EVALUATION OF LAND UTILIZATION AND CIRCULATION SYSTEM IN AN URBAN LAYOUT

Case Study: New Town of Gandhinagar, India

by

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SUBMITTED TO THE DEPARTMENT OF ARCHITECTURE IN PARTIAL FULFILLMENT OF THE REQUIREMENTS OF THE DEGREE OF MASTER OF SCIENCE IN ARCHITECTURE STUDIES AT THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

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ABSTRACT
The study evaluates the issues of an Urban Layout
in an existing situation of a new town in India
and a model is prepared based on the observations.
The comparison is made between the existing case
and the proposed model.
The main issues of the evaluation are Land Subdivision,
adequate Land Utilization and Efficient
Circulation System.
The study of the existing situation is carried
out for the "Sector 21" in Gandhinagar - the new
capital of Gujarat State and the proposed model
is for the same site.

Thesis Supervisor: Horacio Caminos
Title: Professor of Architecture
ACKNOWLEDGEMENTS

I gratefully acknowledge the support, guidance and advice of professor Horacio Caminos during the entire study period at M.I.T. Next, I express my gratitude to Reinhard Goethert for the criticism, personal assistance and moral support throughout.

I am indebted to the Deputy Town Planner and the Senior Architect of the Government of Gujrat State-Mr.Deepak Mewada and Mr. Soli Unwala and numerous officials of the offices of the Chief Architect and Town Planner for their co-operation in my field work in Ahmedabad during the summer of 1982.

I am thankful to my professor Sharad N.Sheth and my colleagues Sudhir Shah and Ismet Khambatta in India, for their assistance in collection of additional data and photographs.

I also acknowledge the J.N. Tata Endowment, R.D. Sethna Scholarship fund, Parsi Panchayat of Surat and Zoroastrian Association of Hong Kong, Mrs. Minnie Cama, my friend Mahiyar Gandevia, uncle - "Minoo Masa" and cousin Burjor for the partial financial assistance without which, the higher studies at M.I.T. would have been impossible.

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BACKGROUND - NEW TOWNS:
In the past two or more decades of rapid urban growth in India there has been attempts to plan completely new towns for specific purposes in chosen locations. Though these new towns are diverse in their planning objectives, all share situation characterised by scarcity of financial, technical and managerial resources. These new towns vary in planned populations of 10,000 to 500,000 and include refugee townships, state capitals, steel and fertilizer towns.

OBJECTIVES:
The focus of this study is on urban dwelling environment in one of the new towns in India. The selected town is GANDHINAGAR planned as a capital city of the state of Gujarat. The major intent of the study is the evaluation of the various important issues of the urban layout and prepare a model based on the observations to improve upon the studied issues.

CONTENT:
The study is carried out at two levels. First, the Identification and Evaluation of the selected planned portion of the town. Second, keeping the basic outline of the program constant as in the existing situation a Model is developed. The proposed Model is compared to the existing primary emphasis on the issue of land utilization and the circulation which would be the major guidelines for the evaluation and the preliminary design of the urban environments and the point of reference for the policy makers for the new planned environments.

As the city is planned with a regular patterns of main roads dividing the city into rectangular "Sectors" measuring 1000m by 750m. One of these Sectors is selected for this study.
GANDHINAGAR
UBER CONTEXT

Primary Information

GANDHINAGAR, the new capital city of the state of Gujrat is situated approx. 24 km. to the North of the previous capital city - Ahemdbad; in western India. The city is located 73m above sea level on 23°4' North latitude and 72°38' East longitude. The site for the whole city occupies an area of approx. 5738 hectares, and is situated on the banks of river Sabarmati. The ground of the site is level and well drained with a gentle slope from North east to South west. The soil is mostly loam sandy, and therefore suitable for the building construction work. The exciting feature of the site is it's Mango groves. The max. average temperature is 40° c in May-June, and a minimum average of 29° c in Dec- Jan. Mean relative humidity is highest in August (86%) and lowest in Jamiaaru (47%). Average yearly rainfall is about 825 mm. The prevailing wind direction varies from Southwest to West. Gandhinagar is conveniently located from the point of view of transport. The existing Ahmedabad Airport is midway between Ahmedabad and Gandhinagar. The major highways (Ahmedabad - Mt. Abu), and (Bombay - Ahmedabad - New Delhi) bypass the site 5 km. to the west and 5 km. to the East respectively. The extension work of the existing, Broad-guage railway line is finished, and the railway station is designed on the west boundary on of the township.

