person who is occupying the land without title. The colonies of squatters may result into slums. The flow of migrants per day increases in metropolitan cities. About, one-third of the urban population live in ramshackle huts with no civic amenities.

(8) Powers of local authority: If the local authority concerned does not possess adequate powers to control the development of town, the slums may be formed.

(9) Repairs and maintenance: If cheap houses, constructed by the land owner for the purpose of collecting rents, are not properly maintained, the conditions favouring formation of the slums may develop.

5-3. CHARACTERISTICS OF SLUMS

Following are some of the usual or general characteristics of slums:

(1) Appearance: This is rather the universal mark of the slum and its unpleasant appearance offends the eyes, nose and conscience. The structures appear to be deteriorated and to be of over-age.

(2) Fire hazards: The slum area is often exposed to fire accidents and consequent damages. One stick of matches may prove to be sufficient to reduce the whole slum to ashes in no time.

(3) Health and sanitation: The slum is characterized by low standards of sanitation and is often neglected most by the public services for sanitation. It also refers an area of high sickness and death rates.

(4) Income criteria: The slum is a poverty area and it is occupied by people of the lowest income group of the society.

(5) Morals: The socially disorganized slum may prove to be an area of delinquency, crime and vice.

(6) Overcrowding: The slum is overcrowded with buildings or the buildings are overcrowded with people or in the worst condition, both the conditions prevail in the slum.

(7) Population: If the slum population is racial or cultural, it grants a degree of social organization even though the area looks poverty-stricken slum area. For a heterogeneous occupancy, the inhabitants are of different categories which are not welcome in other localities or they cannot afford to live elsewhere.

(8) Social isolation: The slum area is of the lowest social status and it is usually linked up with the rest of the community through its labour force. In a democratic society, the slum dwellers can identify themselves with certain political groups because of their equality of voting and other legal rights with the rest of the community.

(9) Way of life: Depending upon the manner in which the slum has come up, the way of life of the inhabitants may be such that they are strangers to one another or they form a family slum with thick acquaintance with one another.

5-4. EFFECTS OF SLUMS

The effects of slums on the town life are manifold. They can be briefly mentioned as follows:

(1) Absence of amenities: The surrounding area of slums is lacking in essential amenities in required proportions because of overcrowding.

(2) Health: The persons residing in slums are easily attacked by various types of diseases. The climate of slums is such that it easily leads to unhealthy conditions of living.

(3) Surrounding locality: The working of institutions like library, school, hospital, etc., located nearby slums, is seriously affected.

(4) Undesirable spots: The slums as such on a city plan forms undesirable spots and in a sense, disturbs the appearance of good features of a city plan.

(5) Working conditions: It is not possible to work peacefully in slums because the whole area is full of noise, traffic congestion, smoke, dust and darkness.

It is an accepted fact that if housing conditions are improved, there is considerable improvement in the community welfare. A good mind becomes a Devil's workshop in an unfavourable environment. The above view is also endorsed by social workers, magistrates, health authorities and police department. It is, therefore, more advisable to spend the public money in the slum clearance projects as prevention proves to be better than cure.

5-5. SLUM CLEARANCE

(1) Objects: The process of improving the existing conditions of slums is known as the *slum clearance* and the main four objects of taking up slum clearance programmes can be enumerated as follows:

(i) To bring down the disparity in the living standards of the people of various classes.

(ii) To prevent the occurrence of epidemics in the town or city.

(iii) To provide the absolute basic minimum standards of essential amenities for a healthy living.

(iv) To remove the ugly spots or slums from the map of town or city.

(2) Methods: Following are the two methods by which slum clearance programmes can be effected:

(i) Complete removal method

(ii) Improvement method.

It should, however, be remembered that the slum clearance, if not properly carried out, does not abolish slums, but on the contrary, it shifts and spreads them.

(i) ***Complete removal method:*** In this method, the ill-constructed houses are demolished and only those which are really good are retained. The open spaces left are used for widening of roads, providing recreation grounds or building new houses of approved standards. The slum clearance, by this method, proves to be too costly and further, the people who are dishoused are to be provided with alternative housing facilities.

For the selection of the slum areas for clearance as against improvement, the following two important factors should be considered:

(a) the degree of public health hazards involved; and

(b) the economic potential of the land i.e., the full use to which the land can be economically exploited after removal of the slum.

(ii) ***Improvement method:*** It is observed that certain areas where slums are due to poor drainage arrangement and insanitary environments need not necessarily be demolished. If the houses are fairly good, certain steps such as improvement of the street system, filling up of low ground, modifications of drainage arrangements, removal of obstructing structures, etc. may be taken up to implement slum clearance scheme. By proper selection of improvement works, the desired results can be achieved with minimum expenditure.

The important points to be carefully attended to in any slum clearance or improvement project are as follows:

(a) *Amenities:* In addition to widening of roads, the public utility services such as water, drainage and electricity should also be made adequate for the affected area. The minimum basic standards fixed by the Govt. of India for the environmental improvement of slums are as follows:

(1) One water tap for every 150 persons living in the slum.
(2) Two latrines for every 20 to 25 persons living in the slum
(3) One street light for every 30 metres.

(b) *Legal aspects:* The legal formalities required to implement the slum clearance project should be strictly followed. The unnecessary haste results into serious legal complications and considerable time is required to correct the mistakes made. The legal aspects include publication and circulation of the slum clearance project, acquisition of lands, compensation of the acquired properties, arrangements for the evicted population, etc.

(c) *Transit camps:* When a slum clearance scheme is taken in hand, the persons occupying the slums will have to be dishoused. The transit camps in the form of semi-permanent or temporary buildings are constructed in some other parts of the town to accommodate such persons temporarily till their new houses are built. The transit camps of temporary nature should be designed in the simplest way possible to bring down their costs and they should just be strong to satisfy the requirements of the floating population likely to pass continuously through them.

(d) *Unauthorized persons:* To arrest the unauthorized persons to take advantage during the transit period, it is desirable to issue the slum dweller, who is qualified to get a tenement after slum improvement scheme, a pass book containing the complete photo of the family including the children. Such a practice will avoid falsification and impersonation of unauthorized persons and the pass book will serve as a proper authority for the slum dweller to claim a tenement.

5-6. WORKS OF IMPROVEMENT

The term *works of improvement* in relation to any building in a slum area includes the execution of any one or more of the following works:

(1) construction of open or covered drains;
(2) necessary repairs;
(3) opening up or paving of courtyards;
(4) provision of additional or improved fixtures or fittings;
(5) provision of bathing places, water taps and light points;
(6) provision of latrines including conversion of dry latrines into flush latrines;
(7) realignment or replotting of streets;
(8) removal of rubbish and debris;
(9) structural additions and alterations;
(10) miscellaneous including the demolition of any building or any part of building for executing any of the works mentioned above.

5-7. OPEN PLOT SCHEME

In this scheme, the available open land is suitably subdivided and allotted to slum dwellers. Extreme care however should be taken to see that the beneficiaries of the scheme do not pass away their title and possession to other better off groups.

Further, constant watch should be kept on the area developed under this scheme so that the open plot scheme areas do not deteriorate into the worst slums.

Some of the precautionary measures to be adopted for the successful implementation of the scheme are as follows:

(1) The area of the plot should not exceed 20 m^2 to 25 m^2 so that the scheme may not attract the better off classes.

(2) The individual lessees may be provided with the possible alternative designs for the construction of small houses.

(3) The plots should be given on long-term lease with necessary conditions for cancellation and re-entry in case of breach of terms of the lease document.

(4) The self-help combined with the use of locally available materials and methods of construction should be encouraged.

5-8. SLUM CLEARANCE AND REHOUSING

The complete removal of slum has been recognized as the ultimate objective and slum improvement has been considered as an immediate alternative to give relief to the slum dwellers. The available limited resources should be exploited to the maximum possible extent for providing rehabilitation to the urban poor people in healthy and planned colonies. The main five difficulties to be encountered while pursuing the slum clearance programme are as follows:

(1) constraint of resources;

(2) high cost of alternative sites near place of work;

(3) lengthy and time-consuming procedures of the acquisition of slum area;

(4) low rent paying capacity of the slum dwellers with the result that the subsidized rents may also prove to be too high; and

(5) reluctance or unwillingness of the slum dwellers to move from the areas selected for clearance.

Following are some of the measures which may be adopted to make the slum clearance and rehousing schemes successful:

(1) In the surrounding area of the metropolitan city, a chain of growth centres, popularly known as the *satellite towns*, should be formed with a view to provide for growing employment opportunities and better living conditions in such centres. These towns will discourage the migration tendency and will also provide an attractive alternative to the city for the purpose of future expansion.

(2) The slum rehabilitation scheme may be combined with some commercial schemes so as to make it self-supporting in finance.

(3) The minimum carpet area including sanitary conveniences may be decided for a family.

(4) The potentialities of the open plot scheme combined with self-help housing on the part of the slum community should be fully exploited.

(5) The State Governments should make enough provision in the budget every year for the construction of minimum houses for the slum population.

5-9. PREVENTION OF SLUM FORMATION

The formation of slums is a very slow process and extreme care should be exercised by the authorities concerned to prevent the springing up of new slums in the town. The failure to take precaution of formation of new slums results in equalizing or even overtaking the progress achieved in slum clearance projects. Ultimately the housing shortage and coming up of new slums become the permanent features of the town.

Some of the important measures which can be taken to effectively prevent the slum formation are as follows:

(1) Cheap housing: Sufficient number of subsidized cheap housing should be made available to the poor people. The investment of public funds for such purpose certainly gives good results.

(2) Compulsion to employers: The employers of a good number of labourers may be compelled or forced to provide housing accommodation for their staff.

(3) Construction of buildings: Certain rules and regulations may be framed and strictly enforced to restrict the coming up of buildings of subnormal standards.

(4) Maintenance and repairs: The responsibility of maintaining and carrying out repairs should be fixed and defined in housing codes or Acts. It then becomes the duty of either landlord or tenant to keep the existing building in a living condition. Such an attitude on the part of the local authority helps in preventing the conversion of existing good buildings into slums.

(5) Rent restrictions: If provision is made to restrict the increase of rent, the tenants will be protected. The Rent Restriction Act is in force in many towns of our country. It is advisable to revise this Act periodically so that landlord may be inclined or tempted to maintain his property in proper form.

(6) Social education: It is possible to check the growth of slums by carrying out effective social education of the slum dwellers. The social education makes the slum dwellers conscious of the evils of slums and if an intensive social propaganda is carried out with the help of service organizations through literature, posters, exhibition of films, television shows, etc., there is great improvement in the living standard of slum dwellers.

(7) Unauthorized construction: It is absolutely necessary to arrest immediately the unauthorized construction in the form of huts and temporary structures on vacant pieces of lands.

The authorities concerned should take drastic actions in demolishing and removing such unauthorized constructions. The law should be suitably amended to give such powers to the authorities concerned. The delay in such matters proves dangerous as time passes and interference of outside agencies even on humanitarian grounds should not be at all encouraged. The term *squatting* is used to mean the encroachment on land owned by private or individual or public body.

Thus, the squatter occupies the land without any title or right. The squatting may be brought to an end by police action or it may at least be legalised, if there is widespread public sympathy for the squatters.

5-10. RESOURCES FOR SLUM CLEARANCE PROGRAMMES

The slum clearance works require considerable fund and the resources for the successful implementation of the scheme should be properly analysed and arranged.

The financial management should be made in such a way that maximum benefit is derived from the available limited resources. Some of the possible measures to augment the slum clearance schemes are as follows:

(1) distribution of national housing cess for rural and urban housing;

(2) granting interest free loans or loans with nominal rate of interest for a period of 30 to 40 years;

(3) lottery funds;

(4) relaxation of the provision for loans by the Life Insurance Corporation;

(5) surcharge on urban properties; etc.

5-11. THE INDIAN SLUM

It is a sad state of affair that some of the worst slums in the world can be found in major Indian cities like Mumbai, Calcutta, Ahmedabad, Surat, Chennai, Delhi, etc. The slums are spreading like white ants and cancer due to lack of proper and effective town and country planning. It is not possible to accommodate the ever-increasing flow of migrants from rural areas and small towns in our big cities.

The problem of slums in Mumbai is very acute. The areas of slums in Mumbai vary from a fraction of a hectare to as many as 24 hectares for Kamathipura and about 132 hectares for Dharavi. Kamathipura is the biggest slum comprised of privately owned properties. Dharavi is the biggest eye-sore as a slum on the city map of Mumbai.

Due to the rapid growth and migration of population, the slums have also considerably expanded in Calcutta, Chennai, Surat, Delhi, etc. In a similar way, the slums are also on the increase at places like Poona and Ahmedabad. The city of Poona is fast developing with an expanding industrial sector. The city of Ahmedabad is now a major industrial centre and over its 50 per cent slum dwellers live in single rooms with 4 to 9 people.

It is also important to note that slums have appeared on the periphery of newly built capital Chandigarh which was conceived by the master architect and town planner Le Corbusier. The critical nature of the problem is demonstrated by the fact that 42 to 67 per cent homes do not have tap water and 26 to 50 per cent homes do not have toilets in Mumbai, Calcutta and Delhi. These figures are increasing day-by-day.

Table 5-1 shows the approximate estimated slum percentage in various towns and cities of our country ranging from less than 50000 to more than 10 lakh.

The study of the table also reflects that nearly 74.20 percentage of slum exists in 222 big towns and cities (nos. 3 to 6) forming only about 6.59 per cent of total number of towns or cities.

With the limited resources available, the government and semi-government bodies will have to plan out intelligently slum clearance programmes to grant adequate and decent housing to every human being.

TABLE 5-1
SLUM PERCENTAGES

No.	Population	Number of towns or cities	Percentage of slum (app.)
1.	less than 50000	2874	14.40
2.	50000 to 1 lakh	275	11.40
3.	1 to 3 lakh	151	15.00
4.	3 to 5 lakh	28	6.80
5.	5 to 10 lakh	31	13.60
6.	Above 10 lakh	12	38.80
	Total	3371	100.00

The slum is like cancer in the life of a city and all efforts in the form of sound land policy, efficient administration, maximum financial economy, planned development, etc. should be made to improve the existing slums and to prevent the formation of new ones.

QUESTIONS 5

1. Define and explain what is meant by slums.
2. What are the causes of slums?
3. What are the characteristics of slums?
4. What are the objects of slum clearance programmes?
5. Enumerate the effects of slums.
6. Write short notes on:
   (1) Slum clearance project
   (2) Transit camps
   (3) Rent Restriction Act
   (4) Unauthorized construction.
7. Mention the points to be carefully attended to in any slum clearance project.
8. What is meant by works of improvement?
9. Discuss the open plot scheme for removal of slums.
10. Write a critical note on slum clearance and rehousing.
11. What are the resources for slum clearance programmes?
12. How can formation of slum be prevented?
13. Describe the two methods of slum clearance.
14. State the legal aspects to be considered in any slum clearance project.
15. Write a critical note on the Indian slum.
16. Differentiate between the following:
   (1) Slum clearance and slum improvement
   (2) Transit camps and rehousing
   (3) Unauthorized construction and unauthorized persons
   (4) Slum formation and slum prevention.

17. Give reasons for the following:

(1) The formation of slum converts the land into a place of vices and miseries.

(2) The decentralization is responsible for formation of slums.

(3) The slums may be said to be the direct evil result from industrialization.

(4) The surrounding area of slums is lacking in essential amenities in required proportions.

(5) It is not possible to work peacefully in slums.

(6) The slum clearance by complete removal method proves to be too costly.

(7) It is advisable to revise the Rent Restriction Act periodically.

(8) If housing conditions are improved, there is considerable improvement in the community welfare.

(9) It is more desirable to spend the public money in slum clearance projects.

(10) Extreme care should be exercised by the authorities to prevent the springing up of new slums in the town.

(11) It is absolutely necessary to arrest immediately the unauthorized construction in the form of huts and temporary structures on vacant pieces of lands.

(12) The colonies of squatters may result into slums.

(13) It is desirable to issue the slum dweller, who is qualified to get a tenement after slum improvement scheme, a pass book containing the complete photo of the family including the children.

(14) When a slum clearance scheme is taken in hand, the transit camps are constructed.

(15) In the surrounding area of the metropolitan city, it is desirable to form satellite towns.

(16) The slum rehabilitation scheme may be combined with some commercial schemes.

(17) The slum is like a cancer in the life of a city.

Chapter 6

PARKS AND PLAYGROUNDS

6-1. GENERAL

In his natural state, the man moved and roamed in forests and he thoroughly enjoyed his association with the nature. During course of time, the man moved to town and city and there came the urban civilization. Even at this state, he has got the deep rooted desire to remain in contact with the soil and it is for this reason that open spaces in the form of parks and playgrounds should invariably be provided in all town planning projects.

It is not an exaggeration to state that no town planning scheme is complete without its well planned park system.

It is not merely sufficient to acquire few pieces of land and reserve them for development as parks and playgrounds in future. With the new ideas and concepts of town planning and country planning, it has become essential to tackle the problem of the design of park system on a scientific footing. The location and development of open spaces should be controlled so as to give the maximum benefit to the entire people of the area.

The life in unplanned cities and towns is an unnatural life. There is presence of monotony of bricks and stones and of dust and dirt. It is not possible to breathe fresh air and enjoy the beauty of colours exhibited by nature.

The most important function of any local authority towards its citizens is to develop the area in such a manner as to grant the maximum opportunities to the individual to enjoy the life in the best possible manner.

It is for this reason that a well-designed town should contain sufficient playgrounds and local recreation and pleasure grounds. Such policy not only makes the town or city beautiful, but also grants it a special character and personality of its own.

At this stage, it will be interesting to mention the experience of city Chicago (U.S.A.). Chicago as such had no diversified topography or lands of a high order of natural beauty. But the city has developed gigantic system of parks and boulevards by artificial means with the help of highly skilled persons.

Chicago would not have been the same city as she stands today in the absence of her parks and boulevards. Chicago has tremendous power of attracting men and money every year and has attained the place among the great cities of the world.

In this chapter, the importance of parks and playgrounds in the town planning schemes will be discussed.

6-2. TYPES OF RECREATION

On the basis of services rendered by open spaces in the form of recreation, they can be divided into the following two types:

(1) Passive type recreation or parks

(2) Active type recreation or playgrounds.

(1) Passive type recreation or parks: The parks are provided to meet with the needs of fresh air and peaceful enjoyment of the unspoiled nature. In congested city areas, it is not possible for the inhabitants to secure this type of recreation and therefore, the parks should invariably be provided for the benefit of such people. Thus, the open spaces in the form of parks furnish the passive type of recreation.

(2) Active type recreation or playgrounds: The playgrounds furnish opportunities for the physical growth of body by actively engaging muscles in various games. Thus, the playgrounds or playing fields offer active type of recreation. The demand for playgrounds in recent times has greatly increased due to the rapid development of organized athletic games.

Both the types of recreation, passive as well as active, have considerable effects on civic, cultural, social and physical aspects of town life. The gap between the two types of recreation is very narrow and sometimes the sphere of one overlaps that of other. In any case, it becomes the duty of a town planner to give serious thought on these two types of recreation and adjust them accordingly in the proposed town planning scheme of the area.

6-3. LOCATION OF URBAN GREEN SPACES

The urban green spaces should be located in the town plan very carefully as they serve as a kind of filter or protection against noise, dust, hot sun and harmful winds.

Following aspects should be observed in this connection:

(1) Distribution: The green spaces in a town plan should be distributed evenly in the residential area to ensure sanitary and hygienic conditions. They should be located near the places for rest and recreation.

(2) Location: The central part of the town or large spaces in front of public buildings are usually landscaped with lawns and flowerbeds. The main streets of town should be provided with tall trees planted in rows.

(3) Planning: While planning a system of urban green spaces, the climatic features of a locality should be taken into consideration. In towns having the advantage of sea shores, lakes, etc., the large parks and green spaces should be placed near the water. The green belts should be located at right angles to the direction of the wind to offset the effects of unfavourable winds.

(4) Site selection: The lands required for the parks and playgrounds should be acquired well in advance before the value of land increases due to any proposed development in the town planning scheme. The land obtained by filling of pools, ponds, etc. and also the land which is unsuitable for any development should be converted into gardens, parks and playgrounds.

6-4. CLASSIFICATION OF PARKS

Although the parks may be said to serve as breathing spaces and attractive areas for refreshment to both, mind and body, they are subject to considerable variation in size, purpose, character, location, etc. and they are therefore amenable to a variety of classifications.

The parks can be classified into the following three ways:

(1) according to character;

(2) according to purpose; and

(3) according to size.

Each of the above classification of parks will now be briefly described.

(1) According to character: The parks, according to character, are classified into the following two types:

(i) Artificial parks

(ii) Natural parks.

(i) ***Artificial parks:*** These parks are prepared artificially with great care by experts in the park layout. They are planted with grass, shrubs, flowers and trees. The water may be introduced in the form of fountains and pools. The seats of suitable design may be provided. They are usually prepared in the heart of a town and given an attractive finish.

(ii) ***Natural parks:*** In case of natural parks, all efforts are made to maintain in tack the original natural features of the parks and only the necessary minimum adjustments are made to put them for public use.

(2) According to purpose: The parks, according to purpose, are classified into the following two types and they provide green spaces for special use:

(i) Botanical parks

(ii) Zoological parks.

(i) ***Botanical parks:*** These parks are primarily meant for the study of plant specimens. But their atmosphere can be made more pleasant and appealing by the presence of beautiful trees, flowers and lawns.

(ii) ***Zoological parks:*** These parks contain zoo and it is absolutely necessary for the zoo to be given an attractive park-like setting. It is undoubtedly true that for the vast majority of people, a visit to the zoological park is more or less an outing or a picnic, usually accompanied by children. A zoological park contains houses and other facilities for animals to be maintained in the zoo.

(3) According to size: The parks, according to size, are classified into the following five types:

(i) Small size parks

(ii) Medium size parks

(iii) Large size parks

(iv) Reservations

(v) National parks.

(i) ***Small size parks:*** These parks are generally in the form of squares enclosing a public building. They are provided in dense business or residential areas where land is costly. The area of these parks varies from 1 hectare to 4 hectares. These parks may also be located as settings for architectural public buildings or monuments at junctions of roads or in the midst of blocks of flats. For children, small parks of size about 0.20 hectare can be developed at suitable sites in the town. Such children's parks should have easy accessibility and safety and they should be well equipped with modern type of sporting items like merry- go-round, slides, swings, etc.

(ii) ***Medium size parks:*** These are also known as the *neighbourhood parks* and they are preferred for every residential locality in a town. Both the types of recreation, passive as well as active, may be provided in these parks. The community centre can also be located in this park. The size of these parks should not be less than 12 hectares.

(iii) ***Large size parks:*** These parks serve the town or city as a whole or a number of neighbourhood units. They may provide active recreation for games like cricket, boating, riding, swimming, etc. and may also accommodate zoological gardens. The large beaches on the ocean front can also be included in this class of parks. They should be provided with paved footpaths, drive ways, shelters, parking places, drinking water fountains, restaurant, etc. The minimum area required for this type of park is about 40 hectares.

(iv) ***Reservations:*** These parks are situated outside the city limits and they include extensive areas of natural sceneries. They also provide facilities of moving into the forests and sea beaches. They are kept in a natural condition. They are also used to conduct camps and picnics. The minimum area required for this type of park is 400 hectares.

(v) ***National parks:*** These parks are very extensive in area and they are mostly unexplored. They may include within their limits rivers, forests, waterfalls, mountains, wild life, places of historical importance, coastal belts, etc. Such parks should be evenly distributed throughout the country so that whole of population can enjoy them. They should be accessible from a number of towns. These parks also provide facilities to the scientists and students for the study of natural flora and fauna. The students of various branches of science such as geology, entomology, ecology, meteorology and seismology can take advantage of these parks for their studies. The area for a national park may run into thousands or lacs of hectares.

6-5. THEME PARKS OF AMERICA

In America, the amusement parks, known as the *Theme Parks*, are existing and they entertain the entire family from grandparents to grandchildren at a reasonable cost. These are called *theme parks* because everything in such parks is themed or given specific attraction. The architecture of a restaurant, the costume of a street cleaner, names of various attractions, etc. are given amusing touch and finish. Even the technical terms such as visitors are also themed. For instance, there is no such thing as a '*visitor*' to a theme park. They are called '*guests*' and when these guests go through the entrance gates, every tiny detail they see is designed to convey them into another world.

The pioneer in the field of theme parks was Walt Disney (1901-1966). He was the son of a radical worker of Irish-Canadian descent, Elias Disney who went bankrupt while trying to grow oranges in Florida. He was later on running a carpenter's shop at Chicago and it was at this point on December 5, 1901 that Walt was born. In 1950, he took his grand-daughter to an amusement park and he was shocked to see that the place was a shabby, run down park. This incident inspired him to build a park for adults as well as for children. He established Walt Disney Productions and the first theme park, the famous Disneyland in Anaheim, California, U.S.A. was completed on July 17, 1955. The temperature stood at about 43°C and although 22000 guests had been invited, somehow many more arrived. A reporter asked Walt on the opening day when the project might be completed and his reply was very simple, "Never, not as long as there is imagination left in the world". Since its opening, more and more attractions with novel ideas have been added to this park involving expenditure of millions of dollars. It is said that millions of people from all over the world are being hosted every year by this world famous theme park.

The success of Disneyland encouraged the idea of theme parks and there are over 40 major theme parks in America. These popular worlds of fantasy and fun have become some of the hottest attractions in the entertainment and recreation field. They are situated near major population centres, so that in time of recession and high travel costs, it is cheaper for a family to visit a nearby park of recreation than to travel for a distant destination.

In a similar way, the price paid for a ticket to a theme park certainly proves to be a good bargain when compared with the high cost of attending a professional musical or sporting event.

The biggest reason for the popularity of theme parks is the pure fantasy which is offered by such parks. The people can safely leave the woes and worries of the real world outside when they enter these lands of make believe. The theme parks are hermetically sealed environments, clean and wholesome enough to appeal to the entire family.

The fantastic characters, spectacular rides, live entertainment programmes, etc. are the main features of a theme park. The performers in the live shows are energetic young singers and dancers who are trained to maintain high professional standards and to impart quality shows of the highest order. Also, no detail or cost is spared in creating major rides at theme parks.

The single most important contribution to the quality of a theme park is its employees. These clean-cut, well-dressed and smiling young people perform various duties such as restaurant hosts, street cleaners, ride operators and show performers. They are always reminded that they are the real image-makers of the park and they should always be polite and courteous to the guests.

The major theme parks have practically saturated all available market in America and hence, the future of theme parks in America includes many smaller sized parks having some special feature that no other park has such as unique live entertainment, multi-media show, etc.

However, the potential for foreign growth is now being realized and it is quite likely that this American phenomena of the theme park may soon become something which people all over the world can enjoy.

6-6. PARK SYSTEMS

The ideal park system in any town planning scheme is one which functions to the best advantage of population — present as well as estimated. The park system should be adequate in relation to the population to be served and it should provide for arrangements connecting the bulk of the open spaces together. These arrangements may take the form of parkways or avenues or boulevards or green belts.

The various park systems have been developed with advantages of their own. Following three important types of park systems will be briefly described:

(1) Belt or ring system

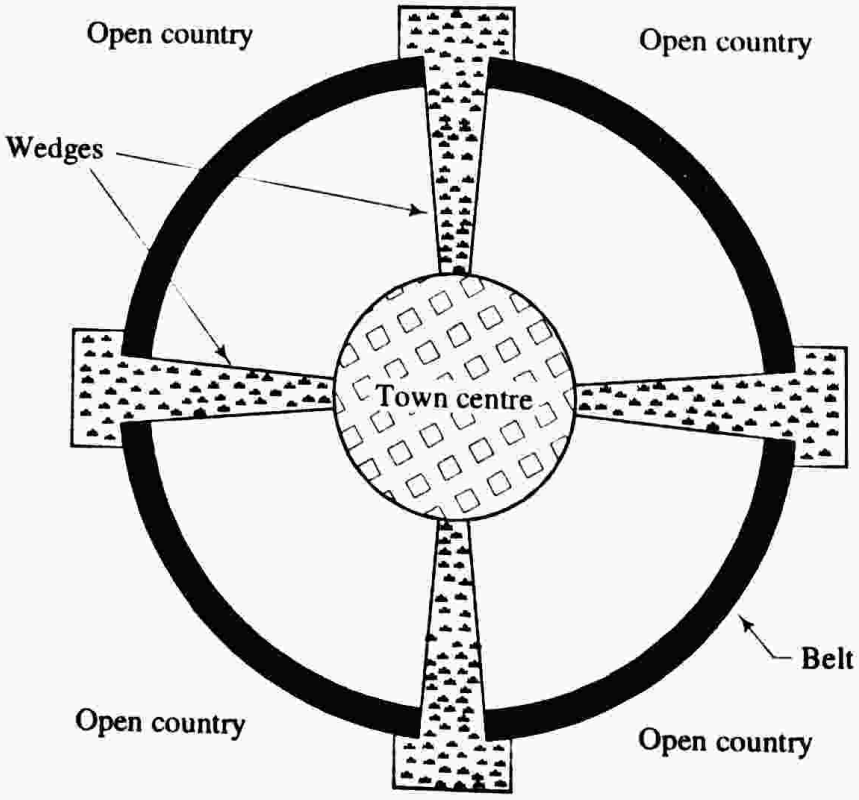
(2) Wedge or radial system

(3) Combination of belt and wedge systems.

(1) Belt or ring system: In this system, the parks are provided on the periphery of the town in the form of belt or ring. This system of open spaces exists in some old towns and cities. The main purpose of adopting this system in old time was to provide an elaborate ring in the form of park as a measure of defence to the town or city.

(2) Wedge or radial system: In this system, the wedge-shaped strips of open spaces are provided to link up centre of the town with the rural area. The main advantage of this system is that it enables fresh air from the country to reach right upto the heart of the town. In some cases, the wedges may be developed as parkways or boulevards.

(3) Combination of belt and wedge systems: The combination of belt and wedge systems gives excellent results. In this system, it is possible to practically link up major open spaces of the town and people can travel from one part of the town to the other part through shaded parkways or boulevards. Fig. 6-1 shows the layout plan of combined belt and wedge system.



Combined belt and wedge system

FIG. 6-1

6-7. PARK DESIGN

The design and layout of parks and playgrounds require the collaboration of disciplines from various fields. No satisfactory results can be obtained without proper cohesion, orderly planning and landscaping of various elements comprising the park system. The main specialist required in the design of parks is the landscape architect and he should be adequately assisted by the arboriculturist, the architect, the hydraulic engineer and the horticulturist.

It is true that for parks of special purposes and possessing sites of peculiar characteristics, the design will be based on individual aspects. But for average parks, the general principles to be observed in their design can briefly be mentioned as follows:

(1) Collection of data: It is necessary for the designer to collect data such as characteristics of site, population likely to visit the park, purpose of park, facilities to be provided, etc. before he commences his work on the design of park.

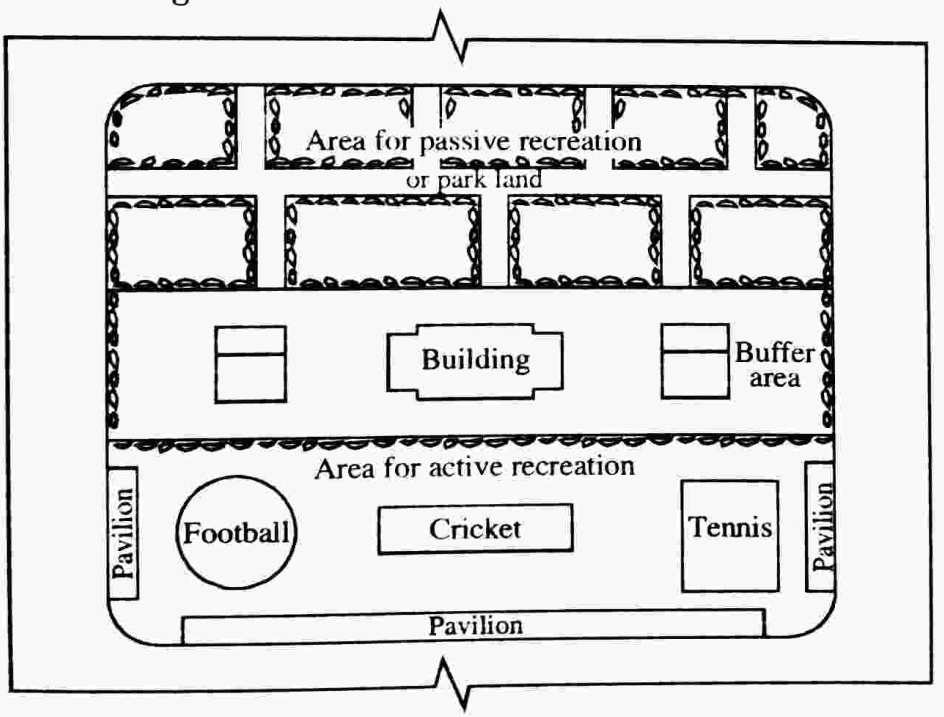
(2) Commercial sports: The grounds for commercial sports such as cricket and football should be surrounded with walls as entry to such grounds will be limited to those who pay for admission.

(3) Division: The usual practice is to divide the whole area of park into three distinct divisions as shown in fig. 6-2. These divisions are as follows:

(i) area for passive recreation or park land;

(ii) buffer area consisting of flower gardens or some such arrangements around buildings; and

(iii) area for active recreation or playground area including pavilion and other buildings.



Layout of park
FIG. 6-2

(4) Facilities: The park design should properly accommodate the usual facilities such as sanitary blocks, shelters, seats, drinking fountains, etc.

(5) Marine parks: The design of a marine park requires careful considerations with respect to the large number of persons to be assembled on holidays, movement of pedestrian and vehicular traffic, parking areas for private cars, etc.

(6) Paths and walks: The design of a park should provide for a satisfactory system of paths and walks so that there is easy circulation throughout the area.

(7) Plantation: For providing screens between various components of park, the designer should provide plants arranged in attractive shapes and patterns.

(8) Proportion of each type of recreation: An average park is usually designed for both the types of recreation, namely, passive as well as active. The designer should work out the proportion of site for each type of recreation.

(9) Views through trees: The surrounding buildings of the park area should be well designed and properly grouped so as to give excellent views through trees.

(10) Water: The flowing water contributes greatly to the decorative effect of the park. From upper levels, the water may be allowed to flow by gravity in the form of cascades and at lower levels, it may be converted into lakes and pools.

6-8. FINANCE FOR PARKS

The finance for parks can be obtained by any one of the following ways:

(1) By donations: The land required for parks can be received as donation from generous persons and donations can also be accepted for various other components of parks such as drinking fountains, seats, pavilion, etc.

(2) By raising loan: The loan of required amount on long term basis may be floated in general public by giving the complete details of the project and thus, the fund for parks can be collected.

(3) By spending from public fund: The local authority acquires land for parks and gives compensation to the land-owners. The part of acquisition cost can be recovered in the form of betterment charges.

6-9. PARKWAYS

A parkway may be defined as a *freeway* constructed along and through a strip of public land with no access from adjoining properties. The sides of road are planted with trees and other vegetation. A parkway is thus a road and a park combined with a special legal quality which denies right of access from abutting lands. The important facts to be remembered in connection with the parkways are as follows:

(1) A parkway should not be confused with a boulevard, the latter being a wide tree-lined avenue in a town or a city.

(2) It should be seen that trees and other vegetation do not interfere vision at and near curves and intersections.

(3) The arrangement of trees and vegetation should be such that unsightly and displeasing views adjacent to the parkways are avoided from vision.

(4) The artificial slopes on the parkways should be blended and converted into the form of natural contours.

(5) The crossing of parkways with other traffic roads is made at a different level and for this purpose, handsome well-proportioned bridges are provided.

(6) The parkway is free from ribbon development and it results into segregation of private vehicles.

(7) The parkway may provide special paths for riding or walking and immediate access to open areas for picnic, rest and play.

(8) The planting along roadside should be done carefully and it should be seen that overhanging growth will not interfere the passage of vehicles of more height such as double-decker buses, etc.

(9) The width of roadway in a parkway may vary from place to place and further, the roadway need not necessarily be centrally placed.

(10) The width of strips through which the parkway is passing should be at least 90 m wide and preferably, it should be 150 m to 300 m wide.

6-10. BOULEVARDS

The use of word boulevard has originated from Paris, France. The ring roads used as defensive walls were subsequently demolished and the roads thus formed came to be named as boulevards in that country.

At present, in town planning parlance, the boulevards are used to mean wide tree-lined avenues in a town or a city. The important facts to be remembered in connection with the boulevards are as follows:

(1) A boulevard should not be confused with a parkway, the latter being a freeway along and through a park.

(2) The boulevard connects various recreation reserves of the town and it serves as a link between large size and medium size parks.

(3) The boulevard enables the busy people having no time to visit parks to enjoy the natural scenery while passing along or through the boulevard.

(4) The boulevard forms an important part of any urban park system and its presence gives an added attractiveness to the town.

(5) The boulevards should be of sufficient width and it is desirable to provide separate arrangements for cyclists, pedestrians, horse-riders and vehicle, etc.

6-11. PLAYGROUNDS

The size and location of playgrounds will depend upon the age group of people for whom they are required. The provisions for various age groups are as follows:

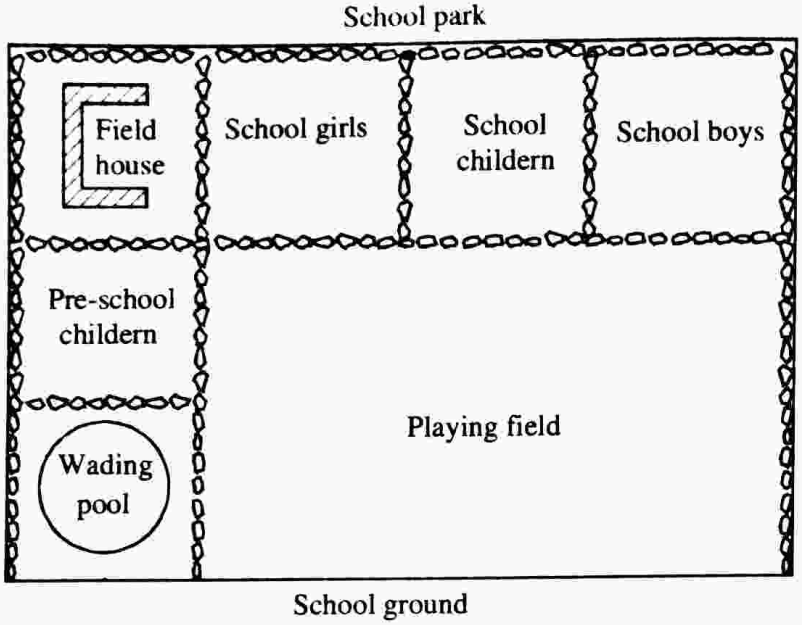
(1) Children upto the age of 6 years: It is quite obvious that playground must be near their homes, say within a radius of 400 m, as they cannot be expected to travel safely further than this distance. The playground must have fencing all round and for further safety, the children's play must be supervised. The usual provision is 0.13 hectare per 1000 children.

(2) Children at school: Each school should have its own playground. The land required for primary school is about 0.40 hectare for 1000 pupils and for secondary school, it is about 1.20 hectares per 1000 pupils. Refer to fig. 6-3.

(3) Youths and adults: The playground should be within a range of 3 km or so. The land required is about 1 hectare per 1000 population.

(4) Private clubs: The provision should be made at the rate of 1.20 hectares per 1000 members.

If all the above requirements are grouped together, the aggregate area of land required works out to about 2.40 hectares per 1000 population and hence, the open spaces for playgrounds should accordingly be reserved in the town planning scheme. Fig. 6-3 shows the typical layout of a fully developed school playground with respect to the arrangement for students of different age groups.



Typical playground of a fully developed school
FIG. 6-3

The important facts to be noted are as follows:

(i) ***Equipment:*** The various apparatuses such as swings, slides, etc. should be freely provided.

(ii) ***Field house:*** It serves as administrative block, centre for indoor games and library.

(iii) ***Organized games:*** Enough space should be allotted for organized games such as basketball, kabaddi, kho-kho, etc.

(iv) ***Sex segregation:*** It is desirable to have sex segregation except the youngest children.

(v) ***Wading pool:*** The accommodation of a feature like a wading pool is desirable to improve the pleasantness of playground.

For big towns, it is necessary to have multipurpose stadium also. The size of such stadium may vary from 8 to 20 hectares and it must provide facilities for all types of games, athletics, wrestling, cricket, football, etc.

6-12. SPACE STANDARDS

It is very difficult to lay down any specific standard for the aggregate area of parks and playgrounds as it depends upon many factors such as density of population, individual open spaces around houses, widths of streets, etc.

The various standards have been advocated from time to time. According to one standard, a minimum area equal to 10 per cent of the gross area of town should be reserved for parks and playgrounds. But this standard has now been abandoned as it has proved to be illogical.

The main factor influencing the standard of open spaces should be density of population rather than a fixed percentage of total land. Hence, another standard based on density of population has been suggested and accepted in practice. According to this standard, a minimum provision of one hectare, excluding the forest reservations and the forest parks, is desirable for every 500 to 750 persons for parks and playgrounds.

It is not enough to have merely the required area reserved for parks and playgrounds in a town. The parks and playgrounds should form a comprehensive layout in a town plan. They should be varying in sizes, well distributed throughout the town, reasonably accommodated in the general town plan and designed to serve the probable future population.

As for suitable sites for parks and playgrounds, the land which is not usually fitted for buildings may be taken advantage such as low lying area, hill side, marshy places, etc. The places of natural beauties such as flowing streams, rock-slopes, etc. may be also used with advantage for the purpose of parks and playgrounds.

6-13. LANDSCAPE ARCHITECTURE

The landscape design is the job of landscape architect who is specially trained for exploiting fully the potentialities of open spaces. The competent landscape architect is trained in various disciplines of science such as geology, soil mechanics, ecology, arboriculture, forestry, topography, colour effects, etc. For a fairly big project, it is worthwhile to combine the services of town planner and landscape architect.

The objects or purposes of landscape architecture can briefly be mentioned as follows:

(i) In the overcrowded town of today, with high densities of population, the landscape architecture decorates the town with gardens, parks, recreational open spaces, tree-lined avenues and streets.

(ii) The proper landscaping imparts beauty and it results into a good setting of the buildings.

(iii) The provision of trees in a town results into many practical advantages. The trees relieve eye strain, reduce glare on paving surfaces and walls, lower street temperatures, absorb carbon dioxide and give out oxygen, act as wind breakers, provide shade during summer, etc.

(iv) The urban landscaping is intended for developing an agreeable, cheerful, pleasant and attractive environment.

The landscape architecture is a topic by itself and it is not intended to discuss it at length. Some of the salient features of the landscape architecture are as follows:

(1) Continuous park system: It is desirable to provide a continuous park system instead of small sized green spots or patches here and there in a town plan. For instance, if small-sized trees are planted on front sides of plots touching street roads, a continuous greenway leading to schools or shopping centres or other public buildings may be formed along the footpaths and such an arrangement would certainly prove to be pleasant and attractive. In a similar way, a continuous walkway through wooded areas and linking important centres of the town will definitely be equally liked by persons of all ages.

(2) Selection of trees: The final selection of types of trees to be planted along roadside is made by considering subsoil conditions, type of earth, moisture content and climatic conditions of the locality. A number of alternatives may be found out as many varieties of trees are available in this country. The trees having long, spreading and strong roots are not recommended as they present danger to the adjoining compound walls and pavements.

The selection of proper trees along roadside is a difficult task and only competent landscape architect will be able to guide properly in this matter. The names of some of the trees are mentioned for information only. Eucalyptus trees are suitable in marshy areas as they absorb excess moisture from the earth. Neem is a good tree and it can be planted along wide roads. Amaltas, Jackaranda and Gulmohar trees make the atmosphere colourful in their blossoming seasons. Peepal and Banyan trees are very much suited for trunk roads as they grow big and tall.

(3) Size of trees: Depending upon the space available and the effects desired, the size of trees should be decided. The small-sized trees are suitable at places where open spaces available for planting of trees are small and they can be well planted at focal points to arrest the attention of people. On the other hand, the large-sized trees will require more space for their growth and the space between successive trees is to be decided by considering climatic conditions of the locality, nature of soil and type of the tree. The large-sized trees are helpful in developing better architectural effects of the locality as they more or less look like structural members.

(4) Standard of living: The number of trees and green spots in a town have a direct bearing on the standard of living of the citizens. In busy life and overcrowding condition of present time, the parks and tree-lined avenues are the only mediums through which men can maintain contact with nature. The landscape architecture, if properly planned, helps in improving the health conditions of persons and it also gives mental peace, comfort and cheerfulness to the persons. The absence of well-planted trees along streets and surroundings is certainly a definite sign of substandard living of the population.

(5) Street trees: The trees on streets should be carefully spaced in accordance with the species of trees and the effect desired. The spacing varies from 6 m to 14 m or more between the trees. For narrow streets, spacing of trees may be staggered on opposite directions. The trees to be adopted for streets should be hard, durable, clean, highly resistant to the attack of insects, etc. and the roots of such trees should be such as will interfere to the footpaths and underground services to the minimum possible extent. There is no doubt that trees on streets disturb public utility services to a certain extent. But the advantages of rightly planted trees are so many that such disturbance can be tolerated. In addition to street trees, the design of street furniture such as post boxes, lamp-posts, hydrants, telephone kiosks, etc. should be also carefully made.

QUESTIONS 6

1. What are the two types of recreation?
2. How are parks classified according to character?
3. How are parks classified according to size?
4. Write a detailed note on the theme parks of America.

5. Write short notes on:
   (1) Botanical parks
   (2) Zoological parks
   (3) National parks
   (4) Selection of trees
   (5) Size of trees
   (6) Location of urban green spaces
   (7) Marine parks
   (8) Street trees.
6. What is an ideal park system? Describe important types of park systems.
7. Explain the general principles to be observed in park design.
8. What are the different ways of financing parks?
9. Define a parkway and mention the important facts to be remembered in connection with it.
10. What are boulevards? Explain them in details.
11. Give sketches of the following:
   (1) Combined belt and wedge park system
   (2) Layout of a typical park
   (3) Typical playground of a fully developed school.
12. How are playgrounds provided for various age groups?
13. Suggest a typical layout for playground of a fully developed school.
14. What are the space standards for parks and playgrounds?
15. What is landscape design? What are its purposes?
16. Describe some of the salient features of landscape architecture.
17. Differentiate between the following:
   (1) Parks and playgrounds
   (2) Artificial parks and natural parks
   (3) Medium size parks and large size parks
   (4) Parkway and boulevard
   (5) Reservations and national parks.
18. Give reasons for the following:
   (1) It is not an exaggeration to state that no town planning scheme is complete without its well-planned park system.
   (2) The demand for playgrounds in recent times has greatly increased.
   (3) The design and layout of parks and playgrounds require the collaboration of disciplines from various fields.
   (4) It is very difficult to lay down any specific standard for the aggregate area of parks and playgrounds.
   (5) The design of a park should provide for a satisfactory system of paths and walks.

(6) For a fairly big project, it is worthwhile to combine the services of town planner and landscape architect.

(7) The combination of belt and wedge systems gives excellent results.

(8) A parkway is a road and a park combined.

(9) The provision of trees in a town results into many practical advantages.

(10) The trees having long, spreading and strong roots are not recommended.

(11) The landscape architecture, if properly planned, helps in improving the health conditions of persons.

(12) The life in unplanned cities and towns is an unnatural life.

(13) Chicago has tremendous power of attracting men and money every year.

(14) It is absolutely necessary for the zoo to be given an attractive park-like setting.

(15) The national park should be evenly distributed throughout the country.

(16) The large-sized trees are helpful in developing better architectural effect of the locality.

(17) The urban green spaces should be located in the town plan very carefully.

(18) The lands required for the parks and playgrounds should be acquired well in advance.

(19) The neighbourhood parks are preferred for every residential locality in a town.

(20) The Theme Parks of America have become very popular.

Chapter 7

INDUSTRIES

7-1. GENERAL

After independence, India has made rapid progress in the development of industries of various types and categories. It is a sorrow state of affair that the industrialist of a big concern has absolutely free choice in making selection of site of his industry. It is quite evident that the sites for industries are chosen near large towns to take advantage of power, water and transport facilities. Further, such developments have occurred on sides of highway resulting in the worst type of ribbon development.

It is also found that such unorganized and uncontrolled development of industries has acted adversely on economic and social conditions of the community of the town as a whole. The growth and living conditions of a town are greatly influenced by the neighbouring big industry. The rapid growth of industries of important products has made it necessary in the national interest to disperse some of the factories among many towns of the country rather than to concentrate them at few centres.

Without proper zoning and restrictions on installation of industries, it is not possible to achieve balance, coherence and orderliness in the development of sites for industries. The problem is not serious with small-scale industrial units which can easily be fitted at proper places in the town planning schemes.

An industrial survey of the existing industries in a particular locality would reveal the factors responsible for inducing the industrialists to locate their industries at particular places. The analysis and study of such survey prove useful for future growth of industries. As each industry has peculiarities of its own, it is not possible to lay down definitely a set of principles favourable for any one industry.

In this chapter, an attempt will be made to examine factors influencing industrial location, types of industries, means to control location of industries, industrial townships, etc. It should, however, be noted that the proportion of land devoted to industrial purposes will be different for different urban areas.

The urban areas in which heavy manufacturing industries are located will devote a fairly large proportion of land to industrial use and on the other hand, the urban areas specializing on services such as university campus or resort town will devote a much smaller proportion of land to industrial use.

However, in all urban areas, there will be some demand for industrial land so as to satisfy the local requirements such as baking, laundering, etc.

7-2. CLASSIFICATION OF INDUSTRIES

According to nature of dependence on circumstances, the industries may be classified as fixed industries, linked industries and foot-loose industries.

In case of *fixed industries*, the requirements of the industries will be such that there will be practically no choice for their alternative locations. The mining and quarrying may to some extent be treated as the fixed industries.

In case of *linked industries*, the presence of large industries is essential for their existence. They serve and depend on the functioning of large industries. The intermediate industries which grow up near big concerns may be included in this category.

In case of *foot-loose industries*, the location is mainly decided on transport facilities and markets for their products. Some types of light industries may be considered as the foot-loose industries.

Depending upon the nature of industry, a broad classification may be formed as follows:

(1) Manufacturing industries
(2) Miscellaneous industries
(3) Special industries.

(1) Manufacturing industries: The manufacturing industries can be grouped into four sub-divisions as shown below:

(i) ***Heavy industries:*** Heavy industries include steel projects, oil refineries, fertilizers, ship-building, etc. Such industries consume raw materials which are heavy and bulky to transport and they produce a product which is usually substantial. As a matter of fact, the works of heavy industries cover a huge area and the whole project grants an impression of massiveness. The choice of site for a heavy industry is restricted as its efficiency depends on nearness of raw materials, transport facilities, etc.

(ii) ***Intermediate industries:*** Intermediate industries include spinning, weaving, brewing, plastics, tanning, manufacture of machinery and spare parts, etc. These industries either serve the heavy industries or further process the products of heavy industries or carry out both the functions. In fact, these industries cover a wide spectrum between heavy industries and light industries. For intermediate industries such as spinning, weaving, brewing, plastics, tanning, etc. which do not depend upon heavy industries, there is considerable scope for finding out alternatives for their locations.

(iii) ***Light industries:*** This include products of domestic use, furniture, assembling of small machines, knitted goods, boots, products of confectionery, etc. These industries use raw materials which are light in weight and easy to transport. The principal factors affecting their locations are availability of local labour and nearness to markets through which the manufactured products are distributed. The light industries are usually foot-loose industries. But they are sometimes linked up with one another or occasionally with heavy industries.

(iv) ***Minor industries:*** Minor industries include bakeries, laundries, etc. and they do not produce any nuisance to the inhabitants of the locality. They can be grouped and located very near to the residential zone for the benefit and convenience of the public.

(2) Miscellaneous industries: These industries include professional services, shipping, education, entertainment, etc. By the nature of their functions, these industries are concentrated in large cities.

(3) Special industries: There are certain industries such as mining, quarrying, etc., which require special treatment for their locations. The sites for special industries are adjusted to take the maximum possible advantage of the existing economic, local and social circumstances.

Another way of classifying industries is to group them in four categories as follows according to what they produce:

(1) Primary industries: These industries are involved in the primary production and they include quarrying, mining, fishing, forestry, agriculture, etc.

(2) Secondary industries: These industries are involved in the transformation of the primary product and they take up the form of manufacturing industries as mentioned above.

(3) Tertiary industries: These industries provide a service to products that have already passed through the primary and secondary stages. They include office staff in primary and secondary industries, workers of public utility services, lawyers, teachers, etc.

(4) Quaternary industries: This is relatively a small group of industries for training and research in scientific field. They provide advanced training and education for technocrats in service occupations. The importance of this small sector can be judged by the fact that it forms a decision making organization in the economic system of nation.

7-3. CONCENTRATION OF INDUSTRIES

The reasons, advantages and disadvantages of concentration of industries will now be briefly mentioned.

(1) Reasons: Following are the reasons which have led to the concentration of industries at certain places:

(i) ***Electric power:*** Easy availability of electric power at certain places has resulted into concentration of industries.

(ii) ***Growth of light industries:*** There is sudden growth of a number of light industries in large towns.

(iii) ***Heavy industries:*** The sitting of a heavy industry attracts other subsidiary industries and as a result, an industrial complex is formed.

(iv) ***Road transport:*** The developments of road, railway and air transport have made it possible to locate industries at previously inaccessible sites.

(v) ***Types of population:*** The people of certain areas are known for their initiative and hard work and as a result, a number of industries of varying nature might have come up in those areas.

(2) Advantages: Following are the advantages of the concentration of industries:

(i) ***Co-ordination:*** It is possible to achieve co-ordination in selling, marketing and common godown arrangements, when there is grouping of similar industries.

(ii) ***Efficiency of workers:*** The workers may be provided with residential facilities round about the industries and hence, there will be considerable increase in their efficiency as they have not to travel long distances for their places of destination.

(iii) ***Industrial activity:*** If industries of similar type are grouped together, the industrial activity is accelerated and efforts are made to stimulate the efficiency and invention.

(iv) ***Linked industries:*** The finished product of one factory may prove to be the raw material of other. Hence, the linked up industries may be formed with mutual advantage.

(3) Disadvantages: Following are the disadvantages of the concentration of the industries:

(i) ***Economic crisis:*** If demand falls or if there is sudden change in public taste, the industrial area faces economic crisis. The workers as well as employers both suffer and the economic structure of the whole area collapses. The closing of an industry has far reaching repercussions on the prosperity of the whole community and it is estimated that only cities having populations of over half a million have a built-in-self-adjusting mechanism i.e., when one industry closes or fails, the other industry expands and requires more workers or a new source of employment opens up.

(ii) ***Health of workers:*** The unhealthy conditions prevailing in most of the congested areas of industrial units affect adversely on the health of workers.

(iii) ***Pollution:*** If trade wastes are not properly treated before disposal, the air pollution and water pollution occur.

(iv) ***Traffic congestion:*** The grouping of industries develop problems of the traffic congestion which are not too easy to solve.

7-4. REQUIREMENTS OF AN INDUSTRY

There are various types of industries and it is not the intention to list the requirements of each individual industry.

Following are the general requirements of all typical normal industries:

(1) amenities in the form of landscape features such as parks, trees, playgrounds, etc.;

(2) availability of cheap land;

(3) facilities for industrial waste disposal such as big perennial rivers, tidal streams, etc.;

(4) nearness to the markets;

(5) nearness to the related industries;

(6) nearness to the source of supply of raw materials;

(7) public services such as electricity, sewerage and water supply;

(8) supply of skilled and unskilled labour at reasonable rates;

(9) tax structure of the local authority;

(10) the overall industrial climate of the surrounding locality;

(11) topographical conditions of site such as good drainage, level, firm soil, etc.;

(12) transport facilities by rail, road or ship; etc.

7-5. SITTING OF AN INDUSTRY

The sitting of a particular industry should be carefully decided by taking into account the various requirements of that industry. Where zoning is adopted, the industrial zone in the town plan should be located at suitable places.

The sitting of industries in residential localities is not desirable. The heavy industries creating noise and throwing smoke are not to be allowed in residential areas. But at the same time, no rigid rule should be framed for prohibition of industries in residential zone. Certain industries of the present-day have improved their processes considerably and they have proved to be quite unobjectionable from the view-point of noise, odour or smoke. Such industries may be accommodated in the residential areas.

If the process of manufacture involves noises, odours and smokes, the site should be far removed from the residential areas and it should preferably be on that side of town where prevailing winds will blow away from the main town or city. At the same time, the site should be conveniently connected by road or railway with the homes of workers.

While deciding the sitting of an industry, provision should also be made for its future growth or expansion. If this precaution is not taken, resort has to be made to other modes of increasing production such as improved techniques of production, automation, rearrangement of machineries, vertical expansion, etc.

7-6. MEASURES TO CONTROL LOCATION OF INDUSTRIES

The main object of an industrialist for locating his industry at a particular place is his profit. The town planning authorities are concerned in location of an industry from the view point of public interest. The success of measures adopted to control location of industries will depend on the adjustment of these two motives or interests. Following are the three important ways which are adopted for controlling the location of industries:

(1) By developing industrial townships: The favourable sites for industries are set apart and they are then developed as industrial centres or townships. Such townships may be equipped with facilities which attract various industries to settle in them. The requirements of workers as well as economic, social and political needs of the community are accommodated in the design of industrial townships.

(2) By granting concessions: The establishment of industries at certain places in the country may be encouraged by granting concessions in various forms such as giving land at nominal lease rent, extending loans with attractive terms, supplying water and electricity at concessional rates, reducing railway freight charges, imposing nominal local taxes, etc.

(3) By imposing restrictions: The development of certain industries is prohibited in particular areas by law. If similar industries are already existing in that area, a time limit is fixed for vacating or stopping the use of premises to run such industries.

7-7. INDUSTRIAL TOWNSHIPS

To decrease the load of industries on residential areas and to provide better facilities to industries for their establishment and growth, the various industrial townships or estates have been set up either by government or local authorities. The important aspects of such industrial estates are as follows:

(1) Layout: The whole area is suitably divided into rectangular plots of different sizes. It is not possible to know beforehand the plot area required for various industries

and hence, the layout plan is kept flexible to a certain extent to accommodate as many industries as possible. The plots are given on long term lease or sold out at concessional prices with certain restrictions. The industrial buildings are then constructed in accordance with certain rules and regulations. In another arrangement, which is most suited for small-scale industries, the buildings are constructed by the management of the estate and they are let out at reasonable rents to various industries.

(2) Management: The industrial townships are developed and managed either by local authorities or corporations set up by State Governments.

(3) Services and amenities: The industrial township furnishes facilities to industries in the form of ample supply of water, sewerage, electric power, internal roads, etc. It further accommodates services and amenities for the community such as schools, health centres, temples, shops, theatres, recreation centres, etc.

(4) Site: The site for industrial townships is decided carefully by the planning authority. They are usually placed at the periphery of towns and connected with the main road system so that no excessive amount of industrial traffic enters the heart of town.

(5) Size: It is not possible to evolve a formula for determining the size of an industrial estate. From the statistics available, the probable number of industries to be set up is decided and from this data, the estimated number of workers likely to take advantage of the industrial township is worked out. The size of the industrial estate is estimated by applying a rule-of-thumb of 125 to 150 workers per hectare.

7-8. TREATMENT OF INDUSTRIAL WASTES

(1) General: The industries in general have one goal in view and that is the production of their goods. They have as such least bothered for the proper disposal of their wastes. The concerned local authorities have formed codes suitable for wastes of different types of industries. But these codes are generally not satisfactory and it is suggested that detailed studies should be made of the particular industrial waste to be treated by public treatment plant and the owner of that industry should be given the outline of the treatment which he should give to the industrial waste before it is discharged into the public sewer.

It is evident that satisfactory control of industrial waste can be achieved only if there is full co-operation among the management of industry and the local drainage authority with a genuine desire to progress towards an acceptable solution. It should always be remembered that no commercial or industrial products are as important as the environment. This is due to the fact that the pollution of environment due to the industrial wastes becomes costly and uncontrollable subsequently leading to hardships to the community as a whole. It is therefore to be seen that the environment which is a gift of nature, is not disturbed by the haphazard and disorderly planning of the industries.

(2) Characteristics of industrial wastes: Following are the characteristics of the industrial wastes:

(1) The Biochemical Oxygen Demand (B.O.D.) is higher than that of ordinary domestic sewage.

(2) The flow is uncertain and variations during the year or even day are extremely high.

(3) In modern days, the industrial wastes may also contain substances with radioactivity.

(4) The temperatures may be too high or too low.

(5) There may be a number of harmful substances present in the industrial wastes. These substances may be grease, oil, explosive, highly odorous substances, etc.

(6) They may be acidic or alkaline.

The above mentioned characteristics are only few of many. There is considerable variation in various types of industries and hence, the characteristics of particular industrial waste will depend on the nature of industry by which it is formed or developed.

For the purpose of treatment, the industrial wastes may broadly be classified into three categories as shown in table 7-1. The classification is the most general one and it is likely that one industry may give wastes of more than one category.

TABLE 7-1
CLASSIFICATION OF INDUSTRIAL WASTES

No.	Category	Industries
1.	Wastes of animal origin	Dairies, fertilizer industry, glue industry, leather industry, soap industry, woolen textile mills, etc.
2.	Wastes of mineral origin	Chemical industry, dyeworks, gas plants, mines, oil refineries, metal industry, water treatment plants, etc.
3.	Wastes of vegetable origin	Beet-sugar industry, cotton textile mills, canning industry, paper industry, rubber industry, saw mills, etc.

(3) Treatment methods: The treatment methods for the industrial wastes will depend upon their characteristics and various other factors. In general, the treatment recommended should be such that it recovers some useful substances from the industrial wastes. This will encourage the industry owner for the suitable treatment to the industrial wastes and it will also reduce the cost of such treatment.

Following are the methods adopted for the treatment of industrial wastes:

(1) aerobic biological oxidation;
(2) anaerobic digestion;
(3) chemical coagulation;
(4) chemical oxidation;
(5) chlorination;
(6) deionisation;
(7) dewatering and drying;
(8) filtration;
(9) incineration;
(10) lagooning or ponding;
(11) screening;
(12) sedimentation;
(13) spray irrigation;
(14) vacuum filtration; etc.

The disposal of liquid industrial wastes through deep well injection has been tried at some places with success. The depth of well may be more than 1000 m or so. The deep well injection is costly. But at the same time, it proves to be the least costly for the disposal of industrial wastes which are very difficult to treat. It will be, however, necessary to establish the fact that there is no contamination of underground water sources at places where deep injection wells are practised for the disposal of liquid industrial wastes.

QUESTIONS 7

1. Write a critical note on the importance of planning of industrial units.
2. How are industries classified according to the nature of dependence on circumstances?
3. Discuss the types of industries classified on the basis of nature of industry.
4. Mention the reasons, advantages and disadvantages of concentration of industries.

5. State the requirements of a normal typical industry.
6. Explain what is meant by sitting of an industry.
7. Write short notes on:
   (1) Industrial survey
   (2) Foot-loose industries
   (3) Intermediate industries
   (4) Special industries
   (5) Layout of an industrial township.
8. What are the measures to be adopted to control the location of industries?
9. Describe the important aspects of industrial estates.
10. How is problem of treatment of industrial wastes tackled? Mention some of the important characteristics of industrial wastes.
11. State the general classification of industrial wastes and mention some of the industries in each classification.
12. Enumerate various methods which may be recommended for the treatment of industrial wastes.
13. Differentiate between the following:
   (1) Fixed industries and linked industries
   (2) Heavy industries and light industries
   (3) Linked industries and foot-loose industries
   (4) Light industries and intermediate industries
   (5) Primary and secondary industries
   (6) Tertiary and quaternary industries.
14. Give reasons for the following:
   (1) The analysis and study of an industrial survey prove to be useful for future growth of industries.
   (2) The choice of site for a heavy industry is restricted.
   (3) The light industries are usually foot-loose industries.
   (4) There is considerable increase in efficiency of workers, when there is concentration of industries.
   (5) The sitting of industries in residential localities is not desirable.
   (6) While deciding the sitting of an industry, provision should also be made for its future growth or expansion.
   (7) The layout plan of an industrial township is kept flexible to a certain extent.
   (8) The linked up industries may be formed with mutual advantage.
   (9) The various industrial townships or estates have been set up either by Government or local authorities.
   (10) The proportion of land devoted to industrial purposes will be different for different urban areas.
   (11) The concentration of industries may adversely affect on the health of workers.
   (12) The site for industrial townships is decided carefully by the planning authority.
   (13) It is not possible to evolve a formula for determining the size of an industrial estate.
   (14) No commercial or industrial products are as important as the environment.
   (15) The treatment suggested for industrial wastes should be such that it leads to recovery of some useful substances.

Chapter 8

PUBLIC BUILDINGS

8-1. GENERAL

In ancient times, the royal palaces and temples were built at great expense and on impressive scale with charming beauty and grandeur as they symbolize respectively the power and dignity of the State or bear the expression of the devotional spirit of the people. Today their place is taken by the public buildings such as libraries, museums, town halls, public markets, civic centres, etc., which symbolize civil ideals and achievements. These buildings therefore must not only be adequately provided for in a city, but they must also be planned beautifully and on imposing sites so as to truly express their purpose and also to serve the needs of the people of town.

In this chapter, the topic of public buildings with special reference to their significance in the planning pattern of a town will be discussed.

8-2. LOCATION OF PUBLIC BUILDINGS

The town planner should give careful considerations for the location of various public buildings such as town hall, auditorium, municipal buildings, post office, central public library, university campus, schools, hospitals, etc.

Following factors should be examined at the time of site selection for the public buildings:

(1) Foreground
(2) Grouping
(3) Monumental buildings
(4) Parking space
(5) Purpose.

Each of the above factor will now be briefly described below.

(1) Foreground: The site of public buildings should have sufficient foreground so that a full view may be obtained and it can be seen to its best advantage. For achieving better results, it is desirable that the observer should be at a distance equal to twice the height of the building. The shape of the foreground should rather be oblong.

If there is no foreground available, a site at the terminus of a thoroughfare or at an intersection of the streets at which the traffic converges may be desirable. Such a location affords a view from distance.

(2) Grouping: The public buildings whose functions are interrelated should be located very near to each other. If possible, it is desirable to form a group of such public buildings on a common site.

(3) Monumental buildings: A monumental building should, if possible, be located at the summit of a grade in hilly countries so that it can be seen with advantage from avenues approaching it. The sites with a park view or river front or sea front or axis of a parkway are also excellent for location of the public buildings.

(4) Parking space: The sites for certain public buildings such as town hall, hospital, etc. should have ample and adequate parking space around them.

(5) Purpose: The site should be of easy access and best suited to the purpose for which the public building is intended. Some of the illustrations are as follows:

(i) The central library should be readily accessible to the whole or part of the city it serves and should be in a quiet place with ample open space around it.

(ii) The educational institutions like university campus which provide residential facilities may be on the outskirts of a city in park like surroundings and on extensive areas sufficient for future development. There should be enough level space for buildings and playgrounds. The schools and other small educational institutions should be located in the residential areas they serve and should be away from arterial roads so as to be free from noise, dust and risk of accidents.

(iii) The hospitals should be, as far as possible, in the closely inhabited area so as to be readily accessible to all the people provided that there is sufficient open space surrounding it so as to give ample light and air. They should also be free from noise and dust and should have sufficient area for future extension.

(iv) The main post office should, if possible, be near the railway station and within easy walking distance from the business centre.

(v) The municipal and government buildings should be near the main business area of the town. But they should be on the edge and not in the centre of this area.

(vi) The sanatorium, medical hospitals and other special medical institutions should be located away from the centre of town.

(vii) The town hall should be located near the transit facilities.

8-3. CLASSIFICATION OF PUBLIC BUILDINGS

From the town planning view, the public buildings can be divided into the following four categories:

(1) Dependent buildings: These are the buildings whose functions are related to each other and therefore they can be grouped together in the form of civic centres, recreational and art centres, public markets, etc.

(2) Independent buildings: These are the buildings which have to stand alone such as monumental buildings, etc.

(3) Institutional buildings: These buildings are in the form of institutions, mostly educational and they include schools, colleges, etc.

(4) Miscellaneous buildings: These buildings provide services and amenities to the town and they include power houses, pumping stations, sewage disposal plants, etc.

8-4. PRINCIPLES OF DESIGN OF PUBLIC BUILDINGS

Following are the broad principles which are to be observed while designing the site and size of the public buildings:

(1) Adequate sites: It is necessary to acquire and to reserve in advance adequate sites in relation to the prospective needs of the public buildings. This is true especially in case of civic and educational groups. The adequate space and appropriate architectural forms are necessary to emphasis their dignities.

(2) Approaches: The approaches to and from the groups of public buildings are of vital importance and they should accordingly be designed.

(3) Business buildings: The public buildings should not be mixed up with business buildings. It is the usual practice to have frontage of business buildings on main through roads where traffic is congested and land values are high. The public buildings, on the other hand, should be near to but not abutting main roads.

(4) Comprehensive study: The sites of public buildings should be determined on the basis of a comprehensive study of city and of its consequent neighbourhoods so that they may have qualities necessary for convenience and orderly development.

(5) Education: The educational institutions such as primary schools, secondary schools, colleges of different faculties, etc. should not be placed directly on through roads and particularly not at their junctions. A liberal provision with respect to area of land should be provided to accommodate future population.

(6) Fire stations: The location of a fire station will depend upon the shape of town. It should abut on the streets and it should be centrally located. For a population of about 1.50 lakh of people, one fire station would be enough.

(7) Hospitals: Enough area should be reserved for hospital and other medical relief centres. In most of the cases, a provision of 4 to 5 beds per 1000 population proves to be adequate for hospital in an average town. The dispensaries for the out-patients should be adequate and well spread throughout the town. The specialized hospitals to treat certain types of diseases only such as cancer, tuberculosis, leprosy, etc. can be provided in case of large towns only.

(8) Markets: The wholesale markets for fruits, vegetables, etc. should be provided away from the congested area as a lot of traffic as well as a number of delivery trucks are to be employed for transporting goods to the markets. The number of such markets will depend upon the size of town.

(9) Refuse disposal: The provision should also be made for the collection of various types of refuse and disposal units should be located at places where they do not cause any nuisance to the public.

(10) Shops: The town should be equipped with a number of small shops containing items of day-to-day use. The design of a shopping centre requires the considerations of community needs, traffic problems, purchasing capacity of customers, etc. A provision of 7 to 8 shops per 1000 population, in most cases, proves to be adequate. The large scale shopping centres in the form of supermarkets are coming up in the major cities of India.

(11) Social and cultural centres: Considering the needs and tastes of the community, the adequate provision should be made for various social and cultural centres such as cinemas, theatres, marriage halls, clubs, art galleries, lecture halls, community halls, churches, temples, etc.

8-5. TOWN CENTRES

A town centre is a meeting place for the population as a whole. It is the focus of circular system and either in or near to it will be the central bus terminus, large service garage and railway station. The town centres can broadly be divided into the following three groups:

(1) Business centres
(2) Civic centres
(3) Light shopping centres.

(1) Business centres: A business centre includes offices, big shops, warehouses, etc. It may also be considered as a main shopping centre serving the town as a whole. The form of a business centre depends on the pattern of town centre and on the habits of the citizens. It is therefore not possible to specify any general arrangement for the business centre as it depends on many variable factors. The investigations should be carried out to know the likes, dislikes and tastes of the customers. Such investigations include whether a customer expects home delivery of goods; whether he travels on foot or by bus or by private car; whether he prefers to order goods on telephone or would like to bargain across the counter; etc.

The business centres usually consist of the following three groups of shops or stores:

(i) Convenience stores
(ii) Demand stores
(iii) Impulse stores.

(i) ***Convenience stores:*** These shops sell goods of daily use such as bread, vegetables, sweets, newspapers, groceries, fruits, washing powders, etc. These shops form a backbone of the trade in the shopping centre. Such shops will also spring up at suburb centres and will be located within easy reach of the customers. Thus, the convenience goods are purchased at fairly regular short intervals and the amount spent for the purchase of such goods represent a small part of the income of the customer. At the same time, the selection is also relatively unimportant and the customers will be inclined to purchase such goods from the shop nearest to their home.

(ii) ***Demand stores:*** These shops sell goods which are not frequently required such as radios, cycles, clocks, clothes, etc. But these goods call for greater inspection and comparison before purchasing. Such goods are known as the *comparison goods* and shops of these goods form a large part of the town centre and attract a steady flow of customers. Thus, the demand stores are meant for shopping goods which are bought at irregular and infrequent intervals.

(iii) ***Impulse stores:*** These shops sell goods and articles of luxury such as perfumes, jwellery, expensive foods, ornamental utensils, etc. Such luxury goods are purchased or bought suddenly on the impulse or sentiment of the buyer. These stores in a town centre exhibit an attractive appearance and it is always interesting and pleasing to look at them. Thus, the impulse stores sell speciality goods and the purchase of such goods can be delayed for getting a choice from a wide range of different models. Thus, the customer will be prepared to spend some more time or wait or travel a long distance for the purchase of speciality article by comparing the goods not only within a shop but between shops. The number of impulse stores in a business centre will depend upon the function and

extent of the market. In general, it can be stated that the larger the shopping or town centre, the more impulse stores there will be.

In a well-located and well-designed business centre, the above three types of stores are suitably proportioned and they serve as complementary to each other in the sense that a shopping trip can combine the purchase of convenience, shopping and speciality goods.

(2) Civic centres: These are also known as the *community centres* and they symbolize civic pride and dignity. They require special consideration with regard to location and treatment for beauty. A civic centre is an assemblage of public buildings. The civic centres may be cultural or educational or government. They may serve the entire city or some of the suburbs. The buildings included in civic centres are town hall, court, post office, public library, auditorium, art museum, etc.

The civic centres should be conveniently located near or close to the transport facilities. They may be near the centres of business, but not in their midst. Otherwise they may be an interruption to the business activities or may prevent commercial expansion.

The civic centres should have one prominent building preferably located on a commanding site. There should be ample foreground and convenient approaches. The architecture of civic centres should be such that the whole group presents a picture of harmony and impresses every visitor to the town with its high standard of architectural features.

(3) Light shopping centres: A light shopping centre is intended to sell goods of various categories on a small scale as compared to a business centre and it may take the forms of the following type:

(i) Departmental store
(ii) Shopping street
(iii) Market.

(i) ***Departmental store:*** It consists of several different kinds of shops under one roof. A typical departmental store will sell all types of goods right from a needle to a refrigerator. The selling departments are so arranged that the customer follows an easy path during his shopping activity. These stores are located in heavily populated areas where land values are very high. The modern departmental store, in many cases, extends for a number of floors with efficient lift arrangement, restaurants, water rooms, sanitary blocks, etc. The selling stores require continuous window display, excellent show cases, large spacious selling space and vehicle parking facilities.

(ii) ***Shopping street:*** A shopping street develops by custom and constant use of the street for the purpose of shopping. It contains shops on one or both the sides. The shops have show-windows and entrance to the shops is provided at the end of footpath. The shops also have enough storage space on the back side.

(iii) ***Market:*** This is rather the oldest form of shopping activity and it consists of a series of stalls arranged in a covered place around which the public can circulate. The stalls deal with convenience goods. It is essentially a centre for cheap goods and the shopping activity is carried out only by the pedestrians. The vehicles are kept outside the market and enough parking space outside the market is to be provided for them.

8-6. GROUPING OF PUBLIC BUILDINGS

The considerations for grouping of the public buildings are generally convenience as in case of hospital and medical college, existing conditions of site or buildings, aesthetic requirements, etc.

The grouping of public buildings may be in the form of a concentrated arrangement or a dispersed arrangement. A concentrated arrangement results in economy, easy supervision, good architectural effect and convenient access from one building to the other. A dispersed arrangement, on the other hand, provides more light and air, and less risk from fire and nuisance.

The aesthetic considerations which favour the grouping of public buildings are as follows:

(i) common architectural style of the buildings;
(ii) entrance to be provided at the centre and making it an axial line for the whole scheme of the buildings;
(iii) proper setting of buildings by planting trees and shrubs;
(iv) provision of the fountains and statues at approaches;
(v) sufficient open space for full view; etc.

The grouping of similar public buildings makes a beautiful composition which is in harmony with the surrounding development and it produces the most charming effect. Following are the five categories in which the public buildings are generally grouped:

(1) Administrative buildings: These are known as the *civic centres* or *community centres* and the buildings such as municipal office, secretariat, law courts, post office, public library, town hall, etc. are included in such centres.

(2) Educational buildings: The buildings included in this category are schools, colleges, university campus, research institutions, etc. and they form the educational centre of the town.

(3) Health institutions: The buildings like clinics, nursing homes, child welfare centres, hospitals, etc. are grouped to form what may be referred to as the *health centre* of the town. Such institutions should be located in calm and quiet atmosphere.

(4) Recreation institutions: The recreational centres are formed by grouping cinema halls, music halls, opera theatres, etc.

(5) Social institutions: The buildings which deal with social and cultural activities of town include art galleries, museums, musical academies, etc. and they are grouped to develop art and cultural centres of the town.

8-7. CIVIC AESTHETICS

A city should not only be a unit satisfying the practical needs or requirements of the community. But it must also be beautiful, if it has to satisfy the aesthetic aspirations of the citizens. The measures to be adopted for developing the civic aesthetics can broadly be divided into the following three groups:

(1) Constructive measures
(2) Destructive measures
(3) Preventive measures.

(1) Constructive measures: The city can be made beautiful by adopting creative or constructive measures. Some of such measures are as follows:

(i) The buildings such as art galleries, museums, etc. may be constructed to attract the tourists and to encourage the local industries.

(ii) The entry to a city is either by rail, water, air or road. Hence, railway stations, harbours, airports and bridges should be constructed with high architectural standards as these structures create a lasting impression on the tourists.

(iii) The focal points such as street intersections or open squares should be lined with the public buildings of graceful design.

(iv) The open squares should be adorned with fountains and sculpture, designed with due regard to the site and environment.

(v) The parks and playgrounds are conspicuous elements of buildings and they should be regarded as works of art.

(vi) The residential neighbourhoods should be properly and suitably planned.

(vii) There should be proper illumination of streets as well as buildings. The street lamps of an artistic design add further to the beauty of town.

(viii) The trees of appropriate colours, growth and shades should be planted on either side of the road. They purify air, control the climate and make the town beautiful at the lowest cost. They also happen to make a happy combination between the town and the country so as to grant an opportunity to the town dwellers to enjoy nature.

(2) Destructive measures: The conditions and features of the city which are objectionable from the view-point of civic aesthetics are removed gradually. For instance, the overhead telephone wires may gradually be replaced by the underground cables. In a similar way, the open drains can be replaced by the underground drains to carry storm water, sewage, etc.

(3) Preventive measures: Under this category of measures, the steps are taken to restrict or to prevent the constructions or installations of certain structures in the city. Some of such restrictions are as follows:

(i) Some sort of control is put up on the advertisements exhibited in public places. The unrestricted advertisements ruin the appearance of streets and buildings and they cause nuisance and danger to the pedestrians. Many cities have adopted regulations controlling the erection of advertisements on through roads or in the vicinity of parks or in residential areas.

(ii) The elevations of houses and structures are to be approved beforehand from the concerned planning authority and the execution of works is to be carried out strictly in accordance with the approved elevations only.

It may be mentioned that the concept of civic aesthetics is no longer considered as a luxury item at present. The aesthetics of the town symbolize the pride and dignity of the cultured society. They also serve as great assets and contribute substantially in granting status or personality to the town.

QUESTIONS 8

1. Discuss the factors to be examined at the time of site selection for public buildings.
2. Give some illustrations to indicate the importance of site selection with respect to the purpose of public buildings.

3. How are public buildings classified?
4. What are the broad principles of design of public buildings?
5. What is a town centre? What are its different forms?
6. Write short notes on:
   (1) Business centres
   (2) Civic centres
   (3) Convenience stores
   (4) Shopping street
   (5) Grouping of public buildings
   (6) Constructive measures for civic aesthetics.
7. Mention the categories in which the public buildings are generally grouped.
8. What are the different measures adopted for developing civic aesthetics?
9. Differentiate between the following:
   (1) Dependent buildings and institutional buildings
   (2) Demand stores and impulse stores
   (3) Business centres and civic centres
   (4) Departmental store and market
   (5) Public buildings and business buildings
   (6) Concentrated arrangement and dispersed arrangement
   (7) Educational centre and health centre
   (8) Community centre and cultural centre.
10. Give reasons for the following:
   (1) The public buildings must be planned beautifully and on imposing sites of the town.
   (2) The site of public buildings should have sufficient foreground.
   (3) The wholesale markets should be provided away from the congested areas.
   (4) It is not possible to specify any general arrangement for the business centre.
   (5) The civic centres may be near the centres of business, but not in their midst.
   (6) A monumental building should, if possible, be located at the summit of a grade in hilly countries.
   (7) The hospitals should be, as far as possible, in the closely inhabited area.
   (8) The sites of public buildings should be determined on the basis of a comprehensive study of city and of its consequent neighbourhoods.
   (9) Many cities have adopted regulations controlling the erection of advertisements on through roads or in the vicinity of parks or in residential areas.
   (10) The convenience stores, demand stores and impulse stores are suitably proportioned in a well-located and well-designed business centre.
   (11) Enough parking space is to be provided outside the market.
   (12) The trees of appropriate colours, growth and shades should be planted on either side of the road.
   (13) The schools should be located in the residential areas they serve and should be away from arterial roads.
   (14) The concept of civic aesthetics is no longer considered as a luxury item at present.
   (15) The public buildings should not be mixed up with business buildings.
   (16) The small shops form a backbone of the trade in the shopping centre.

Chapter 9

RE-PLANNING EXISTING TOWNS

9-1. GENERAL

It is very easy to design a new building and at the same time, it is very difficult to re-plan an existing building. In the latter case, a practical engineer or an architect will be more useful than a purely theoretical man. Such is the case with existing towns and cities of today. These towns, when they were developed, were full of charm and pleasure. The original designers took care of needs of the then population and accordingly provided sufficient areas for industry, recreation, commerce, etc.

The sudden and unprecedented explosion of urban population together with other factors has made most of the existing towns and cities unfit for living. The two important factors contributing to the population increase in towns are natural growth and tendency of villagers to migrate for various reasons such as employment, education of their children, enjoying glamour of town life, etc.

The overcrowding of population in existing towns has developed many serious problems. The residential areas, which were once spacious and well-planned, have been converted into slums. The parks and playgrounds have become inadequate. The industries have invaded the residential areas of the town. The communication facilities have totally failed. The road system has become obsolete. The recreation and amusement centres are haphazardly located. A number of such evils can be listed to show the dark side of town life.

Someone has rightly said that the cities are always out of date and always out of order. Just like automobiles and other machineries, the towns and cities become obsolete from the moment they are produced and sometimes even before. The obsolescence is the reverse of progress and the faster the progress, the earlier obsolescence occurs. There will be no necessity of renewal of towns only in a stagnant society. Otherwise it is a fact that towns and cities developed to satisfy the needs of urban life yesterday are no longer suited to serve the life of today and tomorrow.

Some of the existing towns and cities of the world have been re-planned with success by the application of principles of modern town planning. A careful study of methods and details of such schemes suggests that it is possible to give relief to the population of the existing towns which have been deteriorated by the passage of time. Each existing town, however, will have problems of its own and detailed study of such problems will be necessary before recommending measures to arrive at workable solution.

It is thus clear that the planner's task for re-planning the existing town is not simple. He cannot ignore the limitations placed on him by factors beyond

his control. For instance, the cost of complete reorientation of the inherited road system may prove to be prohibitive and in that case, he has to satisfy himself by making some minor changes in the existing road pattern here and there. Similarly, he may find that society wishes to preserve certain monumental buildings and in such cases, he has to frame his plan accordingly. Thus, the planner entrusted with the job of re-planning an existing urban area, is truly the slave of past decisions and he has to plan within these limitations to work out an economically sound revised town plan.

The task of re-planning an existing town should be entrusted to the planners who are well qualified and have broad vision. Their plans and efforts should be aimed to achieve community planning alongwith city re-planning. The requirements and needs of community of the city to be re-planned should be studied in detail and efforts should be made to encourage the elements essential for every community and to remove the elements endangering its existence.

The city of man is in crisis and as it is complex in nature, all efforts should be made at the time of its re-planning to use technology to create human conditions within an in-human frame with the help of experts in various fields such as economists, administrators, sociologists, etc.

It is well-known that the municipal bodies stagger under the burden of huge deficits. The cities have more people than their infrastructure can take. The water is in short supply. There are not proper facilities for repairing roads, clearing garbage, dredging sewers, etc. As a matter of fact, the private entrepreneurs have come forward in each of these difficulties of the crumbling Indian city. The water is for sale practically everywhere. The garbage removal and public transport are widely getting privatised. The greater privatisation is perhaps necessary and the common man should learn to pay for the facilities he might prefer to take for granted. The time has come to streamline the decision-making process of various local bodies so as to achieve greater benefit from the existing towns.

In this chapter, the discussion will be focussed on the re-planning of the existing towns.

9-2. OBJECTS OF RE-PLANNING

Following are the objects of re-planning of the existing towns and cities:

(1) To add further to the civic aesthetics of the town.

(2) To attempt for an orderly, appropriate and balanced arrangement of land use.

(3) To contribute to the economic and social welfare of the community.

(4) To correct the past errors as far as possible.

(5) To develop healthy, attractive and efficient environment within the finance available.

(6) To insure against the possible future errors.

(7) To provide the scheme which will control the future growth and development of the town.

(8) To suggest short-term and long-term measures for the future growth of town.

9-3. DEFECTS OF EXISTING TOWNS

It is significant to note that the problems existing in most of the modern unplanned towns and cities are more or less similar in nature. The usual problems of general nature are as follows:

(1) absence of co-ordination between various forms of public transport facilities;

(2) absence of neighbourhood development in the residential areas;

(3) absence of the parking facilities for the vehicles;

(4) absence of sites for the industrial developments;

(5) acute shortage of well-planned houses;

(6) conditions favouring traffic congestion, resulting into more number of traffic accidents;

(7) considerable distance between places of works and homes resulting in wastage of time, energy and money;

(8) construction of high buildings without any consideration of light and ventilation of the surrounding buildings;

(9) development of residential areas over new lands without any considerations for amenity, convenience and health;

(10) excessive costs of the public utility services as they are laid without any regard to the future needs;

(11) existence of slums around central business area with excessive density of population;

(12) improper grouping of the buildings causing inconvenience to the public;

(13) inadequate provision and distribution of the parks and playgrounds;

(14) insufficiency and improper location of the public buildings;

(15) insufficiency of main traffic routes;

(16) intrusion of undesirable industries and shops into residential areas;

(17) lack of cohesive civic designs of buildings;

(18) location of shopping centres on main roads leading to the traffic congestion and accidents;

(19) overcrowding of land with buildings and buildings with population; etc.

Thus, the problems of city are serious in character and they can be mentioned in the form of too many cars for the streets, too many commuters for the transport system, too many chemicals for the water to carry, too many sick for the hospitals, too many students for the schools, too much crime for the police, too much sewage for the sewers, etc.

9-4. DATA TO BE COLLECTED

The details obtained from the civic survey of a town are fully made use of while re-planning the town. To tackle the problems of existing towns with scientific approach, it is absolutely necessary to carry out a civic survey before re-planning of the town is taken in hand. The data to be collected for re-planning of a town can briefly be listed as follows:

(1) arrangements to convey sullage and storm water;
(2) character, distribution and type of existing industries;
(3) communication amenities;
(4) conditions of social and community life;
(5) economic basis of town;
(6) existing density of population in various parts of the town;
(7) existing land uses and land values;
(8) existing parks and playgrounds;
(9) history and causes of growth of town;
(10) housing conditions;
(11) means of refuse collection and disposal;
(12) nature and distribution of the town centres;
(13) physical features of the town;
(14) public utility services; etc.

9-5. URBAN RENEWAL PROJECTS

When a town has reached at an advance stage of deterioration, it becomes necessary to adopt immediate and forceful actions to improve undesirable conditions. The drastic measures for this purpose may include pulling down of the deteriorated structures, carrying out extensive renovation of the buildings to be retained, redesigning the street system, changing the pattern of land use, etc. The procedure to be followed for implementing all such measures is termed as the *urban renewal project.*

Following are the important aspects of an urban renewal project:

(1) Conservation: The existing sound buildings are preserved or retained in their position by the application of certain bye-laws and ordinances from the local authority. Such a measure arrests the future deterioration of decent properties.

(2) Co-operation: An urban renewal programme involves the co-operation of various agencies such as owners of private properties, tenants, local authority and government machinery.

(3) Development plan: After careful study of the present conditions, a development plan of the town containing proposals for urban renewal is prepared and it is given wide publicity to create public opinion in favour of its implementation.

(4) Finance: An urban renewal project by its character and nature demands sizeable funds spread over a number of years. Hence, its success depends on adequate provision of finance.

(5) Legislation: An urban renewal project should be approved by the authority concerned and as such, it should be supported by a suitable legislative action.

(6) Period of project: It is desirable to carry out the urban renewal project in stages spread over a number of years. The measures for urban renewal are divided into two classes, namely, short-term measures and long-term measures.

(7) Redevelopment: The area of town which is seriously affected is totally demolished and it is redeveloped as per town planning concepts. The families and businesses affected by redevelopment are resettled in other parts of the town.

(8) **Rehabilitation:** The owners of substandard buildings are forced to reinstate their properties or such properties are covered under slum clearance projects for future improvement.

During the process of re-planning, it may be desirable to consider the possible use of subterranean space so as to solve major city-planning problems. The use of underground space will make it possible to reduce the urban noise, fire hazards and air pollution. It is also possible to locate underground structures and buildings such as cinemas, shopping centres, etc. which practically do not require day-light and which are used by people only for a short time. Some of the other advantages of the use of subterranean space will be as follows:

(i) It will increase the area of green spots, sports complexes, places of rest and recreation, etc.

(ii) It will result in the application of more economic systems of engineering infrastructures and thereby the lengths of pipe lines and cables will also be reduced because their locations will be near their consumers.

(iii) The culture and public facilities and services will be brought together and the public will be concentrated at transportation facilities.

(iv) The transportation organization of the city will be improved, resulting in its efficiency.

(v) The underground space may prove to be the ideal locations for various public utility services, public buildings, transportation facilities, etc.

9-6. DECENTRALIZATION AND RECENTRALIZATION

It is now realised that evils of congestion in towns appear as a consequence of ill-planned centralization rather than centralization itself. However, the decentralization affords many community advantages such as dispersion of industries, better living conditions for workers, more opportunities for employment, stimulation of country development, etc. At the same time, the unplanned decentralization of both industry and population may lead to such evils as ribbon development, lack of skilled and trained workers, higher costs of production, inadequate supply of raw materials, etc. Thus, at present, the movement for relieving congestion in the towns is better defined by the term *recentralization*. The garden city is an excellent example of recentralization.

The basic idea in decentralization as well as recentralization is to make town more healthy by introducing the advantages of country or village. The well-planned centres and sub-centres with large open spaces around them form an ideal arrangement. The places for these centres can be deliberately chosen and developed as such.

The arrangements to be accepted for decentralization and recentralization include the following:

(1) diffusion of residential units into compact residential neighbourhoods throughout the whole urban region;

(2) recentralization of industry with the objects of lessening the density of congested centres and of creation of new centres;

(3) sub-centralization of business centres so arranged as to provide the maximum convenience to the residential areas; etc.

9-7. GARDEN CITY

As a long-term measure for reducing load on existing town or city, the concept of garden city was floated by a shorthand writer in the House of Commons, Ebenezer Howard (1850-1928), in the year 1898 in his small remarkable book "To-morrow", later re-published under the title "Garden Cities of To-morrow". Howard was residing in London and with deep regret, he witnessed various evils of unplanned town life. He conceived the idea of a city, called by him a garden city, to reconcile country life and town life and to grant various other advantages to population of this garden city. Thus, the term *garden city* means as such 'a city in a garden' or 'a city of gardens'.

The definition of a garden city as conceived by Howard has been formulated by the Garden Cities and Town Planning Association, in 1919 as follows:

A garden city is a town designed for healthy living and industry; of a size that makes possible a full measure of social life, but not larger; surrounded by a rural belt; the whole of the land being in public ownership or held in trust for the community.

Thus, the principles of a garden city can briefly be summarized as follows:

(1) co-operative holding of land to insure that the advantage of appreciation of land values goes to the community and not to the private individuals;

(2) economic and social advantages of the large-scale planning;

(3) establishment of cities limited in size, but at the same time, possessing a balanced agricultural industrial economy;

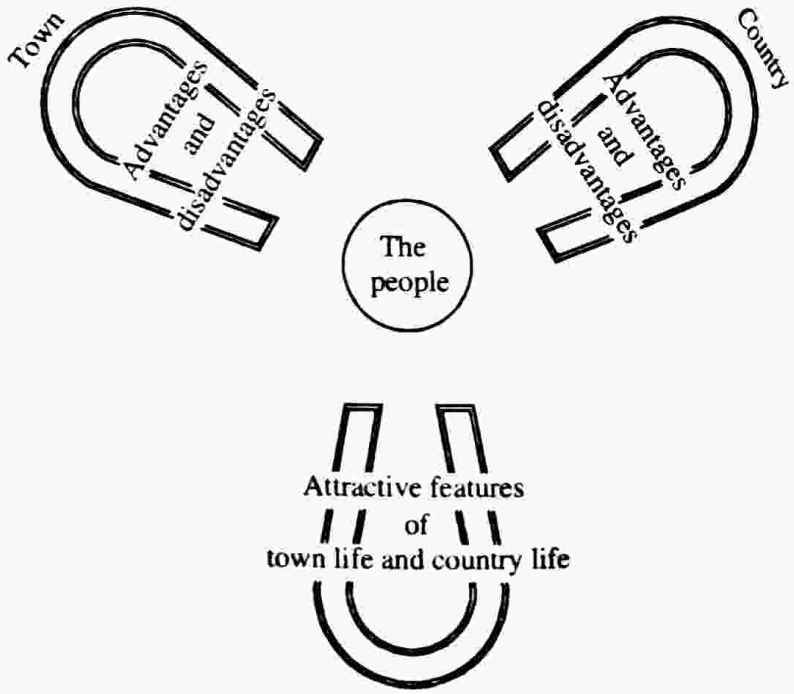
(4) urban decentralization; and

(5) use of a surrounding green belt to serve as an agricultural recreational area and to assist the extension of limit.