History:

After the bifurcation of the Bombay state a separate state of Gujrat came into existence on 1st of May 1960. The Chief Minister declared that the State will have a new
Capital to be named Gandhinagar. However no progress could be made towards the execution of the project for the new city, as the Oil and Natural Gas Commission was exploring the area for oil. In 1964, the commission declared the proposed site, to be free of oil and the project was started.

Masterplan for the township was then prepared by the team led by the Dept. of P.W.D. and was approved by the Govt. in 1966. The construction progressed with hectic speed till 1971. Due to some political changes of the ministry the program was suspended, though the next ministry in power started the development again.

Gandhinagar today is a full fledged city and in the last thirteen years, the population has grown from 25,000 to 100,000. All the sectors are not yet finished and the new Capital complex had its opening, in the summer of 1982.

City Planning Concept:
Functionally Gandhinagar is the capital city and therefore is predominantly the administrative centre of the state, though gradually it is acquiring important civic and cultural functions. Initially the principal employer in the city would be the state government and the design population is based on the government employment structure. The city is planned for the population of 300,000.

Conceptually, the major work areas are provided in the centre and other work areas are distributed along the major town roads.

On the leeward side of the city is located the industrial areas having small scale and light industries. Capital complex forms the major activity centre of the city and is placed in the central sector of the city. The railway station located at the periphery just faces the capital complex - together forms the central axis of the city which is to be developed into a major park.

The total area of the site is app. 5738 hectares which includes the area under the river (800 hectares). The New city is planned on the Western bank of the river. Out of which 700 hectares along the river (which is eroded land) are left out for the river front development. The area on the eastern bank of the river is not proposed for immediate use.
Residential Area:

The main roads of the city divide it into rectangular areas called "SECTORS" which measure 1 km. in length and 3/4 km. width enclosing an area of 75 hectares. Each of the sectors accommodates on the average residential community of the density ranging from 7000 to 17000 people. Each sector has the necessary facilities like schools, shopping centres, playgrounds, parks etc. Mostly 50% of the total population of the city will be constituted by the government employees, most of the Residential Sectors are proposed to have the population dependent on other occupations of professions also. The aim was to avoid developing isolated government colonies. Different types and categories of home types have been used in the planning. Government employees are accommodated in five different categories of houses built by the government.

Ten categories of residential plots ranging from a minimum of 50 sq. meters to a maximum of 1600 sq. meters are made available to the people.

In each sector there is an attempt to have a balanced combination of four categories each of private plots and government quarters.
WORK AREAS:

CAPITOL COMPLEX AND GOVERNMENT OFFICES
The most important work place in the city is the Capital Complex and Government Offices. The Capital Complex, comprising of Secretariate, Legislative Assembly, the High Court and Offices of Heads of Departments are located centrally in one 'Sector', with an area of 75 hectares. It has been so planned as to merge gradually with the river front landscape to the south-east. Other Offices of the State Government have been located to the north of the Capital Complex covers an area of about 150 hectares. The area is so located as to be within easy reach of the residences of most of the Government employees.

LIGHT INDUSTRIES AREA:
Though Gandhinagar is primarily to be an administrative centre, it must have a diversified economic base to make it a living city. It is therefore desirable that light industries which will not basically alter the character of the city be established.
It is estimated that about 20000 workers will be engaged in such industries. An area of about 120 hectares has been earmarked for this purpose to the north of the city and about 160 hectares on the north-west of city. It includes provision for establishment of industrial training schools or such other technical institutions requiring close proximity with the "workshop".

PUBLIC INSTITUTIONS AREA:
To the south of the city an area of about 50 hectares has been earmarked for public institutions of State-wide importance.

SHOPPING, COMMERCIAL AND WAREHOUSING AREA:
At the intersection of the two central roads in the city is located the main shopping centre for the city. Though it will spread to some extent along these two roads, it has been so planned as not to cause any hindrance to traffic on them. This area will accommodate retail shopping facilities as well as other commercial premises.
Along the central avenue, connection the City Centre with the Capital Complex to the south-east and the warehousing area to the north-west there is a strip of land reserved for special buildings requiring larger plots. At the north western tip of this strip is located the wholesale and warehousing area to which will flow goods from the surrounding region without any hindrance to the traffic within the city.
This section evaluates the issues of an urban layout by comparison of the existing and the proposed Land subdivision, Land utilization and Circulation, with the help of plans and comments.
EVALUATION: URBAN LAYOUT

MAJOR TOWN ROAD - "CH"

PROPOSED CIRCULATION

1:5000
LAND SUBDIVISION

Land Subdivision for the project determines the overall layout of the streets dividing the "Site" in smaller portions of the Land viz. Blocks, Lots and Clusters. The placement of different activities of semipublic nature and commercial areas is also covered in Land Subdivision.