Howard attempted to push his idea of a garden city by an impressive diagram of '*The Three Magnets*' as shown in fig. 9-1. He mentioned advantages and disadvantages of town life and country life on the respective two magnets, namely, town magnet and country magnet.

The advantages of town magnet are opportunities for work, high wages, social opportunities and amusements, and well-lit streets. The disadvantages of town magnet are distance from work, isolation of crowds, sunlessness and dirty air, and the slums.

The advantages of country magnet are natural beauty, fresh



The Three Magnets
FIG. 9-1

air and healthfulness. The disadvantages of country magnet are dullness, lack of society, low wages, lack of amusements and general decay.

On the third magnet, he wrote the attractive features of town life and country life and then posed the problem, where will the people go? The attractive features on town-country magnet were beauty of nature, bright homes and gardens, high wages, low rents, no slums, no smoke, fresh air, healthfulness and social opportunity. Thus, Howard found the solution in a combination of the advantages of town and country in the town-country magnet and he proposed a town in the country.

From the study of the above definition of a garden city, its features can be summarized as follows:

(1) It contains open spaces and gardens around all the dwelling houses and also factory buildings.

(2) It has a population which is neither too small nor too large. Howard advocated the limit of population between 30000 to 40000 people. Thus, the growth of a garden city is limited in order that its inhabitants may live near work, shops, social centres and each other and also near open country.

(3) It is a city owned by all citizens on a co-operative basis. The ownership extends upto the green belt or agricultural zone.

(4) It is an independent entity having its own civic life and affording all the daily needs with adequate space for schools and other functional purposes and pleasant parks and parkways.

(5) It is a self-sufficient unit having its own industries.

(6) It is surrounded on its periphery by a green belt. Thus, the town area is defined and a large area around it is reserved permanently for agriculture. Thus, the farmers are assured of a nearby market and culture centre and the town dwellers get the benefit of a country situation.

(7) It need not have the rapid transit arrangements.

(8) The principles of zoning are applied to the city and no alterations in the use of land are allowed.

(9) The surplus fund is utilized for the development of the community itself.

Howard was fortunate enough to apply his theory of garden city in actual practice. The Garden City Association was formed in 1899 and it was resolved in 1900 to form a limited company for the building of a garden city. In 1903, a site known as *Letchworth*, about 48 km from Central London, was purchased from fifteen different owners for £ 155587. The area was about 1586 hectares. The additional land was added subsequently bringing the present land area to 1851 hectares and the total price of £ 178717. The new town, on the concepts of a garden city, was planned by Barry Parker and Raymond Unwin for an estimated population of 35000 persons.

Raymond Unwin crystallized and codified the standards and his name became well-known in the planning and housing history because he combined three distinguished qualities, namely, ability to explain, proficiency as a technician and sociological insight. Letchworth provided the first testing ground for the

concept of a garden city and in the course of time, it has steadily grown with great success on predetermined lines of development.

At present, it forms a pleasant town situated in country with green belt of about 1200 hectares. The foundation celebrated the town's centenary in 2003 by building a landscaped path for walkers and cyclist. The path forms, 20 km loop around the town, which is known as '*greenway*'. Letchworth is an independent city with a complete municipal life of its own. It is an industrial city with all the functions and activities of a self-contained community. It is planned as the home of all kinds of industries with facilities of cheap light, power, fuel and water. It is designed to meet with the requirements of workers and labourers so as to keep them healthy and efficient.

Thus, Letchworth is meant for people of all the classes, the worker and the owner, and it grants dividends not only on property, but also in human health and happiness.

The extraordinary success of Letchworth led Howard to develop another garden city, Welwyn in 1920 situated midway between London and Cambridge. It should, however, be noted that these two towns are based on the principles advocated by Howard and they are different from other towns. But at the same time, they are also different from each other because of various reasons such as regional situation, differences of topography, date of their foundation, social and cultural developments, etc. There was a gap of sixteen years between the beginnings of two towns.

In 1904, when Letchworth was founded, the concept of town planning was unknown in Great Britain. In 1920, when Welwyn Garden City was started, just after the first World War, the idea of town planning was in existence and housing was being accepted for the first time as a public responsibility. However, both the garden cities of Letchworth and Welwyn were the result of the enterprise and labour of small groups of people who believed that the idea floated by Howard was sound and practicable. The progress was achieved without encouragement of the general public and with the minimum of official help.

Subsequently, Howard's ideas were used to develop New Towns in Britain and even at present, his contribution to the science of town planning is very well appreciated.

For the purpose of classification, the garden cities can be grouped in the following three categories:

(1) the garden city or self-contained industrial community like Letchworth and Welwyn;

(2) the garden suburb for residential accommodation like Hampstead; and

(3) the garden or factory village built around a large manufacturing concern by its employer like Bournville (1895) and Port Sunlight (1888).

It should, however, be noted that some superior authority has control over the functioning of all the types of garden cities mentioned above.

At this stage, it will be worthwhile to distinguish salient features of garden cities and satellite towns. The topic of satellite towns is described in Article 1-8 of Chapter 1. Table 9-1 shows the comparison of garden cities and satellite towns.

TABLE 9-1
COMPARISON OF GARDEN CITIES AND SATELLITE TOWNS

No.	Feature	Garden cities	Satellite towns
1.	Dependence	Self-sufficient and self-contained unit	Dependent on the parent city except having local shops, primary schools, etc.
2.	Gardens	Around all houses and factories	Not compulsory
3.	Green belt	Surrounded by green belt	Situated outside green belt of the parent city
4.	Industries	Permitted	Not permitted
5.	Rapid transit arrangement	Not necessary	Necessary in the form of local trains and buses
6.	Roads and communication	Some roads are arterial and others are communication streets	Only one arterial road to the parent city
7.	Zoning	Essential	May or may not have

9-8. SURFACE DRAINS

(1) General: At the edge of street roadways, the surface drains or gutters are sometimes provided to serve as open waterways for surface drainage. The drains are located on the highest elevations of the territory and water is conveyed to the collection channel through a system of ditches. The drains may be open, closed or combined. The closed or underground pipes are costly and they are adopted in large cities.

(2) Requirements of the surface drains: The surface drains or open drains are used mostly for small towns. They are less hygienic as they are open and exposed to the atmosphere.

For efficient working, the surface drains should fulfil the following six requirements:

(i) The depth of surface drains from the ground level should not exceed 1 m.

(ii) The inner surface of such drains should be made smooth. This is usually achieved by applying plaster to the inner surface of drain.

(iii) The joints of surface drains should be properly and neatly finished.

(iv) They should be laid at such a gradient that self-cleansing velocity is developed.

(v) They should be laid on easy curves.

(vi) They should be properly designed with reasonable provision of free board.

(3) Shapes of surface drains: Following are the usual four shapes which are commonly adopted in the construction of surface drains:

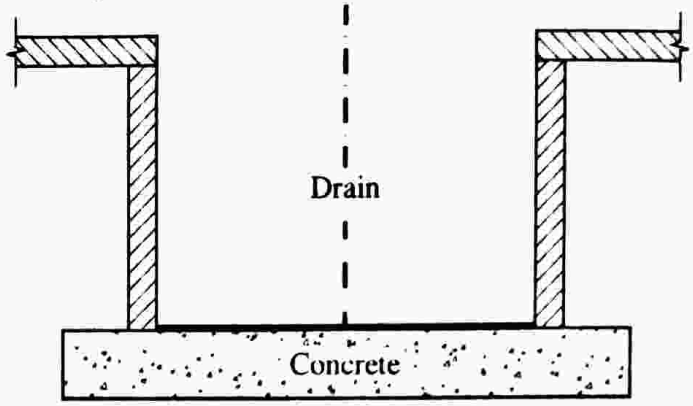
(i) Rectangular surface drains

(ii) Semi-circular surface drains

(iii) U-shaped surface drains

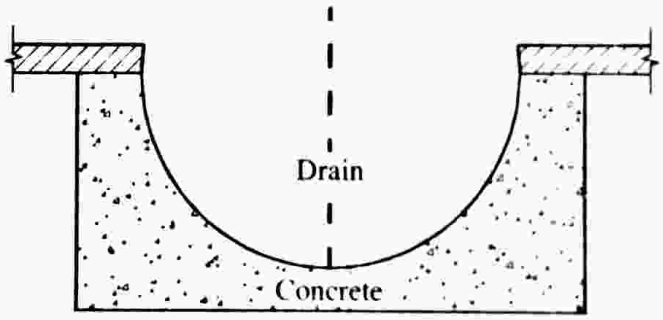
(iv) V-shaped surface drains.

(i) ***Rectangular surface drains:*** These drains are suitable for carrying heavy discharge. They, however, do not develop the required velocity when depth of flow is small and hence, they get easily deposited. Fig. 9-2 shows a rectangular surface drain.



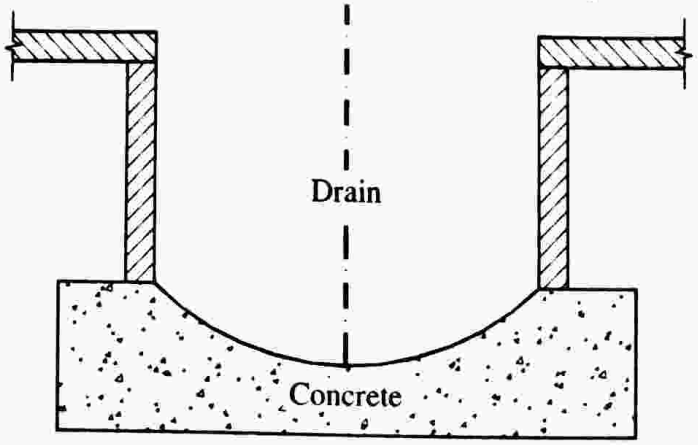
Rectangular surface drain
FIG. 9-2

(ii) **Semi-circular surface drains:** These drains can easily be constructed. The drains can also be formed by using readymade semi-circular sections of stoneware or concrete or asbestos cement pipes. Fig. 9-3 shows a semi-circular surface drain. These drains are found to be suitable for small streets where the discharge to be accommodated is of small quantity.



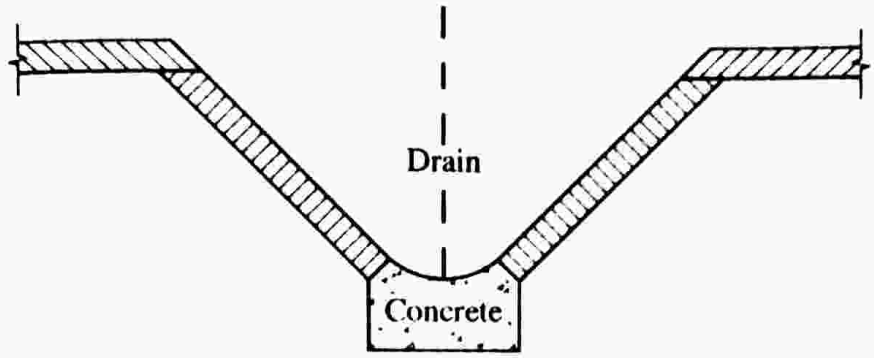
Semi-circular surface drain
FIG. 9-3

(iii) ***U-shaped surface drains:*** As these drains are in the shape of letter U, they are known as *U-shaped surface drains*. These drains are also easy to construct and they combine the advantages of semi-circular drains and rectangular surface drains. The sides of U-shaped drains are vertical and the bottom is curved. Fig. 9-4 shows a U-shaped surface drain.



U-shaped surface drain
FIG. 9-4

(iv) ***V-shaped surface drains:*** These drains possess better hydraulic properties, but they are difficult to construct. Fig. 9-5 shows a V-shaped surface drain. These drains will carry the fluctuating discharge without depositing solids at any point because of the fact that during fair weather, the less volume of sullage will occupy only the bottom portion of the drains and even then, these drains will be capable of producing a reasonable good velocity.



V-shaped surface drain
FIG. 9-5

9-9. REFUSE OF TOWN

The term *refuse* is used in public health engineering to indicate what is rejected or left as worthless and it is divided into the following five categories:

(1) Garbage: It indicates dry refuse and it includes leaves, decayed fruits, grass, paper pieces, sweepings, vegetables, etc.

(2) Sewage: It indicates the liquid waste from the community and it includes sullage, discharge from latrines, urinals, stables, etc., industrial waste and storm water. The term *night soil* is sometimes used to indicate the human and animal excreta.

(3) Storm water: It indicates the rain water of the locality.

(4) Subsoil water: It indicates the ground water which finds its entry into sewers through leaks.

(5) Sullage: It indicates the waste water from bath-rooms, kitchens, etc. It is merely waste water and does not create bad smell.

The collection and disposal of refuse in a modern town are carried out by the water carriage system. In this system, water is used as medium to convey the sewage to the point of its treatment or final disposal.

The quantity of water to be mixed with solid matter is quite sufficient and the dilution ratio of solid matter with water is so great that the mixture behaves more or less like water. The sewage is conveyed in suitably designed and maintained sewers.

The garbage or dry refuse is collected from roads and streets in pans or baskets. It is then conveyed by carts, trucks, etc. to some suitable place. The garbage is separated into two categories, namely, flammable and inflammable matters. The former is burnt into incinerators and the latter is buried into low lying areas for the reclamation of soil. The storm water may be carried separately or may be allowed to flow with the sewage.

The initial cost of the installation of water carriage system is very high and it becomes difficult to adopt it when the financial condition of the area is very poor. However, the water carriage system is the modern method of conveyance of sewage and it is to be recommended wherever possible. It can even be adopted in stages as the town develops.

Following are the advantages claimed by the water carriage system of conveyance of sewage:

(i) ***Compact design:*** The system permits compact design of the building as lavatories can be accommodated in any part of the building.

(ii) ***Hygienic:*** It is hygienic in nature as the night soil, foul matter, etc. are carried in this system in closed conduits. The risk of outbreak of epidemic is greatly reduced.

(iii) ***Land for treatment works:*** The area of land required for treatment plant and sewage disposal in this system is smaller than that required in case of conservancy system.

(iv) ***Methods of treatment:*** When this system is adopted, it becomes easier to apply modern methods of sewage treatment. The sewage from the entire area can be carried to the treatment plant and after proper treatment, it can be suitably disposed off.

(v) ***Water requirement:*** It is said that the water carriage system requires more quantity of water for flushing of solid matter. But in practice, no considerable amount of water is required for the functioning of this system except the usual water supply.

It is true that the water carriage system has become the universal technique of collection and transport of domestic or sanitary waste of a community. But the irony lies in the fact that the system generates liquid wastes nearly 100 times the volume of the actual domestic waste produces, in order to transport in close conduits or sewers to the final point of disposal. Thus, the water carriage system generates enormous quantity of waste having high pollution potential. It also ultimately leads to the pollution of land and water resources.

The use of filtered processed water for the flushing of closets and cleaning of small sewer lines is appreciably high in this system. For instance, a typical flush toilet will contaminate each year about 60000 litres of fresh water to move a mere 800 litres of body waste. Thus, the valuable fresh water is mixed with body waste having high fertilizing potential and then we pay dearly to separate them again. The load on treatment plant, pumping station, etc. is increased and it results in high investment and recurring costs. It is, therefore, quite likely that in future, the possible alternatives of the water carriage system may be thought of such as decentralized treatment and disposal, on-site treatment and disposal system, conveying system requiring less quantity of water for its functioning, etc.

QUESTIONS 9

1. Mention some of the evils of existing unplanned towns.
2. What are the objects of re-planning of the existing towns and cities?
3. Enumerate the usual defects of existing towns.

4. State the data to be collected for the re-planning of a town.
5. What is an urban renewal project? What are its important aspects?
6. Write short notes on:
   (1) Re-planning existing towns
   (2) Urban renewal projects
   (3) Letchworth
   (4) Welwyn
   (5) Garden city
   (6) Rectangular surface drains
   (7) V-shaped surface drains
   (8) Refuse of town.
7. What are the arrangements adopted for decentralization and recentralization?
8. What are the advantages of the use of subterranean space with respect to the re-planning of the existing towns?
9. Define a garden city and explain in detail how Ebenezer Howard conceived it.
10. Enumerate the features of a garden city.
11. Compare garden cities with satellite towns.
12. Give sketches of the following:
   (1) Rectangular surface drain
   (2) Semi-circular surface drain
   (3) U-shaped surface drain
   (4) V-shaped surface drain.
13. Why are surface drains constructed? What are their requirements? State the shapes which are commonly adopted in the construction of surface drains.
14. Mention the five categories of refuse of a town.
15. Write a critical note on the water carriage system of conveyance of sewage.
16. Differentiate between the following:
   (1) Decentralization and recentralization
   (2) U-shaped surface drain and V-shaped surface drain
   (3) Garbage and sewage
   (4) Subsoil water and sullage
   (5) Garden cities and satellite towns.
17. Give reasons for the following:
   (1) It is possible to give relief to the population of the existing towns which have been deteriorated.
   (2) It is absolutely necessary to carry out a civic survey before re-planning of the town is taken in hand.
   (3) The unplanned decentralization is not desirable.
   (4) The rectangular surface drains get easily deposited.
   (5) An urban renewal programme involves co-operation of various agencies.

(6) The decentralization affords many community advantages.

(7) The surface drains are less hygienic.

(8) In water carriage system, the mixture of water and sewage behaves more or less like water.

(9) The water carriage system is to be recommended wherever possible.

(10) The planner, entrusted with the job of re-planning an existing urban area, is truly the slave of past decisions.

(11) There will be no necessity of renewal of towns only in a stagnant society.

(12) The problems of city are serious in character.

(13) The V-shaped surface drains will carry the fluctuating discharge without depositing solids at any point.

(14) At present, the movement for relieving congestion in towns is better defined by the term recentralization.

(15) During the process of re-planning, it may be desirable to consider the possible use of subterranean space.

(16) It is quite likely that in future, the possible alternatives of the water carriage system may be suggested.

Chapter 10

BUILDING BYE-LAWS

10-1. GENERAL

A *bye-law* is a local law framed by a subordinate authority. The building codes or bye-laws are defined as the standards and specifications designed to grant minimum safeguards to the workers during construction; to the health and comfort of users; and to provide enough safety to the public in general.

Every locality has peculiarities of its own and with respect to its weather conditions, availability of materials and labour, other local factors, etc., it becomes economical to construct residential buildings and other structures in a definite planned way. Hence, every locality prepares or frames certain rules and regulations controlling the development of area under its command.

Every local authority under its jurisdiction has got the following two types of areas:

(1) Gamtal or gaothan

(2) Revenue.

The bye-laws for the above two categories of areas are different. The land values in gamtal area are much higher and hence, the bye-laws are framed in a liberal way. The latter category of area is covered under a town planning scheme which controls the uses of land, roads, etc.

The building bye-laws should not be confused with zoning regulations. The former regulates the construction aspects of buildings. The latter regulates the uses of land and (or) buildings.

The difference between the following terms should also be noted:

(1) Standard: It refers to a fixed or an established rule.

(2) Norm: An authoritative standard is known as the *norm*.

(3) Regulation: An order prescribed is known as the *regulation*.

(4) Bye-law: The law of a local authority is known as the *bye-law* and it is supplementary law or regulation.

(5) Law: The rules of State or community are termed as the *laws*.

In urban area Municipal Corporation and in rural area Gram Panchayat or Nagar Panchayat is acting as local body to control building construction activity by defining building bye-laws. Ahmedabad Municipal Corporation (AMC) and Ahmedabad Urban Development Authority (AUDA) acts as a local authority in Ahmedabad city. Similarly, GUDA (Gandhinagar Urban Development Authority, SUDA (Surat Urban Development Authority), RUDA (Rajkot Urban Development Authority) act for Gandhinagar, Surat and Rajkot respectively.

In this chapter, the study of the building bye-laws as related to the knowledge of a town planner will be made.

10-2. OBJECTS OF BYE-LAWS

The bye-laws are necessary to achieve the following three main purposes or objects:

(1) It becomes easier to pre-plan the building activities and provisions of bye-laws give guide lines to the designing architect or engineer.

(2) The building bye-laws prevent haphazard development without any resemblance to the development of the area as a whole.

(3) The provisions of building bye-laws usually afford safety to the human beings who work and live in them against fire, noise, health hazard and structural failure.

10-3. IMPORTANCE OF BYE-LAWS

The importance of enforcing building bye-laws by law is quite evident from the fact that unless prevented by law, the house owners, with profit as the only motive, will construct residences lacking in amenities and health conditions. In the absence of suitable building bye-laws and machinery to enforce them, the poor people will be left at the mercy of well-to-do people.

The contents of the building bye-laws should be framed in a scientific way. It is desirable to take assistance while framing building bye-laws of experts on various subjects such as town planning, law, civil engineering, health, traffic, general administration, etc. The consultation by the local authority is desired on the following three grounds:

(1) Consultation with superior authority: The local authority should take into confidence the superior authority, usually higher levels of government, before attempting to change, modify or alter its bye-laws. Such a consultation is necessary for keeping smooth harmony between national or regional policies and the local government.

(2) Consultation with subordinate authority: It is necessary for the local authority to consult subordinate neighbouring or independent public authorities who are likely to be affected or influenced by the bye-laws of the local authority. Such a policy will lead to some degree of consistency in collective public policy.

(3) Consultation with interested groups: The local authority should try to secure support of its policy by consulting interested groups such as chambers of commerce, professional bodies, etc.

Having realized the importance of building bye-laws and to smoothen the work of government departments, municipal bodies and other construction agencies, the National Building Code or NBC has been published by the Bureau of Indian Standards. It is prepared to unify the building regulations throughout the country. In fact, it is a single document in which, like a network, the information contained in various Indian Standards is woven into a pattern of continuity and cogency with the interdependent requirements of sections carefully analysed and fitted in to make the whole document a cogent continuous volume. The NBC has been drafted with performance orientation so as to give better freedom to the architect and engineer.

10-4. FUNCTION OF LOCAL AUTHORITY

A local authority is a body created by law and it has to carry out various functions and obligations in connection with community life. One of the important duty of a local authority is to frame suitable building bye-laws and to provide suitable machinery for its successful implementation.

For this purpose, it should form a department to receive plans of proposed buildings. The department checks every detail on the plan and defects, if any, pertaining to prevailing bye-laws, are pointed out for rectification. Only those plans are approved which comply with the requirements of prevailing bye-laws. The approval of plan means the acceptance of local authority of the following requirements only:

(1) arrangements of stairs, lifts, corridors, doors, windows and parking;
(2) height of building and its various storeys;
(3) minimum requirements of high-rise building or low-rise building as the case may be;
(4) minimum requirements of sanitary facility;
(5) minimum requirements with respect to areas of rooms;
(6) permissible built-up area;
(7) permissible F.S.I.;
(8) permissible open spaces and set-back;
(9) permissible use of buildings; and
(10) provision for light and ventilation.

However, the approval of plan by the concerned local authority does not mean the following:

(1) easement rights;
(2) structural reports and structural drawings;
(3) title of the land or building;
(4) variation in area from recorded area of a plot or a building;
(5) workmanship and soundness of materials in construction of the building.

The department also supervises the execution of such buildings from beginning to end. The permission to occupy the building is granted only after verification of the fact that it is constructed as per details of the approved plan.

It should, however, be observed that the procedures laid out by the local authority should be easy and simple and should not lead to undue delay in granting the permission for the construction of the building. The unnecessary delay in sanctioning of plans may lead to the following undesirable consequences:

(1) It leads to the increase in housing shortage which might result in shooting of house rents.
(2) It may lead to the formation of more slums and more financial burden on the local authority for their removal or improvement.
(3) The enthusiasm of the owner who wants to construct the building quickly may slow down because of changes in circumstances due to passage of time.

(4) The local authority may also suffer loss in revenue from various taxes such as water tax, sanitation tax, betterment charges, etc.

(5) The open land remains idle for a long time resulting in undue hardship and loss of revenue to the land owner.

(6) There is considerable depression in the construction industry as a whole.

It is also the duty of the local authority to keep a constant watch on the behaviour of building bye-laws. The complaints and suggestions received from the public, practising engineers and architects should be properly recorded. The existing building bye-laws should be then periodically modified or altered to suit the changed local needs and conditions.

In general, there should be a rational approach to the building bye-laws at the time of either framing or implementing them. The important points to be remembered in connection with the building bye-laws can be enlisted as shown below:

(1) The authority concerned should provide more field staff for the effective implementation of the bye-laws.

(2) The bye-laws causing undue hardships to the public at large should be immediately removed or rectified.

(3) The procedural requirements should be brought down to the minimum possible extent.

(4) The professional institutions, engineers and staff should be consulted at the time of framing or changing the bye-laws.

(5) There should not be frequent changes in the basic requirements of the bye-laws.

(6) They should aim at the socio-economic housing conditions.

(7) They should be given proper publicity through various popular mediums.

The Delhi administration has gone a step further in the matter and has introduced two major reforms in the bye-laws relating to the construction of houses on plots upto 500 m^2 in area. These reforms are as follows:

(1) Building bye-laws: The 17 pages of the building bye-laws are reduced to few and intelligible controls which are related to ground coverage, set-backs, floor area ratio and maximum height. All that is necessary for architects and house owners to do while designing their houses is to conform to these controls and they are not required to submit their plans for approval prior to the building. The plans are finalized by the architects themselves in accordance with the controls. However, a copy of the plans is to be filed with the concerned civic authority who has the legal authority to check whether the controls have been adhered to or not.

(2) Powers to architects: The powers of issuing or certifying the completion certificates are now delegated to the architects registered with the council of architecture and who are engaged by the owners for designing and supervision of their houses.

The new scheme avoids the cumbersome official procedure for getting completion certificates for those involved in the construction of houses on small plots having areas not exceeding 500 m^2. Such owners are able to occupy their newly constructed houses without any delay, resulting in saving of time and energy.

10-5. RESPONSIBILITY OF OWNER

It is the duty of owner to appoint suitable supervising agency as recognized by the local authority for the implementation of bye-laws in an effective manner. In case of big local authorities, the persons interested to supervise the work during construction have to obtain the necessary license from the concerned authority. Only such licensed persons will be recognized by the concerned local authority as the supervising agencies employed by the owner.

Following are the usual supervising agencies recognized by the local authority:

(1) **Surveyor:** A person can be qualified as a licensed surveyor, if he is holding a degree in Civil Engineering or Architecture or if he is a Diploma holder in Civil Engineering.

(2) **Architect:** If the person is registered as an architect as per the Architect Act, 1972, he can obtain the license to work as an architect.

(3) **Engineer:** A degree holder in Civil Engineering with two years of practical experience or a Diploma holder in Civil Engineering with five years of practical experience can obtain the license to work as a licensed engineer.

(4) **Structural designer:** A degree holder in Civil Engineering with three years of practical experience in structural design can qualify a person to obtain the license to work as a structural designer.

(5) **Clerk of works:** The qualification is the same as that of the surveyor.

The first three categories, namely, licensed surveyor, licensed architect and licensed engineer are authorized to sign plans and to submit progress certificates. They are expected to furnish the details on site correctly on the plan and to observe that the requirements prescribed by the bye-laws are satisfied on the plans prepared by them.

The structural designer is expected to furnish structural drawings and other details with respect to the structural stability of the structure.

The category of clerk of works is required only for important structures. It is the duty of a clerk of works to see that the work is carried out as per the specifications. He is a full-time employee on the project and he cannot take employment or appointment on any other site.

10-6. APPLICABILITY OF BYE-LAWS

The bye-laws are made applicable under the following three circumstances:

(1) **Additions and alterations to a building:** If the owner desires to make certain additions, alterations, modifications or extension to a building, the plans showing the proposed work should be got prepared from the licensed person for submission to the concerned authority. The owner can carry out such additions, alterations, etc. only after getting his plan approved by the concerned authority.

(2) **New construction:** The plan showing the project proposed to be constructed on a particular site has to be suitably sanctioned before commencing the work.

(3) **Requirement of open space:** The open space shown on plan and provided in confirmity with the bye-law cannot be covered and it has to be kept permanently

open. If the bye-law is subsequently amended and if it becomes legal to cover the open space, the same can be carried out only after getting the approval of concerned authority.

10-7. PRINCIPLES UNDERLYING BUILDING BYE-LAWS

The broad principles to be observed while framing the building bye-laws for any locality can be summarized as follows:

(1) classifying the buildings with unit as a family and mentioning the requirements accordingly;

(2) classifying the rooms according to use and then mentioning minimum standards of each room with respect to size, height, floor area, ventilation and light;

(3) controlling the height of compound wall and location of compound gates;

(4) controlling the height of structures and putting maximum limit of height in certain zones;

(5) controlling the area of projections in the marginal spaces;

(6) insisting suitable F.S.I.;

(7) insisting upon suitable arrangements with respect to drainage and water supply;

(8) making compulsory the appointment of a licensed architect or engineer for works of the specified nature and magnitude;

(9) making compulsory to construct the buildings with the materials and the workmanship as per standard specifications;

(10) mentioning the light plane, set-backs and marginal spaces;

(11) mentioning the minimum size of plots, their dimensions and frontages; etc.

10-8. SET-BACK OR BUILDING LINE

A set-back may be defined as frontage margin or open space in front of the abutting street or road as shown in fig. 10-1. The land contained in set-back belongs to the owner of the property. But he is prohibited from putting any structure in the set-back portion. The width of set-back varies from 1.00 m to 1.50 m for congested area to 4.50 m to 6.00 m for new undeveloped area.

A set-back is also referred to as a *building line*. In connection with light plane, the horizontal distance to be left from vertical face of the building is also known as the *set-back* as shown in fig. 10-2.

Following are the advantages of set-backs:

(1) If absolutely necessary, part of the set-backs may be acquired for the purpose of widening the road.

(2) If the set-back is uniform, the buildings are constructed in one line parallel to the axis of road, resulting in improvement of road.

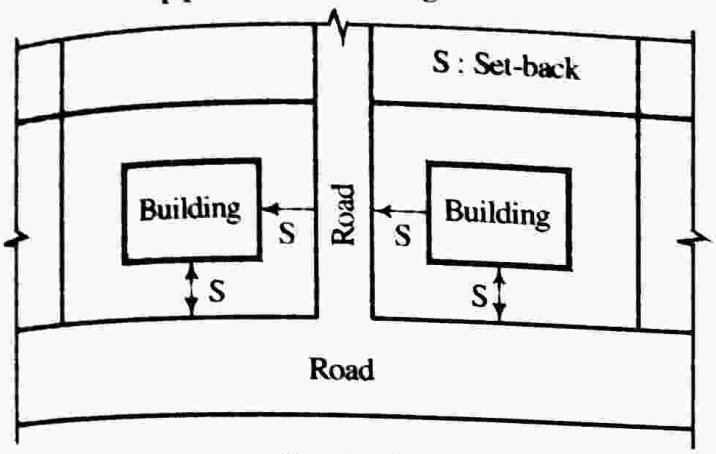
(3) The provision of set-backs results into better conditions of air, light and ventilation of the buildings.

(4) The set-backs at street corners improve visibility and impart safety to the traffic.

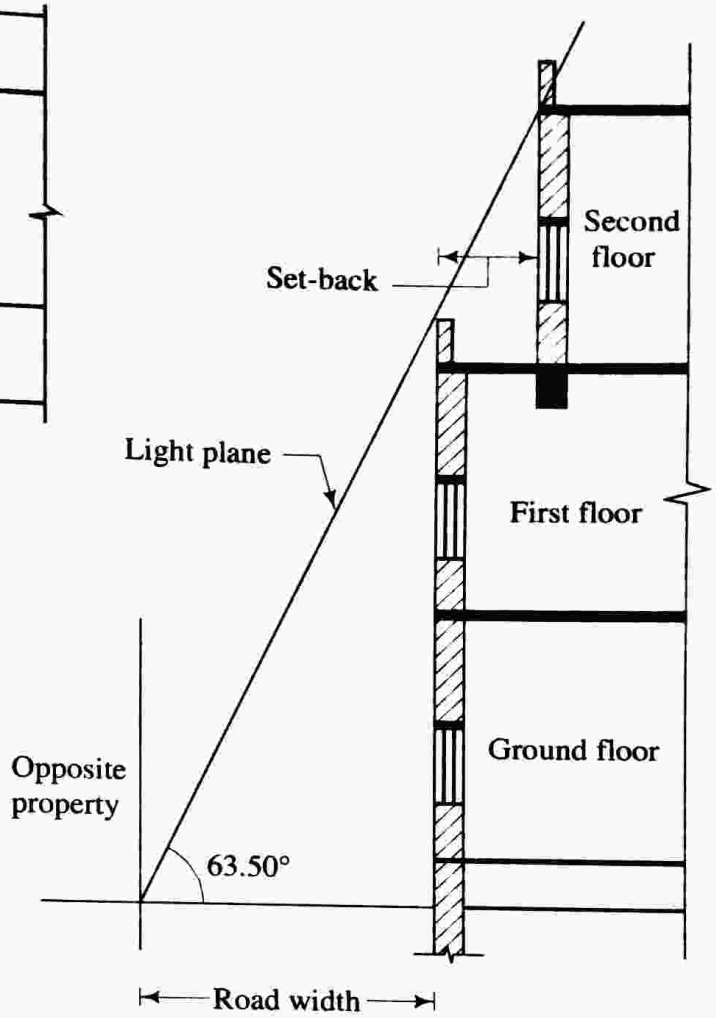
(5) The space of set-backs can be conveniently used as a parking place or for developing as a garden.

(6) They are necessary for the protection of the buildings from street nuisance.

(7) They reduce the danger of fire by increasing the distance between opposite buildings.



Set-back
FIG. 10-1



Light plane and set-back
FIG. 10-2

10-9. LIGHT PLANE

In city area or gamtal area as it is known, the construction is allowed on the full area without the provision of margins on any side. In such cases, it becomes necessary to check that the height of one building does not obstruct ventilation of the property on the other side of the road. For this purpose, a light plane is marked at a suitable angle from the edge of road on other side and the height of building is suitably curtailed off to allow the light plane to pass as shown in fig. 10-2. The angle of light plane is 45° or 63.50°, the latter being very common. With an angle of 63.50°, the set-back becomes necessary when the total height of the building exceeds twice the width of road or street.

10-10. FLOOR SPACE INDEX

The ratio of the total floor area inclusive of walls of all the floors to the area of the land on which the building stands is known as the *floor space index* or F.S.I. In some cities, it is also known as the *floor area ratio* or F.A.R. The value of F.S.I. or

F.A.R. is determined by the local authority and it may be different for different areas and for different buildings of the town. Floor area means built-up area excluding area of walls.

Table 10-1 shows tentative figures of F.S.I. for a typical town.

TABLE 10-1
FLOOR SPACE INDEX (F.S.I.)

No.	Use zone	Area	Maximum permissible F.S.I.	Remarks
1.	(a) Residential Zone I	As per margin and maximum built-up area.	1.8	--
	(b) Residential Zone II		1.2	Ground floor plus two upper floors or 10m height whichever is less.
	(c) Residential Zone III	15%	0.30	Ground floor plus one upper floor or 7 m height whichever is less.
2.	Natural Growth of village	As per margin and maximum built-up area	1.2	Facing street of more than 12 m width
3.	Commercial Zone	45% (low rise building) 30% (high rise buildings)	1.8	Facing street of less than 12 m width
4.	Industrial	50%	1.0	Maximum allowed on G.F. 0.50
5.	Stars hotels on 18.00 m and above wide road	45% Low rise 30% High rise	2.25 2.25	Maximum allowed on G.F. 0.40

Residential zone I, is the main zone of the city covering the largest area. It includes residential, commercial and mixed land use. The buildings in this zone, can range from single dwelling units per plot to high rise buildings.

Residential zone II, permits land uses similar to residential zone I, but at a lower density.

Residential zone III, permits only detached dwelling units having minimum area of 1000 m^2.

All above zones will be mentioned in city plan with different colour codes.

The F.S.I. controls the development activity on the plot of land and consequently, it can be used as a measure to check density of population. For instance, if the plot area is say 450 m^2 and if permissible F.S.I. is 1.00, the maximum built-up area which can be put up on the plot is 450 m^2. This permissible built-up area can either be consumed in five floors each being 90 m^2 or in three floors each being 150 m^2.

It would however be seen that provisions of other building bye-laws are respected. The unused F.S.I. indicates the potential or hidden value of land.

It may, however, be noted that the term *built-up area* of a unit means any area which is built upon whether below or above the ground level. However, for computing the F.S.I., the following items are not added in the total built-up area:

(1) parking spaces without any enclosures and partitions of any kind, with clear height of 2.4 m and in case of slabs with beams, height should not exceed 2.8 m;

(2) spaces of hollow plinth with maximum clear height of 2.8 m including beams in residential buildings only (not even in mixed development) at ground level without any enclosures or walls and partitions in any form;

(3) basement exclusively used for parking with maximum clear height 2.4 m;

(4) 7 % of total basement area used for safe deposit vault and air-conditioning plant room;

(5) electric cabin or electric sub-station as specified by electric board;

(6) security cabin upto 4 m^2;

(7) weathershed upto 0.60 m width;

(8) ramps landing to cellar or upper floors;

(9) staircase with maximum intermediate landing width equal to the width of stair, maximum landing width at floor level shall be twice the width of stair;

(10) lift, lift well with lift cabin, stair cabin, lift landing of lift well and water tank;

(11) interior open spaces and ducts required subject to 4% of built-up area;

(12) wells, bores and tube wells;

The novel idea of using the available F.S.I. or F.A.R. of a particular plot of land on some other land has been advanced in recent times and this right is known as the *floating F.S.I.* or a system of *transferable development rights* (TDR). The essential condition would of course be that both the lands must fall within the jurisdiction of the local authority which permits the use of floating F.S.I.

The use of floating F.S.I. is generally made to regularize the excess F.S.I. utilized by the owner or developer on his plot. For instance, let us assume that the plot area is 1500 m^2 and permissible F.S.I. is unity. Hence, the total construction of 1500 m^2 built-up area can be made. But suppose the developer has already made constructed area of 2500 m^2. It is evident that he will be forced to remove (2500 – 1500) = 1000 m^2 of the constructed area. If the local authority agrees, he can, as an alternative, purchase a plot of land of 1000 m^2 with a similar character and then gives an undertaking that it will be kept permanently open and its permissible F.S.I. of unity may be treated as consumed for the plot on which an excess built-up area of 1000 m^2 has been put up. Thus, the permissible F.S.I. of newly purchased plot floats and settles on the plot of land with existing structure.

The term *floating F.S.I.* should not be confused with the balance or available F.S.I. The difference between permissible F.S.I. and the F.S.I utilized indicates the balance or available F.S.I. on the plot itself. However, if the circumstances permit, the balance F.S.I. can be made to float and settle on the adjoining property.

The concept of floating F.S.I. has yet to become popular because it invites many practical difficulties and is not so simple as it looks. Otherwise the balance F.S.I. of under-developed properties which cannot be developed either due to legal restrictions or other reasons can be purchased, floated and settled on some profitable property.

To make this instrument truly equitable, the F.S.I. should be indexed depending on its location, utility, etc. For instance, if F.S.I. is transferred from the city centre to the periphery of an urban area, a multiplier index will have to be applied in order to ensure that TDR values are equally realised irrespective of the location to which they are transferred.

The city of Mumbai (Bombay) is the first one to have adopted the TDR concept in a regulated manner for land acquisition and development of city. Some of the broad guidelines are as follows:

(1) The TDR is not permitted to be utilized on the coastal areas and on plots falling on certain major roads.

(2) The island city being more congested and highly developed, the TDR is not allowed to be used in this area of the city.

(3) The owners are allowed to sell the TDR in part so that they can utilize and plan the sale proceeds realised from sale of TDR as per their convenience.

(4) The TDR can be transferred from plots in similar zones only i.e., residential for residential or commerical for commerical, etc.

(5) The congested areas are identified where the TDR benefits are not permitted.

10-11. OFF-STREET PARKING

The public parking facilities are inadequate and hence, when a new building is constructed for uses or when the use of old building is changed to any of the uses or when new additions are made to the existing buildings for certain other uses, the bye-laws relating to off-street parking are to be respected. Most of the bye-laws contain provisions for parking of three vehicles, namely, cars, scooters and cycles. The usual parking space mentioned for these units is as under:

Car : 5.50 m × 2.50 m

Scooter : 2.50 m × 0.50 m

Cycle : 2.00 m × 0.50 m

Depending upon the use of the building, the bye-laws specify the provision to be made for the parking spaces of cars, scooters and cycles.

Table 10-2 shows the typical usual off-street parking required for various types of structures. Following points are to be noted:

(1) If the parking is not provided at street-level, the gradient of ramp leading to parking space should not exceed 14.3%, i.e., the vertical rise should not be more than 1 metre over a horizontal distance of 7 metres.

(2) Clear head way of 2.4 m shall be provided on every excess leading to parking space and at any point in parking space.

(3) It is necessary to put up a sign-board indicating the location of parking spaces for different types of vehicles.

(4) The exemptions in the off-street parking may be granted in deserving cases such as:

(a) area of land in gamtal is less than 200 m^2;

(b) area of land in T.P. scheme is less than 800 m^2;

(c) height of building is not exceeding 10 m; and

(d) special buildings used as temple, mosque, prayer hall, etc.

(5) The off-street parking is not permitted in area within 6 m from the perimeter of the building.

(6) The parking layout should include adequate vehicular access to the street, drive-ways and manoeuvring space over and above the parking space.

TABLE 10-2
TYPICAL OFF-STREET PARKING FOR VEHICLES

No.	Type of use	Off-street parking
1.	Cinema, theatre, public assembly halls, auditorium, stadium, etc.	1 m^2 per seat. 50% of total parking shall be reserved for cars.
2.	Colleges and coaching classes	70 m^2 for every 100 students.
3.	Commercial buildings including bussiness office, bank, hotel, guest house, lodge, restaurant, institutional building, etc. and health facilities including hospitals and nursing homes, etc.	30% of maximum permissible F.S.I. 50% of total parking space requirements shall be reserved for cars.
4.	Community buildings such as community hall, recreational club, marriage hall, religious buildings, party plot, club house, etc.	50% of building unit 50% of total parking space shall be reserved for cars
5.	Grain market, timber market, iron market, agricultural market and such other wholesale trade	30% of maximum premissible F.S.I. 50% of total parking space shall be reserved for cars
6.	Industrial premises	10% of building unit. 50% of total parking space shall be reserved for cars.
7.	Primary school	20 m^2 for every 100 students.
8.	Residential flats or apartments	15% of maximum permissible F.S.I. for dwelling units having built-up area above 80 m, 50% of total parking space shall be reserved for cars and for dwelling units below 80 m^2 built-up area, 25% of total parking space shall be reserved for cars.
9.	Secondary and higher secondary schools	50 m^2 for every 100 students
10.	Stock market	30% of maximum permissible F.S.I. 50% of total parking space is reserved for cars.

10-12. FIRE PROTECTION

As the tendency at present is to construct high-rise buildings, the problem of fire protection should also be properly accommodated in the building bye-laws. Some of the provisions to grant safety to buildings from fire can be enumerated as follows:

(1) Lift and stair: If the height of building is 25 m or more, at least one fire-lift and one staircase shall have to be provided in the building.

(2) Water supply: For buildings having height between 13 m to 25 m, the provision of an underground storage tank of 75000 litres capacity is necessary. If the height exceeds 25 m, the internal fire hydrants will have to be installed and an external fire hydrant connected with public water main line has to be provided. The provisions should comply with the National Building Code or the relevant Indian Standard Codes.

(3) Special provisions: Separate electric circuits should be provided for the operation of lifts, pumps, lights in corridors, etc. If the height of building

(ii) In case of folded roof, the minimum height of 3 m shall be measures from the lowest point of the fold.

(iii) In case of gabled or slopping roof, the minimum height below the lowest part of roof shall not be less than 2.2 m and an average height of the rooms shall not be less than the minimum prescribed here above.

(iv) In case of trussed-roof, the minimum height shall be measured from the pavement to bottom of the tie beam.

(v) For verandah, Bathrooms, W.C., passages, pooja room, store room, stair cabin, the minimum height shall be 2 m.

10-18. LOFT

The loft shall be at a minimum height of 2 m from the floor level. Area of the loft shall not be more than 30% of floor area of the room, in which the loft is provided.

10-19. STAIRS, LIFTS, LOBBIES AND CORRIDOR

The width of lobbies or corridors in building shall be as under:

(i) In case of residential and non-residential building except individual detached building minimum clear width of corridor shall be as mentioned in table 10-5:

TABLE 10-5
LENGTH AND WIDTH OF CORRIDOR

Length of corridor	Width of corridor	
	Residential	Non-residential
Upto 6 m	1.0 m	1.2 m
Upto 9 m	1.2 m	1.5 m
Upto 15 m	1.2 m	2.0 m
Above 15 m	1.5 m	2.5 m

For every additional 9 m length or part thereof, the width of corridor shall be increased by 0.30 m upto a maximum of 3 m.

In case of starred hotels, the width of the corridor shall be as per the authorized standards of the starred hotels.

(ii) In case of residential dwelling unit occupies by a single family and constructed upto three floors, width of the stairs shall not be less than 1.2 m.

(iii) In case of all non- residential and high-rise residential buildings, the clear width of stair and landing exclusive of parapet shall not be less than 1.5 m.

(iv) The minimum stair width for more than 6 tenements or flats on each floor shall be 1.5 m.

(v) The stair-case and lifts (elevators) shall be within accessible distance of not more than 25 m from any entrance of tenement or an office provided on each floor.

(vi) The tread and riser of the stair shall comply with the provisions of the National Building Code for that class of building.

(vii) No winders shall be allowed except in case of individual dwelling unit.

10-20. SANITARY ACCOMMODATION

All the buildings when erected or re-erected from foundation or when additions to the floors are made shall be provided with minimum sanitary accommodation as follows:

(1) **Office and public buildings:** In case of office building and public building except cinemas, theatres, meetings and lecture halls, minimum sanitary facilities should be provided as under:

(i) Every office building or public building shall be provided with at least one water-closet.

(ii) Water-closets shall be provided for each sex and the number of such water-closet for each sex shall in every case be based upon the maximum number likely to occupy such building at any one time.

(iii) One urinal shall be provided for every 25 males and one water-closet for every 25 females 100 persons. For any number exceeding 100, one urinal for every 50 persons shall be provided.

(iv) One water-closet for every 50 persons of each sex upto 500 persons shall be provided and for excess over 500, one water-closet for every 100 persons of each sex or part thereof shall be provided.

(v) All water-closets and urinals shall be in an accessible location and shall be provided with signs, indicating their purposes and the sex for which they are meant.

(2) **Industrial buildings and warehouses:** All types of industrial buildings shall be provided with minimum sanitary facilities as under.

(i) Every such building shall be provided with at least one water-closet or privy.

(ii) Water-closets or privies shall be provided for each sex and number of such closets or privies for each sex shall in every case be based upon the maximum number or persons of that sex employed in occupying such building.

(iii) At least one water-closet or one privy for every 25 females and one water-closet or one privy for every 25 males shall be provided.

When the number of males employed exceed 100, it shall be sufficient if there is one water-closet or one privy for every 25 males upto first 100, and one water-closet or one privy for every 50 thereafter.

(iv) In every such factory there shall be provided one urinal for every 100 persons or any lesss number thereof.

(v) In every such factory, there shall be provided one washing place of 3.6 m^2 in area with sufficient number of taps as per standards laid down by rules in respect of factories.

(vi) In every building of the warehouses class, there shall be provided one water-closet for every 50 males or any less number thereof and one water-closet for every 50 females or any less number thereof. There after water-closet shall be provided at the rate of one water-closet for every 70 persons.

(vii) In every building of the warehouse class, there shall be provide one urinal for every 100 persons or any less number thereof.

(viii) Such water-closets and urinals shall be accessible in location and shall be provided with signs, indicating their purpose and the sex for which they are meant.

(3) Educational buildings: Any building used for educational purpose shall be provided with minimum sanitary facilities as follows:

(i) There shall be one water-closet and four urinals for every 200 students or part thereof.

(ii) The building shall be deemed to be occupied by students at the rate of one student per 1 m^2 of the floor area of all the class-rooms and sanitary facilities shall be provided according to the number of students so worked out.

(4) Residential building or residential tenements: Each residential building or residential tenement shall be provided with at least one water-closet.

10-21. VENTILATION

(1) Ventilation of rooms: Every room, whether it is a living room or a kitchen, shall be provided with windows or ventilators for the purpose of ventilation. A window or windows and/or ventilators shall have opening directly into an interior or exterior open air space or into an open verandah or gallery abutting on open air spaces. The area of windows and ventilators excluding frames shall be at least one-tenth of the floor area of the room.

(2) Factories and building of the warehouses: Every room in such building shall be lighted and ventilated by sufficient number of windows, ventilators and sky lights exclusive of doors having clear opening not less than $1/7^{th}$ of the floor area abutting on open air space of width not less than $1/3^{rd}$ of the height of the part of the building abutting such open space.

(3) Ventilation of stair-cases: Every stair case shall be lighted and ventilated to the satisfaction of the authority from an open air space not less than 1 m^2.

(4) Windows in stair-case bay: The windows of an aggregate area of at least 1.2 m^2 on each storey in the wall of the stair-case room shall be provided, which abuts on 1 m^2 open air space.

(5) Ventilation from the top and skylight etc.: Where an open well for light and ventilation, within the space enclosed by a stairway and its landings, is proposed to be provided, the least horizontal dimensions of which are equal to two times the width of the staircase, then skylight shall be provided directly in the roof. A ventilating skylight shall be provided with fixed or movable louvres to the satisfaction of the competent authority. The glazed roof of the skylight shall not be less than 3.7 m^2 in area. No lift or any other fixture shall be erected in such staircase well.

10-22. SILLS OF OPENINGS

Every opening abutting to any open space shall have sill not be less than 90 cm above the level of the floor from which such opening is accessible.

If such opening is to be constructed flush with floor level, its lower portion upto a height of 90 cm shall be protected by bars or grill or similar other devices to the satisfaction of the local authority.

10-23. STAIRWAY OR STAIRCASE

Stairway shall confirm to the following provision mentioned below. In addition, in order to satisfy fire fighting requirements any stairway identified as an exit stairway shall confirm to the requirement stippled in fire protection regulations provided.

(1) Width: The minimum width of a staircase other than a fire escape shall be as mentioned in table 10-6.

TABLE 10-6
MINIMUM WIDTH OF COMMON STAIRCASE OR STAIRWAY

No.	Type of occupancy	Minimum width of stairway
1.	***Residential building***	
	(a) Low rise	1.2 m
	(b) Hotels and high rise	1.5 m
2.	***Educational building***	
	(a) Upto 24 m high	1.5 m
	(b) Over 24 m high	2.0 m
3.	***Hospitals***	
	(a) Upto 10 beds	1.5 m
	(b) Over 10 beds	2.0 m
4.	***Assembly buildings***	2.0 m
5.	***Mercantile, business, industrial storage, hazardous, buildings***	
	(a) Low rise	1.5 m
	(b) High rise	2.0 m

(2) Flight: No flight shall contain more than 12 rises, but in residential buildings, in narrow plots and in high density housing a single flight staircase may be permitted.

(3) Risers: The maximum height of a riser shall be 19 cm in a residential building and 16 cm in any other case. However, an internal stairway within a dwelling unit may consist 25 cm high riser.

(4) Treads: The minimum width of the tread, without nosing shall be 25 cm for staircase in a residential building, other than fire escapes. In other cases the minimum width of the tread shall be 30 cm. It shall have a non-slippery finish and shall be maintained in that fashion.

(5) Head room: The minimum head room in a passage under the landing of a staircase shall be 2.2 m.

(6) Floor indicator: The number of each floor shall be conspicuously painted in figures at least 15 cm large on the wall facing the fight of a stairway or at such suitable place as is distinctly visible from the fights.

(7) Hand Rail: Hand rail of a minimum height 90 cm from the centre of the tread shall be provided.

(8) Pitch: The pitch of stair shall be within 30° to 45°.

10-24. RAMPS

(1) Ramps for pedestrians:

(i) ***General:*** The provisions applicable to stairway shall generally apply to ramps. A ramp in a hospital shall not be less than 2.25 m wide in addition to satisfy the fire fighting requirements.

(ii) ***Slope:*** A ramp shall have slope of not more than 1:10. It shall be of non-slippery material.

(iii) ***Handrail:*** A handrail shall be provided on both the sides of the ramp.

(2) Ramps for handicapped people: The provision of the ramp with a handrail to every public building on ground floor only as compulsory for handicapped people, as per the revised national building code.

(3) Ramps for basement or storied parking: For parking spaces in a basement and upper at least two ramps of adequate width and slope shall be provided preferably at the opposite and such ramps may be permitted in the side and rear marginal open spaces, after leaving sufficient space for movement of firefighting equipments.

10-25. ROOFS

The roof a building shall permit drainage of the rain water by means of rain water pipes. The rain water shall be carried away from the building without causing dampness in any part of the walls or foundations of the building or to the adjacent buildings. Rain water pipes shall be affixed to the outside of the walls of the building or in recesses or chases cut or formed in such walls or in such other manner as may be approved by component authority.

10-26. PARAPETS AND TERRACES

Parapet walls and handrails provided on edges of the roof, terrace, balcony, etc. shall not be less than 1.15 m high from the finishing floor level and not more than 1.3 m high above the unfinished floor level. Parapet construction shall be made of material and design, which ensures optimum safety to the occupants of the building. Terraces shall be free from partition of any kind and shall be accessible by a common staircase.

10-27. MOSQUITO-PROOF WATER TANK

Water storage tank shall be maintained perfectly mosquito-proof condition by providing a properly fitting hinged cover and every tank more than 1.50 m in depth shall be provided with a permanently fixed iron ladder to enable inspection by anti-malaria staff.

10-28. REFUSE AREA/DISPOSAL OF SOLID WASTE

Wherever a property is developed or redeveloped, a space for community-bin for disposal of solid waste shall be provided in the road-side front marginal open space with air-tight cover on top with the standard prescribed as follows:

(1) For residential buildings: The size of community-bin (container) shall be calculated at the rate of 10 litres capacity per dwelling unit, with the maximum capacity of 80 litres.

(2) For nonresidential buildings: The size of community-bin (container) shall be calculated at the rate of the 20 litres capacity for each 100 m^2 of floor-area, with maximum capacity of container shall be 80 litres.

(3) For hospitals, hotels, restaurants: In case of hospitals, hotels, restaurants, etc., the disposal of solid waste shall be carried out as per the norms decided by the local authority from time to time.

10-29. DISCHARGE OF RAIN WATER

Each and every roof or terrace abutting on a public street, shall be provided with sufficient number of down take pipes and such pipes shall be so fixed as to discharge the rain water at a level not higher than 60 cm above the street level.

10-30. PROVISION OF LETTER BOX

In all case of building having more than two floors including ground floor, a letter boxes for each separate unit shall be provided at ground floor level in such a way that post man can easily deliver the posts in them.

10-31. MARGIN AND MAXIMUM BUILT-UP AREA

(1) Residential and commercial use:

(i) The margins for all uses except for industrial building and special structures shall be as per table 10-7:

TABLE 10-7

Width of proposed roads	Minimum road side margin
Road upto 9 m and less	3.0 m
More than 9 and upto 12 m	4.5 m
More than 12 m and upto 18 m	6.0 m
More than 18 m and upto 40 m	7.5 m
More than 40 m	9.0 m

(ii) For a low rise building on 9 m or more wide road, road-side margin shall be 4.50 m In case of the building having roads on three sides, for one road of 9 m or less, road side margin shall be 3 m.

(iii) The minimum side margins other than road side and maximum built-up area on any floor for all uses except for industrial building and special structure shall be as per table 10-8 for low rise building:

TABLE 10-8

Plot size	Margins other than road side	Maximum built-up area on any floor
Upto 150 m^2	2.25 m (any one side)	60%
More than 150 m^2 and upto 250 m^2	2.5 m (rear side) and 1.5 m (any one side)	50% or 90 m^2 whichever is more
More than 250 m^2	3.0 m in all sides except road side as the case may be.	45% or 150 m^2 whichever is more
For high-rise building	As described below	30%

(iv) ***High rise buildings:*** In the case of project to be developed with one or more high rise buildings, the minimum margins and open space above the ground level and between the buildings shall be provided as under for all uses and irrespective of road width:

(a) 30% of height of building or 6 m, whichever is more on road sides.

(b) 20% of height of building or 6 m, whichever is more on remaining sides.

(c) Margin between the buildings shall be two times the margins required on remaining side, as mentioned above.

In all above cases, the height of the building shall be measured from the plot level to the highest point in the building. Excluding the height of staircabin, lift well, lift cabin, water tank and parapet wall. Height of parapet wall should not exceed 1.5 m and of all other above mentioned structures should not exceed 2.4 m.

(2) Industrial use: Maximum permissible built-up area on any floor including the ground floor shall be 50% of the plot area. The minimum margins in industrial building shall be as under:

(i) There shall be clear minimum distance of 6 m between two detached structures for plots of more than 1000 m^2 and 4.5 m for plots admeasuring upto 1000 m^2.

(ii) 6 m clear minimum margins shall be kept along the periphery of the plot used for industrial use like mills, godown, warehouses, service station with petrol pump, motor repair garage and a building unit of 1000 m^2 or more. For building units less than 1000 m^2 used for industrial use, the minimum margins shall be 4.5 m.

However, the minimum road side margin on roads 18 m wide and above shall not be less than the margin prescribed as in point (i) above.

10-32. PERMISSIBLE BUILT UP AREA IN MARGIN

The construction of water-closet, bathroom, servant quarter and parking garage shall be permitted in one of the corners of a rear marginal space of an individual or semi-detached residential building unit, except ownership flats/tenements subject to following conditions:

(i) The maximum permissible area of construction in margin shall be 16.50 m^2. Maximum permissible dimension of closed parking is 5.5 m × 3 m.

(ii) The maximum height of construction in margin shall be 3 m with maximum plinth of 30 cm.

(iii) No first floor shall be permitted over a construction in margin.

(iv) It shall be exclusively used for any W.C., bath room, servant quarters or for parking garage.

(v) It shall be considered towards calculation of maximum permissible built-up area and floor space index of the building unit.

(vi) The location of the said construction can be alternatively permitted from the rear corner upto a maximum distance of half the length of the side.

(vii) Openings, doors, windows and any type of projections shall not be permitted over looking adjoining property. The slope of the roof of such structure shall be towards the inner side of the same building unit and away from the adjoining building unit.

(viii) The construction of security cabin to the extent of 15 m^2 shall be permitted (including transformer room, meter room and toilet), near the entrance gate to the plot only, with minimum height of 2.4 m from ground level and shall not be less than 4.5 m from the building.

The area of such construction shall not be considered towards calculations of permissible build up area and Floor Space Index (F.S.I.).

An underground water tank, and a surface water tank upto 1.5 m in height from ground level, well, a tube well and a pump room as directed by appropriate authority with maximum size of 1.5 m × 1.5 m of electric board shall be permitted in margin of a building unit.

The substation shall be permitted above ramp leading to cellar after keeping required headway.

10-33. PROJECTIONS IN MARGINS

(1) In any marginal open space, weather shed projections shall be permitted upto 60 cm at the height of 2 m from the floor level, but not in continuation with floor slab. However it shall not be allowed to be covered in any case.

(2) In case of detached and semi-detached residential dwelling building unit, 1 m wide open cantilever stair with maximum 2 m landing space at floor level shall be permitted in the 3 m and above marginal space except road side margin.

10-34 MARGINS FROM COMMON PLOT

From the common plot, 3 m margin shall be required in case of low rise building and 6 m margin shall be required in case of high-rise building.

10-35 OPEN SPACE

The minimum width of any interior open air space or chowk which is used for light and ventilation of the room, smaller side of it shall not be less than 1.8 m for low rise building and 3 m for high rise building. The open air space or chowk shall be provided at the level at which the light and ventilation is borrowed.

Every open space whether exterior or interior, shall be kept free from any erection thereon and shall be kept open to sky. Every such open space or chowk shall have suitable and sufficient access. No open drain, except for rain water, shall be constructed in any open space.

10-36. DEFINITIONS OF SOME TERMS

The meanings attached to some other terms which are frequently accommodated in the framework of bye-laws of any local authority are given below:

(1) Auditorium: It indicates enclosures, covered or open, where people can assemble for watching a performance given on the stage or screen.

(2) Basement or cellar: The lower storey of a building having at least 1.50 m of its total height below ground level is known as the *basement* or *cellar*.

(3) Building unit: This term is used to indicate a final plot or a part of a final plot or the combination of more than one final plot as approved by the concerned local authority.

(4) Commercial building: It includes any building or part of building which is used as shops, market, for display and sale of merchandise either wholesale or retail, for transaction of business or keeping of accounts and records for similar purposes, professional service facilities, petrol pump, restaurants, lodges, nursing homes, banks, theatres, clubs run on commercial basis, etc.

(5) Consolidated open plot (C.O.P): For a particular development of a site, a certain percentage of land area is kept as an open space and it is known as the *consolidated open plot* or C.O.P. The usual percentage of C.O.P. is 30 % of total land area and no projections except weathershed of 0.60 m width, gallery of 1.20 m width and steps, are permitted. The C.O.P. may be inclusive of the margins and approaches to be provided for the building units on the plot and the area of C.O.P. is not to be deducted from computing the floor space index of the proposed development. If the area to be allotted to the C.O.P. exceeds 500 m^2, the C.O.P. may be permitted to be sub-divided into two units, with one such unit being of minimum size 15 m × 15 m.

(6) Domestic building: This term is used to indicate a building which is not being used as a public building and it includes a dwelling house or a building appurtenant to a dwelling house, whether attached thereto or not, or a shop or a building of the warehouse class or an office building.

(7) Dwelling house: The term *dwelling house* is used to indicate a residential building including outhouse and garage for parking. It is constructed to be used wholly or principally for human habitation.

(8) Dwelling unit: This term is used to refer a residential accommodation for one family with minimum requirements as one living room, one kitchen, one bath room and one latrine.

(9) Height of building: It means the vertical distance measured from the average ground level or high flood level or plot level and upto the top of the finished level of the top most floor slab in case of flat roofs and upto the midpoint of the height of the slopping roof excluding the genuine stair cabin, water tank and lift room. The height of the slopping roof shall be taken as an average height of the relevant floor.

(10) Gamtal: It means all land that have been included by the Govt. or collector within the site of village, town or city on or before the date of declaration of intention to make a town planning scheme or publication of draft development plan but shall not include any such other land which may thereafter be included within the site of any village by the Govt. or collector under the provision of Land Revenue Code.

(11) Garage — private: It means a building or a portion thereof, designed and used for parking of vehicles.

(12) Garage — public: It means a building or portion thereof, designed other than as a private garage, operated for gain used for repairing, servicing, hiring, selling or storing or parking motor-driven or other vehicles.

(13) Habitable room: It means a room occupied or designed for occupancy for human habitation including a kitchen, if used as a living room, but excluding a bath-room, water-closet compartment, laundry, serving and storing, pantry, corridor, cellar, attic, store-room, pooja-room and spaces not frequently used. Height of habitable room shall not be less than 2.80 m measured from finished floor to finished ceiling.

(14) Height of a room: It means the vertical distance measured from the finished floor surface to the finished ceiling surface. The height of a room with a pitched room means the average height between the finished floor surface and the bottom of the eaves and the bottom of the ridge.

(15) Home occupation: It means customary home occupation other than the conduct of an eating or drinking place offering services to the general public, customarily carried out by a member of the family residing on the premises without employing hired labour and for which there is no display to indicate from the exterior of the building that it is being utilized in whole or in part for any purpose other than a residential or dwelling use and in connection with which no article or service is sold or exhibited for sale except that which is produced therein, which shall be non hazardous and not affecting the safety of the inhabitants of the building and neighbourhood, and provided that no mechanical equipment is used except that as is customarily used for purely domestic or household purpose or employing licensable goods. If motive power is used, the total electricity load should not exceed 0.75 KW. *Home Occupation* may also include such similar occupations as may be specified by the competent authority and subject to such terms and conditions as may be prescribed.

(16) Hazardous material: It means any of the following:

(i) Radioactive substances;

(ii) Material which is highly combustible or explosive and/or which may produce poisonous fumes explosive emanations, or storage, handling, processing or manufacturing of which may involve highly corrosive, toxic, obnoxious alkalis or acids or other liquids;

(iii) Other liquids or chemicals producing flame, fumes, explosive, poisonous, irritant or corrosive gases or which may produce explosive mixtures of dust or fine particles capable of spontaneous ignition

(17) Hut: It means any building which is constructed mainly of wood, mud, leaves, grass or thatch and includes any temporary structure of whatever size or any small building of whatever material.

(18) Industrial building: It means a building wholly or principally used as a factory, for the manufacture of products of all kinds including fabrication and assembly, power plant, refinery, gas plant, distillery, brewery, dairy, etc.

(19) Lift: It means a mechanically guided car, platform or transport for persons and materials between two or more levels in a vertical or substantially vertical direction.

(20) Loft: It means an intermediate floor between two floors with a maximum height of 1.20 m it is constructed. It is mainly used for storage purpose.

(21) Low-rise and high-rise buildings: The buildings, having not more than two floors, excluding ground floor, are known as the *low-rise buildings* and the

buildings having more than two floors, excluding ground floor, are known as the *high-rise buildings*.

(22) Margin: It means space fully open to sky provided at the plot level from edge of the building. Built-up area shall not be permitted except specifically permitted projections in the margin.

(23) Mezzanine floor: It means an intermediate floor between two floors overhanging or overlooking a floor beneath.

(24) Neighbourhood centre and civic centre: Neighborhood centre and civic centre shall include following activities such as sectoral shopping centre, market, office building, cinema, small hospital, playground, swimming pool, town hall, open air theatre, civic and cultural facilities, library, higher secondary school, parking plots, public utility and service building such as post office, fire station, police station, religious building and building of public uses.

(25) Natural hazard prone areas: These areas likely to have moderate to high intensity of earthquake, or cyclonic storm, or significant flood flow or inundation, or landslides or mud flows, or one or more of these hazards.

Moderate to very high risk zones of earthquake are as specified as seismic zones III, IV and V in IS: 1893; moderate to very high damage risk zones of cyclones are those areas along the sea coast of India prone to have wind velocities of 39 m/s or more as specified in IS: 875(Part 3) and flood prone areas in river plains (unprotected and protected) are indicated in the flood atlas of India prepared by the central water commission.

(26) Occupancy or use: It means the principle occupancy or use for which a building or a part of it is used or intended to be used, including contingent subsidiary occupancies; mixed occupancy building being those in which more than one occupancy are present in different portions of building.

(27) Open space: It means an area forming an integral part of the plot, left permanently open to sky.

(28) Owner: In relation to any property, owner means a person who is for the time being, receiving or entitled to receive, whether on his own account or on account of or on behalf, or for the benefit of, any other person or as an agent, trustee, guardian, manager or receiver for any other person or for any religious or charitable institution, the rents or profits of the property; and also includes a mortgaging possession thereof.

(29) Office building: It means a building which is intended or used for business purposes and no part of which is used for living purposes except by the care-taker and his family.

(30) Ownership tenement flats: These are residential flats constructed in detached or semi-detached manner on plinth or pillars by a society, a public trust or any authority established by law in India, for separate ownership and with provision of an independent bath room, latrine and a common staircase.

(31) Parapet: It means a low wall or railing built along the edge of roof of a floor.

(32) Parking space: It means an enclosed or unenclosed covered or open area sufficient in size to park vehicles. Parking spaces shall be served by a driveway connecting them with a street or alley and permitting ingress or egress of vehicles.

(33) Partition: It means an interior non-load bearing divider wall one storey or part story in height.

(34) Permission: It means a valid permission or authorization in writing by the competent authority to carry out development or a work regulated by regulations.

(35) Plinth: Plinth shall mean the portion of the external wall between level of the street and the level of the storey first above the street.

(36) Plinth area: It means the built-up covered area measured at the floor level of the basement or of any storey.

(37) Pent house: It means a covered space not exceeding 10 m^2 on the roof of a building which shall have at least one side completely open.

(38) Porch or portico: It means a roof cover supported on pillars or cantilevered projection for the purpose of pedestrian or vehicular approach to a building.

(39) Public and semi-public building: It means a building used or intended to be used either ordinarily or occasionally by the public such as a church, temple, chapel, mosque or any place of public workshop, dharamashala (caravanserai), college, school, library, public concert rooms, public hall, hospital run by public institutions, public exhibition hall, lecture room or any other place of public assembly.

(40) Public purpose: It includes the following:

(i) The provisions of village sites;

(ii) The provision of land for town or rural planning;

(iii) The provision of land for planned development of land from public funds;

(iv) The provision of land for a corporation owned or controlled by the states;

(v) The provision of land for residential purposes to the poor or landless or to persons residing in areas affected by natural calamities, or to persons displaced or affected by reason of the implementation if any scheme undertaken by government, any local authority or a corporation owned or controlled by the state;

(vi) The provision of land for carrying out any educational, housing, health or slum clearance scheme sponsored by government or by any authority established by government;

(vii) The provision of any premises or building for locating a public office, but, does not include acquisition of land for companies.

(41) Road or street: It means any highway, street, lane, pathway, alley, stairway, passageway, carriageway, footway, square place or bridge, whether a thoroughfare or not, over which the public have a right of passage or access or have passed and had access uninterruptedly for a specified period, whether existing or proposed in any scheme and includes all bunds, channels, ditches, storm-water drains, culverts, sidewalks, traffic islands, road-side trees and hedges retaining walls, fences, barriers and railings within the street lines.

(42) Road-level or street-level or grade: It means the officially established elevation or grade of the centre line or the street upon which a plot fronts, and if there is no officially established grade, the existing grade of the street at its mid-point.

(43) Road line or street line: It means the line defining the side limits of a road or street.

(44) Road width: It means the whole extent of space within the boundaries of a road.

(45) Row houses: It indicates row of houses attached to each other by a common wall with only front and rear open spaces.

(46) Semi-detached building: It means a combination of two detached buildings attached together, fully or partly, along a common wall.

(47) Service road: It means a road or lane provided at the front, rear or side of plot for service purposes.

(48) Shopping centre: It means a building which is designed to accommodate shops and/or stalls for forming a retail market. A stall is just like a shop except that its floor area usually does not exceed 5 m^2.

(49) Skip floor: It means a floor provided in a high-rise building for the purpose of common use of the residents of the building. Such a floor can be utilized for community gathering, play space for children and indoor games by the residents of the building. It is usually subject to the following conditions:

(i) Its location is at a minimum height of 15 m from the ground level.

(ii) If it is desired to provide more than one skip floor in a building, the minimum vertical distance between two skip floors should be at least 10 m.

(iii) The minimum height of skip floor should be 2 m.

(iv) No partition or enclosure is permitted anywhere in a skip floor except a railing or parapet at the edge of floor with maximum height of 150 cm.

(v) The area of skip floor is not to be counted while computing the F.S.I. of the building unit.

(vi) The height of skip floor is taken into consideration while working out the total permissible height of the building.

(50) Smoke-stop door: It means a door for preventing or checking the spread of smoke from one area to another.

(51) Stair cover: It means a structure with a covering roof over a staircase and its landing built to enclose only the stairs for the purpose of providing protection from the weather and not to be used for human habitation.

(52) Storey: It means the portion of a building included between the surface of any floor and the surface of the floor next above it or if there is no floor above it, then the space between any floor and the ceiling next above it.

(53) Tenement: It means an independent dwelling unit with a kitchen, or a cooking space.

(54) Tenement buildings and flats: This is a residential building constructed in detached or semi-detached manner by a society, a public trust or any authority established by law in India, in a building plot, each being designed and constructed for separate occupation with an independent provision for bath room, latrine, etc.

(55) Theatre and cinema: The term *theatre* is used to mean an auditorium where the performance is essentially given by live characters with or without the accompaniment of sound. The *cinema* is just like theatre except that the performance is essentially given by projection on screen with or without the accompaniment of sound.

(56) Water-closet (W.C.): It means a privy with an arrangement for flushing the pan with water, but does not include a bathroom.

(57) Water course: It means a natural channel or an artificial channel formed by draining or diversion of a natural channel meant for carrying storm and waste water.

(58) Water course, major: It means a water course which carries storm water discharging from a contributing area of not less than 160 hectares, the decision of the Competent Authority on the extent of contributing area being final. A minor water course is one which is not a major one.

(59) Water tanks or talav or pond or lake: It means a natural existing low lying ground forming a natural water body or wherein rain water gets collected and/or plots designated as Talav under the revised development plan or any other legitimate records.

(60) Warehouse or godown: It is a building, whose whole or a substantial part is used or intended to be used for the storage of goods. It is neither a domestic nor a public building.

(61) Window: It means an opening, other than a door, to the outside of a building, which provides all or part of the required ventilation.

(62) Width of street: It means the clear average width of the existing carriage way and footpaths only on which the building or plot line abuts. The average width shall be computed by taking length of street between two extreme points on building unit abutting the street at right angles to the direction of such streets excluding the steps, projections, forecourts, open areas of other spaces in front of the building erected or intended to be erected. However in case where a regular line of street is prescribed by the Competent Authority, such width shall be considered for the purpose of computing building height.

10-37. BUILDING BYE-LAWS FOR THE BUILDINGS IN GAMTAL AREA

(1) Minimum area: Minimum area of a building unit when subdivided shall be 18 m^2 with no side less than 3 m in width.

(2) Access to buildings: A clear pathway to the building shall not less than 3 m in width from street to the door of such building. In case of existing pathway, the above provision shall not apply.

Such pathway shall be paved and shall always be kept open to sky and no projection or overhang shall be permitted over such pathways.

(3) Set back: The set back of 3 m from central line of existing street shall be provided where regular line of street is not prescribed.

Following points shall be kept in mind for setback:

(i) The land left open as set back shall be deemed to be part of the street.

(ii) No set back shall be required for the building unit of area upto 100 m^2.

(iii) The competent authority shall permit the F.S.I. of any plot or a building unit on the basis of its original area, if the owner of such a land is prepared to release the effected land by road widening or for construction of new road without claiming any compensation thereof.

(4) Margins: The margins shall be provided towards road sides as given in table 10-9:

TABLE 10-9

Width of street	Margins on street
(a) Upto 12 m	1.5 m
(b) More than 12 m	2 m

(5) Open spaces:

(i) ***Chowk:*** No person shall erect, construct or reconstruct from foundation or plinth a building more than 9 m in depth from its front without providing an open space or chowk open to sky from plinth level for every 9 m depth of the building, of at least 5.6 m^2, which may be reduced to a minimum of 3 m^2 with no side less than 1.5 m, if the width of the property to be developed is 4.5 m or less.

This shall not be applicable to a building having doors and windows opening at least on two sides over streets or open compound not less than 2.4 m wide provided the depth does not exceed 18 m.

(ii) ***Open air space:*** Every open air space whether interior or exterior open air space shall not be less than the width prescribed in the scale given in table 10-10 and may be provided at the plinth level or at the floor level of every such room. Linear interpretation from a height not specified herein will be permitted.

TABLE 10-10

Minimum width of open air space throughout (m)	Where height of building (above plinth adjoining the open air space) does not exceed (m)
3	7
4	10
5	13
6	16
7	20
8	24

Every such interior or exterior open air space, unless a street, shall be maintained for the benefit of such building exclusively and shall be entirely within the owner's own premises.

(iii) ***Depth and width of the room:*** For the purpose of the above regulations the depth of the room shall not be more than three times the width of the room which abuts on the air space.

If open air space is provided with more than required open chawk, the additional area shall be counted towards the consumption of F.S.I.

(6) Height of buildings: The height of building shall not exceed twice the width of the abutting road plus the setback provided at ground level.

In case of building unit abutting on more than one road with different widths, the maximum height shall be twice the width of wider road from the regular level of street.

The portion of setback on which the projection is made shall not be computed towards the width of the street.

In case of building situated in Chowk, Falia, Khadki, the height of building shall not exceed twice the width of the road leading to such Chowk, Falia, Khadki whichever is less.

The height of staircase cabin, water storage tank, parapet, lift well and lift cabin with machine room shall not be taken into consideration in determining the total height of the building , provided the height of each does not exceed 2.4 m. The parapet height shall not exceed 1.5 m.

(7) Projections on set backs:

(i) ***Weather shed:*** In any marginal open space, weather sheds projections shall be permitted upto 60 cm at the height of 2 m from the floor level.

(ii) ***Door, window shutters and steps:***

(a) No shutters of any doors or windows of any building shall be allowed to open on the street.

(b) Projections of steps shall not be permitted on set-backs, streets or roads.

(iii) ***Cellar:*** No cellar shall be permitted within required set back area. All-round margin of 1.5 m shall have to be kept from adjoining property for construction of cellar.

(iv) ***Plinth:*** Minimum plinth height of 45 cm from ground level shall be provided.

(v) ***Floor space index and maximum permissible built-up area:*** The maximum permissible built-up area and F.S.I. of a building unit shall be subject to the limitations prescribed in the following table 10-11:

TABLE 10-11

No.	Area of building unit	Maximum permissible built up area on ground floor	Maximum permissible F.S.I.
1.	Upto 90 m^2	75%	2
2.	91 m^2 to 150 m^2	65% or 67.5 m^2, whichever is more	2
3.	151 m^2 to 1500 m^2	50% or 90 m^2, whichever is more	2
4.	1501 m^2 and above	45%	2

(vi) ***Addition to existing structures:*** An addition to existing structures that is not structurally independent from an existing structure shall be designed and constructed such that the entire structure confirms to the seismic force resistance requirements for new structures unless the following three conditions are complied with:

(a) The addition shall comply with the requirements for new structures.

(b) The addition shall not increase the seismic forces in any structural element of the existing structure by more than 5% unless the capacity of the element subject to the increase force is still in compliance with IS : 1893.

(c) The addition shall not decrease the seismic resistance of any structural element of the existing structure unless reduced resistance is equal to or greater than that required for new structures.

10-38. BYE-LAWS FOR CINEMAS, THEATRES, MULTIPLEX, MEETING HALLS, LECTURE HALLS, TOWN HALLS, AUDITORIUM, ETC.

The bye-laws for above structures are very exhaustive and the architect has to study them in detail before preparing his design for the cinema. Some of the specific requirements to be kept in mind with respect to the bye-laws for above structures are as follows:

(1) Air-condition: The auditorium or the cinema should be air-conditioned as per the following general specifications:

(i)	Temperature range	:	22°C to 26°C
(ii)	Change of air per hour	:	approximate 10 minutes
(iii)	Relative humidity	:	50 p.c. to 60 p.c.
(iv)	Fresh air requirements	:	approximately 7.5 C.F.M. per person.

(2) Aisles (passages): A clear passage or aisle not less than 1.2 m in width shall be formed at right angles to the line of seating in such number and manner that no seat shall be 3.8 m away from any aisles measured in the line of seating. Where all these aisles do not directly meet the exit doors, cross aisles shall be provided in such number and manner that no row of seats shall be more than 7 m away from cross aisles. The width of cross aisles shall be 1.2 m.

(3) Balcony: The height of bottom balcony of the gallery shall not be less than 3 m from the floor of auditorium. The minimum width of balcony steps shall be 80 cm provided that for the front and rear steps this distance shall be 90 cm. The minimum height of the roof or ceiling at the highest steps of the balcony shall be 3 m.

(4) Booking office and manager's room: The booking office with minimum area of 4.60 m^2 shall always be located in the foyer so that the intending purchasers of tickets have not to queue up in the open space. A manager's room of minimum area 12 m^2 shall be provided at suitable place in the plan.

(5) Doors: The auditorium doors shall be provided at the rate of not less than one door of dimensions of 1.50 m width and 2.10 m clear height for every 150 seats or part thereof. All outside doors for the use of public shall be made to open outwards and in such a manner that when opened, they shall not obstruct any gangway, passage, stairway or landing.

(6) Front open space: A minimum 12 m width in the form of front open space shall be provided from the side of the building abutting on the road.

(7) Foyer and auditorium: The minimum aggregate area of foyer exclusive of all passages shall be provided at every sitting level at the rate of 0.05 m^2 per seat in the auditorium. The minimum area and volume of the auditorium shall be 0.80 m^2 and 3.50 m^3 per chair.

(8) Location: The building shall be located with frontage directly on a road of 18 m or more in width either existing or proposed.

(9) Parking: The parking facilities for vehicles shall be provided as per details given in table 10-2.

(10) Projection room: The minimum area of projection room shall be 18.50 m^2 and it shall be placed at such a height that the line of projection makes an angle of 70° to 80° with the screen.

(11) Rewinding room: A separate room of fire-proof construction shall be provided for film rewinding and the room shall not be used for any other purpose except for storing the films not in use.

(12) Sanitary accommodations: The sanitary facilities shall be worked out and provided as follows:

(i) The water-closets at the rate of one for 100 seats or part thereof and urinals at the rate of two for 75 seats or part thereof at each seating level shall be provided.

(ii) One wash-basin for every 200 seats or part thereof shall be provided.

(iii) The above conveniences shall be suitably apportioned between the two sexes.

(iv) Such water-closets and urinals shall be in accessible location and shall be provided with signs plainly indicating their purpose and the sex for which they are meant.

(13) Screen: The minimum width of the cinema screen shall be 3 m. The position and height of the screen shall be regulated in such a way that the maximum angle of the line of vision from the front seat to the top of the screen shall not exceed 50°. The farthest seat shall not be more than 45 m away from the screen.

(14) Seats: The minimum width of seat shall be 500 mm provided that 25% of the total seats may be permitted upto the width of 450 mm to adjust the staggering of the seats. The width of the seats shall be measured from centre to centre of the hand rails or arm rests. All seats in the auditorium shall be firmly secured to the floor. There shall be an interval of at least 300 mm between the back of one seat and the front of the seat immediately behind measured between perpendiculars. The clear distance between the backs of two successive rows shall not be less than 1 m but for seats with rocking backs it may 900 mm. The distance between the screen and the front row of seats shall not be less than the width of the screen itself.

(15) Size of plot: The minimum size of plot shall be 2000 m^2.

(16) Stairs: The minimum clear width of all the stairs shall be 1.50 m. The tread of the step shall not be less than 300 mm and riser not more than 100 mm. No staircase shall have more than two flights of 15 steps or less than 3 steps without a turn and the width of landing between such flights shall be at least the same as the width of the staircase.

All enclosed staircases shall have on both sides strong handrails firmly secured to the wall. No space less than 2.4 m in height shall be allowed under the floor of auditorium. Except for a double-decker cinema or theatre, the access to the auditorium from the ground floor, if it is on upper floor or on stilts or balcony shall be provided by not less than three stairs, two of which shall be exit stairs.

The clear width of these next stairs shall not be less than 2 m. In case of double-decker theatre or cinema, the access of upper class auditorium from ground floor shall be provided by at least three stairs out of which two shall be exit stairs with minimum clear width 2 m. The access to lower class auditorium from ground floor shall be provided by at least two stairs, one of which shall be exit stair.

(17) Ventilation: Every auditorium or cinema hall shall be lighted and ventilated by doors, ventilators and windows abutting on an interior open air space shall not be less than 1/5th of the total floor area provided that if exhaust

fans are installed or if the auditorium is air-conditioned, the requirements of this clause may be suitably relaxed by competent authority.

(18) Water-room and snack bars: The facilities of water-room and snack bars or restaurant, each of size not less than 9 m^2, shall be provided at suitable place in the plan.

10-39. BYE-LAWS FOR DRIVE-IN CINEMAS

The term *drive-in cinema* is used to mean a cinema with open air theatre premises into which admission may be given normally to persons desiring to view the film while sitting in the motor cars. However, where an auditorium is also provided in a drive-in cinema premises, the persons other than those desiring to view the film while sitting in the motor cars, can also be admitted. Such auditoriums shall be constructed in such a way that they comply the bye-laws for cinemas. The drive-in cinemas may have a capacity to accommodate not more than 1000 cars.

Following are the requirements of the drive-in cinemas with respect to the bye-laws:

(1) Boundaries: On the boundaries of the drive-in cinema either a compound wall of fire-resting material with a height of not less than 2 m above the level of the ground shall be constructed or the whole compound shall be surrounded by a barbed wire-fence and a hedge of bushes.

(2) Entrance and exit: At the entrance, sufficient space shall be provided for the motor cars waiting to enter the premises. The space shall be sufficient to hold at least one-fifth of the total capacity of the motor cars in the drive-in cinema and at least, two separate entry bays with ticket booths shall be provided for the entry of such cars. For exit of motor cars, two minimum gates shall be provided where the cinema is constructed to accommodate more than 600 cars. The width of each of the entrance and exit gates shall not be less than 4 m. The entrance and exist areas shall be adequately lighted by flood lights.

(3) Frontage: A drive-in cinema shall have a road frontage on a public thoroughfare upon which the site of such cinema abuts and in such frontage, there shall be a suitable provision for entrance and exit for the motor cars.

(4) Loud speaker poles: For serving one motor car, the loud speaker poles shall be provided on either side. The distance between the two poles in a row shall not be less than 6 m. The poles for the loud speakers shall be embedded in a concrete base with speaker fixed on a movable rope and shall have a light over them so as to indicate their position. The light shall be at the side of the poles turned away from the screen.

(5) Passage: A clear passage of not less than 12 m in width shall be provided on either side of the spectator area.

(6) Projection room: The projection room shall be located in a closed building in the centre of the premises. Such projection room may be part of the structure accommodating public toilet, canteen, kitchen, shops and such amenities. It shall be seen that the light from these structures does not fall on or obstruct the proper viewing of the projection. Where the car bays are provided at the back of the projection room also, the area shall be so elevated that proper view is obtained of the screen.

(7) Rows of motor cars: The distance between the screen and the front row of vehicles shall not be less than 1.50 times the width of the picture on the screen. The rows of motor cars facing the screen shall be provided in the form of an arc of a circle, with its centre at a distance of 0.60 times the breadth of the screen, at the back of the screen on the centre-line. The lateral limitation of the spectator area shall be confined to an angle of 50° with respect to the centre-line of the screen.

(8) Screen: The screen or a part thereof shall not be visible from the road side. The screen shall be so constructed as to withstand the wind velocity of 160 km per hour or a pressure of 1.20 kN/m^2. The screen shall be inclined slightly forward. The maximum inclination shall be 8° with the vertical axis. The red warning limits shall be mounted at the highest points of the screen and the flood lights to light the spectator area shall be mounted over it.

(9) Size of picture: Depending upon the number of motor cars, the size of picture projected on the screen shall be as follows:

For 200 to 400 motor cars ... Height 11 m; width 25 m; bottom 6 m above ground.

For 401 to 600 motor cars ... Height 13 m; width 30 m; bottom 7 m above ground.

For 601 to 1000 motor cars ... Height 19 m; width 43 m; bottom 8 m above ground.

(10) Width of bay: The motor car bays shall be uniform by 12 m in width or widths of 12 m and 8 m alternatively provided that the first four rows shall have 12 m wide bays.

10-40. BYE-LAWS FOR GASOLINE FILLING STATIONS AND GASOLINE FILLING CUM SERVICE STATION

The term *filling cum service station* is a place of retail business engaged in supplying goods or services essential for the normal operation of automobiles. These include dispensing gasoline and motor-oil, the sales and services of tyres, batteries and other automobile accessories and replacement item, washing and lubrication. They do not include the body of tender work, painting or other major motors repairs and over hauling. Some of the specific requirements to be kept in mind with respect to the bye-laws for gasoline filling station and filling cum service station are as follows:

(1) Entrance and exit consideration: For easy flow of traffic, a minimum frontage of 30 m shall be provided with wide and easy entrance and exit kerbs at the station. So that entering and leaving vehicles should be fully visible to the traffic on the main road and there should not be any obstruction to view between the station and the road.

Maximum width of the drive ways at the side walk shall be 9 m and minimum angle of intersection of drive ways with street pavement shall be 60°.

(2) Location: Except in hilly terrain, the plot for filling cum service station shall be located on level ground. It shall not be located adjacent to residential houses.

(3) Parking: Every filling station shall be provided for one parking space for each four employees with a minimum of two car parking space. In case of filling cum service station in addition to parking space requirements given above provision shall also be made for one car parking space for each service station.

(4) Size: The minimum size for the location of filling station and filling cum service station shall be as follows:

(i) filling station shall be 30 m × 36.5 m

(ii) filling cum service station shall be 2000 m^2 having frontage not less than 30 m.

(5) Traffic requirements: A filling station or filling cum service station shall be located opposite to a break or opening in the central verge on a dual carriage as it will encourage the traffic to cross the road while entering a filling station or filling cum service station. The minimum desirable distance between an access to a station and the tangent point of the traffic island or intersection shall be 80 m.

A filling station or filling cum service station shall not be sited to closed to an intersection to a traffic island on the main road. The minimum desirable distance between access to a station and the tangent point of the traffic island or intersection shall be 80 m. On the road having heavy traffic, it is desirable to provide one station on either side of the road so that vehicles are not required to cross the road.

The minimum distance between the property line of station and central line of the road must not be less than 15 m or half the proposed right of way of the road, whichever is more. In case of the National Highways and major road in the urban areas they should be set back so as to be outside the ultimate right of way of the highway along which it is to be located. Also, the heaping up of the oil cans and other goods within the premises which tend to create a sort of ugly character of the area should be discouraged.

QUESTIONS 10

1. Explain what is meant by a bye-law.
2. Why are bye-laws necessary?
3. What is the importance of bye-laws? Mention the grounds on which the consultation by local authority is desired.
4. Discuss the function of a local authority with respect to the building bye-laws.
5. Enumerate the undesirable consequences of the unnecessary delay caused in sanctioning of the plans by the local authority.
6. What are the important points to be remembered in connection with the building bye-laws?
7. Define a set-back and mention its advantages.
8. Write short notes on:
   (1) Building bye-laws
   (2) Set-back
   (3) Light plane
   (4) Floor space index
   (5) Projections in margins
   (6) National building code
   (7) Sanitary accommodation for industrial buildings and warehouses
   (8) Minimum plot sizes.

9. What is a light plane? Explain it with the help of a neat sketch.
10. What is meant by the term floor space index? Suggest some of the tentative figures of F.S.I. for a typical town.
11. Mention the items which are not considered while computing the F.S.I.
12. Explain the concept of the floating F.S.I. or transferable development rights (TDR).
13. Enumerate the supervising agencies appointed by the owner.
14. When are the building bye-laws applicable?
15. Suggest the provisions to be accommodated in building bye-laws with respect to the fire protection.
16. Give a typical chart showing minimum sizes of plots for different developments.
17. What is a skip floor? What are the usual conditions it has to satisfy?
18. What are the usual provisions made for off-street parking in bye-laws?
19. Enumerate the broad principles of the building bye-laws.
20. Briefly mention the building bye-laws for residential area of a typical town planning scheme.
21. Discuss the provisions in building bye-laws with respect to the following:
    (1) Permissible size of plots
    (2) Cellar
    (3) Height of floors
    (4) Loft
    (5) Lift
    (6) Lobbies or corridors
    (7) Staircase
    (8) Permissible built-up area in margin
    (9) Ramps
    (10) Parapets and terraces.
22. Differentiate between the following:
    (1) Building bye-laws and zoning regulations
    (2) Set-back and light plane
    (3) Structural aspects and specifications of work
    (4) Plinth height and floor height
    (5) Dwelling house and dwelling unit
    (6) Low-rise and high-rise buildings
    (7) Building unit and tenement building
    (8) Theatre and cinema
    (9) Surveyor and clerk of works
    (10) Domestic building and office building.
23. List out the building bye-laws for gamtal area.
24. Mention the required margin for residential buildings.

25. Mention the specific requirements to be kept in mind with respect to the bye-laws for cinemas and gasoline filling station.

26. What is a drive-in cinema? What are its requirements with respect to the bye-laws?

27. Suggest the minimum areas for rooms of a residential unit.

28. Give the meanings of the following terms:

Auditorium; Cellar; C.O.P.; Loft; Mezzanine floor; Shopping centre.

29. Give reasons for the following:

(1) It is necessary to enforce building bye-laws by law.

(2) The building bye-laws should be periodically modified.

(3) It is necessary to adjust in some cases the floor heights of a building as per light plane.

(4) The F.S.I. can be used as a measure to check the density of population.

(5) The owner of a property is prohibited from putting any structure in the set-back portion.

(6) Every locality frames certain rules and regulations controlling the development of area under its command.

(7) There should not be undue delay in sanctioning of plans by the local authority.

(8) The clerk of works cannot take employment or appointment on any other site.

(9) The problem of fire protection should be properly accommodated in the building bye-laws.

(10) A skip floor is usually provided in a high-rise building.

(11) The Delhi administration has gone a step further in the implementation of the building bye-laws.

(12) The concept of floating F.S.I. has yet to become popular.

Chapter 11

DEVELOPMENT PLAN OR MASTER PLAN

11-1. GENERAL

A *development plan* or a *master plan* or a *town plan* may be defined as a general plan for the future layout of a city showing both the existing and proposed streets or roads, open spaces, public buildings, etc.

A development plan is prepared either for improvement of an old city or for a new town to be developed on virgin soil. Thus, a development plan aims at controlling the future growth of a town along preconceived and predetermined paths.

The concept of development plan was taken up to provide an instrument for preparing a framework incorporating various town improvement schemes and programmes. The classical development plan aims at comprehensive development. It is rightly said that the effective functional jurisdiction of the city or town extends far beyond its physical boundary.