EXISTING

In the existing situation, there are no clearly marked property lines and accesses into the "Sector 21" not being well planned, it can be penetrated all along the peripheral roads.

The existing layout of the "Sector 21" has its streets marked out in geometrically, arbitrary pattern. This creates closed loops, dead ends forming an open space and unplanned open areas providing an access to the dwellings around it.

Semi detached houses are common factor and the large portion of the land remains unutilized or under utilized. It represents a layout with a very elaborate circulation pattern. Community facilities are provided on open spaces scattered throughout the site.

The public domain of the streets and the private domain of shopping or residential, do not have any physical barriers. Same is the case with the boundaries between public and semi-public activities. The lots around the houses are property lines shown only on the drawings and are missing in the existing situation. Few users have built informal hedges out of plants and cacti, as the built physical barriers are economically not affordable.

PROPOSED

The proposed plan for "Sector 21" has four clearly defined accesses into it. These are the centres of the major roads surrounding the site. The primary circulation, in turn gets derived as a central cross joining these access points. Thus, all the residential and the semipublic areas are approached inwardly and not from the main roads as in the existing situation.

The new layout is based on grid pattern unlike the traditional geometrically arbitrary pattern. This minimizes the circulation length per area served and allows more private land for residential purpose. The residences are planned in private lots which are arranged in clusters forming a shared court. The efficiency and a primary achievement of the new layout is seen in the proposed density keeping the adequate percentage of open areas. It allows approx. \( \frac{3}{2} \) times more people and still has 10,350 sq.m area reserved for future development.
COMMENTS: 1. Unmarked property lines; hedges on one side; missing on the other.
2. Streets merge into unused open spaces. 3. Access public land

Photos: Ismet Khambatta & Sudhir Shah
LAND UTILIZATION
In urban layouts, there is a need for a rational adequate land utilization, considering a coherent relationship amongst users, their responsibilities, and physical controls. The most common consequences of an irrational land utilization with land waste and undefinable land use, are misuse of the environment, destruction, vandalism, crime and poor maintenance.

EXISTING PROJECT
The public land in this layout is thrice larger than the proposed one. It leads to the high construction costs of infrastructure and utilities as well as maintenance cost. Small public areas scattered all over the site do not give clearly defined user's responsibilities and do not have physical control. These areas are potentially haphazard.

Semi-public spaces are not distributed equally. The location of the community facilities does not promote concentration of functions. The school's location at the center is improper as this area of high land value should preferably be occupied by community facilities.

Private land utilization does not provide opportunities for private to participate in community activities.

PROPOSED PROJECT
The utilization of the public land is to minimize the circulation length per area, public responsibilities and to offer more land for the "Private" use. Proposed layout has 23 Ha less of public land than the existing. This is achieved mainly by replacing the grid-iron layout by the grid layout and the public open spaces by the semi-private shared courts.

The semi-public land which are community facilities such as veg. market, post office, religious centres, etc. is designed to provide equal access to the entire community and emphasizing the relation of these activities to the importance of the central spine.

The schools are located near the boundaries to avoid high land values at the centre and also the disturbances of the central activities.

The private land is designed to maximize private use, responsibilities and participation by allocating the lots in the cluster courts, creating more social interaction.
EVALUATION: URBAN LAYOUT

COMMENTS:
1. No physical barriers between public, private and semiprivate land.
2. Street and "wasteland" around.
3. Unused wide open spaces in the "Shopping" area.
4. Informal shopping area.

Photos: Ismet Khambatta & Sudhir Shah
CIRCULATION
The system of circulation forms one of the very important elements of an urban layout. It channels the pedestrian and vehicular movements and also determines the pattern of land utilization, land sub-division and layout of the utilities; such as water supply, sewage disposal, street paving, street lighting and storm drainage.

EXISTING PROJECT
The circulation pattern is based on a Gridiron system. There is no obvious attempt at forming regular intervals in the street levels and these change to the size and shape of different blocks. This creates more public land used by the streets and increases the cost of construction and maintenance. It does not give clear direction to residents for accesses to all the community facilities. Primary streets are differentiated into two categories. One is exclusively for bicycles. The street layout does not promote concentration of community activities and consequently there is no incentive for social interaction.