Thus, a well conceived development plan also takes care of the meaningful planning and development of the surrounding area.

A development plan is an ideal plan showing the full development of the town at some future date. At the same time, it should be sufficiently elastic. It is, therefore, not a fixed plan. But it is possible to amend it from time to time to keep it in pace with and to accommodate the new developments of any revised estimate of the future growth and requirements of the city.

In India, the idea of preparation of development plan is understood to have been flourished after 1915 when the Bombay Town Planning Act was passed and was soon followed by the Madras Town Planning Act in 1920.

The first comprehensive Act requiring the preparation of development plans and authorizing its enforcement is the Bombay Town and Country Planning Act, 1954 which actually came into force in 1957. This Act required the preparation of development plans by the concerned local bodies within a specific period.

It thus started a new way of thinking for systematic planning. It is understood that about 200 development plans have been either prepared and they are under the process of preparation in India and though many of them may not have legal status as they ought to have, they have guided the local authorities in some way or other in regard to desirable directions of development.

In this chapter, the concept of development plan as related to the development of a town will be discussed.

11-2. OBJECTS OF DEVELOPMENT PLAN

Following are the main objects of preparing a development plan for the town:

(1) It aims at intelligent and economic spending of the public funds for achieving welfare of the inhabitants in respect of amenity, convenience and health.

(2) It arranges the pattern of a town in such a way so as to satisfy the present requirements without introduction of future improvements by the coming generations.

(3) It helps in restricting the haphazard and unplanned growth.

(4) It places various functions which a town has to perform in physical relationship of each other so as to avoid the chances of mutual conflict.

(5) It removes the defects of unco-ordinated physical growth of the various components of town due to the fact that it considers the entire city area or town as planning and development entity.

(6) It serves as a guide to the planning body for making any recommendations for public improvement.

11-3. NECESSITY OF DEVELOPMENT PLAN

Following are the reasons which have lead to the thinking of having a development plan for the town:

(1) to control the development of various industries in a systematic way;

(2) to discourage the growth of town in an unplanned and unscientific way;

(3) to give a perspective picture of a fully developed town;

(4) to limit to a certain extent the unprecedented flow of rural population to the urban area;

(5) to offset the evils which have come up due to over- crowding of population such as acute shortage of houses, traffic congestion, inadequate open spaces and insufficiency in public amenities; etc.

11-4. DATA TO BE COLLECTED

The information and data obtained from various surveys would be exploited to the maximum possible advantage in the preparation of an effective development plan of the town.

In general, the data required for the preparation of a development plan of a town can be listed as follows:

(1) details of trades and industries;

(2) development of the airports;

(3) economic conditions of the authority;

(4) environments of the site;

(5) facilities of the transport;

(6) geological conditions of the site;

(7) land values and land use pattern;

(8) locations of spots of the natural beauty;
(9) locations of the water supply units;
(10) meteorological details such as intensity and direction of wind, temperature, rainfall, etc.;
(11) mineral resources;
(12) places of the historic origin;
(13) political position of the surrounding area;
(14) population;
(15) requirements for railway stations, goods yards and shipping facilities;
(16) special requirements for power houses, gas works, sewage disposal plant and storm water drainage; etc.

The town planner is expected to make the best use of available statistics on various aspect of urban area which he is developing. The town planning cannot be adequate without statistical information because much of the statistical information is based on factors which have economic significance. With the aid of statistics, the town planner can use the economic forces to increase the usefulness of his plans.

11-5. DRAWINGS TO BE PREPARED

To give graphical representation to various ideas and proposals contained in the development plan of a town, various maps and drawings are to be prepared. Following are the details contained in the usual drawings prepared for the development plan:

(1) boundaries of land of different types such as residential, agricultural, industrial, etc.;
(2) boundary of green belt surrounding the town;
(3) contours of the whole city;
(4) different zones;
(5) landscape features;
(6) locations of the public buildings and town centres;
(7) open spaces including parks and playgrounds;
(8) positions of the natural springs, rivers and streams;
(9) positions of the public utility services such as water supply station, sewage disposal plant, power plant, etc.;
(10) road systems; etc.

In addition to the drawings, perspective views, panoramas, models, etc. should also accompany the project drawings, when found necessary. Also, if required, the micro-seismic zoning map, location plan of architectural and cultural monuments, designs of town centres, etc. may also be prepared as additional documents of the usual drawings of the development plan.

11-6. FEATURES OF DEVELOPMENT PLAN

The development plan serves as an outline for the future growth of town and as such, its preparation demands high skill, training, imagination and experience on the part of person who frames it. He has always to keep before his mind the three

fundamental requirements, namely amenity, convenience and health. He has to so arrange his plan that these needs are satisfied in the fullest possible measure. It is a very difficult task to achieve all the three requirements simultaneously.

At times, it may happen that the proposals for satisfying one of the requirements may come into conflict with those of other requirements. It then becomes for the town planner to proceed further on trial and error basis and ultimately to arrive at a reasonable solution by making adjustments and compromises between the conflicting situations.

The features to be included in a development plan of a town can be listed as follows:

(1) convenience and cheap means of transport;
(2) good sanitation and water supply;
(3) open air spaces;
(4) population density control;
(5) proper situations for places of worship, education and recreation;
(6) rational layout;
(7) width of roads; etc.

11-7. PLANNING STANDARDS

The land is a gift of nature and it cannot be manufactured as its demand increases. Hence, the land-use pattern should be carefully laid out by the town planner by keeping in mind various features of the area to be developed such as soil conditions, topography, vegetation, habits of people, industrial and commercial activities, etc.

The term *planning standard* is used to fix the minimum area for each use for a certain population or for a certain land area. These minimum standards are fixed for a particular locality by studying the functional requirements, number of users, open spaces required around the buildings, social and climatic conditions, economic activities of the locality, etc.

The planning standards are fixed for various types of uses such as:

(1) educational facilities such as primary school, high school and college;
(2) medical facilities such as a dispensary, health centre and hospital;
(3) shopping facilities such as departmental stores, shops, etc.;
(4) miscellaneous amenities such as burial ground, crematorium, cinema, auditorium, stadium, petrol filling cum service station, police station, post office, fire station, library, community hall, telephone exchange, etc.;
(5) width of roads such as village roads, state roads, national highways, etc.;
(6) development of land for the construction of buildings in the form of various building bye-laws; etc.

The planning standards should be carefully watched by the planning or enforcing authority and they may be reviewed and revised to meet with the changing conditions. Thus, the enforcing authorities of the planning standards and regulations play a significant role in achieving the desired goal of town planning.

11-8. DEVELOPMENT PLAN FOR MILITARY TOWN

A comprehensive urban development plan of units, residential sectors, town centres, amenities and training facilities is prepared and it forms the basis for a phased development of the military town. The functional roles, holding of stores, etc. may be suitably modified later on. But the overall planning concept is maintained. All other facilities like playfields, parade grounds, messes, garages, etc. are planned and provided within the same complex.

The requirements of water supply, sewage system and electricity are met through well-planned schemes which are executed in stages to match with the growth of town. The environment aspect is also given due importance while preparing development plan of a new military town.

The development plan of new military towns takes into consideration the changed social environment, new equipment, technological advancements and the training requirements of the armed forces. It aims to evolve self-contained military towns to satisfy the aspirations of troops and their families so that they can live in perfect harmony and remain fit to face any enemy challenge.

11-9. DEVELOPMENT PLAN FOR HILL STATION

The tourists visit the hill stations in their leisure time to enjoy the vacation or holidays. The development of a particular place as a holiday hill resort requires careful planning and the entire layout of development plan should be such that the tourists, while leaving the place, get satisfaction of being refreshed and full of happy memories.

India is a vast country and every State has been bestowed by mother Nature certain locations which are developed as the hill stations. But the distinction of becoming the first full-fledged planned hill station after independence of the country goes to the sole hill station of the Gujarat State, namely, *Saputara* which is situated on the second highest plateau of the Sahyadari range running through the State.

Saputara is located at a distance of about 42 km from Ahwa, the district headquarter. It is linked up from Billimora on the Western Railway (about 112 km) and from Nasik on the Central Railway (about 80 km) in Maharashtra State. It is also easily accessible throughout the year round by all weather roads and regular transport facilities are available to reach the hill station. It is located at a height of about 873 m above sea level with temperature variation of 7°C to 28°C. The average annual rainfall is about 250 cm. The green valley is stretched over a length of about 25 km and is surrounded by several hills which make fine observation points.

Following are some of the salient features of the development plan of *Saputara*:

(1) The development plan accommodates the sites for public buildings like museum, children's park, open air theatre, boating club, stadium, public hall, auditorium, etc. The museum will exhibit pieces of local culture and civilization.

(2) The township is also to be provided with up-to-date hotels, camping grounds for scouting, market place, holiday homes, dormitories, canteens, etc.

(3) The township will also have important Government buildings like circuit house, vishram graha, State Governor's bungalow, etc.

(4) The development plan has an adequate provision for private persons to construct their houses at attractive locations.

(5) A technical feature in the form of a ropeway of about 1 km length and stretching across the valley has been installed to get the pleasant view of the green dense forests. The tourists enjoy the ride in the trolleys of the ropeway.

(6) The lake having an average depth of about 24 m assures permanent water supply besides providing the boating facilities and keeping the temperature at a still lower level.

(7) The sites are reserved for public utility services such as filtered water supply, drainage, electricity, etc.

(8) It is arranged to plant systematically the trees which would enhance the beauty of the township and convert it into a charming place.

(9) The development is so planned in the development plan as to allow even growth of the township in keeping with overall requirements of a modern hill station.

With the above utilities and amenities provided in the development plan of this hill station, it is expected to create minimum permanent population for the township apart from providing much needed normal services to the floating population visiting the hill station during the season.

11-10. REPORT

The written report accompanying the development plan should analyse the existing state of the town and it should include the following topics to suggest the improvement of town in general:

(1) cost estimates for immediate measures;

(2) development of basic industries in urban and suburban zones;

(3) engineering infrastructure, site development, sanitation and hygienic measures;

(4) functional zoning and architectural principles involved in the town plan;

(5) pattern of highways and urban transportation;

(6) population growth for a design period and the first stage of construction;

(7) principles underlying organization of culture-service systems and other types of services accommodated in the development plan;

(8) technical and economic factors of the project; etc.

11-11. STAGES OF PREPARATION OF DEVELOPMENT PLAN

The procedure to be followed in the preparation of a development plan for a town is quite lengthy and takes considerable time as many factors and legal formalities are to be observed. However, for convenience, the various stages of preparation of a development plan can be summarized as follows:

(1) Collection of data and relevant information from civic survey and other sources.

(2) Preparation of a tentative draft of the development plan and notifying the same for comments, suggestions and discussions from experts and the public.

(3) Considerations of views received from experts and the public with sympathy and without any prejudice.

(4) Preparation of the revised development plan accommodating the good aspects of comments received from experts and the public also.

(5) Determination of the sequence in which the development plan will be implemented.

11-12. METHOD OF EXECUTION OF DEVELOPMENT PLAN

The execution of the development plan is carried out by the municipal or corporation authorities. Every new public improvement proposed should fit in the development plan. The first thing to be determined is the layout of the road system. Once that is finalized, the regulation may be made for preventing any building to be built which will upset the street pattern. The improvement work in a development plan can be carried out without affecting the continuity of the project and the progress from part to the whole becomes natural and satisfactory.

It thus becomes easy to divide the proposals of development plan in various stages and the stages thus prepared can be arranged in order of preference for execution of the development plan.

11-13. CONCLUSION

The development plan is nothing more than a skeleton prepared on various assumptions and approximations. If properly prepared, it ensures that the development and growth of various parts of the town will be in harmony and proper proportion. Once the details of the development plan are finalized, the detailed planning of various sections is taken in hand and if found necessary, the proposals of the development plan are reviewed periodically, usually at every five years.

The task of preparing a development plan of any city or town is very complex and demands a high degree of skill from the person in charge of preparing the same. The proposals and ideas advocated in the development plan should be practical and least affecting to the common mass. The development plan takes into dreamland and dreams are translated into realities only by whole-hearted and active co-operation between the public and the planning authorities.

QUESTIONS 11

1. Define a development plan or master plan and mention its objects.
2. What are the reasons for preparing a development plan for the town?
3. Enumerate the data required for the preparation of a development plan of a town.
4. What are the features of development plan for a town?
5. What are the details contained in the usual drawings prepared for the development plan?
6. What is meant by the term planning standards?

7. Write short notes on:
   (1) Features of development plan
   (2) Necessity of development plan
   (3) Method of execution of development plan.
8. Mention the various types of uses for which the planning standards are fixed.
9. Explain the features of the development plan for a military town.
10. Discuss the features of the development plan for a hill station with special reference to the hill station of Saputara in the Gujarat State.
11. What are the topics to be included in the written report accompanying the development plan?
12. Mention various stages of preparation of a development plan for a town.
13. How is development plan executed?
14. Give reasons for the following:
   (1) A development plan is not a fixed plan.
   (2) The various maps and drawings are prepared while framing the development plan of a town.
   (3) The preparation of development plan demands high skill, training, integration and experience on the part of the person who frames it.
   (4) The procedure to be followed in the preparation of a development plan for a town is quite lengthy and takes considerable time.
   (5) The development plan is nothing more than a skeleton prepared on various assumptions and approximations.
   (6) The town planner is expected to make the best use of available statistics on various aspects of urban area which he is developing.
   (7) It is desirable to prepare a development plan of the city.
   (8) The land-use pattern should be carefully laid out by the town planner.
   (9) The enforcing authorities of the planning standards and regulations play a significant role in achieving the desired goal of town planning.
   (10) A well conceived development plan takes care also of the meaningful planning and development of the surrounding area.
   (11) The development plan removes the defects of uncoordinated physical growth of the various components of town.

Chapter 12

URBAN ROADS

12-1. GENERAL

'*A man is known by the company he keeps*'. In a similar way, a city or a town is admired by its road system. A well-arranged layout of a town is spoiled, if it does not contain a well-designed road pattern connecting the various parts of town. The town planner should therefore give careful considerations to the design and provision of streets in the town. The urban road system should be such that it results into free flow of traffic with safety.

The urban roads play an important role in the development of town or city and as such, they attract many evils such as heavy traffic congestion, ribbon development, etc., if not properly attended to by the town planner. It is very difficult, if not impossible, to alter the existing road system at a later stage except at very high cost.

The parks, playgrounds, green open spaces and gardens are the lungs of the town and the roads play the function of the arteries of the town. As such, the road or street plan is considered as the foundation of the town plan.

The efficiency of an urban area is greatly influenced by the urban infrastructure of roads together with public services. It is usually found that in many urban areas, the supply of roads has not been increased in line with demand with the eventual result that as an urban area grows or develops, the roads become heavily congested and makes parking space more difficult to find.

The automobiles of various types have become more and more popular on account of their high speed and flexibility. The invasion of such automobiles has reached an alarming stage in most of the towns and cities of today. As a matter of fact, the development of road system has lagged behind the development of transport system and it has resulted into a number of traffic problems including the accommodation of the automobile population.

In this chapter, the salient features of urban roads will now be briefly described.

12-2. OBJECTS OF URBAN ROADS

The main three objects of urban roads are as shown below:

(1) to facilitate communication of men and materials between the various centres of the town;

(2) to provide air and light to the properties situated on their edges; and

(3) to provide space for laying the public utility services like water mains, drainage pipes, electric cables, telephone lines, etc.

12-3. REQUIREMENTS OF A GOOD CITY ROAD

Following are the ideals which are to be kept in view while designing a good city road:

(1) It should accommodate amenities such as shady avenues, parking places, enough lighting, etc.
(2) It should afford safety to the vehicles and pedestrians by provision of measures such as footpaths, traffic signs, etc.
(3) It should be cheap and durable.
(4) It should be resting on the unyielding soil.
(5) It should have good alignment and visibility.
(6) It should possess easy gradients and smooth curves.
(7) It should possess well-designed junctions.
(8) It should remain in dry condition.
(9) Its overall performance should be such that congestion of traffic is brought down to the minimum possible extent.
(10) Its wearing surface should be impervious and impermeable to the rain water.
(11) Its width and camber should be proper.

12-4. FACTORS TO BE CONSIDERED

Following are the factors which are to be considered by a town planner while designing a town road:

(1) Destination: The points or centres or areas which are being linked up by the road are to be studied with respect to their capacity of attracting the traffic.

(2) Importance of road: The overall importance of road with respect to the surrounding roads is to be ascertained and accordingly, the facilities and dimensions are to be determined.

(3) Nature of traffic: The probable traffic to be carried by the road is studied with respect to its intensity, peak periods, type of vehicles, parking facilities, etc.

(4) Use of road: The probable use to which the road is to be put up for maximum period during the day is to be properly estimated. For this purpose, it is desirable to take a future period of about two to three decades.

12-5. CLASSIFICATION OF URBAN ROADS

The urban roads are classified into the following five categories on the basis of their importance and use:

(1) Arterial roads
(2) Sub-arterial roads
(3) Local roads
(4) Streets
(5) Pathways.

Each of the above category of roads will now be briefly described as shown hereunder:

(1) Arterial roads: The road which connects the town to a state highway or a national highway is termed as an *arterial road*. It passes within the city limits and carries great masses of traffic between different parts of the town. The arterial roads include ring roads, by-pass roads, etc. and they allow free movement of fast traffic at high speeds. These roads are also kept clear of all obstructions such as frontages of buildings, parking places, loading and unloading areas, etc. The junctions on arterial roads should be properly designed and it is desirable to provide minimum number of junctions on the arterial roads. (Refer fig. 12-9.)

In many existing cities, the arterial roads are seen mixed up with the local roads. Such an arrangement results into high frequency of road accidents, devaluation of shopping area and reduction in speeds of vehicles.

The arterial roads serve the following three purposes:

(i) The movement and safety of through traffic, i.e., traffic moving beyond its point of origin, are facilitated.

(ii) There is some economy in construction in the sense that only arterial routes are designed to carry heavy traffic and the other types of roads are provided to carry light local traffic.

(iii) The through traffic is not allowed to pass through the residential areas. Hence, the discomfort and danger to the residents of such areas are minimized.

(2) Sub-arterial roads: These roads are also known as the *major roads* or *secondary roads*. They are contained within city limits and they connect important town centres. These roads serve slow moving traffic over short distances. The intersections on these roads are provided with suitable traffic signals.

(3) Local roads: These roads are also known as the *minor roads* as shown in fig. 12-9. They collect traffic from various parts of the town and lead it to another minor road or major road. These roads give access to abutting properties and importance is given to the non-vehicular traffic on these roads. The local roads are not allowed to touch or to come in contact with the arterial roads and the two are separated by a bridge and one goes over the other.

(4) Streets: A road which serves the needs of an internal portion of a local area is known as a *street*. The portion to be served may either by residential, commercial or industrial. The design of a street is made after considering the purpose and use of the portion to be served by the street and special attention is paid to the social, commercial and other requirements of the local community.

(5) Pathways: These are also known as the *pedestrian ways* and they are in the form of accesses leading to individual shops or premises. The vehicular traffic is not allowed to move on the pathways.

12-6. TYPES OF STREET SYSTEMS

On examination of street systems of existing old towns, it is possible to classify them into various categories or patterns as follows:

(1) Rectangular street system

(2) Rectangular with superimposed diagonals street system

(3) Concentric street system

(4) Radial street system

(5) Combination of radial and rectangular street systems

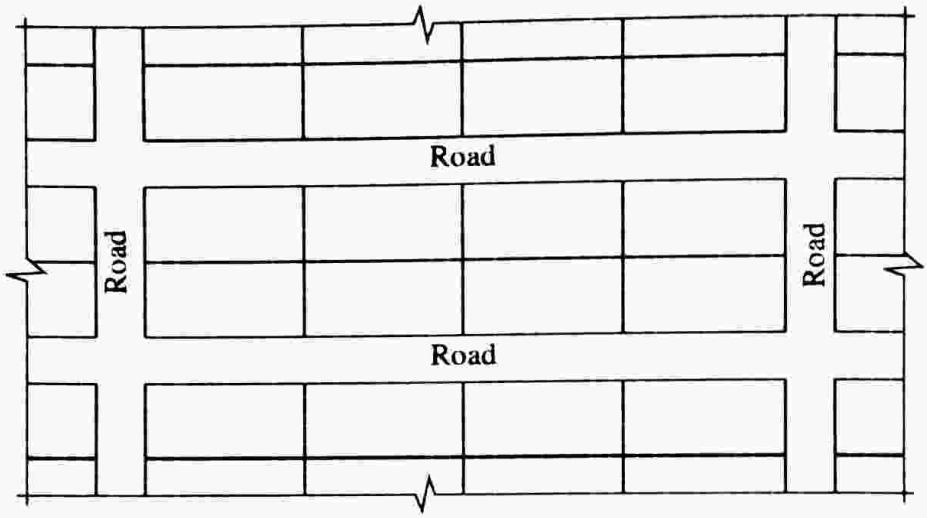
(6) Irregular mediaeval street system

(7) Topographical street system

(8) Combination of rectangular and irregular street systems.

Each category of the above street systems will now be briefly described as shown below:

(1) Rectangular street system: In this pattern, the streets are usually of equal width and they cross at right angles as shown in fig. 12-1. It is also known as *grid-iron* or *chequer-board pattern*. This pattern is suitable for flat or level country without any predominant natural features. The outstanding examples of this pattern are Philadelphia (U.S.A.) and Jaipur (India).



Rectangular street system
FIG. 12-1

Following are the advantages of this pattern:

(i) If a series of continuous parallel streets is provided, it results into considerable increase in the traffic capacity.

(ii) It grants comfort and convenience due to its regularity.

(iii) The intersections are simple in nature.

(iv) It results into economic construction as the area between the streets can be divided into suitable rectangular plots.

(v) The wastage of land is minimized as there are no irregular portions to be left out.

Following are the disadvantages of this pattern:

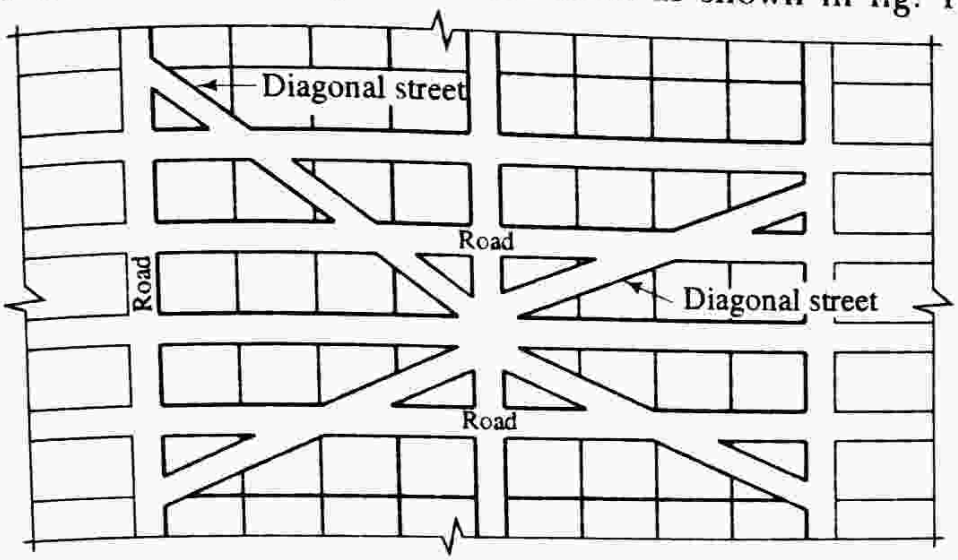
(i) As there are many intersections, there are more chances of road accidents.

(ii) If this pattern is applied on uneven topography, it leads to great inconvenience and discomfort.

(iii) It is too mathematical and monotonous in nature because the roads are straight and hence, the vistas are open and there is no variety.

(iv) There are no short-cuts to reach to the central shopping or other business centres.

(2) Rectangular with superimposed diagonals street system: This arrangement is an improvement on grid-iron pattern. The diagonal streets provide direct communication between distant parts of the town as shown in fig. 12-2.



Rectangular with superimposed diagonals street system
FIG. 12-2

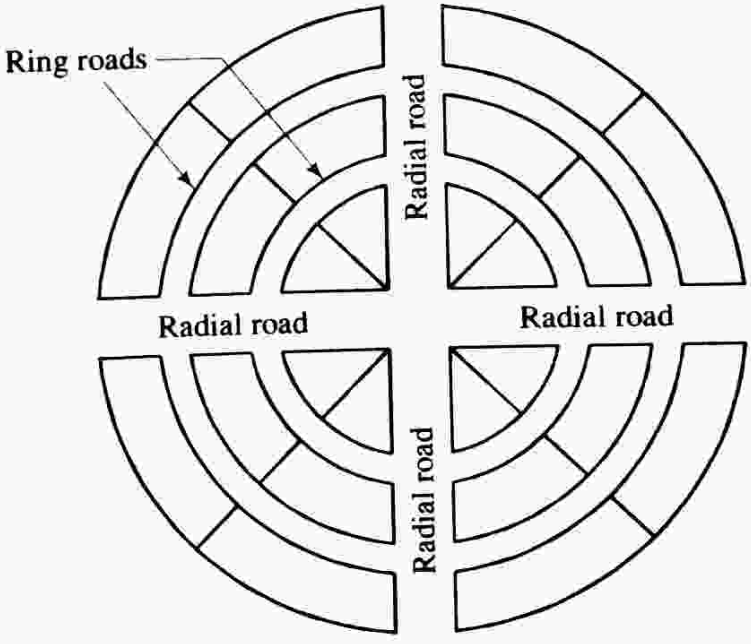
The points where diagonals meet are utilized for park, garden, memorial, etc. However, a dangerous intersection is formed at the crossing point of diagonal street and rectangular street. Washington, the capital of U.S.A., is the outstanding example of this road pattern. This city is considered to be one of the most beautiful cities of the world. It was designed by L. Enfant and was planned methodically in advance. Its natural surroundings are attractive and its salient features are as follows:

(i) The circles, squares and other open spaces at junctions of streets and avenues are profitably utilized as sites for gorgeous statutes, monuments and fountains.

(ii) The public buildings are provided with enough open spaces all around them.

(iii) The streets are very wide and are well planted with trees.

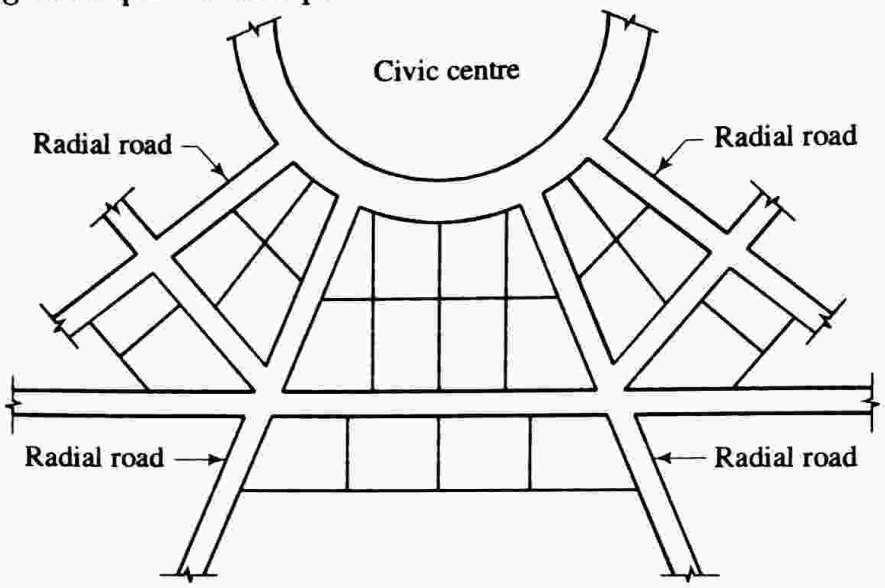
(3) Concentric street system: In this pattern, the ring roads or circumferential roads are connected by radial roads as shown in fig. 12-3 and it results into concentric development. This pattern is also known as the *Spider's Web system*. The concentric system is developed mainly due to the removal of encircling walls and fortifications. If, however, the radial roads are not fully developed, they will overload the central part of the town where they intersect. Moscow (U.S.S.R.), Vienna (Austria), Paris (France) and Frankfurt-Reiderwald (Germany) have adopted this street pattern to a certain extent.



Concentric street system
FIG. 12-3

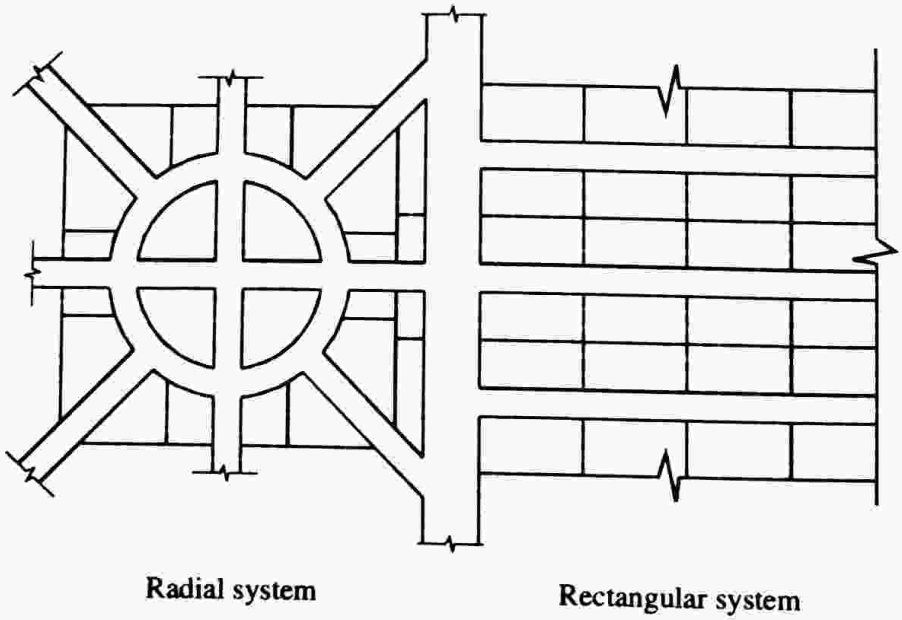
(4) Radial street system: In this pattern, the ring roads spring from a central civic centre like the spokes of a wheel as shown in fig. 12-4. Such an arrangement increases the significance and importance of civic centre which may be in the form of palace, market, public office building, historical monument, beauty spots, etc.

The radial pattern forms large blocks of trapezoidal shape and as there are chances of more wastage of land in the design of buildings, this pattern may prove to be uneconomical from the construction point of view. Karlsruhe (Germany) is an outstanding example of this pattern.



Radial street system
FIG. 12-4

(5) Combination of radial and rectangular street system: In this arrangement, the radial streets are blended or mixed with rectangular streets as shown in fig. 12-5. Such a combination can be used with great success especially where topographical features are favourable and it is possible to derive advantages of both the street systems. The outstanding examples of this pattern are London (U.K.), Canberra (Australia) and New Delhi (India).



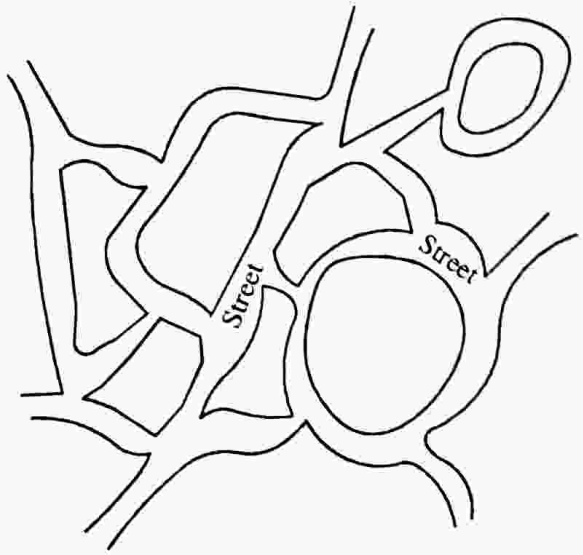
Combination of radial and rectangular street systems
FIG. 12-5

(6) Irregular mediaeval street system: Some of the old cities of middle ages, developed in an irregular way without any definite plan of the street system, possess this type of pattern. The growth of town or city is unmethodical and illogical. The mediaeval street pattern naturally does not efficiently serve the modern traffic and such towns are referred to as *irregular mediaeval towns*. The towns of this category are Nurenberg (Germany), Nasik and Varanasi (India).

(7) Topographical street system: In this arrangement, the advantage is taken of the natural topographical features of the town such as river, lake, sea view, hillock, etc. This system is also known as the *organic street pattern* as it resembles the plan of a microscope slide showing the cell structure of vegetable or animal tissues. It is also sometimes referred to as the *studied irregularities*.

The street system is absolutely unplanned as shown in fig. 12-6 and all sorts of irregularities are seen in this type of street pattern. The streets may not be continuous and they may be of variable widths. The size and shape of open spaces are irregular and there are number of curvatures.

The street pattern, however, becomes pleasing and attractive only if it is in confirmity with topography of the area and natural surroundings. As a rule, this system can only be applied in small towns, satellite towns and in some districts of large cities. The outstanding examples of this pattern are Letchworth and Bourne-mouth (U.K.), Montreal (Canada), Amber and Vijaynagar (India).



Topographical street system
FIG. 12-6

(8) Combination of rectangular and irregular street systems: In this arrangement, a combination of rectangular pattern and irregular streets is made. The rectangular layout indicates the recent development and the irregular pattern indicates earlier growth of town. When it is difficult or too costly to improve the existing irregular street system, a combination is formed. The outstanding example of this type of street system is Edinburgh (U.K.).

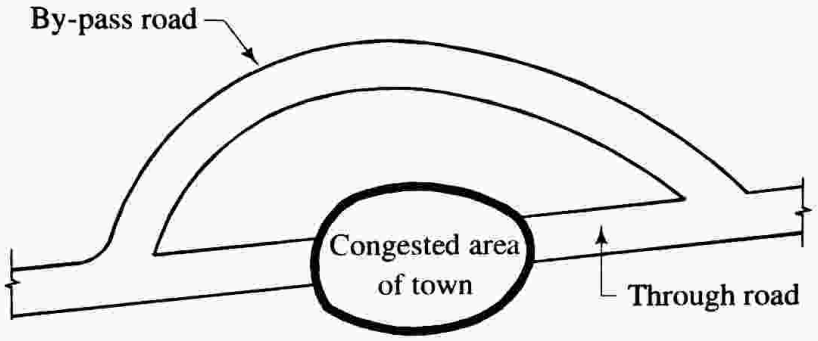
The above mentioned street systems of the existing towns and cities can suitably be applied and adjusted for the street pattern of a modern town. It will however be necessary to study and to analyse the present as well as the future traffic likely to use the streets of the modern town. The street pattern of the modern town should be designed in such a way that it effectively serves various parts of the town as desired and as conceived by the town planner.

12-7. THROUGH AND BY-PASS ROADS

When a through road or a main road passes through the congested portion of the town, there is sharp reduction in the speeds of vehicles and the smooth flow of traffic on through roads is seriously obstructed. To maintain easy flow of traffic on through roads and to give convenience and comfort to the users of such roads, the by-pass roads are constructed as shown in fig. 12-7.

These by-pass roads are also known as the *loop-roads* and they enable the traffic on through roads to avoid the congested area of the town. At suitable points along the main roads, the vehicles are diverted by the by-pass roads from one side and they once again come on the through roads on the other side after surpassing the congested or habitated area of the town.

The provision of a by-pass road results in the reduction in traffic through the congested area of town and thus the chances of accidents are minimized. The land along the by-pass route appreciates in value and unless proper precautionary measures are taken, there are chances for ribbon development to take place along the by-pass. It is also necessary to plan ahead the development of likely area to be developed surrounding the by-pass.



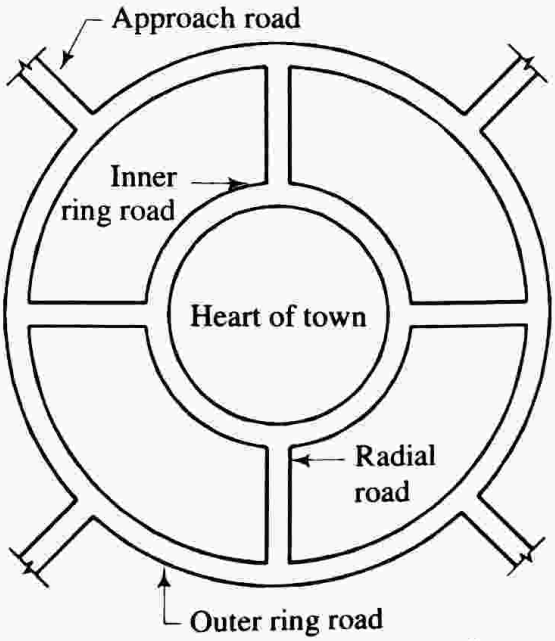
Through and by-pass roads
FIG. 12-7

12-8. OUTER AND INNER RING ROADS

The object of an outer ring road is to divert from the town all the through traffic which has no business in the town.

It is a type of by-pass road for traffic approaching the town from all the directions. All classes of wheeled traffic will be admitted on the outer ring road and the pedestrians should be excluded. The outer ring road should be maintained clear of all existing development and it should be so designed as to compensate for a longer route by unbroken passage and high speed.

The object of an inner ring road is to divert from the town centre all local traffic and other traffic which have no business in the town centre. Such an arrangement will relieve congestion of traffic in the town centre.



Outer and inner ring roads
FIG. 12-8

The inner ring road should have minimum junctions and it should afford a faster passage than that on a direct road through the town centre.

Fig. 12-8 shows the outer and inner ring roads connected by radial roads at suitable points.

12-9. EXPRESSWAYS

The term *expressway* is used to indicate an arterial road on which fast urban traffic is allowed to move speedily and safely. It allows through traffic with full or partial control and generally with grade separations at intersections. The design of these expressways includes easy gradients and smooth curves.

The provision of expressways around big cities relieves to a certain extent the traffic congestion and they provide easy flow of traffic. The expressways do not form a part of the regular street system. But they are suitably joined and linked with the street pattern of the town. The only prohibitive aspect of an expressway is its tremendous cost and hence, it is adopted for big metropolitan cities where the intensity of traffic is such that the cost of an expressway is justified.

12-10. FREEWAYS

The mere widening of an arterial road will not often relieve crowding due to traffic. This creates the need for constructing special routes that will serve only fast moving traffic and will not be subject to interferences from vehicles going to and from the buildings fronting the arterial roads. The freeway is the latest answer for satisfying the demand of special routes which provide an express route for both the type of vehicles, passengers as well as commercial.

A freeway is thus defined as a high class arterial road having controlled access or in other words, it is an expressway with full control of access. The essential features of a freeway can be summarized as follows:

(1) Access from adjacent properties: In case of a freeway, the access from adjacent properties is totally denied and it results into no need for parking, no U-turns and no interference by pedestrians to the vehicular movement. Thus, the full width of freeway is made available for the unrestricted use of the moving vehicles.

(2) Design and construction: It is designed in such a way that it can carry maximum volume of traffic with the highest degree of safety. It should have smooth curves and a high standard of alignment should be maintained. The gradients, visibility and widths of freeways should be carefully determined. The construction aspects of freeways include pavements of concrete or of high grade bituminous mixture, a top class system of lighting and a complete system of direction signs.

(3) Entrances and exits: To give connections to the street systems of the town, the entrances and exits on freeways should be provided at infrequent intervals. For inner areas and suburban areas, the desirable spacings are respectively 1 km and 2 km.

(4) Intersections at grade: The design of freeway is made in such a way that intersections at grade or at the same level are avoided. Thus a freeway has no cross-traffic. For embankments and cuttings, the tunnels and bridges are respectively provided to carry the cross-traffic. The delays and hazards resulting from cross-traffic are thus eliminated in case of a freeway.

(5) Location: In general, the freeways would pass around rather than through a city. But in case of very large cities, they are required to function as main entrances

and exits and in such a case, they form part of the major street pattern of the city. The freeway system may take any form depending upon various factors such as age and development of the city, topographical features, historical landmarks, etc. The alternative freeway patterns should be studied and tested for their economic, social and environmental impact.

(6) Traffic control: The delays which might occur on the freeways can be divided into two groups:

(i) ***Recurrent delay:*** Recurrent delays caused at rush hours by motorists trying to use certain stretches or lanes of freeway than can be handled.

The preventive measures which can be adopted for recurrent delays are as follows:

(a) To add a lane at the freeway bottle-necks.

(b) To install the traffic signals at suitable points along freeway so that the vehicle density can be maintained below congestion limit.

(ii) ***Non-recurrent delay:*** Non-recurrent delays caused by accidents, vehicle breakdowns, confused motorists stopping or slowing, etc.

The preventive measures which can be adopted for non-recurrent delays are as follows:

(a) To detect and remove as early as possible the vehicles in accidents.

(b) To give proper instructions to the confused motorists.

(d) To warn the motorists on the upstream of affected areas so that they can either slow down or leave the freeway.

It should, however, be remembered that the key of effective traffic control on freeway lies in getting early the information and properly analysing the same. For this purpose, the wires are buried at various spots on the freeway and they feed information with respect to presence or absence of vehicles to a central computer and this computer is suitably programmed to indicate coloured signals accordingly on the freeway.

In case of an emergency, a helicopter may be rushed to the spot and with its mini-TV camera, it can take the picture of the scene and the TV picture can then be flashed to the common post where the officer concerned will study the situation and take the immediate necessary steps to remove the traffic congestion on freeway.

It is thus seen that the freeways have got the ability to carry high volumes of traffic at relatively high speeds with a high factor of safety. Hence, they have become principal components of the transportation systems of most of the cities of U.S.A.

12-11. PRECINCTS

The word *precinct* was originally used for the enclosed space surrounding a church, but now it is used in the town planning to indicate an artificially enclosed space formed by the arterial roads and sub-arterial roads. It is a quiet area of the buildings in which through traffic is not allowed. The spaces marked 1, 2, 3 and 4 in fig. 12-9 indicate precincts. The features of a precinct are as follows:

(1) All the roads within a precinct are strictly local roads.

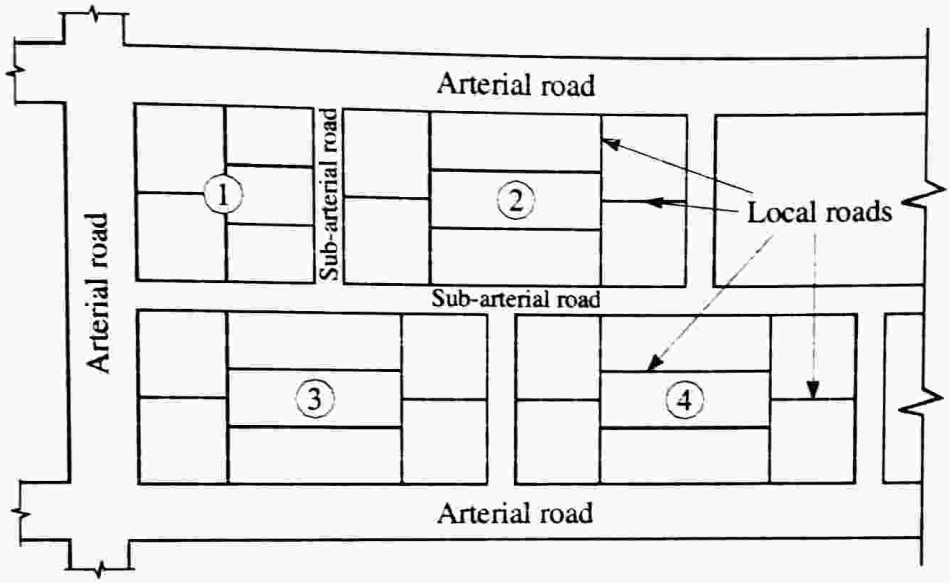
(2) Each precinct is planned and is developed as a distinct unit for residence, business or industry.

(3) The adjoining precincts are connected either by tunnel through or bridge over the arterial road or sub-arterial road dividing them.

(4) The buildings within a precinct do not face towards the arterial or sub-arterial roads.

(5) The connections between the road system of the precinct and sub-arterial roads are few and there is no connection of precinct with the arterial road except through sub-arterial roads.

(6) It diverts noise and bustle of the traffic.



Precincts
FIG. 12-9

12-12. ROAD AESTHETICS

To keep the roads beautiful and pleasing, the following general principles relating to the aesthetics of road should be observed:

(1) Sincere efforts should be made to present decent and pleasing views along the route followed by the road.

(2) The curves along the road should be smooth and easily negotiable.

(3) The footpaths on either side of the road should be provided with concrete or neatly dressed stone kerbs. These kerbs may be suitably painted to present a well-defined alignment.

(4) The ornamental lightings with proper spacing should be installed along the road.

(5) The roads should be provided with side drains to dispose off rain water, where necessary. The road surface should not remain wet unnecessarily for a long time.

(6) The road surface should be maintained clean and neat.

(7) The traffic signs and markings should be exhibited in their proper positions.

(8) The traffic islands situated on the roads should be given some artistic touch by providing statue, fountain, monument, etc.

(9) The trees grown along the road sides should be properly maintained and the over-hanging branches should be periodically pruned.

(10) Wherever possible, the road arboriculture, i.e., growing of the roadside trees, should be encouraged. Such a practice improves the appearance of road and breaks the monotony of long road.

QUESTIONS 12

1. What are the importance and objects of urban roads?
2. Mention the requirements of a good city road.
3. What are the factors to be considered by a town planner while designing a town road?
4. How are the urban roads classified?
5. Discuss the various categories of street systems.
6. Define a freeway and mention its essential features.
7. What is a precinct? State its features.
8. Write short notes on:
   (1) Arterial roads
   (2) Pathways
   (3) Rectangular street system
   (4) Irregular mediaeval street system
   (5) Topographical street system
   (6) Expressways.
9. What are the general principles to be observed for achieving road aesthetics?
10. Give sketches of the following:
    (1) Rectangular with superimposed diagonals street system
    (2) Combination of radial and rectangular street systems
    (3) Through and by-pass roads
    (4) Outer and inner ring roads
    (5) Precincts.
11. Differentiate between the following:
    (1) Local roads and streets
    (2) Major roads and minor roads
    (3) Concentric and radial street systems
    (4) Through road and by-pass road
    (5) Outer ring road and inner ring road
    (6) Recurrent and non-recurrent delays.
12. Give reasons for the following:
    (1) It is not desirable to mix up arterial roads with local roads.
    (2) The radial street system may prove to be uneconomical from the construction point of view.
    (3) It is desirable to put a loop road on a main road passing through the congested portion of the town.
    (4) In case of a freeway, the full width of road is made available for the unrestricted use of the moving vehicles.
    (5) A freeway has no cross-traffic.
    (6) Wherever possible, the road arboriculture should be encouraged.

Chapter 13 TRAFFIC MANAGEMENT

13-1. GENERAL

There is sudden explosion of fast moving vehicular traffic in the last few decades and as such, various techniques and methods are to be found out to make the movement of vehicles smoother and easier. The mere widening of roads or providing new roads do not solve the problems connected with traffic of any modern town.