PROPOSED PROJECT
The proposed circulation network is based on a Grid system. The "Nodes" or the intersections of the streets are 90m & 115m which are smaller enough to facilitate the pedestrian circulation among the various community elements and large enough to minimize public land areas to reduce the public costs of construction, maintenance and operation of utilities plus services.

The existing pattern of major town roads around Sector 21 forms the basic accesses for the proposed circulation network and the Site development. Network provides the utility lines throughout the site by providing continuous access for maintenance and control. The circulation layout also minimizes the infrastructure investment for the public sector.

Following modes are considered for the layout.

MODE 1:
Cluster courts and the 10m wide streets are planned for the major use by the pedestrians, but the light vehicles (Bicycles and scooters) are made an exception as these vehicles are the major forms of owned transportation in India. These secondary streets are in both directions to the primary streets providing entrance to all the clusters.

MODE 2:
The 20m wide primary streets form a "Spinal Cross" running through the center of the site. These give equal importance to the pedestrians and the vehicles but the later do not control the circulation. Community facilities are located along these streets to create a focus of activities. Main bus route is also proposed on this spine.

MODE 3:
The peripheral streets will be dominated by the relatively high speed traffic with moderate volume. These also serve as service roads for the district shopping center and the schools.
EVALUATION: URBAN LAYOUT

COMMENTS:
1. Access into "Sector 21" - too wide a street.
2. Street junctions are unclear and merge with unidentified land.
3. Wide unused open areas along the street.
4. Poor maintenance of public land.

Photos: Ismet Khambatta & Sudhir Shah
BLOCKS, LOTS AND CLUSTER COURTS

Blocks, Lots, and Cluster courts are the major components of Land Subdivision. "BLOCK" is a portion of land containing one or more lots bounded and served by public circulation lines. "LOT" is a measured parcel of land having fixed boundaries and access to public lines of circulation. A group of lots around a private or common court that serves for access to the lots as well as for other activities is a "CLUSTER COURT". The ownership of the cluster court is shared in the condominiums.

EXISTING PROJECT:
In the existing situation, as seen before, no such division of land into Blocks, Lots, and Cluster courts is found. The divisions are irregular. "Lots" with physical boundaries are absent and the arrangement in clusters is not adopted.

PROPOSED PROJECT:
The proposed layout is divided into Blocks measuring 115m x 90m. The lots in are 30m x 20m, 20m x 10m, 20m x 7m and 15m x 12m. These are based upon and evaluated from the existing program of dwellings.
Larger lots are located all along the Primary circulation (Central Spine). These lots accommodate the three storeyed condominiums. Other dwellings in the proposed layout are row houses, with common walls, which offer the obvious economical and climatic advantages in the hot climate.
CONCLUSION

The following observations are based on the comparative analysis/evaluation of the proposed and existing layouts for land utilization and circulation.

<table>
<thead>
<tr>
<th>GOAL</th>
<th>ACHIEVED BY</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Positive social effects which encourage the individual to participate and understand the responsibilities.</td>
<td>Defining clearly the extent of user's territory and providing semi-private areas with condominium ownership in shared courts.</td>
</tr>
<tr>
<td>3. Positive economic effects by the reduction costs of construction, operation and maintenance.</td>
<td>A grid layout and a cluster court design minimizes length and areas of public streets and utilities, basic networks and service connections. The cluster subdivision makes it unnecessary for the public institution to deal with individuals but the groups of people's cooperatives are formed.</td>
</tr>
<tr>
<td>4. Positive effects of less administrative costs.</td>
<td></td>
</tr>
</tbody>
</table>

The proposed land utilization introduces a coherent relationship between user's responsibilities and physical controls. This is one of the basics for an effective use of the land which is ignored in the existing layout.

Land utilization percentages are optimised. Public areas devoted to the circulation, which are costly to begin with and also maintained by the Public Sector are kept to a minimum. This helps to stretch the resources to benefit more people lowering the ratio of circulation length per area served results in utility network becoming accessible to all the blocks.

The proposed project illustrates a more efficient layout with clear distinction between the lines of access and lines of circulation and in terms of circulation lengths per area served.

The existing situation fails in terms of forming cohesive social groups because of its large undivided size of blocks as opposed to the proposed layout which allows a choice of having residential units in a well contained cluster.

Total dwelling areas are divided into 30 sections making small socially and physically manageable clusters. The cluster courts are well controlled having one entrance each.

As seen clearly in the revised layout and land subdivision plan, undefined land is eliminated and private/semi-private land parcels are well controlled.
EXISTING LAND UTILIZATION

<table>
<thead>
<tr>
<th>Category</th>
<th>SQ.M.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRIVATE: RESIDENTIAL</td>
<td>2,20,288</td>
<td>29%</td>
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<tr>
<td>COMMERCIAL</td>
<td>54,912</td>
<td>7%</td>
</tr>
<tr>
<td>SEMIPRIVATE</td>
<td>5,600</td>
<td>3%</td>
</tr>
<tr>
<td>PUBLIC-STREETS</td>
<td>1,66,570</td>
<td>22%</td>
</tr>
<tr>
<td>UNDEFINED</td>
<td>1,72,246</td>
<td>23%</td>
</tr>
<tr>
<td>SEMIPUBLIC-NO REVENUE</td>
<td>1,07,616</td>
<td>14%</td>
</tr>
<tr>
<td>REVENUE</td>
<td>2,768</td>
<td>2%</td>
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PROPOSED LAND UTILIZATION

<table>
<thead>
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<th>SQ.M.</th>
<th>%</th>
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<td>3,39,710</td>
<td>45%</td>
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<tr>
<td>COMMERCIAL</td>
<td>52,310</td>
<td>7%</td>
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<tr>
<td>SEMIPRIVATE</td>
<td>86,300</td>
<td>12%</td>
</tr>
<tr>
<td>PUBLIC STREETS</td>
<td>1,04,800</td>
<td>14%</td>
</tr>
<tr>
<td>PLAZA</td>
<td>4,680</td>
<td>1%</td>
</tr>
<tr>
<td>SEMIPUBLIC-NO REVENUE</td>
<td>1,41,090</td>
<td>19%</td>
</tr>
<tr>
<td>REVENUE</td>
<td>14,540</td>
<td>2%</td>
</tr>
</tbody>
</table>

CIRCULATION

Total Length: 30,000 M
Length/Hectare: 400 m/Ha

DENSITY

Persons/Hectare: 160

16 Hectares

20 persons

CIRCULATION

Total Length: 8790 M
Length/Hectare: 117 m/Ha

DENSITY

Persons/Hectare: 253

16 Hectares

20 persons
APPENDIX

INDIA: National Context
EXISTING PROJECT PROGRAM
EXISTING DWELLINGS PROGRAM
DESIGN STAGES: Proposed Project
INDIA
NATIONAL CONTEXT

PRIMARY INFORMATION

Country: Republic of India
Capital: New Delhi
Population: 659.2 million (1981) 22% urban, 78% rural
Population growth: 2.1% per year
Area: 3,280,483 sq. km.
Languages: Hindi, English, there are 14 other official languages
Currency: Rupee (9.34 Rupees = U.S. $1, 1982)
Per Capita Income: U.S. $190
Religion: 84% Hindu, 11% Muslim
Government: Democracy
Major Cities:
- Calcutta 7,005,362*
- Bombay 5,968,546
- Delhi 3,629,842
- Madras 2,470,288
- Hyderabad 1,798,910
- Bangalore 1,648,232
- Ahmedabad 2,515,195
- Kanpur 1,273,016
(2). GEOGRAPHY:

India, situated between 8° 4' and 37° 6' latitudes, dominates the South Asian subcontinent geographically. It is bounded on the east by Bangla Desh, Burma and the Bay of Bengal; on the west by Pakistan and the Arabian Sea; and on the north by the People's Republic of China, Nepal and Bhutan. It measures 3,214 km. north to south and 2,933 km. east to west has a land frontier of 15,200 km. and a coastline of 6,083 km. Its diversified topography has three major regions:

(1) sparsely populated Himalaya Mountains which extend along the whole of the north border; (2) heavily populated, well watered and fertile area in the north, on the Indo-Gangetic Plains; and (3) southern peninsula including the tabeland of the Deccan Plateau. The major river systems are associated with each of the main regions. Chains of low mountains and hills lie roughly west to east across central India and north to south along the peninsular coasts. Deserts and arid regions of west-central India contrast with the heavy forestation in the eastern area.

The climate varies from tropical in the south to temperate in the north. Four seasons are recognized south of the Himalayas: a relatively cool, dry period from December through February; a dry, hot season from March through May and a rainy season or southwest monsoon period from June through September as well as a northeast or retreating monsoon period of October and November. The temperatures seldom lower below freezing anywhere south of the Himalayas but often reach as high as 110°F during summer months. Precipitation ranges from over 1,000 cm. annually in the northeast (Assam Hills) to less than 12 cm. in the northwest (Rajasthan Desert).