The term *traffic management* is being used to express means and methods adopted to utilize the road systems of a town to the maximum possible extent so as to grant convenience, comfort and safety.

It is a truism that a well-planned town is faced with minimum traffic problems. Hence, while planning for a new town, enough care should be taken to see that no traffic problems of any magnitude will arise in future. In a similar way, the roads of existing towns should be properly relaid and realigned so as to solve some of the acute traffic problems of that town. It is, therefore, necessary for a town planner to have the knowledge of some of the basic principles of traffic engineering also.

The traffic management is a science by itself and it includes the study of regulations for traffic, controlling and guiding measures for traffic, flow of traffic at junctions, parking areas, traffic survey, engineering elements of road system affecting traffic operation, improvement of traffic facilities in existing towns, etc.

In this chapter, some of the aspects of the traffic management which are of interest to a town planner will be briefly described.

13-2. OBJECTS OF TRAFFIC MANAGEMENT

Following are the main objects of the traffic management:

(1) to achieve smooth and easy flow of the traffic at intersections;

(2) to develop the methods for improvement in general and for solving specific problems in particular;

(3) to have safe, convenient, rapid and economic transport of persons and goods;

(4) to improve the speeds of vehicles;

(5) to increase the traffic carrying capacity of roads;

(6) to make the streets safe for the movements of both, pedestrians and vehicles;

(7) to reduce the delays in road journeys;

(8) to reduce the chances of road accidents to a minimum;

(9) to remove the traffic congestion; etc.

13-3. TRAFFIC SURVEYS

It is necessary to collect the required data in connection with the traffic to be carried by the road system of the town. For this purpose, the traffic counts are carried out. The procedure adopted and the information collected are as follows:

(1) A typical proforma to be filled up during the traffic survey is framed. It contains columns such as variations of traffic, volume of traffic, speed of vehicles, type of vehicles, maximum wheel loads, goods conveyed and origin and destination of traffic.

(2) The numbers of convenient and representative points are selected along the road.

(3) The traffic counts are carried out at these points, usually once or twice or more a year depending upon the importance of road.

(4) Each traffic count is extended for a reasonably long period, usually a week and during this period, the count is taken continuously i.e., for 24 hours of the day.

(5) For more important roads, the separate traffic counts are made for the up and down traffic.

In addition to the above procedure, the additional informations such as location and nature of street accidents; volume, nature and extent of parking; public parking facilities; routes followed by public vehicles; volume and variations of pedestrian traffic; conditions of road surfaces; existing traffic rules and regulations; etc. are also collected during the traffic survey work.

The proforma of traffic count should be carefully filled up and no item should go unattended. The data obtained from the traffic survey should be properly studied and analysed before recommending measures of improvements for the road under consideration.

The chief uses of the traffic surveys are as follows:

(1) It becomes possible to suggest suitable remedies for proper functioning of the road.

(2) It enables a town planner to prepare town planning schemes capable of meeting traffic requirements.

(3) The details collected in traffic surveys are used to decide the location of signals and other controlling devices on the road.

(4) The economic costs of construction and maintenance of the road can be worked out with reasonable accuracy.

(5) The selection of proper type of surface can be made from the study of results of the traffic surveys.

(6) The statistics collected during traffic surveys can be exhibited in the form of maps, charts and tables.

(7) The width, thickness, gradient and alignment of road can be appropriately designed to meet with the expected traffic volume.

13-4. TRAFFIC CONGESTION

In urban areas, there is heavy rush of vehicles and pedestrians during peak hours of the day and it results into overcrowding of road. Such a condition is referred to as the *traffic congestion* and it is developed mainly due to the following causes:

(1) The factors such as faulty intersections, narrowness of roads, steep curves and gradients, poor condition of vehicles using the road, etc. also contribute to the occurrence of traffic congestion.

(2) The haphazard parking of vehicles and physical encroachments on the road are not handled severely.

(3) The movements of vehicles are allowed in the conflicting directions.

(4) There is absence of civic sense and strict enforcement of the traffic rules and regulations is not carried out.

(5) The streets originally planned for a single use are occupied by the slow-moving and fast-moving automobiles, cyclists and pedestrians.

The roads are not owned by individuals and as such, the transportation by road is a form of public utility service. The proper functioning of road network depends on the co-operation of public using the road system. In the transportation system, the people responsible for traffic congestion, can be grouped in the following three categories:

(1) General public: It is treated as a passive element, but sometimes becomes a major source of certain nuisances to the transportation management.

(2) Road users: This is in the form of vehicular traffic and trips are made by the owners of vehicles by any suitable mode of transport.

(3) Transport personnel: The planning, design, operation and management of transportation system are carried out by persons who have expert knowledge on the subject.

It is significant to note that every individual falls in all the above three groups at one time or other, but strangely behaves indifferently in different capacities at different times.

The disadvantages of traffic congestion are many and they can be stated as shown below:

(1) It makes the surrounding area polluted with undesirable gases, vapours and odours.

(2) The chances of the road accidents are increased.

(3) The driving through traffic congested area becomes very tedious and it adversely affects on the health of drivers of the vehicles.

(4) There is more wear and tear on vehicle and the persons have to spend considerable time sitting idle during traffic jams which they might have more productively spent somewhere else. Thus, the road congestion involves an economic loss also.

(5) There is national wastage of petrol and gasoline used for running automobiles because the automobiles do not attain the optimum speeds for which they are designed.

To avoid traffic congestion, the various devices of traffic control can be applied and the remedies which are usually adopted to reduce traffic congestion can be enumerated as follows:

(1) accommodating bus-stops of public vehicles at suitable places along the road;

(2) adopting means to segregate the traffic of the various categories;

(3) adopting the system of staggered working hours so as to have better matching of street capacity with traffic volumes generated by employment centres;

(4) arranging educational methods like lectures, films, video cassettes, slide shows, T.V. programmes, etc. to develop public opinion to abide by the traffic rules and regulations;

(5) controlling the movements of vehicles by making one-way schemes;

(6) enforcing strictly the traffic rules and punishing the defaulters;

(7) fixing time and area for the movement of certain types of fast-moving and slow-moving vehicles;

(8) prohibiting parking on one side or even on both the sides of the road;

(9) prohibiting U-turn movements on the major roads;

(10) restricting loading and unloading of the goods;

(11) requiring pedestrians to cross major streets at specified locations, designated and demarcated for such purpose; etc.

13-5. TRAFFIC CONTROL

The objects of having effective traffic controlling devices are as follows:

(1) To develop free and rapid flow of traffic on the roads and streets in towns;

(2) to prevent the rapid traffic flow from being in undue danger either to its own units or to the public at large.

The traffic control is achieved either by means of constructive measures or restrictive measures. The constructive measures include design of junctions, number of traffic lanes, layout of curves, etc. and they are looked after by the town planners and road engineers. The ultimate aim of the constructive measures is to make the roads as safe for movements as the railways.

The restrictive measures include traffic rules and regulations, traffic signs and signals, etc. and these measures are enforced by the police department of the government. The ultimate aim of the restrictive measures is to maintain public safety until such time as the roads have been made structurally safe and adequate.

The various methods of traffic control adopted in practice can be enlisted as follows:

(1) achieving segregation or separation of traffic of conflicting nature like slow and fast, local and through, etc.;

(2) imposing heavy penalties on the defaulters of traffic rules and regulations;

(3) imposing speed restrictions as in case of the road over a bridge;

(4) installing devices consisting of signs, signals and markings placed on or adjacent to a street or a road for the purpose of regulating, warning or guiding the traffic;

(5) making proper design of junctions i.e., providing them with traffic islands, roundabouts, subways or bridges;

(6) making the streets one-way;

(7) providing good visibility, easy curves, sufficient widths and parking places;

(8) regulating turning of vehicles at junctions manually by policemen; etc.

13-6. ROAD JUNCTIONS OR INTERSECTIONS

The general term *junction* or *intersection* describes all roadway situations where two or more roads meet or cross one another at the same or different elevations.

The design and layout of road junctions demand careful considerations from the view point of traffic management because it is very essential to have safety of vehicular traffic and pedestrians at such places. The accidents generally occur at road junctions and hence, proper precautions should be taken in their design and layout. They should also be properly signalled and it is essential to have proper segregation and control of the traffic. As such, there is no type of road junction which can be adopted for all traffic conditions.

The factors to be considered while making selection for a particular type of road junction are as follows:

(1) availability of means of traffic control;

(2) degree of traffic congestion;

(3) funds available;

(4) number of intersecting streets or roads; and

(5) volume and nature of traffic.

The basic consideration in the design and operation of intersections must be the capabilities and limitations of the drivers, pedestrians and vehicles using the facility. A confused driver is an unsafe driver. Hence, the intersection design and operation must be predicted upon what the driver will do rather than what he should do. The adoption of this principle will be facilitated, if sound traffic operational procedures are inherent in all phases of the design process.

The general principles to be observed in the design of road junctions to minimize the risks of accidents are as follows:

(1) Angle of crossing: As far as possible, the acute-angled junctions should be avoided. The subsidiary roads should be made to meet at right angles to the main roads as far as possible.

(2) Camber: At junctions, the camber usually allowed is avoided and as far as possible, the whole area of the road junction should be done in one level.

(3) Channelizing: The road junctions should be properly channelized i.e., the number of points of conflict of traffic are minimized and lines of flow of traffic are made to cross at right angles or nearly at right angles. A properly channelized road junction permits right actions to do smoothly and makes wrong actions difficult.

(4) Entry speeds: The road junctions should be designed in such a way that high entry speeds are discouraged.

(5) Gradient: It is desirable to avoid change of gradient at the road junctions.

(6) Importance of roads: If road junction is meant for major roads and local roads, the latter should be carried under or over the former by subways or bridges respectively.

(7) Kerbs: To demarcate the boundary between the road and footpath, the kerbs are provided. They should be of suitable height and should be made visible at night.

(8) Pedestrian traffic: For road junctions having heavy pedestrian traffic, the hand rails should be provided adjacent to the kerbs with openings at pedestrian crossings.

(9) Simplicity: The road junction should be made as simple as possible. The routes for traffic across the junction should be clearly defined and they should be obvious, especially if the driver is a stranger.

(10) Visibility: There should be ample visibility at the road junction. Each driver approaching the road junction should be capable of clearly seeing the vehicles coming from other directions. In that case only, he will be able to slow down his vehicle at junction, if found necessary.

The arrangements made at important road junctions can be divided into the following three categories:

(1) Traffic islands

(2) Roundabouts or rotaries

(3) Grade separations.

(1) Traffic islands: The space at a road junction over which traffic is not allowed to move is known as a *traffic island.*

Fig. 13-1 and fig. 13-2 show the arrangements of traffic islands for the road junctions with four streets and three streets respectively.

The arrangement at the road junctions in the form of traffic islands serves the following five objects:

(1) The efficiency of traffic handling is increased.

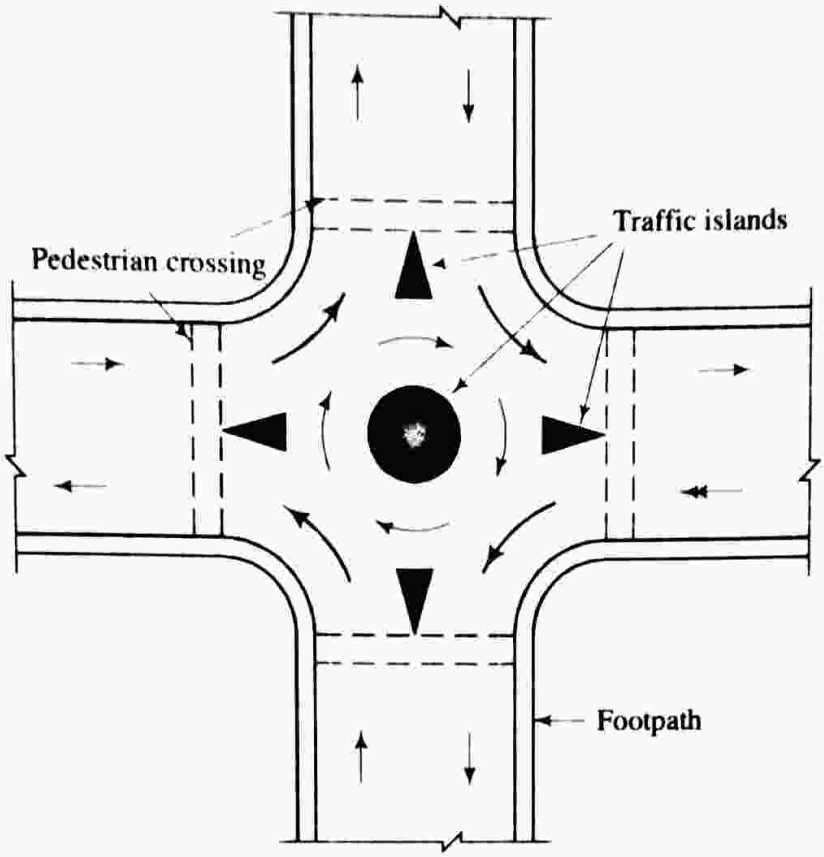
(2) There is segregation of traffic into proper channels as they serve as guide to the drivers in negotiating the junctions.

(3) The traffic islands serve as shelters for pedestrians crossing the roads. Hence, they are referred to as *refuge islands*. They prove to be a special boon for the aged and infants.

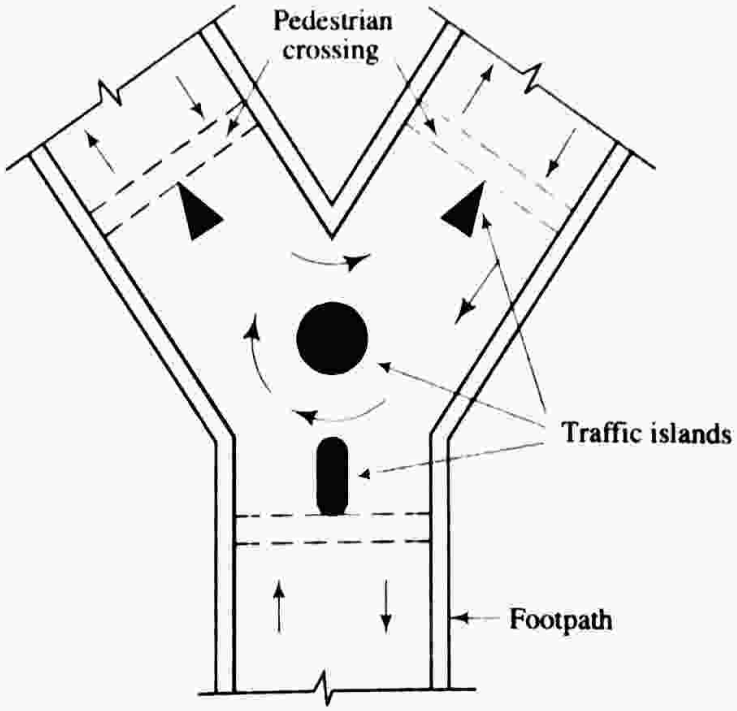
(4) The vehicles are compelled to move in one direction only and separate strips across the roads are provided for the crossing of pedestrians. Thus, the chances of accidents are reduced.

(5) They provide proper place for the installation of traffic signs and other controlling devices.

The traffic islands are constructed about 200 mm higher than the road level. They are sometimes provided with lawn, statue or fountain to make them distinct and attractive. The traffic islands should be painted with colour which contrasts with the colour of road pavement.

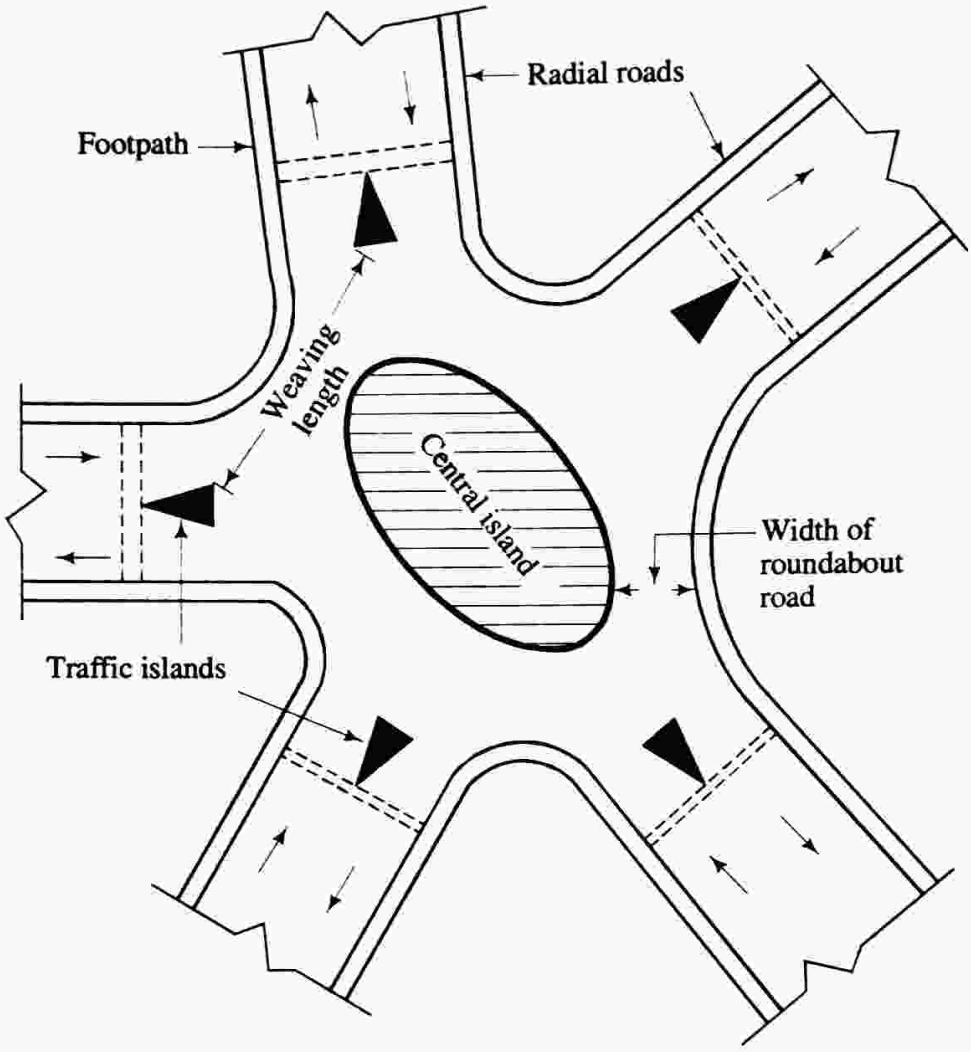


Traffic island
FIG. 13-1



Traffic island
FIG. 13-2

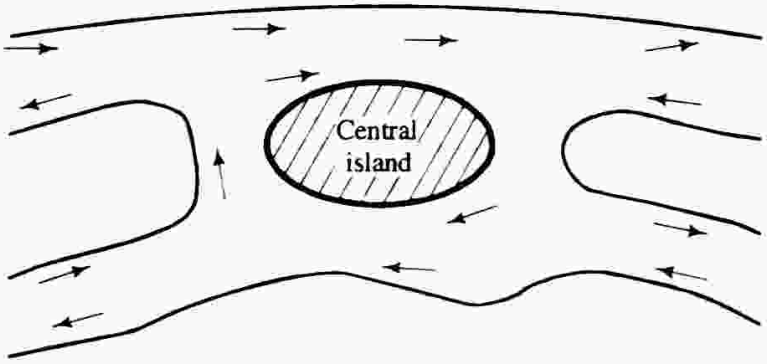
(2) Roundabouts or rotaries: A roundabout or rotary junction consists of a central island surrounded by the roads forming the junction as shown in fig. 13-3. The shape of central traffic island is elliptical. But it can also be made circular or rhombus or diamond shape. The provision of a roundabout junction introduces unidirectional (clockwise direction) circular movement at the intersection.



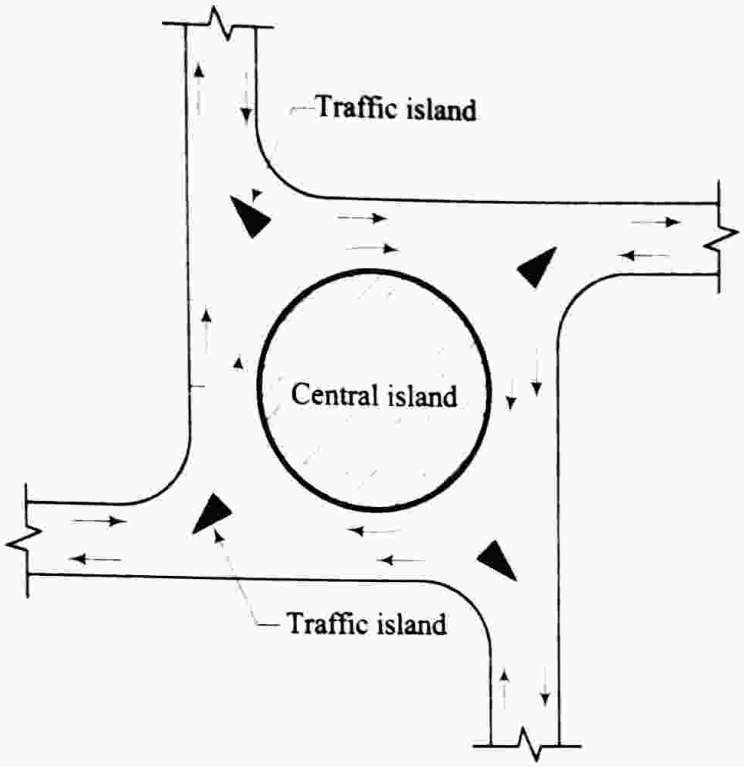
Elliptical roundabout
FIG. 13-3

Fig. 13-4 and fig. 13-5 show two other forms of the rotaries. Fig. 13-4 shows a rotary where more than two roads enter and leave it tangentially. The through traffic is not obstructed in this type of intersection and it can move with high speed. However, such rotaries are dangerous.

Fig. 13-5 shows a rotary with turbine type island. The traffic is forced to slow down when it enters the roundabout as it has to take a left hand turn and while leaving the roundabout, the traffic has a tangential exit.



Tangent type roundabout
FIG. 13-4



Turbine type roundabout
FIG. 13-5

Following are the advantages of roundabouts:

(1) It provides a simple solution for a road junction where more than four roads meet and it proves to be advantageous when the number of intersecting roads is between four and seven.

(2) There is little loss in traffic capacity as there is continuous flow of traffic through the roundabout. A well-designed rotary can accommodate a total traffic of about 3000 vehicles per hour and it also enables radial streets to carry traffic to their full capacity.

(3) There is smooth and orderly flow of traffic with little delay.

(4) The vehicles as they approach the roundabout are merging and weaving in the traffic stream. It thus provides a high degree of safety and hence, there are less chances for serious collisions or accidents.

(5) The wear and tear of vehicles using the roundabout are reduced as stopping and starting of the vehicles are less frequent.

(6) The maintenance cost is considerably reduced due to the fact that the rotary can be made a self-controlled traffic intersection avoiding the necessity of traffic police or signals.

Following are the disadvantages of roundabouts:

(1) If traffic is to be stopped from time to time for the crossing of pedestrians, the orderly movement of traffic is seriously upset. Hence, the roundabouts are sometimes elevated and subways are provided for the pedestrians to pass for all the time.

(2) It becomes congested and hazardous under fog conditions.

(3) It may confuse the drivers who are not familiar with such types of construction.

(4) It requires large area of flat land and hence, it cannot be adopted where land values are high.

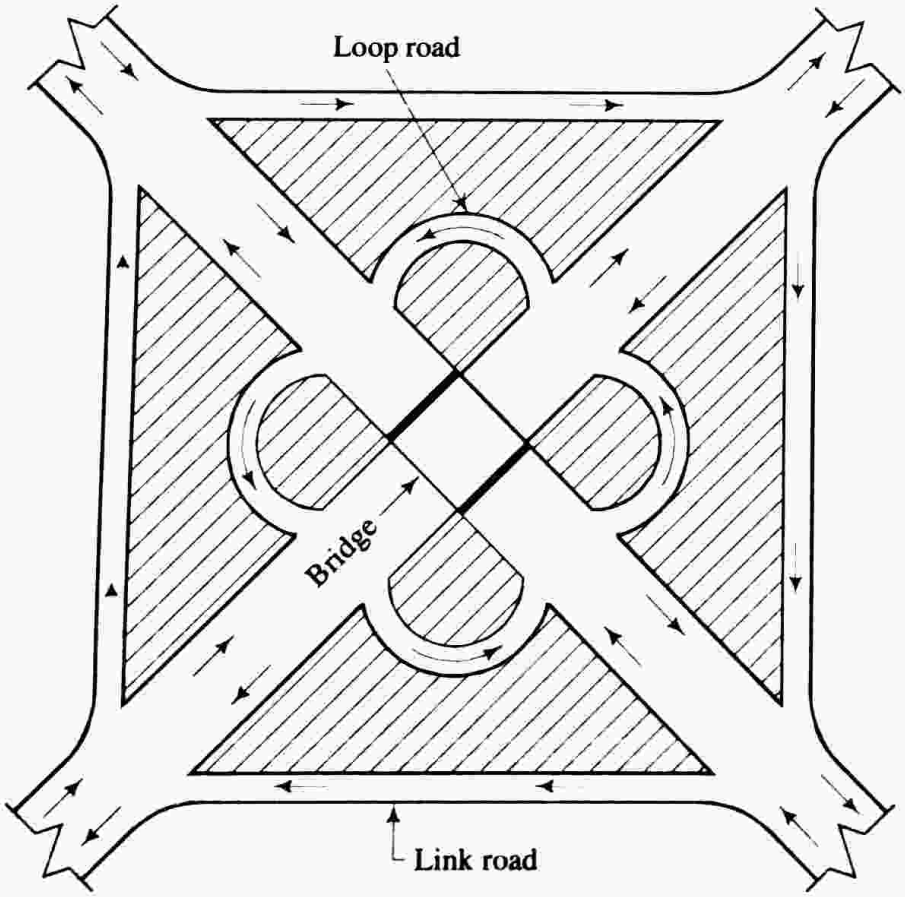
(5) It requires the installation of complicated traffic signs, having heavy mixed traffic and large number of cyclists, pedestrians and animal drawn vehicles.

(6) It proves to be unsuitable for high speed roads.

The roundabouts have proved to be useful for urban conditions having relatively slow moving traffic. The dimensions of central island of the roundabout are determined after assuming adequate weaving length. The distance between the successive entrances is known as the *weaving length* as shown in fig. 13-3 and depending on the design speeds, the weaving lengths of 30 m to 50 m are provided.

There is an increase in the size of the rotary with an increase in design speed. Hence, the application of the rotary is more suitable for urban and suburban conditions having relatively slow moving traffic.

(3) Grade separations: A grade separation is the arrangement of taking one road over or under another by means of a bridge. It is also known as a *fly-over junction*. There is no physical connection between the separated roadways in a grade separation.



Clover-leaf crossing
FIG. 13-6

The term *interchange* is used to indicate a grade separation having facility for traffic to pass from one intersecting road to the other. Thus, the *connecting roads* known as *ramps* or *turning roadways* are provided to enable limited or full movements between the separate roads at an interchange.

Following are the four common types of interchange:

(1) clover-leaf crossing as shown in fig. 13-6;

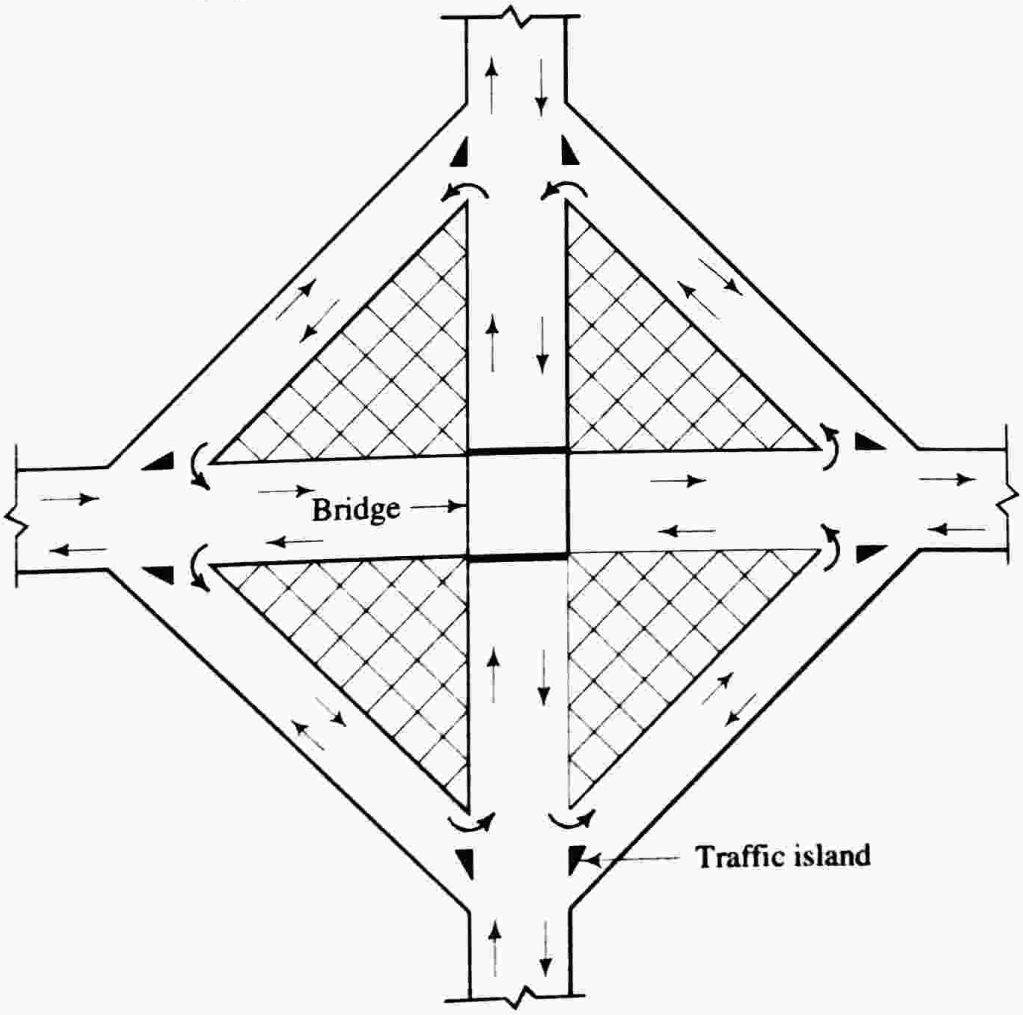
(2) diamond crossing as shown in fig. 13-7;

(3) rotary interchange as shown in fig. 13-8; and

(4) three-way interchange as shown in fig. 13-9 and fig. 13-10.

The arrows in the sketches show the lines of movement of traffic on the intersecting roads. Fig. 13-6 shows the layout of a typical *clover-leaf junction*. It avoids all the right-hand movements which are the major source of the road accidents. The radii of ramps can be suitably increased to accommodate the desired volume of traffic. However, the time saved by increased speed may be lost in covering long distance of ramp length, if the radii of ramps are too large. If the traffic is heavy, there may be serious interference which might result in slowing down of the through traffic.

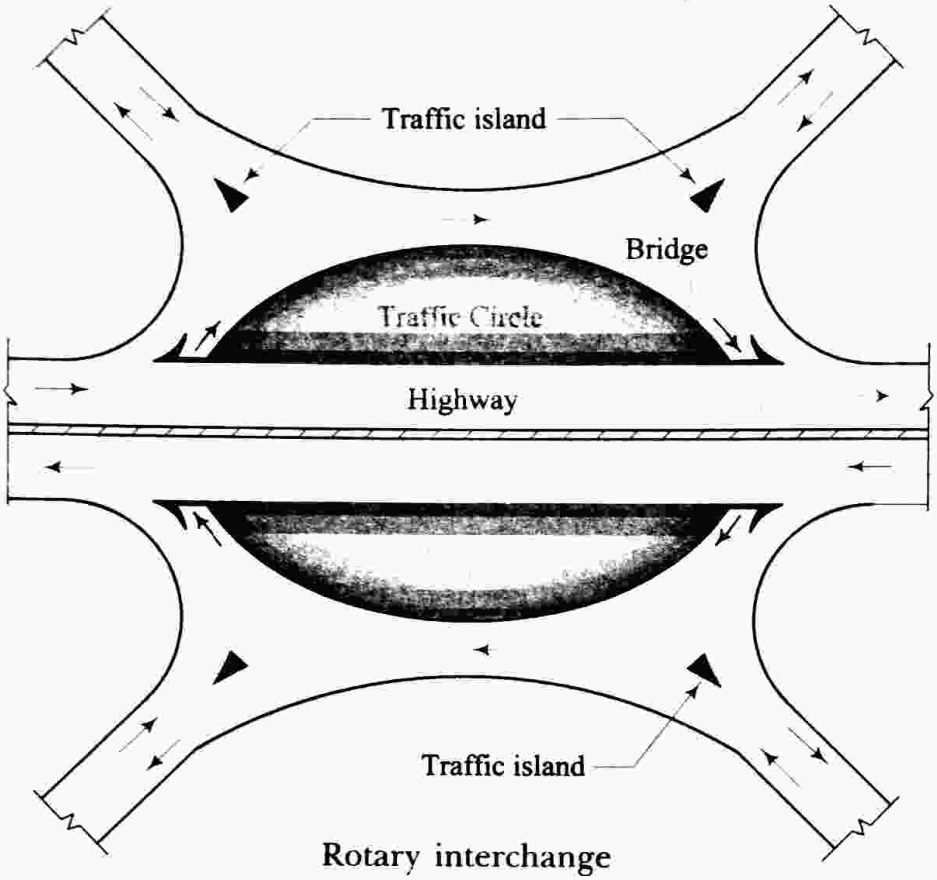
Fig. 13-7 shows a typical *diamond interchange*. It has a wider range of applicability than any other type of interchange. It may be used at minor roads carrying low volume of traffic in the initial stage for the purpose of providing points of access. With proper treatment of the minor highway, the diamond interchange is also capable of accommodating intermediate traffic volumes in rural areas where operating speeds are high and relatively large volumes in urban areas at lesser operating speeds. It requires little additional right-of-way beyond that of the normal roadway and it usually proves to be the least expensive of all interchange types.



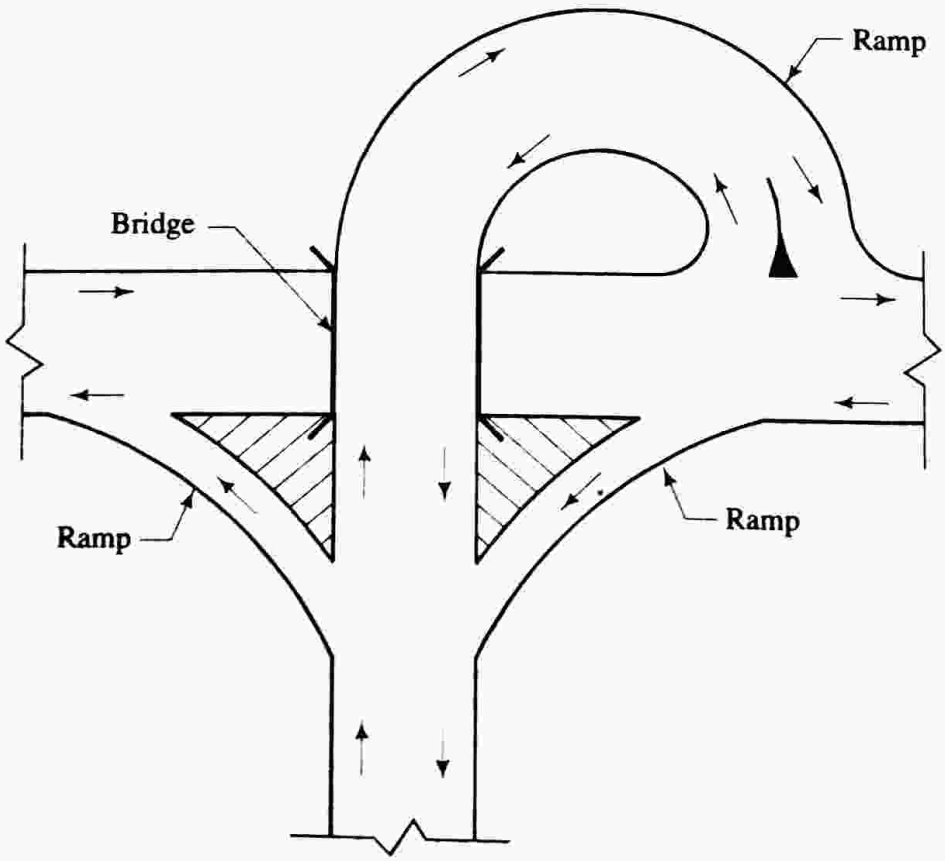
Diamond crossing

FIG. 13-7

For some situations, the design incorporating grade separations with the help of a traffic circle is made, as shown in fig. 13-8. The rotary in such a case functions like the collector and distributor of traffic as shown by arrows.



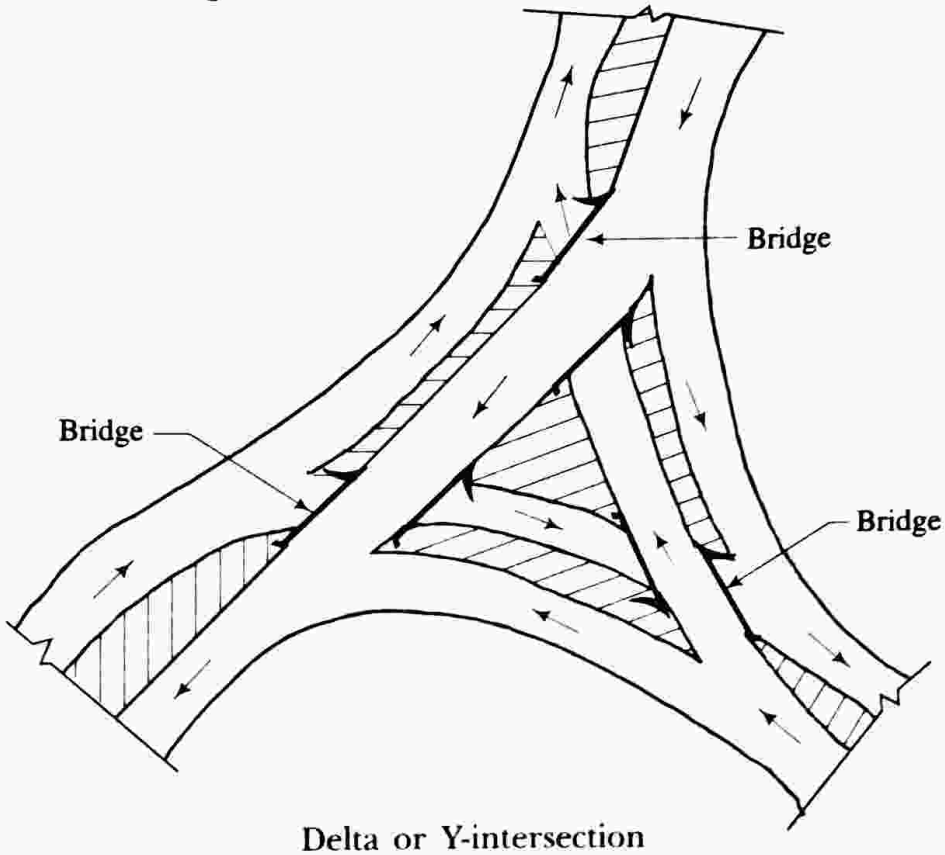
Rotary interchange
FIG. 13-8



Trumpet or T-intersection
FIG. 13-9

The *three-way interchange* is utilized at locations where there are only three approaches to the interchange. The arrangement with a single bridge, as shown in fig. 13-9, is known as the *trumpet* or *T-intersection*.

The arrangement with three bridges, as shown in fig. 13-10, is known as the *delta* or *Y-intersection*. The arrows in the sketch show the lines of movement of the traffic on the intersecting roads.



Delta or Y-intersection
FIG. 13-10

A grade separation serves the following purposes:

(1) It affords the greatest road safety to vehicles at junction.

(2) It can be adopted for all likely angles and layouts of the intersecting roads.

(3) The capacity of grade separation is practically the same as that of two cross roads.

(4) It grants maximum facility to the crossing traffic. The accidents while crossing are avoided because the roads are separate and there is no necessity of stopping.

(5) It helps a large volume of traffic to move easily and smoothly without reducing speeds.

(6) It permits stage construction in the sense that additional ramps may be provided after the grade separation structure between the main roads is constructed.

(7) It proves to be an essential component of the controlled access highways like expressways and freeways.

(8) The problem of traffic congestion during the peak hours does not arise.

(9) There is overall increase in comfort and convenience to the road users. It results in considerable saving of travel time and also reduces the vehicle operation cost.

A grade separation, however, is very costly to construct and it requires considerable area of land, say about 6 to 8 hectares, for efficiently serving high speed traffic. In plain or flat terrain, it may introduce undesirable crests and rags in the vertical alignment.

13-7. PARKING

The parking facilities for the vehicles to stand should be properly and adequately provided by the town planner.

The parking facilities can be grouped in the following two categories:

(1) On-street or kerb parking

(2) Off-street parking.

In case of *on-street parking*, the vehicles are allowed to be parked on the kerb and it may either be restricted kerb parking or unrestricted kerb parking. The former is controlled by police or parking metres and there is no such control in the latter type. The on-street parking reduces the effective width of road and if not properly designed or planned, it leads to traffic congestion, especially during peak hours. On the other hand, the removal of kerb parking can increase the capacity of a roadway to the extent of 40 to 65 per cent depending on such factors as roadway width, type of adjacent land use and composition of the traffic stream. However, most of the drivers prefer to park at the kerb, if space can be made available.

The effects of improper on-street or kerb parking on the urban environment are as follows:

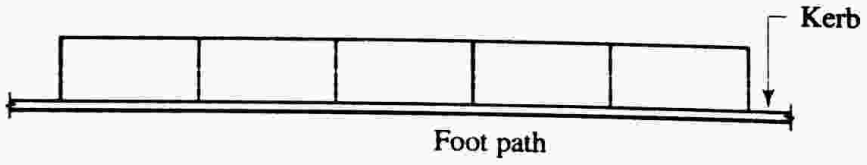
(1) The haphazard parking spoils the aesthetics of road.

(2) The safety of various classes of road-users is adversely affected.

(3) The standing vehicles on road decrease the effective width of road and thus, the traffic carrying capacity of road is reduced.

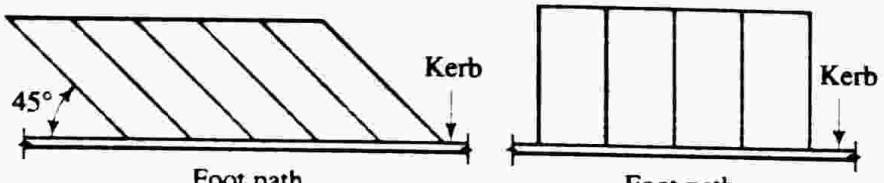
In case of *off-street parking*, the vehicles are parked at a separate place away from the kerb. This facility avoids undue traffic congestion and delay on the road.

The on-street parking can be permitted in a specified manner only. It may either be parallel parking, as shown in fig. 13-11, or angle parking, as shown in fig. 13-12.



Parallel parking

FIG. 13-11



45° angle parking Right angle parking

Angle parking

FIG. 13-12

The vehicles parked parallel to kerb are generally preferred because they offer much less disruption to the moving traffic. It is adopted when width of street is limited. However, the operation of parking and unparking in this pattern may prove to be very difficult.

In cases where traffic volumes are light and roadway widths are greater than 20 m, the angle parking is possible. The parking at 60° to the kerb is usually the maximum practicable with 45° parking usually yielding the best results.

The *right angle parking* is generally permissible only under special conditions. The angle parking is found to be more convenient for the motorists than the parallel parking. But it produces considerable obstruction to the through traffic which may result in more accidents as compared to the parallel parking.

The various methods adopted to grant the parking facilities, on-street or off-street, are as follows:

(1) basement floors and open spaces or margins around new buildings by the implementation of suitable building bye-laws;

(2) constructing central parking stations in areas of high land value in the form of multi-storey buildings with open walls and cheap construction;

(3) constructing underground parking stations below parks and playgrounds;

(4) developing plots for off-street parking and charging a reasonable parking fee as per type of vehicle and duration of parking;

(5) installing parking metres for short-duration parking on roads;

(6) kerbside parking with effective road marking techniques;

(7) providing parking stations at ground level where land values are low; etc.

13-8. TRAFFIC CAPACITY OF ROADS

The traffic carrying capacity of any road primarily depends on the following factors:

(1) characteristics of road such as gradients, number of lanes, visibility, cross-traffic, pedestrian's movement, etc.; and

(2) characteristics of traffic such as speed of vehicles, type of vehicles, driving habits of road-users, etc.

To arrive at the theoretical maximum capacity of road per lane width, the following three assumptions are made:

(1) All vehicles on road are of uniform length.

(2) All vehicles on road are running at uniform speeds.

(3) The distance between successive vehicles is uniform.

The average capacity of a normal lane varies from 700 to 2000 vehicles per hour. In practice, it is found that when capacity of lane increases to 1000 vehicles per hour, it leads to discomfort, congestion, more chances of road accidents and inconvenience in driving.

The width of traffic lane is determined by the following equation:

Width of traffic lane = Width of the largest vehicle + Clearance.

The clearance will depend upon the speeds of vehicles. The faster the traffic, the greater the clearance and vice-versa.

The number of lanes will be decided from the volume of traffic. The suggested number of lanes for different traffic capacities are as follows:

4 lanes 2 in 1 direction 600 vehicles per hour per lane

6 lanes 3 in 1 direction 800 vehicles per hour per lane

8 lanes 4 in 1 direction 1200 vehicles per hour per lane.

At curvature and for providing parking facilities, extra lanes may be provided as required.

13-9. ROAD TRAFFIC PROBLEMS

The problems of traffic on road result from the performance and requirements of the following three components:

(1) fixed facilities for the accommodation of traffic on the road,

(2) human beings using the road, and

(3) vehicles on the road.

All the traffic controls and improvements can be reduced to the behaviour of the above three components. It has been rightly said that the traffic control methods can be expressed by three E's i.e., Education, Enforcement and Engineering.

The *educational methods* include training of public opinion for respecting traffic rules and regulations by means of lectures, films, posters, radio talks, articles in newspapers, safety drive programmes, etc.

The *enforcement methods* include framing of a proper traffic code, appointing an authority to supervise the road traffic and punishing the defaulters of traffic code, introducing proper signal system, medical check up of drivers, special precautions for commercial vehicles, speed control, etc.

The *engineering methods* include suitable street systems, proper design of junctions, land-use zoning, location of public bus stops, physical features of road, decentralization of industries, parking facilities, proper road lighting, etc.

Thus, the best engineering devices will not prove successful, if not supplemented by constant education of the public and firm enforcement of traffic regulations. A sense of traffic can be developed by introducing traffic education right from school stage and making the rules and regulations of traffic simple but strict.

It is not desirable to impose rules which are difficult to observe. At the same time, the growth of city should be planned to absorb the traffic growth and to avoid the mismanagement of transport facilities.

The traffic problem plays a great role in shaping of the modern city. The compromise of one-way streets and parking meters to accommodate new technique of motor car into outdated cities seems to be a stop-gap arrangement and hence, novel ideas will have to be found out to save the city.

The first move in this direction came from America, when motels began to supplement hotels. It was found that hotels located in the centre of cities rarely can accommodate even a fraction of cars of their clients.

On the other hand, the motels are situated on the approaches to a city and they are designed to take care of both, travellers and their cars. The major American cities are now ringed with motels and they are beginning to make their appearance in our country also.

In the same way, the big shopping centres capable of accommodating heavy motor traffic may be provided outside the city to solve the traffic problem to some extent. The drive-in cinemas and restaurants, built beyond the city limits, will also release the pressure of traffic on the city centres.

13-10. ROAD ACCIDENTS

There are chances of road accidents due to complex flow patterns of vehicular traffic, presence of mixed traffic and pedestrians. The traffic engineering should aim at safe movements on roads to bring down the occurrence of road accidents to the minimum possible extent. On analysis of statistics available for any town, it is found that in most of the cases, the following four general observations can easily be arrived at:

(1) Most of the road accidents occur on the straight roads.

(2) The favourable range of speeds at which most of the road accidents occur is 15 to 30 km p.h. only.

(3) The greatest number of sufferers in road accidents is that of pedestrians.

(4) The human failure was responsible for most of the road accidents.

The contributory causes of road accidents are as follows:

(1) defects in road surface;

(2) defects in vehicles;

(3) faults of driver, cyclist or pedestrian;

(4) insufficient provision of weaving length at roundabouts;

(5) interference by animals on roads;

(6) lack of facilities for crossing of pedestrians;

(7) lack of segregation of traffic;

(8) lack of visibility at corners and junctions;

(9) uncontrolled intersections;

(10) unfavourable weather conditions; etc.

The recording of road accidents should be carried out in suitable forms and the results should be exhibited on suitable maps and diagrams. The analysis and study of such details help in deciding actions to be taken to reduce the chances of road accidents.

For the safety of pedestrians on road, the following measures may be taken:

(1) The fencing or railing is provided at kerb line with openings at pedestrian crossings.

(2) The pedestrians are completely segregated at road junctions and they are not allowed to enter the road intersections. The subways or bridges are provided for their movements on junctioning roads or streets.

(3) The shopping entrances on roads are provided with telescopic railings so that such railings can be removed during certain hours of the day for the movement of goods.

(4) The traffic islands coupled with proper markings for pedestrian crossing are provided at the road junctions.

(5) The vehicles are allowed to move in the urban areas at certain restricted speeds.

13-11. TRAFFIC SIGNALS

To control traffic at important road junctions, automatic traffic signals are installed in big towns. There are usually three colours namely, red, yellow and green included in the traffic signals. The red and green colours indicate stoppage and movement respectively. The yellow colour signifies impending change or clearance time. Sometimes, the arrows indicating the directions are included in the light signals at complicated road junctions. The lenses of signal faces are normally arranged in a vertical line and hoods are provided in certain cases to limit the visibility of signal indications to the intended approaching traffic as well as to reduce the effect of lighting of the lenses by the sun.

The traffic signals of various patterns and designs are available. The most commonly adopted traffic signal is the automatic fixed time traffic signal. At complicated junctions, numbers of traffic signals are installed to link up the junctioning streets and correct synchronization is to be ensured for maintaining a proper sequence of movement of traffic as well as pedestrians through various streets.

The intervals at which the changes occur in signals are predetermined from the study of volume of traffic of the junctioning streets and such changes in lights are made automatic.

Following are the advantages of the traffic signals:

(1) There is increase in the traffic handling capacity at the road junction.

(2) There is overall improvement in the quality of traffic flow at the road junction.

(3) They allow safe crossing of the heavy traffic.

(4) They help in reducing certain types of accidents especially those at right angled collisions.

(5) They permit the pedestrians to cross the roads safely and with confidence.

(6) They prove to be economical as compared to the manual control.

(7) They provide for the orderly movement of traffic.

It is found that many traffic signals have been installed where no actual need exists. The installation of an unwanted signal generally leads to increase hazards and traffic delays and thus, worsens the traffic operation rather than its improvement.

The major drawback of an automatic fixed time traffic signal is that it does not adjust itself to unusual circumstances such as long processions, big crowds, etc. Hence, the presence of traffic police near such signals becomes essential and necessary.

The other disadvantages are as follows:

(1) If the design and location of signals are improper, it may lead to the violations of the control system.

(2) If the signals stop working due to electric power failure or any other reason, there is confusion among the road users.

(3) There are chances of rear-end collisions.

In U.S.A. and various other foreign countries, computerized signal system is adopted for their big cities. The best computerized system of signal grants the following two important advantages:

(1) The information about traffic conditions or abnormalities such as caused by an accident, is quickly conveyed by computers at a central control point and the traffic engineer, in charge of the operation of the system, can then take suitable steps to accommodate heavier flows on alternate routes.

(2) To give quicker response to meet the changing traffic patterns, the computers can be programmed accordingly. For instance, the computer can be programmed to skip a signal phase, to change the sequence of traffic signals, to give priority to buses at traffic signals, to give priority or pre-emption to emergency trips by police, fire brigade and ambulances.

13-12. ROAD SIGNS

(1) Purpose of road sings: The *road sign* or *traffic sign* is the most used and least costly of the traffic control devices. Along the roads, it becomes necessary to install suitable road signs for the following purposes:

(1) to achieve orderly movement of the traffic;

(2) to control speeds of the vehicles;

(3) to control the traffic behaviour such as parking, over-taking, etc.;

(4) to direct the traffic on different routes;

(5) to guide the road users of hazardous conditions ahead;

(6) to intercept heavy traffic in order to allow other vehicles and pedestrians;

(7) to reduce the chances of accidents; etc.

The road signs are however capable of several negative functions such as:

(1) They confuse the semi-informed public by providing conflicting or complicated information.

(2) They create distrust and cause accidents when they are improperly used.

(3) They generate tension in the mind of driver when the required or sought information is not obtained.

(4) They misinform the public when the message is incorrect or misunderstood.

The road signs should be properly designed with respect to size, shape, colour and dimensions. They should be located in such a way that they are clearly visible by drivers of the approaching vehicles. The important road signs should be illuminated by night.

(2) Limitations of road signs: The road signs have certain limitations in accomplishing their desired objectives. They can be enumerated as follows:

(1) They are not capable of being read at long distances which can be done with flashing or continuous traffic signal indications.

(2) They are not capable of providing continuous guidance through complicated areas and around hazardous location which road markings can do under normal conditions.

(3) They are not capable of providing the positive barriers available by use of kerbs, fencing, raised traffic islands and guard rails.

(4) They are not capable of spacing vehicle platoons on busy streets so that the same traffic performance is obtained as with traffic signals.

(3) Design and location of road signs: The I.R.C. has prepared the code for road signs with an intention to achieve uniformity of design and application of road signs. The general remarks regarding design and location of the road signs are as follows:

(i) ***Design:*** The uniformity of design includes shape, colour, dimensions, legends and illumination. The details of standard signs including letter style, size and colour are prescribed. The standard legends consisting of symbols and word messages are also mentioned.

(ii) ***Location:*** The standardization of location of road signs cannot always be accomplished in practice. However, the general rule is to locate signs on the left hand side of the road. However, under some circumstances such as sharp curves to the left, the signs may be placed on the right-hand shoulder or channelizing island. The overhead signs are desirable or necessary where some degree of lane-use control is desired or on wide expressways or where space is not available at the roadside.

(4) Types of road signs: As per the provisions of the Indian Motor Vehicles Act and I.R.C. code, the road signs can be classified in the following three categories:

(i) Guide or informatory signs

(ii) Regulatory or mandatory signs

(iii) Warning or cautionary signs.

(i) ***Guide or informatory signs:*** The guide signs show route designations, destinations, directions, distances, services, points of interest and other geographical or cultural information. In general, it may be stated that these signs are meant to give useful information to the motorist to help him along his way in the most simple and direct manner. The common guide signs are:

(a) end of speed limit;

(b) flood marks;

(c) locations of petrol pump, hospital, hotel, rest house, etc.;

(d) names of streets and highways;

(e) parking places;

(f) public telephone; etc.

(ii) ***Regulatory or mandatory signs:*** The regulatory signs provide notice of statutory traffic laws and regulations which usually are unenforceable in the absence of such signs. They are thus meant to inform the public about the traffic laws, regulations and legal requirements that would not otherwise be apparent. Some of the common regulatory signs are:

(a) bullock cart or cycle or truck prohibited;

(b) certain speed limit;

(c) load, length, height and width limits of vehicle;

(d) no entry;

(e) no parking;

(f) prohibition of use of horns;

(g) right turn or left turn prohibited;

(h) 'U' turn prohibited; etc.

(iii) ***Warning or cautionary signs:*** The warning signs are provided to call attention to conditions which are potentially hazardous to traffic operations and which otherwise may not be immediately apparent. These signs require caution and may warrant a reduction in speed or some such action in the interest of safety. The cautionary signs which have significance during the hours of darkness must be reflectorized or illuminated.

As per the I.R.C. standardization, a warning sign is in the form of an equilateral triangle with side as 450 mm supported on post at a height of 2750 mm above the ground level upto the base of the triangle. A rectangular explanatory device plate of size 450 mm × 400 mm is placed at a distance of 150 mm below the base of the triangle. Some of the typical warning signs are:

(a) cross roads;

(b) dead end or side road;

(c) ferry;

(d) hair pin bend;

(e) narrow bridge;

(f) school;

(g) steep hill;

(h) zig zag turn; etc.

13-13. ROAD MARKINGS

The certain lines, patterns, words, symbols or reflectors on the pavement, kerb, side of islands or on fixed objects near the roadway are marked on the road surfaces as a means of guiding and controlling the traffic. These are known as the *road markings* or *traffic markings*.

The road markings are required on important roads, curvatures and intersections as they promote road safety and ensure easy flow of traffic by guiding it into natural paths of travel.

Following are the usual forms of road markings:

(1) arrow markings;

(2) bus stop markings;

(3) centre-line markings;

(4) guide lines;

(5) kerb markings;

(6) markings demarcating traffic lanes;

(7) parking space limits;

(8) pedestrian crossings;

(9) stop lines; etc.

The following points should be noted in connection with the road or traffic markings:

(1) In some cases, they are used to supplement traffic signals and certain regulatory and warning signs. In other cases, they are used alone and produce results which cannot otherwise be clearly achieved.

(2) The painted or built-in markings have a definite and important role in a proper scheme of vehicular and pedestrian traffic control.

(3) They are also used for the pedestrian cross-walks.

(4) They are important instruments of the traffic control.

(5) They may be made illegible by snow and ice and may not be visible when wet. Thus, unfavourable weather and visibility conditions may restrict their application on the road.

(6) Under favourable conditions, they convey messages to the driver without diverting his attention from the roadway.

13-14. STREET LIGHTING IN A TOWN

The night use of public roads has considerably increased. Hence, the streets of a town should be properly illuminated by the installation of street lights at suitable points.

(1) Purposes: The street lights are required for the following purposes:

(i) to discourage the illegal actions and also anti-social activities on the streets;

(ii) to enable the vehicles and pedestrians on road surface to move safely;

(iii) to illuminate the road surface; etc.

(2) Efficient and proper street lighting: Following factors should be considered for efficient and proper street lighting:

(i) The electric posts should be located at appropriate places on the road.

(ii) The height of lamps or bulbs should be adjusted in such a way that it does not produce a shadow which may darken the entire lane or street.

(iii) The light from the source should illuminate the entire road surface uniformly.

(iv) The light should be such that it does not produce glare.

(v) The spacing of electric posts should be uniform.

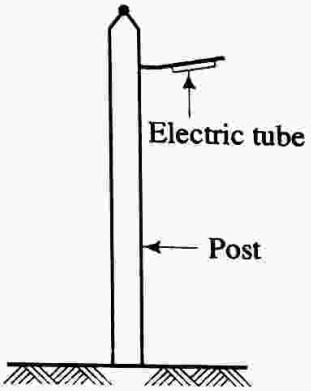
(3) Types of street lights: The usual types of street lights or lamps are of the following three types:

(1) Electric tube

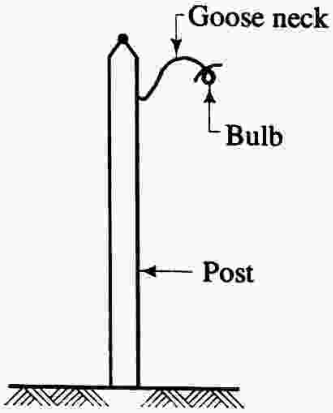
(2) Goose neck

(3) Ornamental light.

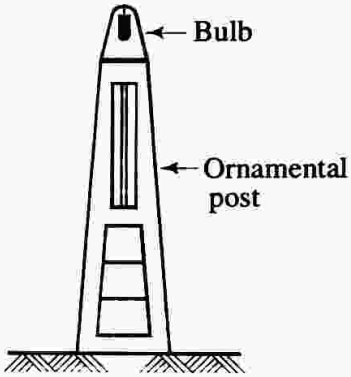
Fig. 13-13 shows a street light in the form of electric tube. Fig. 13-14 shows a street lamp in the form of goose neck. Fig. 13-15 shows an ornamental street light and it is used only on important streets of the town to promote the aesthetic appearance of the surrounding area.



Electric tube
FIG. 13-13



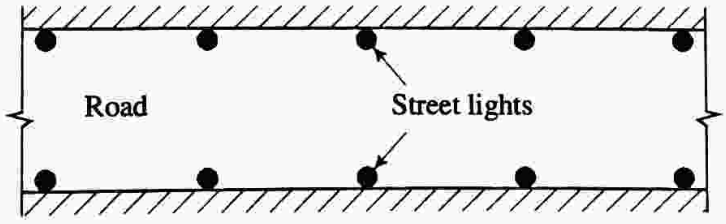
Goose neck
FIG. 13-14



Ornamental light
FIG. 13-15

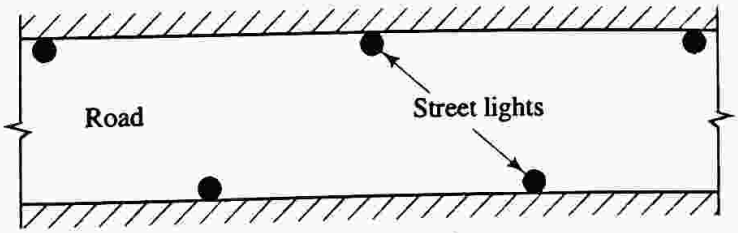
(4) Arrangements of street lights: The street lights can be arranged in different ways as shown in fig. 13-16 to fig. 13-19.

Fig. 13-16 shows the arrangement of street lights in which they are placed just opposite to each other on either side of the road. In this arrangement, the road is well defined. But it can be adopted for wide roads only.



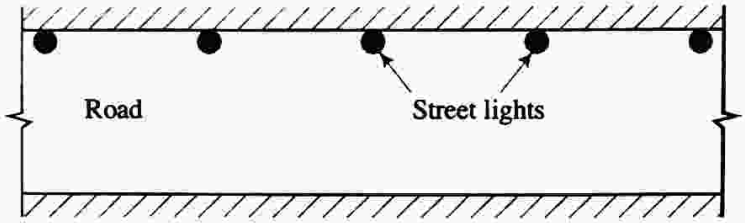
Street lights — opposite arrangement
FIG. 13-16

Fig. 13-17 shows the arrangement of street lights in a staggered manner on either side of the road. Such an arrangement may mislead the drivers on curves.



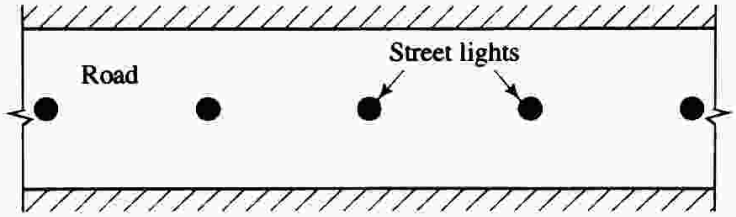
Street lights — staggered arrangement
FIG. 13-17

Fig. 13-18 shows the provision of street lights only on any one side of the road. This arrangement is good on curves, but it grants light on one side of street only. It is adopted for narrow streets.



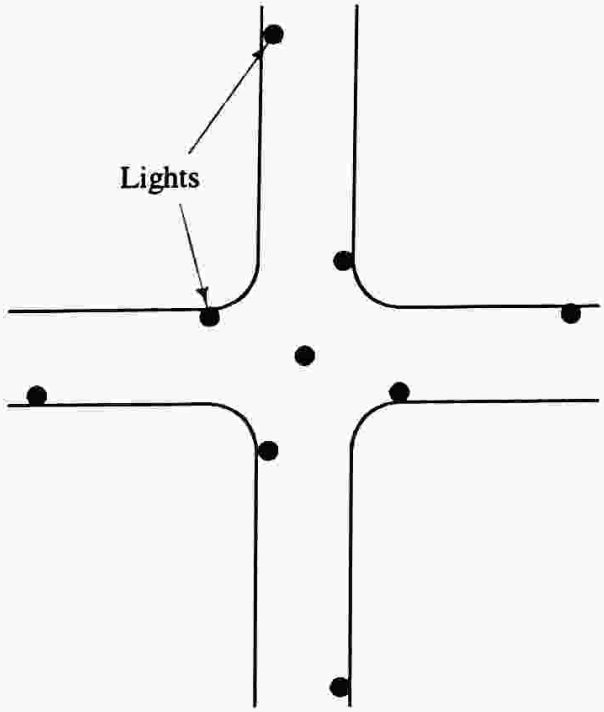
Street lights — one side arrangement
FIG. 13-18

Fig. 13-19 shows the provision of street lights on the centre-line of the road. In this case, a narrow central strip or median divides the roadway longitudinally in two portions. This arrangement provides a very effective lighting system at less cost because of the saving in laminar supports and electrical conductors. It gives the impression of continuous well-lighted road without any obstruction. However, the defect with this arrangement is that the footpaths and cycle tracks remain comparatively dark.

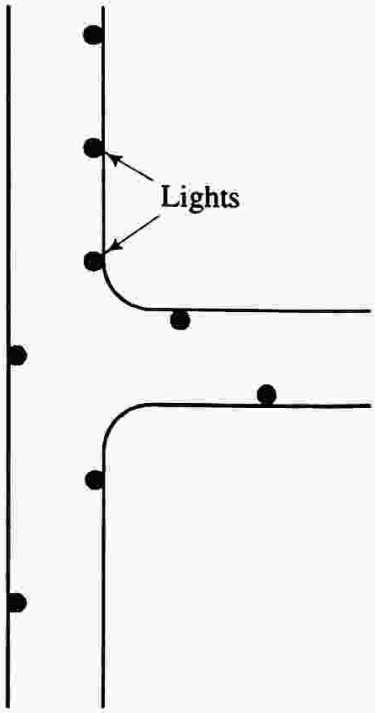


Street lights — central arrangement
FIG. 13-19

(5) Lighting at intersections: The arrangement of lights is more important at the intersections. There are more conflicting points of vehicular traffic and pedestrians and hence, more illumination is necessary at the intersections.



Lighting layout at cross-roads
FIG. 13-20

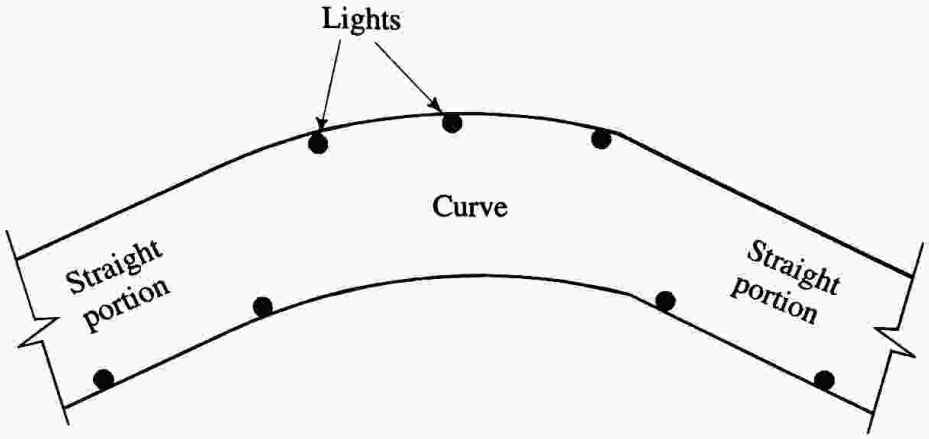


Lighting layout at T-intersection
FIG. 13-21

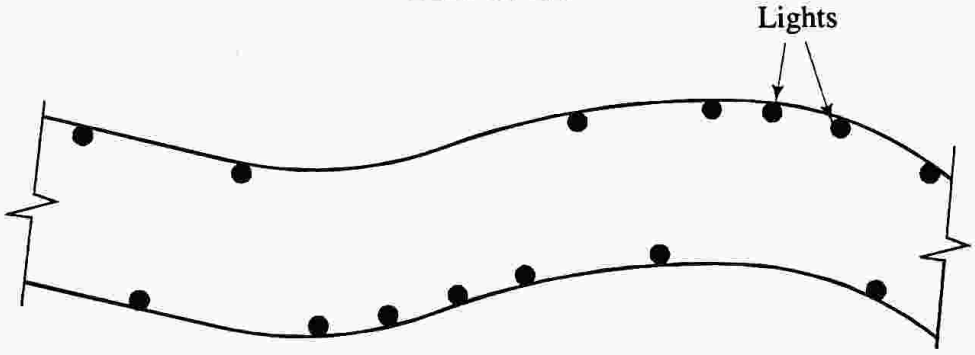
It is therefore desirable to conduct a detailed study of traffic volume before deciding the layout of lights. The units of lighting should be located near the channelizing island, pedestrian crossing and traffic signs. Fig. 13-20 and fig. 13-21 show respectively the lighting layout at cross-roads and T-intersection respectively.

(6) Lighting on curves: The location of lights on the curves requires special treatment. The spacing of lights should be closer as compared to the spacing on the adjacent straight sections.

The lights should be located on the outer side of the curve for achieving better visibility, as shown in fig. 13-22. For reverse curves, it is necessary to change the location of lights from side to side, as shown in fig. 13-23.



Lighting layout for simple curve
FIG. 13-22



Lighting layout for reverse curve
FIG. 13-23

13-15. TRAFFIC PROBLEMS OF EXISTING TOWNS

It is significant to note that the traffic problems of almost all the growing towns and cities are the worst and the most serious ones in the sense that they are physically experienced daily by the common people in the form of road accidents and traffic congestion. It requires great skill to improve traffic facilities in the existing towns. A properly planned urban transportation system leads to the following advantages:

(1) It assists in guiding and stabilizing the land use patterns.

(2) It ensures quick movement of the people and goods.

(3) It improves the employment potential for the urban population.

(4) It makes the urban environment more attractive.

The traffic problems in the towns and cities and the rapidly expanding suburbs are as important as the problems of slums, housing, etc. Without proper traffic control and traffic movement, the big cities are likely to become substantial economic liabilities rather than assets.

Most of the existing towns are faced with a paradox. The automobiles are capable of running at high speeds several times greater than bullock carts or horse-drawn coaches. But on the other hand, the speeds of such vehicles in the congested parts of urban areas have been reduced to that of a bullock cart or horse-drawn coach.

Thus, a person using such an automobile has to travel along the streets, search for a parking place and then walk to the office and in the ultimate analysis, it is found that the total time taken for all such operations works out to be much more than the nineteenth century horse-drawn coach to cover the same distance.

The entire economy depends on the capacity to move people and goods rapidly and smoothly. Every effort should therefore be made to improve the traffic conditions in an existing town by suitably applying measures and methods of traffic congestion and traffic control. For this purpose, the seriously affected portions of the town are studied in detail with respect to their behaviour with traffic and the experts on traffic management are consulted for the solution of traffic problems at these points. The suggestions are then put up in practice and the results achieved are carefully watched. If necessary, the measures may then be suitably modified.

13-16. PECULIARITIES OF TRAFFIC

In this chapter, some of the essential features of traffic management have been discussed. It will be of interest to mention the special characteristics of traffic at the end of this chapter. Following are the important peculiarities of traffic:

(1) Along with the idea of motion, the traffic represents, two efforts — to get somewhere and to return again i.e., to attain a goal and to return to the point of starting. In this sense, the traffic flows between a point and a point of destination and it is thus said to have definite aim and purpose.

(2) From the consideration of direction, the traffic may be uptown, downtown, cross-town or around town.

(3) In terms of distance travelled, the traffic may be local or inter-urban.

(4) Just like the individuals whose minds drive it, the traffic is in more of a hurry in its approach to and convergence upon a common focus. On the contrary, the return is somewhat slower and accompanied by comparative leisure. In the former case, it is convergence of traffic while in the latter case, it is divergence and dispersal of traffic.

(5) The traffic is the strongest during certain days and during particular hours of the day.

(6) The traffic, like the tides, ebbs and flows. As traffic increases in volume, like water, it requires larger channels.

(7) The traffic may be thinly scattered or dense and it may be fast or slow and it may be light or heavy.

(8) The traffic tends to flow into direct wide roads and it tries to follow the lines of least resistance.

QUESTIONS 13

1. What are the main objects of traffic management?
2. What is the procedure adopted for a traffic survey? Discuss the information collected in such a survey.
3. What are the chief uses of traffic surveys?
4. What is traffic congestion? What are the causes responsible for developing traffic congestion?
5. Mention the disadvantages of traffic congestion and state the measures adopted to avoid traffic congestion.
6. What is traffic control? What are its objects and how is it achieved?
7. Write short notes on:
   (1) Traffic management
   (2) Methods of traffic control
   (3) Traffic islands
   (4) Grade separations
   (5) Road traffic problems
   (6) Traffic signals
   (7) Traffic counts
   (8) Traffic congestion
   (9) Weaving length
   (10) Design and location of road signs
   (11) Lighting at intersections
   (12) Lighting on curves.
8. What are the factors to be considered while making selection for a particular type of road junction? Mention the general principles to be observed in the design of road junctions.
9. Discuss the arrangements made at important road junctions.
10. What is a roundabout? State its advantages and disadvantages.
11. Give sketches of the following:
   (1) Traffic islands
   (2) Elliptical roundabout
   (3) Clover-leaf crossing
   (4) Diamond crossing
   (5) Tangent type roundabout
   (6) Turbine type roundabout
   (7) Rotary interchange
   (8) T-intersection
   (9) Y-intersection
   (10) Street lights.
12. What are the effects of improper parking on urban environment? Mention various methods adopted to grant parking facilities.
13. Write a critical note on traffic capacity of roads.
14. What are the causes of road accidents?
15. What are the advantages and disadvantages of traffic signals?
16. State the measures to be taken for the safety of pedestrians on roads.
17. Why are road signs necessary? Mention their several negative functions.
18. What are the limitations of road signs?
19. Discuss various types of road signs as per the provisions of the Indian Motor Vehicles Act and I.R.C. code.

20. What are the usual forms of road markings?
21. Why are street lights necessary? Mention the usual types of street lights.
22. Explain, with the help of neat sketches, various arrangements of the street lights.
23. Write a critical note on traffic problems of existing towns.
24. State the important peculiarities of traffic.
25. Differentiate between the following:
    (1) Traffic island and roundabout
    (2) Clover-leaf crossing and diamond crossing
    (3) Guiding road signs and regulatory road signs
    (4) Mandatory road signs and warning road signs
    (5) On-street parking and off-street parking
    (6) Hotel and motel
    (7) Parallel parking and angle parking.
26. Give reasons for the following:
    (1) There should be effective traffic controlling devices on the road.
    (2) There is no type of road junction which can be adopted for all traffic conditions.
    (3) There should be ample visibility at the road junction.
    (4) The wear and tear of vehicles using the roundabout are reduced.
    (5) The roundabouts are sometimes elevated.
    (6) The parking facilities for the vehicles to stand should be properly and adequately provided by the town planner.
    (7) It has been rightly said that the traffic control methods can be expressed by three E's i.e., Education, Enforcement and Engineering.
    (8) The presence of traffic police near automatic fixed time traffic signals is essential and necessary.
    (9) The streets of a town should be properly illuminated by the installation of street lights at suitable points.
    (10) Every effort should be made to improve the traffic conditions in an existing town.
    (11) The road congestion involves an economic loss also.
    (12) During traffic congestion, there is national wastage of petrol and gasoline used for running automobiles.
    (13) It is desirable to have a properly channelized road junction.
    (14) There is adverse effect of improper parking facilities on the urban environment.
    (15) The design and layout of road functions demand careful considerations from the view point of traffic management.
    (16) When traffic islands are provided, there is segregation of traffic into proper channels.
    (17) The height of street lamps or bulbs should be properly adjusted.
    (18) The vehicles parked parallel to kerb are generally preferred.

Chapter 14 MISCELLANEOUS TOPICS

GENERAL

In this chapter, the following important miscellaneous topics of the subject of town planning are briefly discussed:

14-1. Airports
14-2. Betterment and compensation
14-3. City blocks
14-4. Conurbations
14-5. Cul-de-sac streets
14-6. Focal points
14-7. Green belt
14-8. Land use planning
14-9. Neighbourhood planning
14-10. Protective strips
14-11. Public utility services
14-12. Radburn layout
14-13. Rapid transit.

14-1. AIRPORTS

(1) Introduction: An *airport* is an *aerodrome* at which facilities are provided for receiving or discharging passengers and goods by aircraft and in addition, it contains shelters for public and facilities for the repairs and parking of aircraft. Every large town requires an airport and hence, the town plan should also include the provision of an airport for the town.

(2) Location of an airport: The airports must inevitably be located on the outskirts of a town or a city where sufficient open space can be found for the landing field and where there are no neighbouring structures which would interfere with the landing or taking off the aircraft.

As a matter of fact, the formation of suitable zoning laws is an essential part of an airport master plan and they are to be implemented as soon as the final selection of the airport site is made. The zoning is considered to be the most effective vehicle for achieving excellent results from the functioning of the airport.

Following are the factors which are to be considered while selecting the site for an airport for a town:

(i) ***Accessibility:*** An airport should be located as close as possible to the central areas of town and there should be reasonably economical and quick road transport to the city centres.

(ii) ***Adjacent airports:*** There should be sufficient distance between adjacent airports so as to avoid the conflict between flying operations.

(iii) ***Area:*** The surrounding area should be ample for future development of the airport. The field of aviation is expanding day-by-day. It is therefore necessary to acquire land in advance or to be able to acquire sufficient real estate in the future for expanding the airport.

(iv) ***Availability of materials:*** The materials required for the construction of an airport should be easily available near the site.

(v) ***Availability of public utility services:*** At the site for an airport, the public utility services, especially water supply, electric power and telephone, should be easily available.

(vi) ***Cost:*** The land should be cheap. If alternative sites are available and equally well-suited, the site which is more economical to construct should be given preference.

(vii) ***Densely-populated areas:*** There will be considerable noise of aircraft at the time of landing and taking off. The site should therefore be so selected that there is the least disturbance to the population of the surrounding areas.

(viii) ***Nature of soil:*** The soil should be reasonably porous and its bearing capacity under wet weather conditions should be good. The airport with favourable soil characteristics is desirable because it reduces the cost of grading and drainage to a considerable extent. The area should as far as possible be self-drained.

(ix) ***Nature of winds:*** The site possessing unfavourable wind conditions with respect to aircraft working should, as far as possible, be avoided.

(x) ***Obstructions:*** The site should be free from natural or artificial obstructions. It is necessary to control heights of structures around the site for an airport. The obstructions may either be natural like trees, sloping ground, etc. or man-made like building, grid towers, etc. The removal of the obstructions surrounding the airport site is absolutely necessary to grant safety to the aircraft activities relating to losing or gaining altitude gradually.

(xi) ***Submergence due to floods:*** The site for an airport should be located at a high level and it should not be submerged at the time of heavy rain or flood.

(xii) ***Topography:*** The site should have gentle slopes so as to ensure good surface drainage.

(xiii) ***Water table position:*** If water table is located very near to the ground, the bearing capacity of the soil may be reduced and costly arrangements will have to be made to bring it down. Hence, it is not desirable to select sites having high water table.

(xiv) ***Weather conditions:*** The sites having poor visibility due to fog, smoke and low clouds should not be selected for an airport.

(3) Size of an airport: The size of an airport is governed by types of aeroplanes, the volume of traffic to be accommodated and the probable crowds likely to attend the airport. The length of runway required for light aeroplanes is about 120 m to 240 m and that for heavy aeroplanes varies from 300 m to 600 m. Generally, a length of about 600 m is considered to accommodate all types of aeroplanes. But in some cases, the length of runway required may be more than 1000 m or so.

The sizes of existing airports vary from 10 hectares to 400 hectares. For unfavourable weather conditions, an exhaustive analysis of meteorological data should be carried out and the length of runway should be decided by experts in the field of aeronautics. The area required for parking of aeroplanes is about 2 hectares for 100 aeroplanes.

(4) Noise control at airports: It is found that considerable noise is generated by aircraft operations of landing, take off and taxiing. It causes disturbance in the area surrounding the airport and hence, measures should be taken to control the noise within permissible limits. The site of airport should be located far away from the habitated area and if possible, quieter jet engines should be developed by necessary research. It may be noted that the manufacturers of the aircraft are well aware of this problem and all efforts are made to reduce the noise to a minimum level consistent with the operating economics and safety of the aircraft.

(5) Parts and facilities required of an airport: The facilities required at a major airport can broadly be divided into two categories, namely:

(i) Facilities required for aircraft

(ii) Facilities required for public.

(i) ***Facilities required for aircraft:*** Following are the facilities which are usually to be provided for the aircraft:

(a) buildings for the airport management and pilots;

(b) control tower and telecommunication sites;

(c) hangars to provide an enclosure for housing and repairing of the aircraft;

(d) space for radio equipment, ambulance, weather bureau and fire-fighting equipment;

(e) storage of fuel for the aircraft;

(f) store for aerodrome maintenance equipment; etc.

(ii) ***Facilities required for public:*** In general, it may be stated that all the services one would expect to find in a big city are concentrated into the airport terminal and they can be enumerated as follows:

(a) banks with foreign exchange desks and sometimes open for 24 hours;

(b) bath or shower where the tired passengers can clean up and get refreshed;

(c) bookshops and newspaper sales booths holding a wide range of reading matter including magazines, books and papers in various languages;

(d) cloak rooms and sometimes lockers for depositing cumbersome baggage that will not be needed for a few hours;

(e) general information desks and tourist offices for giving guidance to the passengers;

(f) medical shop selling toiletries, perfume, sunglasses, make-up and pharmaceutical goods including air sickness tablets;

(g) medical unit and first aid centre where the passengers can go for treatment with everything from heart attacks to premature births;

(h) post office where letters can be dispatched, telephone calls made and cables or telexes sent;

(i) restaurant and snack bar facilities for the people finding themselves in a strange place with time on their hands for feeding;

(j) rest rooms where the passengers can relax and sleep for a few hours before departure of the aircraft;

(k) sauna and massage parlours as well as beauty salons and hairdressers;

(l) space for customs, immigration, duty-free shops, health services and inspection of passengers, crew, baggage, aircraft, etc. for the airports with international operations;

(m) space for nursing mothers where they can wash and change their babies and feed them in privacy and at some places with a nurse on duty to assist in case if any problem arises;

(n) stall keeping a selection of items including stationery, small gifts and games and toys for the children;

(o) toilets on every floor with the facilities for the disabled; etc.

From the above list of the facilities, it can easily be concluded that there is very little that cannot be bought or acquired within a nicely designed airport.

14-2. BETTERMENT AND COMPENSATION

When a town planning scheme for an existing town is framed, some owners of the property will be injuriously affected and as such, they will have to be paid some amount as compensation. In the same way, some owners of the property will be benefited by the proposed town planning scheme. The share of increase in values of the properties of such owners to be paid to the planning authority is known as the *betterment*. The share is fixed as percentage, usually 50 per cent, of the assessed increase in value of the property affected.

If the same owner has a claim for compensation in one respect and betterment in other respect of the scheme, the betterment is offset or partly offset against the claim of compensation.

The procedure for arriving at the figure of betterment is as follows:

(1) The value of the property before the notification of the town planning scheme is worked out.

(2) The value of the property on the completion of the town planning scheme is estimated.

(3) The difference between the two indicates the unearned increase in value of the property due to the proposed town planning scheme.

(4) The owner and the planning authority share this unearned profit. In other words, the owner has to surrender 50 per cent of increase in value of his property to the planning authority in the form of betterment.

It has been found in practice that it takes a lot of time and many legal formalities are to be observed before finalizing the town planning schemes. The main difficulties are:

(1) It is very difficult to ascertain with accuracy the area improved in value by the provision of a certain work or provision in the planning scheme.

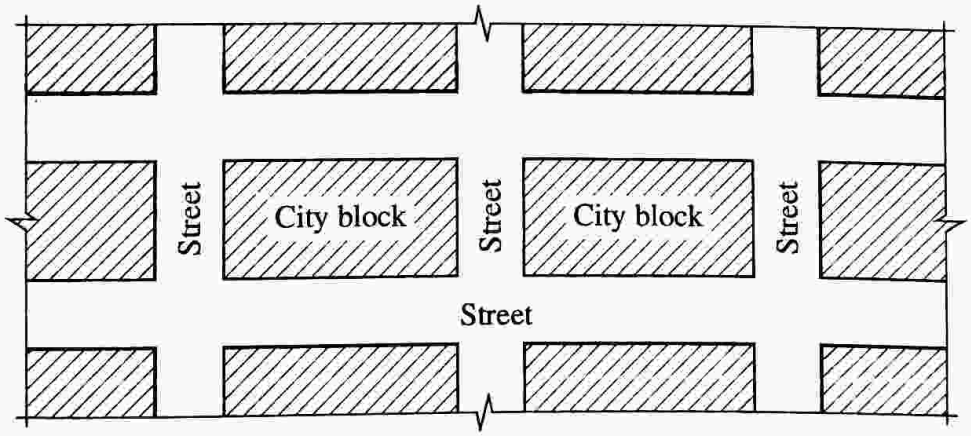
(2) It is very difficult to prove that the increase in values of the properties are only due to the town planning scheme and not due to other factors such as overall development of the area, transport facilities, etc.

(3) The fact that in case of betterment proceedings, the owner has to make payment, induces him to make all the efforts to bring down betterment to the minimum possible extent.

It is thus seen that the owners of lands which are acquired for non-profit-making uses under the town plan, are to be compensated and owners of lands which are benefited by town plan are to be taxed. Thus, the compensation is payable and betterment is collected. In the strict economic sense, the town planning merely redistributes land values and does not alter them overall. Hence, in theory, the compensation and betterment should balance each other. In practice, such is not the case and the public expenditure on a town planning scheme is usually governed by the difference of betterment to be collected and compensation to be paid.

14-3. CITY BLOCKS

The central parts of a large town are usually in the form of blocks and they are occupied by public buildings, theatres, offices, hotels, stores, etc. Such blocks are known as the *city blocks*. If the site is flat, a rectangular layout of streets is preferred as shown in fig. 14-1. If the topography is irregular, suitable adjustments are to be made in the layout of city blocks.



City blocks
FIG. 14-1

The size and shape of the city blocks will depend on the street pattern adopted. The city blocks should be small so as to provide ample light and air on all sides and also give plenty of space for access by motor vehicles and for parking.

In general, half the total land area in a business district should be in public ownership i.e., for streets, public parking areas, etc. Of the other half which may be left in private ownership, at least one-fifth should provide for the open spaces or gardens. It is found that the city blocks of convenient size, including streets, will occupy about 2 to 3 hectares.

14-4. CONURBATIONS

The word *conurbation* is derived from the latin word *conurbs*, *con* means together and *urbs* means city. Hence, the linking up of urban areas is known as the *conurbation* or *urban agglomeration*. The term conurbation was coined by Patrick Geddes, the Scottish biologist who was a pioneer in city planning and in the modern times, it indicates development around the metropolis or chief centre of the locality. Thus, the conurbation indicates metropolitan area.

The growth of towns in the form of suburbs requires to be properly planned. The uncontrolled growth of urban areas leads to conurbations. It is for this reason that a garden city is to be surrounded by a green belt. The provision of a green belt prohibits conurbation.

The certain industries prefer to remain in or near towns because of availability of various facilities such as power, water, communication, etc. The unchecked growth of such conurbations or metropolitan areas should not be encouraged because of the following reasons:

(1) Employment: The concentration of industry in such conurbation will lead to employment of workers at the expense of unemployment in other places.

(2) Living standard: Such conurbations are rarely planned units and as such, the living standard of the inhabitants is very poor. The employees live in insanitary high density developments simply because their work-places are nearby. As such, there is absence of social life and amenities.

(3) Public amenities: The local authority concerned will be faced with serious difficulties in respect of providing suitable amenities to the industries located in conurbations.

The term *metropolis* has a different meaning historically. It is derived from Greek words, meaning mother city. However, in modern times, it is a common term in many languages indicating the name of a major city centre and its environs. The modern metropolis differs from the traditional city in the following ways:

(i) Formerly the people used to stay in the country. Then came the city which became the seat of the political, religious, commercial and cultural leaders of the society. The modern metropolis has become more important and complex than even before. It has provided to be the most important seat of material production and the majority of its population is engaged in manufacturing commodities for the nation and world. Thus, the modern metropolis combines two important functions, namely, leadership and production, which were previously divided between city and country respectively.

(ii) It attracts the consumers because it affords a wide freedom of choice. The necessities of life can be effectively satisfied by the various agencies

of the metropolis such as large department stores, well-equipped institutions for medical care, art galleries, opera houses, sport stadiums, special schools, theatres, etc.

(iii) It gives easy access to a variety of goods and services on which any business enterprise depends. Thus, a metropolis accommodates large inventories, transportation facilities and specialized services.

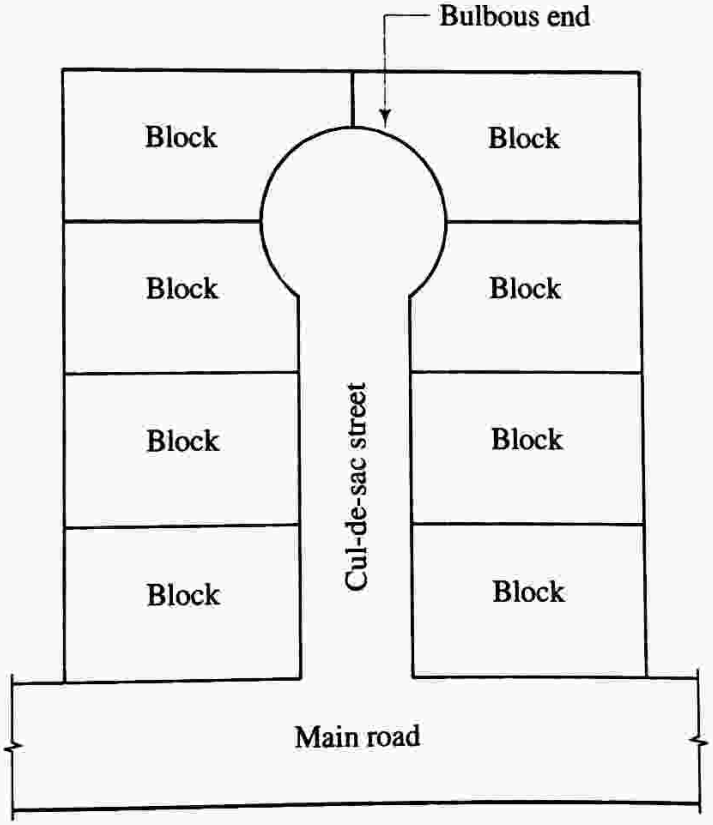
(iv) It grants opportunity to people without changing their homes. The workers have choice of employees and similarly, the employers can find workers of a wide variety of skills including professional and managerial.

(v) It is neither city nor country in the sense that sufficient open space is allotted for parks and playgrounds and for other recreational purposes.

(vi) Its size has increased enormously because of the modern fast transportation system. Its residential and work areas need not be combined in one place. But they can be located in separate distinct districts.

14-5. CUL-DE-SAC STREETS

A comparatively narrow street or approach road with a dead-end is known as the *cul-de-sac street* as shown in fig. 14-2. At one end, it is connected with the main road and at the other end, it is provided with a bulbous end or some such arrangement so that vehicles may take a turn to return to the main road.



Cul-de-sac street
FIG. 14-2

The cul-de-sac streets are best suited for flat or nearly level sites. They are unsuitable for hilly sites. For the purpose of convenience, it is desirable to limit the length of cul-de-sac streets to about 60 m to 100 m with minimum width of about 6 m.

Following are the advantages of the cul-de-sac streets:

(1) It affords reasonable privacy to the homes.

(2) It facilitates in the preparation of layout consisting of suitable blocks of an irregularly shaped plot of land.

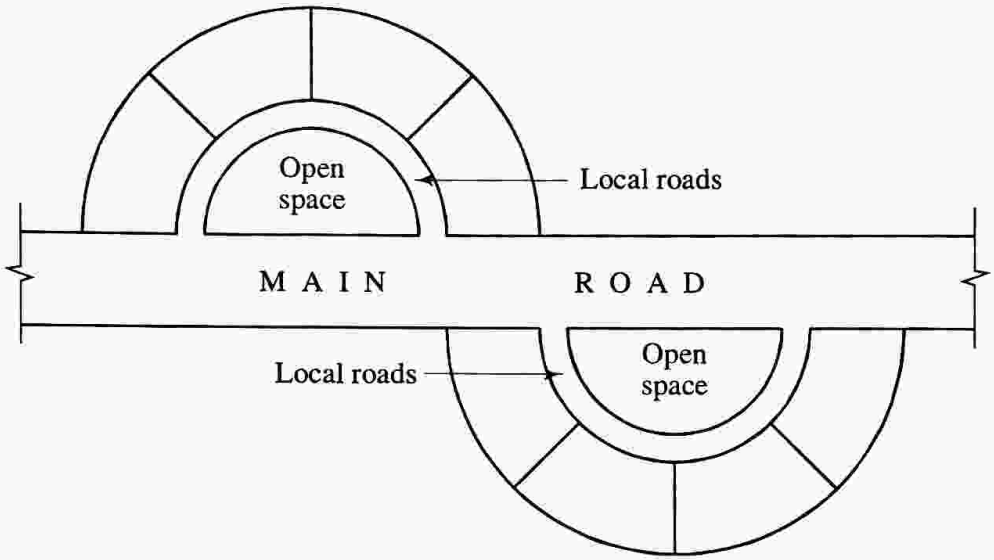
(3) It is economical in the pavement construction.

(4) It provides quiet and healthy sites for the homes.

(5) It reduces the dust nuisance and road accidents to a minimum.

(6) It reduces to a considerable extent the noise and danger from traffic to a minimum.

An improved variety of the cul-de-sac street may take the form of a shoe-string development as shown in fig. 14-3.



Shoe-string development
FIG. 14-3

The houses are arranged around a local road encircling a park with important features as follows:

(1) The houses are arranged in groups in the shape of shoe around a local road.

(2) The local road forms the string.

(3) Each group is placed on the left and right side of the local road facing the park forming the shape of letter 'S'.

(4) Every house has approach from the local road only encircling the park or open space. There is no direct approach for any house from the main road.

(5) The open space can be utilized for park, playground, etc.

The shoe-string development grants the following advantages:

(1) It avoids the traffic accidents.

(2) It is absolutely free from dust and noise.

(3) It provides better social living.

(4) It provides calm, quiet and peaceful atmosphere.

14-6. FOCAL POINTS

The activities of a town are generally grouped around certain points of special interest. Such points are known as the *focal points* and they include markets, shopping centres, theatres, public buildings, railway stations, etc.

The focal points attract and distribute traffic. The size, shape and location of the focal points in the town planning schemes should be carefully decided especially with respect to reception and distribution of traffic.

The street systems of the town should be designed in such a way that there is no traffic congestion around focal points and the needs of traffic near the focal points are efficiently and smoothly fulfilled.

In a broad sense, the town itself may form a nucleus in the development plan of region or nation as a whole and accordingly, it should be connected by means of national highways with other parts of the nation.

14-7. GREEN BELT

An open strip of land provided on the periphery of a town for the special purpose of limiting the growth of a town is known as the *green belt*. The lands contained in the green belt are to be used for carrying out the agricultural activities and the construction of buildings in green belt is strictly prohibited. If however the necessity arises, the construction work may be carried out over the lands in green belt with the special permission of the authorities concerned. The term *farm belt* is also used for the green belt when it is mostly used for the purpose of farming.

The green belt is provided for the following purposes:

(1) It can be developed as parks and playgrounds.

(2) It can be developed as picnic spots and recreation grounds. It thus helps in preventing the slum formations.

(3) It can be developed as poultry farm or nursery.

(4) It defines the size of city or town and in this respect, it assists in suitably designing the various public amenities for the city or town.

(5) It is to be used only for agricultural purposes and hence, fruits and vegetables required for the town can be grown in green belt area.

(6) It prevents the spreading of town and conurbation is thus prevented by the provision of a green belt around the town.

14-8. LAND USE PLANNING

Definition: *Land use planning* is planning of a region or a town according to the use of land. It is a very important tool for making development plan or master plan.

Land use plan shows residential zones, industrial zones, public zones, open and green spaces, water bodies, roads, railway, etc. Every town has existing land use plan also helps to understand present situation. Overall economical, transport activity can be analysed from the existing land use plan and overall life pattern of the people residing in that region can be understood.

Following are the considerations taken into account while preparing a land use plan:

(1) Area allocation: Area allocation for residential, commercial and industrial areas are decided depending on the city and its activities.

(2) Central Business District (CBD): Location of central business district is decided and if it is to be shifted from the existing place, its implications are considered.

(3) Demography: Population and demography index are important factors while deciding about residential, commercial and industrial areas.

(4) Land market: Land prices are determined from a land use plan. Land use plan can be a measure to control land prices and also a reason to increase land prices.

(5) Location: Location for industry, commercial and residential areas are considered while making a land use plan.

(6) Natural elements or resources: Location of natural resources like river, sea, hills, lakes, etc. are considered. Also mines, chemicals and other resources are identified before preparing a land use plan.

(7) Topography: Topography of the region i.e., hills, slopes, etc. are considered.

14-9. NEIGHBOURHOOD PLANNING

(1) General: The concept of *neighbourhood planning* is fundamentally an American idea and it is based on the simple principle that one is planning for society and not for an aggregate of houses. It is the general tendency of all the human beings to be friendly with neighbours and to share their interests. In case of big towns, it sometimes becomes difficult to develop a sense of neighbourliness, mainly for the following two reasons:

(i) The neighbours are not dependent on one another's company and aid because city life gives a wide field of acquaintance and entertainment.

(ii) The neighbours may not have common modes and habits of living.

The neighbourhood planning is an attempt to form various physical units of residential areas in which people belonging to a particular rank of life settle or stay. It is the intention of a town planner to rejuvenate the valuable idea of neighbourhood which has been lost in busy uncontrolled city life.

The neighbourhood principle can be applied for new residential estates or re-planning of existing areas.

(2) Principles of planning: Following are the principles of planning a neighbourhood unit:

(i) ***Facilities:*** The internal planning within a neighbourhood unit should provide for an orderly arrangement of all those facilities which are to be shared in common by the residents. The grouping of facilities should be done while keeping in view the convenience of the residents. The facilities may include school, temple, club, sport centre, etc. The location of such facilities should form a nucleus for the development of the local social life of the neighbourhood unit.

(ii) ***Population:*** There is no standard fixed for the density of population for a neighbourhood unit. The population of four to five thousand persons is considered to be suitable to support its own primary school and other facilities required for community life.

(iii) ***Sector:*** It becomes necessary to combine the adjacent neighbouring units to form, what is called, a *sector*. Such a combination makes it possible to afford facilities which a neighbourhood unit cannot support such as secondary school, big markets, entertainment centres, etc. It is found that population equivalent to that of three neighbourhood units i.e., twelve to fifteen thousand persons is suitable for a sector.

(iv) ***Size:*** The neighbourhood unit should be capable of accommodating the population for which one primary school is required. The actual size of a neighbourhood unit, however, will be determined from the spacing of houses. For re-planning of existing town, a minimum area of 5 hectares is considered to be necessary for the formation of a neighbourhood unit.

(v) ***Street system:*** The layout of streets in a neighbourhood unit should ensure safety from traffic accidents to school-going children and the population as a whole. The neighbourhood unit should be bounded on all sides by main streets wide enough to encourage the passing of vehicles around rather than through the unit.

(3) Importance: The neighbourhood planning can make a valuable contribution towards the creation of a community spirit and a properly balanced population structure.

The neighbourhood plan aims at welding various elements of social and cultural life of a community in a proper order.

It should, however, be remembered that mere neighbourhood planning will not ensure the development of community with common interests. The real purpose of neighbourhood planning will only be achieved by sincere efforts and spontaneous movements on the part of members of neighbourhood unit.

(4) Features of neighbourhood unit: The essential features of a neighbourhood unit can be listed as mentioned below:

(i) It is desirable to devote a minimum area of about ten per cent or so for parks and playgrounds.

(ii) The boundary of the unit need not be fixed by arterial roads. It may even take the form of physical barriers such as a large park, a railway station, a river, an industrial area, a hill, etc.

(iii) The exact shape of the unit is not necessary. But it is preferable to have all sides fairly equidistant from the centre of unit.

(iv) The planning of residential units of the neighbourhood unit should be carefully done with respect to the habits of residents, direction of winds, sanitation, etc.

(v) The provision of shopping centre should be at the periphery of unit and near traffic junctions.

(vi) The widths of interior streets of the unit should be just sufficient to serve a specific purpose and these streets should give easy access to the shops and community centres.

14-10. PROTECTIVE STRIPS

The strips of land provided between freeways and streets of neighbourhood units are known as the *protective strips* and their widths may vary from 30 m to 300 m. They are meant for the following purposes:

(1) They can be converted into park strips by suitably developing them as parks between freeways and neighbourhood units.

(2) They help in future expansion programmes such as road widening, grade separations, etc.

(3) They protect the neighbourhood units from the nuisance resulting from through traffic.

(4) They provide a quiet environment for the neighbourhood unit.

(5) They provide excellent sites for volley ball grounds, badminton courts, horse-back riding, cycle paths, etc.

(6) The picnic spots can be also suitably accommodated in these strips.

14-11. PUBLIC UTILITY SERVICES

In relation to town planning, the various public utility services required may be enumerated as follows:

(1) cemeteries;
(2) educational institutions;
(3) electricity;
(4) fire-stations;
(5) gas;
(6) hospitals and health centres;
(7) local industrial units;
(8) markets and shopping centres;
(9) parks and playgrounds;
(10) public buildings;
(11) public transport in the form of roads and streets;
(12) refuse disposal;
(13) sewerage;
(14) stores;
(15) stormwater drainage;
(16) street lighting;
(17) telephones;
(18) water supply; etc.

It should be remembered that public utility services are the components of the physical structure of a town and extreme care is to be exercised by the town planner to locate them at suitable places in the master plan of the town. If the public utility services are properly designed and located, the town as such achieves the maximum efficiency of performance. On the other hand, the unplanned installation of public utility services may prove to be a constant burden on the community.

14-12. RADBURN LAYOUT

Clarence Stein and Henry Wright, two American architects and planners, were greatly influenced by the concept of garden city of Ebenezer Howard. They prepared the town plan in 1928 for Radburn, New Jersey, about 25 km from New York, U.S.A. The land required for development was purchased by the New York City Housing Corporation and the plan aimed to accommodate about 25000 persons. The idea of architects in the preparation of layout at Radburn was not to construct a new town or a garden city, but to develop a new form of design for community housing to suit the requirements of the age of automobiles. The Radburn layout is a sort of garden suburb laid out on neighbourhood principle.

Following are the main elements of the Radburn layout:

(1) A community park running through the centre of superblock is provided instead of one big park at some distance which may not be used at all.

(2) All houses are oriented to face the gardens and park strips. The roads and back of the houses are usually not kept clean. If the houses are turned inside out, the working areas like store, kitchen, bath, etc. will face the front roads whereas the living areas like drawing room, bed rooms, dining room, etc. will be on the rear side of the roads. This is also referred to as the *Radburn idea* and it has earned the name of the *town for the motor age*.

(3) The footpath for pedestrians and vehicular traffic are completely separated to grant safety to the movement of the pedestrians.

(4) The service lanes or cul-de-sac streets are designed and built for one use instead of for all uses.

(5) The superblocks are enclosed by main roads from which a succession of narrow lanes or cul-de-sac streets lead to and accommodate a succession of groups of houses with garages attached.

(6) The town is divided into large blocks known as *superblocks* instead of the usual narrow subdivision pattern between streets.

(7) The town is so planned that children will not be run over on their way to school as there are subways or passages tunnelled under the streets from block to block.

The development of Radburn was however not completed as planned. But the residential sector which has been built adequately demonstrates the advantages of the Radburn layout.

14-13. RAPID TRANSIT SYSTEM

As the transport facilities have developed, the size of urban communities has also increased and it is difficult which is the cause and which is the effect. The *rapid transit system* is meant for relieving the traffic congestion and it generally includes the elevated and underground railways. Such a system is meant to meet the needs for higher speeds and greater capacities. Some of the leading cities of the world have adopted various and novel means for rapid transit.

The rapid transit handles mass transportation and it has thus led to the formation of suburbs whose radius of influence has extended to distances of 30 km to 50 km or more from the metropolitan centres.

The problem of rapid transit is the rush hour load especially during morning and evening. The rush hour traffic load may be four to six times than the average hourly load of the day. The only solution to tackle this problem seems to be planning the city in such a way that the rush hour traffic is distributed in a number of directions instead of only in one direction.

The term *passenger flow* is used to indicate the number of passengers that may be taken during a given time at a given point on a route. The multiplication of the number of transportation units passing a point during one hour with the capacity of each transportation unit gives the hourly passenger flow. The metropolitan traffic system should be such that it grants an hourly passenger carrying capacity to the best possible extent. The higher hourly passenger flow will be achieved by reducing the interval required by transporting units to follow one another. This minimum interval depends on the considerations of:

(i) safety intervals in case of railways; and

(ii) traffic congestion in case of road vehicles.

The rapid transit system operates on pay as-you-ride system and the person who benefits from a service pays for it. However, there are some who believe that it is desirable to provide free transportation to all as in the case of providing free facility in lift or elevator of any multi-storeyed office or apartment building. The collecting, checking and book-keeping of fares adds to the operating costs of the transit system and hence, it is advocated that if fares are abolished, the following benefits are obtained:

(1) Maintenance of roads: The density of traffic is reduced and hence, it results in reduction in expenditure on road maintenance, parking facilities and various other allied items.

(2) Reduction in traffic congestion: Some percentage of the passengers who otherwise would have gone by private cars also enters the public transport system and thereby the traffic load on the street is decreased. It results in smoothening the problem of traffic congestion.

(3) Reduction of running time: The passengers can enter the vehicle from more than one doors and hence, the running time is considerably reduced. The faster rides would also attract more passengers.

The idea of free transportation does not seem to be applicable in practice. But in big cities and metropolitan areas, substantial relief is given to the regular users of convenient and popular rapid transit system in that locality by the concerned authorities. The daily users are issued pass or consolidated ticket for a week or a fortnight or a month on payment of a concessional amount and thus, they are relieved from the trouble of purchasing the ticket everyday at regular price.

QUESTIONS 14

1. What is an airport? What are the factors to be considered while making selection for its site?
2. Enumerate various facilities required at a major airport.
3. What is a betterment? How is it calculated?
4. Mention the difficulties encountered in practice while deciding the figure for betterment.

5. What are city blocks?
6. What is conurbation? Why is it necessary to discourage the unchecked growth of such conurbations?
7. Mention the ways in which the modern metropolis differ from the traditional city.
8. What is a cul-del-sac street? Mention its advantages.
9. What is a shoe-string development? Mention its advantages.
10. Write short notes on:
    (1) Size of an airport
    (2) Betterment
    (3) Cul-de-sac street
    (4) Focal points
    (5) Green belt
    (6) Protective strips
    (7) Rapid transit.
11. Why is green belt provided?
12. What is meant by the term neighbourhood planning? What is its importance?
13. State the principles of planning a neighbourhood unit.
14. What are the essential features of a neighbourhood unit?
15. What are the purposes of providing protective strips?
16. Enumerate various public utility services.
17. Write a critical note on Radburn layout.
18. What are the benefits of free transportation?
19. Differentiate between the following:
    (1) Betterment and compensation
    (2) Conurbation and green belt
    (3) Green belt and farm belt
    (4) Neighbourhood unit and sector
    (5) Metropolis and city.
20. Give reasons for the following:
    (1) The site for an airport should be away from densely-populated areas.
    (2) It will not be desirable to select the sites having high water table for an airport.
    (3) It is difficult to fix betterment fees or charges.
    (4) The city blocks should be small.
    (5) A garden city is surrounded by a green belt.
    (6) The certain industries prefer to remain in or near towns.
    (7) In case of big towns, it sometimes becomes difficult to develop a sense of neighbourliness.
    (8) It becomes necessary to combine the adjacent neighbouring units to form a sector.

(9) The unchecked growth of conurbation should not be encouraged.

(10) It is desirable to provide green belt on the periphery of a town.

(11) The provision of protective strips near neighbourhood units is desirable.

(12) Extreme care is to be exercised by the town planner to locate the public utility services in the master plan of the town.

(13) In the strict economic sense, betterment and compensation should balance each other.

(14) The modern metropolis combines leadership and production.

(15) The modern metropolis attracts the customers.

(16) A metropolis grants opportunity to people without changing their homes.

(17) A metropolis is neither city nor country.

(18) The size of a metropolis has increased enormously.

(19) The cul-de-sac streets are provided with a bulbous end or some such arrangement.

(20) The rapid transit system has led to the formation of suburbs around the metropolitan centres.

(21) It is advocated by some people that it is desirable to provide free transportation to all.

(22) The airport with favourable soil characteristics is desirable.

(23) The removal of the obstructions surrounding the airport site is absolutely necessary.

(24) The formation of suitable zoning laws is essential part of an airport master plan.

(25) The modern metropolis attracts the consumers.

Appendix 1

CHANDIGARH

The partition of India took place in 1947 and Punjab was divided into two parts. One part with the ancient capital Lahore went to Pakistan and it became necessary to provide a capital for the other part of Punjab which has been left in Indian territory. The decision to construct a new capital for State of Punjab at Chandigarh was taken by the Government in 1948. It has been named Chandigarh after the famous temple of Goddess Chandi. The formal opening of Chandigarh was done by the then President of India, Late Shri Babu Rajendra Prasad on 7th October 1953.

Chandigarh is situated at a distance of about 100 km from Delhi on Delhi-Simla road. It is situated at a height of about 366 m from sea level. With the background of the Siwalik Hills of the Himalayas, the ground has a gentle southern slope. The soil is fertile and it is exceptionally good for tree-growth.

In 1950, when the first phase was developed, a total of about 3035 hectares of land was acquired for sectors 1 to 30, there being no sector bearing no. 13. The second phase of Chandigarh was developed in 1960 land acquiring about 2023 hectares for sectors 31 to 47. For the third and last phase of development in 1991, the additional land of about 625 hectares was acquired for sectors 48 to 56. The last phase of development is for the co-operative housing societies which are divided into three categories, namely, low (LIG), middle (MIG) and high (HIG) income group.

The State of Punjab was reorganized by The Punjab Reorganization Act, 1966 which came into force from November 1, 1966. As a result of this Act, Chandigarh not only became a seat of the Union Territory, but also the capital of the States of Punjab and Haryana.

Thus, the tenth Union Territory of Chandigarh was added to the First Schedule of the Constitution and separate representation was provided for Chandigarh in Lok Sabha.

As per the provisions of the Article 239 of the Constitution of India, the administration of Chandigarh is the direct responsibility of the President of India and for this purpose, the administrator, known as the *Chief Commissioner of Chandigarh*, is appointed by the President of India together with subordinate staff of various categories. The provisions of Articles 239A and 240 of the Constitution of India are not made applicable to Chandigarh and hence, there is no legislature for Chandigarh and Parliament is directly responsible for enacting the laws for Chandigarh.

The status of Chandigarh as a Union Territory was thought of as temporary measure till a lasting solution was found out for the future of Chandigarh. But

the matter, as it stands today, is not finally decided by the States of Punjab and Haryana and Chandigarh still continues to be a Union Territory.

The master plan for the new town was prepared by the celebrated architect, Le Corbusier assisted by Maxwell Fry and Jane Drew of England. The master plan aimed to accommodate about 150000 persons with future expansion upto about 700000 persons.

Chandigarh is planned on the principle of precincts or superblocks and they are termed as *sectors*. Each sector measures about 1.21 km in length and 0.81 km in width. The rectangular sectors are framed with the layout of a grid of main roads. Le Corbusier himself designed the four main Government buildings, known collectively as Capitol, situated at the northern end of the town. The buildings are the Assembly Hall, the Secretariat, the High Court and the Governor's Palace. The southern sector is reserved for the industrial development.

The central sector contains the city's civic and commercial buildings. The cultural centre with the university in a park is situated in the north-west side. Thus, the city plan contains clear and well-defined centres.

Some of the salient features of Chandigarh with respect to the principles of town planning can be summarized as shown below:

(1) Each sector is bisected on its long axis by a strip of continuous open space or green strip for recreation and on its short axis by a street called the Bazaar street containing local shops, markets and entertainment buildings. The cycle tracks and footpaths are accommodated in green strip and thus they are segregated from the main thoroughfares. On the other hand, schools, health centres, etc. are located in the interior of each sector so that children and others need not cross the main roads for their normal daily requirements.

(2) It is so designed that none of the properties in the township have direct frontal access to the main road. This type of planning has proved to be the most effective in maintaining a high level of service on the main roads.

(3) The construction of a dam on the river Sukhna-Choe on the northern boundary of town has provided an opportunity for the formation of a lovely park.

(4) Great emphasis has been laid on tree planting.

(5) The main avenue leading to the Capital is 90 m wide and it provides an excellent parkway.

(6) The principle of superblock adopted in its layout helps in the segregation of vehicular and pedestrian traffic. The general plan of the city provides for complete segregation of automotive and pedestrian traffic.

(7) There is ample provision of public utility services such as water supply, drainage, electricity, telephone, etc.

(8) The residential sectors are laid out as neighbourhoods and special care has been taken to design the houses to suit the local climatic conditions.

(9) The residential zone is segregated by a wide green belt from the industrial zone. The locations of both the zones are such that wind from the

industrial zone will not blow towards the residential zone. However, the industrial zone occupies a small area and the city as such is designed mainly as the administrative cultural centre.

(10) Le Corbusier got the idea of the design of Chandigarh from the human body. The Government buildings form the head; the business area or commercial centre is the heart; the university area and museum are the brain; the industrial areas are the hands; the leisure valley and parks are the lungs; and the roads are the arteries.

LE CORBUSIER (1887-1965)

It will be interesting to know in brief about the great Swiss-born French architect whose ideas have greatly influenced the modern town planning. He came from a poor family and worked as a mason in his early days. His work as an architect and town planner is of very high order. He worked with passion, vigour and zest throughout his career of over 50 years of architecture. His long association and practice on the international scene has left a strong mark of association which will not fade but continue to direct the future generation.

Corbusier is no longer a man but a principle which is to be appreciated. He wanted man to live in urban life in truth with security and ease, collectively and individually. He was a big man both in size and in spirit. His awareness for urban design and environment in the town planning problem are very significant.

The meaning and idea of visual order and relationship and the city as a synthesis of form embracing varieties of structures and systems is the theme repeatedly proclaimed by him. In every field of urban planning and architecture, he offered basic answers and has renewed his messages by over-fresh surprising creations. He has created a new set of values deep enough to enrich generations to come.

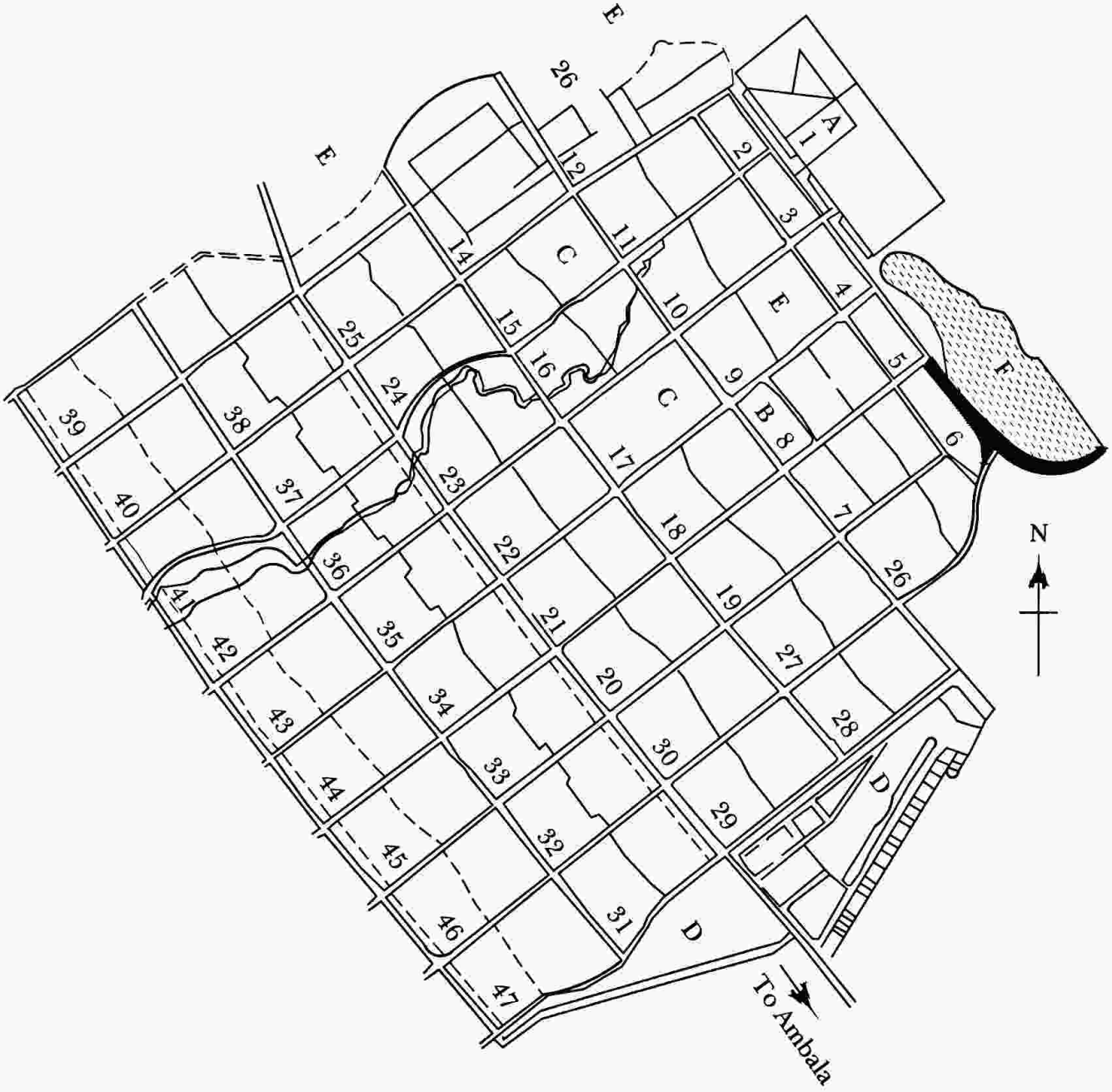
Corbusier was sympathetic, kind, emotional and helpful. His physical requirements for living were very plain and modest. For many years, he dined in Paris in a tiny restaurant and drove around in a ramshackle little green car called by him as his frog. His office in Paris too was in the ruins of a monastery. His private workroom in his studio was only a minimum cubby-hole or room where he could reach each wall by hand from his seat.

Corbusier lived an austere life and admired the simple style of living in India. He loved the useful Indian things like lotah and charpoy. When he first visited an Indian village and a charpoy was brought out for him to sit, he hesitated to sit on someone else's bed. He however soon realised that the charpoy was more than a bed. It had a multi-purpose function. It was used in any season and was light in weight for shifting easily from one place to the other.

The planning of Chandigarh is the great contribution of Corbusier to India. Some observers blame and criticise it on cost and functions. But the good it has done to the profession and thinking processes of people will not be equalled by any known physical value.

To the critics, Corbusier once said, "I am an ass but one who has an eye, the eye of an ass having the capacities for sensation. I am an ass having an instinct for proportions. I am and I remain an impenitent advocate of the visual".

Corbusier found him to be the loneliest man after the death of his wife Yvonne in 1957. A great prophet and saint went into eternity on 27-8-1965 while swimming in the Mediterranean with the blue below and blue above. Like all rishis, he found a watery grave.



1 ..... 47 - Sectors of city
Sector : 01 - Reserved for Government houses
Sector : 13 - Omitted

A - Government office
B - Town centre
C - Local shops
D - Industrial area
E - Greet belt
F - Lake

Plan of Chandighar
FIG. A-1

Appendix 2

GANDHINAGAR

With the bifurcation of bilingual Bombay State, a new State of Gujarat came into existence on 1st May 1960. The necessity of a new capital town for the newly formed Gujarat State was soon felt and ultimately, a site measuring about 5738 hectares was selected for the new capital town which has been named as *Gandhinagar* after the Father of the Nation, Mahatma Gandhiji. The master plan of Gandhinagar was finalized and approved in 1966 and its construction was started in 1967. It became the seat of Gujarat Government in June 1970. However, the parade and celebrations of 1993 Republic Day were held for the first time at Gandhinagar, i.e., nearly after 23 years of its formation. All key Government offices have almost been shifted in 1993 from Ahmedabad to the town.

The site is located at a distance of about 24 km to the north of Ahmedabad. It is situated on the banks of river Sabarmati. The river itself occupies about 400 hectares and the city is planned on the western bank of river. The site is well drained and it has a gentle slope from north-east to south-west. The soil is mostly sandy loam and hence, there are no chances for serious foundation problems. It has on altitude of 21 m higher and temperature of at least 6 degrees lower than the city of Ahmedabad. The site is suitably linked by roads, rail and air with all parts of the State.

Gandhinagar is planned to function mainly as administrative centre for the State and as such, the principal employer of the town is the State Government. The town is planned on the principle of sectors, each measuring about 1 km in length and 0.75 km in width. The sectors are numbered from one to thirty and they are formed by seven roads running in each direction and cutting each other perpendicularly. Out of 30 sectors, 27 sectors are residential and the remaining 3 sectors are non-residential. They are planned on the neighbourhood concept. The Government employees reside in these sectors in various categories of staff quarters along with other residents who have constructed their own houses. The day-to-day needs of individuals are suitably catered in each sector.

However, the capital township is not remaining a seat of the Government only. For instance, the functional industrial estate for the modern electronic equipment, coming up on 260 hectares of land, will be putting the Gandhinagar township on the world map. Thus, Gandhinagar is acquiring a character and a status of its own as time passes.

During the development, the city as passed through following four stages:

Phase 1: Between 1970 to 1980, the infrastructure of city was completed and it was known as *Gandhian city*, as it was based on Gandhiji's concepts and principles.

Phase 2: The city was known as *unpolluted city*, during 1980 to 1990.

Phase 3: Many trees were planted after 1990 and the city was called the *green city*.

Phase 4: In 2002, chief minister of Gujarat, Shri Narendra Modi, proposed a triple focus for the city

(i) it should be green;

(ii) it should use solar energy;

(iii) it should cosmopolitan.

Some of the salient features of Gandhinagar with respect to the principles of town planning can be summarized as follows:

(1) Afforestation: Except for soil potent enough to nurture vegetation, there was hardly anything in favour of the site. In fact, the town was jocularly called Andhinagar for the dust storms that lashed its barren land. In 1965, the forest department was summoned to the scene and entrusted with the job of greening Gandhinagar.

The undulating area possessed rich soil and so indigenuous species like neem, babool, mango and berries were planted under the afforestation scheme. In addition, Gandhinagar accounts for the highest number of sandalwood trees in the State as also hydrocarbon plantations, ayurvedic gardens and arboretum. There are more than 3 lakh trees in Gandhinagar at present. It is satisfying to note that Gandhinagar has emerged today as the greenest capital city of the world.

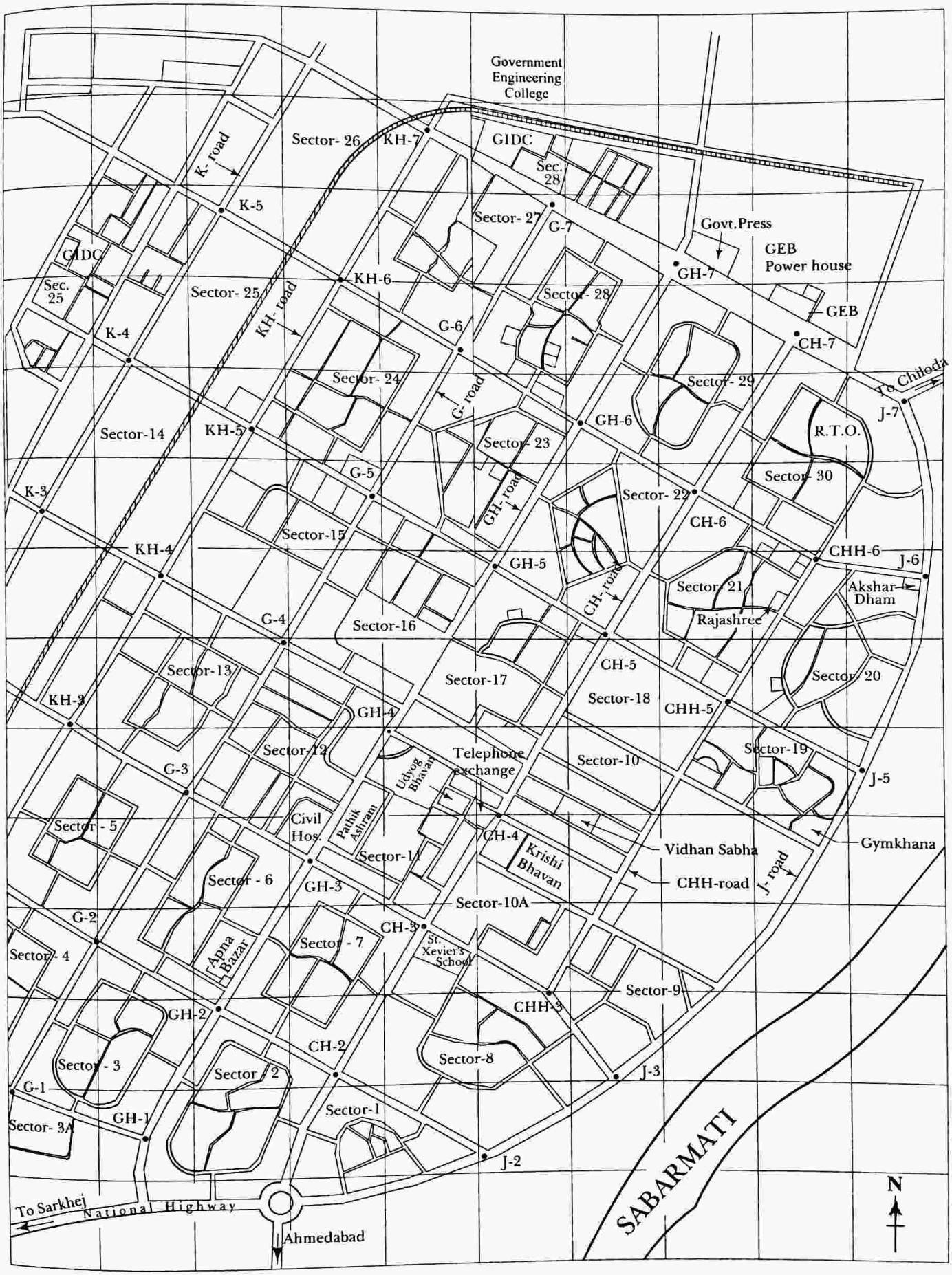
(2) Capital complex: This is the most important part of the town and it includes buildings of secretariat, legislative assembly, high court, heads of various departments, etc. The entire complex is located in such a way that it can be easily reached from residences of most of the government employees. The Sachivalaya Complex with the State Assembly building named after late Mr. Vithalbhai Patel and with two administrative wings — the Sardar Bhavan (the Sachivalaya) and the Narmada Bhavan (housing directors and allied offices) are located in the heart of township.

The State Assembly building was constructed in 1982 at a cost of Rs. 5.80 crores and it is set up in the midst of a circular pond with flower gardens surrounding it. It exhibits one of the finest specimens of the Indian Architecture. The Sardar Bhavan and the Narmada Bhavan were completed in 1984.

(3) Construction activities: Due to various steps taken by the Govt. and overall development of the area, the construction activities has been going on with break-neck speed. For instance, the Government has allotted hundreds of plots to its employees working in the capital township on concessional rates and accompanied by loans to construct houses on easy terms.

(4) Drainage: The complete sewage treatment plant consisting of grit chamber, clarifiers, sludge digestors, drying beds, etc. is located at a distance of about 18 km towards south-west of the town. The treated effluent will partly be used for irrigation purpose and the remaining will be disposed off in river Bhogavo. The permanent storm water drains are not provided except in secretariat area.

(5) Electric supply: The Gujarat Electricity Board supplies the electricity to the town. All the electric lines within the town are laid with underground cables. The mercury vapour lamps are provided on main roads and ordinary lamps are provided on the remaining roads.



Plan of Gandhinagar

FIG. A-2

(6) Light industries: The town plan accommodates the light industries which will not basically alter the character of town. An area of about 120 hectares has been allotted for light industries on the north side of town.

(7) Orientation of roads: The roads are oriented to run 30° north of west and 60° north of east. Such an orientation helps in avoiding direct facing of morning and evening sun. Thus, the driver of a fast moving vehicle is not disturbed and the houses located on these roads, either parallel or perpendicular, get the benefit of south-west winds during hot summer.

(8) Parks and playgrounds: The average standard adopted for the open spaces is about 1.50 to 2.00 hectares per 1000 population, excluding school playgrounds and town level parks, etc. The playgrounds for organized games are provided in each of the zonal centres.

(9) Population: The town plan is designed to accommodate about 400000 persons with possible physical expansion on west side, if found necessary in future. The population at present is around 409000. At present the town is expanded with the construction of new buildings, parks, institutes, temples, fountains etc., on west side.

(10) Public buildings: The town plan accommodates hospitals, town hall, schools, colleges, guest house, etc. to satisfy the medical, social, cultural and other needs of the population.

(11) Public institutions: The town plan also includes the provision of public institutions of State-wide importance. The public schools, colleges and institutes with hostels are included in this category.

(12) Railways: On official record, the railways have connected the capital town with Ahmedabad by providing a daily passenger train service which is hardly patronised by the people because the railway station in Gandhinagar is situated far away from the main township. It is linked with Ahmedabad by electric train.

(13) Residential area: The residential units are planned in a compact form with the necessary facilities such as schools, parks, playgrounds, etc. The government employees are accommodated in different categories of houses which are constructed by the government.

(14) Road system: The pattern of main roads of the town is usually rectangular and such a pattern divides the town into more or less rectangular sectors. All the main roads are provided with road side trees of different varieties, the total length being about 275 km.

(15) Shopping centre: The shopping centre and godowns are suitably provided so as not to cause any hindrance to traffic of the town. An area of about 500 m^2 per 1000 population is provided for retail shopping.

(16) Town centre: For the purpose of accommodating the major civic, cultural and business facilities, an area of about 75 hectares has been allotted in the town plan. The main bus terminus for internal and regional traffic routes is also included in this part. In 1992, Swaminarayan religion completed and opened for public its prestigious town centre known as *Akshardham*. It has attained not only national but international status and thousands of tourists visit this beautiful and excellently developed holy place every year.

(17) Traffic system: The important centres generating traffic are placed in the town plan in such a way that the total volume of traffic is well distributed within the town with a balanced pressure on traffic routes. The cycle-ways and motor roads are segregated with grade separations at their intersections.

(18) Water supply: The supply of water is from river Sabarmati and the treatment plant including filters is located at a distance of about 4 km in the north of town. The treated filtered water is stored in underground storage tank from which it is pumped to an R.C.C. elevated reservoir having capacity of about 27 lakh litres. The average rate of demand of water works out to about 270 litres per head per day. To over cum the present requirement of water new elevated reservoirs are also constructed.

(19) Width of roads: The roads leading to government offices and the approach roads are 100 m wide. The peripheral roads and roads giving access to the town centre are 65 m wide. The rest of the town roads are 45 m in width.

(20) Zonal centres: For every four to five sectors, a zonal centre is provided and it includes cinema, dispensary, bank, post office, police station, shop of selective nature, etc. The zonal centres also serve the population of adjoining villages.

(21) Thermal power station: The state Government has set up a thermal power station with GEB colony for employees of the power plant near GH-7.

(22) Software technology park of India, Infocity: This park was established and registered as an autonomous society on 6th June 1991, under the Department of Information Technology, Ministry of Communication and I.T., Government of India. It is located a the entrance of Gandhinager highway.

(23) Educational Institutes: So many famous educational institutes are established in and at the outskirt of Gandhinagar, e.g., National Institute of Fashion Technology (NIFT), Pandit Deendayal Petroleum University (PDPU), National Institute of Design (N.I.D.) Gandhinagar, Dhirubhai Ambani Institute of Information and Communication (DA-IICT), Institute of Plasma Research (IRR), Government Engineering College, Gujarat National Law University (GNLU), etc.

(24) Mahatma Mandir Convention cum Exhibition Centre: Mahatma mandir is one of the biggest conventional centres of India, spread ovr 34 acres. It is located at sector 13, between KH-3 and KH-4. It is developed by Government of Gujarat at the cost of approximately Rs. 215 Crore. The construction work was started during 2010. Business meet like Vibrant Gujarat Global Summit 2011 and 2013 were organised here.

Appendix 3

RECENT PLANNED CITIES OF INDIA

A-3-1. LAVASA – (THE FIRST PLANNED HILL CITY OF INDIA)

LAVASA is the first private planned hill city and also one of the best going green city of India. Lavasa is developed near Pune in the Mose valley and Temghar-Lavasa ghat of the Western Ghats and is spread over 25,000 acres. It is located on the bank of river Baji Pasalkar and behind the Varasgaon Dam.

Lavasa is surrounded by rolling hills, clouds and seasonal waterfalls and full of green nature beauty. It is situated 600 m to 900 m above sea level.

Lavasa, the first private planned hill city of India, is to develop in four phases. 1st phase is about to complete in 2013 with 1000 villas and 500 apartment named as *Dasve*. Rest of the phase will complete according to schedule. Complete Project of Lavasa Hill City will be get ready hopefully in 2021. It will be India's one of the best hill stations and tourist attractions. Lavasa city will be connected by road and air. To enter into the city, one will need a driving license, as roads inside the Lavasa hill city are very smooth and curvy.

A-3-2. GUJARAT INTERNATIONAL FINANCE TEC – CITY (GIFT CITY) — A GLOBAL FINANCE HUB

GIFT city will be India's largest financial services potential, which would offer global firms a world-class infrastructure and facilities. It aims to attract the top talent in the country by providing the finest quality of life all with integrated townships, IFSC (International Financial Services Centre) and multi speciality special economic zone (SEZ). GIFT master plan facilitates multi services SEZ with IFSC (International Financial Services Centre) status, Domestic Finance Centre and associated Social infrastructure.

The site is about 12 km away from the Ahmedabad International Airport and about 8 km away from Gandhinagar.

Following are the salient features of GIFT city:

(1) Emergency control facilities: GIFT city would have a command and control center to monitor the IT infrastructure and respond quickly during emergencies.

(2) Energy-efficient system: GIFT city will use energy-efficient district cooling system instead of air-conditioning.

(3) Automated waste collection system: It will also use an automated waste collection system that sucks away garbage from buildings at high speed.

(4) Multi services SEZ: GIFT city limited has been formed for development of multi services SEZ at Gandhinagar with the prime focus on development of IFSC and allied activities in GIFT city.

(5) Emphasis on integrated development: GIFT city is divided into well defined processing and non-processing areas with emphasis on integrated development such as limited residential and recreational facilities to make the area lively 24 × 7.

(6) Intelligent Building Management System (IBMS): The buildings in GIFT city will be provided with Intelligent Building Management System (IBMS) and same will be connected to central control and command center to provide interface between user and utility service providers.

(7) Fire safety: In all buildings, arrangement or occupancy for fire fighting will be provided with warning to occupants, automatic fire detecting and alarm facilities, fire escape facilities, etc. Two levels control room, one at zone level and another at building level will be provided. Zone level control room will centrally monitor different zones of GIFT city and will coordinate with building level control rooms in case of any fire event to minimize the impact of such event on the functioning of GIFT SEZ.

(8) Infrastructure facilities: The infrastructure facilities are planned to be modular in nature. The distribution of the infrastructure services would be through the utility service corridors. These corridors would be integrated with the overall GIFT infrastructure.

(9) Business opportunities: Business opportunities like offshore banking, fund custody, administration and custody, insurance, assurance and reinsurance, corporate treasury management, securities trading, back office operations, etc. will be developed.

(10) Development: The predominant land use in GIFT SEZ is for commercial, residential and social facilities. Commercial development is the primary focus of development with major built up space dedicated to offices. Residential development will focus on housing facilities, which are provided in the form of studios and apartments for employees working in GIFT SEZ, which is a part of non-processing area. Social facilities will include all educational institutes, health centre, communication hubs and distribution facilities.

(11) Transportation: Internal transportation infrastructure will be strongly supported by an external transport network. Public transport will be encouraged with an aim at zero fatal accidents. The major transport infrastructure components will be as follows:

(i) Transit nodes

(ii) Internal circulation and access

(iii) Multi level parking

(iv) Pedestrian pathways

(v) Travellators

(12) Power supply: Reliable, quality and uninterrupted power will be supplied to the users with the best quality power distribution infrastructure. An emergency power arrangements will be made for critical areas of power supply.

(13) District cooling system: District Cooling System (DCS) will supply chilled water to the buildings from a centralized chilling plant. The efficiencies gained by central chilled water facilities result in lower overall energy consumption, increased reliability, increased diversification of cooling load and reduced environmental impact.

(14) Water supply and distribution: The water from the canal temporarily stored along with the buffer stock in the water reservoir called *Samruddhi Sarovar*. Then it would be conveyed to the water treatment plant for treatment. After treatment, water will be distributed to all the enclaves for local treatment and storage before pumping for use. The water supply system would be designed such that water is available on demand enabling GIFT city as water nutrient.

(15) Sewerage and waste water treatment: The wastewater shall be a combination of domestic sewage and blow down from cooling tower and other areas. Wastewater will be collected and conveyed to the Sewage Treatment Plant (STP). The treated water would be used for flushing, landscaping and as make-up water for District Cooling Towers, enabling GIFT city to be a Zero Discharge Zone.

(16) Domestic gas: The domestic gas will be supplied to all the occupants of GIFT city through pipes with the most reliable and economical way through gas supply company.

(17) Solid waste management: An automated waste collection system comprising of chute system will be provided in buildings and at road side for collection of waste to minimize human intervention. The initial treatment shall be through local sources and once critical mass is developed, suitable treatment plant may be developed. The system will reduce adverse environmental and health impacts, reduce traffic inconvenience, improve the aesthetic value and will be economical in the long run.

(18) Central command and control system: Central Command Center would be developed in GIFT city to control and co-ordinate various services and provide security and assistance in disaster management and emergency situations.

(19) Utility infrastructure areas: The utility infrastructure plants for various services such as water, sewerage, solid waste collection and treatment, district cooling system, power supply, etc. will be provided so as to meet the requirements of the zones optimally.

A-3-3. DHOLERA SPECIAL INVESTMENT REGION (DSIR)

This is one of the most ambitious projects of Gujarat government at Dholera, near Dholka and has been recommended for environmental clearance by the expert appraisal committee of the *Ministry of Environment and Forest* (MoEF). It is yet to get node for *Coastal Regulatory Zone* (CRZ) clearance from the state government authorities itself.

DSIR was notified in 2009 as a *Special Investment Region* (SIR) under the Gujarat Special Investment Region Act. This was the first SIR of its kind in India, which is proposed to be developed with an objective to provide for establishment, operation, regulation and management of large size investment regions and industrial areas in Gujarat. It is to be developed as global hubs of economic activity

supported by world class infrastructure, premium civic amenities, centers of excellence and proactive policy framework.

The SIR is the node in Gujarat for the proposed Dedicated Freight Corridor (DFC) between Delhi and Mumbai covering a total length of 1483 km and passing through six states. DSIR is being developed by Delhi-Mumbai Industrial Corridor Development Corporation Limited (DMICDC) with Gujarat Infrastructure Development Board (GIDB) as the nodal agency. It falls within limits of the Ahmedabad district and comprises of an area of 920 km^2 spread across 22 villages.

The land required for DSIR comprises of land partly owned by farmers, government and gauchar land. DSIR does not envisage land acquisition for the project. Land pooling and readjustment will be done under the Town Panning mechanism under Gujarat Town Planning and Urban Development Act 1976 for DSIR development.

DSIR will include clusters of electronics, high tech and emerging technologies, pharmaceuticals and biotechnology, heavy engineering, automobile and auto ancillary industries, general manufacturing, metals and metallurgical products, agro and food processing, IT along with tourism and education sectors.

The project is to be developed in three phases of 10 year each. Phase I, II and III shall be comprised of urban area of 11505 hectares, 12045 hectares and 10147 hectares respectively.

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