(3). PEOPLE:

Two major ethnic groups predominate in India: Indo-Aryan in the north and Dravidian in the South. The aboriginal tribal people live in the central forests and mountains, and some Mongoloid people live in the far northern regions. 84% of the people are Hindus, 11% Muslims, and the rest are
Christians, Sikhs, Jains, Parsis Buddhists, etc. The caste system, based on employment/occupation related categories ranked on a theoretically defined hierarchy, is gradually down under the impact of urbanization, industrialization, wider communication and educational opportunities. According to the 1961 census 1,652 languages were reported as mother tongues. However, the 14 principal languages described in the Indian Constitution are collectively spoken by about 87% of the people. The Indo-Aryan languages are spoken by 73% of the population in the northern regions whereas 24.5% speak the Dravidian languages in the south. English is widely used in government, business and education throughout the country.

(4). HISTORY:
The known history of the Indian people spans some five millennia. Between 3000 and 1500 B.C., a number of settlements developed in the Indus River Valley (now in Pakistan) into complex urban centres based on commerce, trade and agriculture. Aryan tribes originating in Central Asia absorbed parts of this culture as they spread out over the South Asian subcontinent. During the next few centuries India flourished under several successive empires. The Muslim Arabs came to Western India in the seventh and the eighth centuries, A.D. The Mughals reigned from 1526 to 1707, A.D. and were constantly challenged by the Rajputs, the Sikhs and the Marathas. The first British outpost in South Asia was established in 1619. Later in that century, permanent trading stations were opened by the East India Company at Madras, Bombay and Calcutta; the British gradually expanded their influence from these footholds. Following the first war of independence in 1857, the East India Company was withdrawn and a direct rule of the British Crown was established.

The Indian National Congress, formed for the purposes of promoting political reforms, was transformed into a mass movement for independence by Mahatma Gandhi in 1920, adopting parliamentary and extra-parliamentary means: non-violent resistance and non-cooperation. After partition of the Indian subcontinent into India and
Pakistan, India became independent on August 15, 1947, with Jawaharlal Nehru as the Prime-Minister. India's Constitution was promulgated on January 26, 1950 and the country was declared to be a Democratic Republic. India is a member of the United Nations, the Commonwealth of Nations, the Asian Development Bank, the International Atomic Energy Agency, the International Bank for Reconstruction and Development, the Colombo Plan and the International Monetary fund.

(5). GOVERNMENT:

India is a Sovereign Democratic Republic with a parliamentary form of government. The President, elected by an indirect electoral college, is the executive head of the Indian Union. His term of office is five years and is eligible for re-election. He also acts as the Supreme Commander of the armed forces and appoints the Prime Minister, the Attorney General, Governors of the States of the Union, the Chief Justice and other Justices of the Supreme Court as well as the High Courts, and appoints and receives diplomatic representations. The President is aided and advised by a Cabinet of Ministers, headed by the Prime Minister. Members of the Cabinet are chosen from among the two houses of the Parliament and are responsible to it.

The Parliament consists of the President and the two houses the Rajya Sabha, or the Council of States, and the Lok Sabha or the House of the People. The Parliament usually holds three sessions a year. One of the principal functions of the Parliament is to make laws on the matters the Constitution specifies to be within its domain. Among its constitutional powers are the fixing or changing of the state boundaries, making amendments to the Constitution, controlling the nation's finances, and removing the Cabinet by a vote of no-confidence. The Rajya Sabha consists of a maximum of 250 representatives, 13 of whom are nominated by the President and the rest are related indirectly by the members of the state and territorial legislatures. One-third of the members retire every two years, with each member completing a six year term. Members of the Lok Sabha are elected directly by the people, all for a five-year term. Lok Sabha seats are allocated to states in proportion to their population. In 1973 there were 523 members of the Lok Sabha, including 3 nominated by the President.

By early 1974 there were 21 States and 9 Union Territories. The governmental structure at the state level is similar to that of the Central government. The President appoints a Governor for a five-year term, who is aided and advised by a Cabinet of Ministers headed by a Chief Minister. Subject to legislation by the Parliament, the President governs the Union territories through appointed administrators. The District is the major geographical and administrative subdivision within the state, and usually has 4 to 5 million people, with the District Collector as the chief administrator. The "Panchayat Raj" system, as a means of decentralizing administration at the very local levels, involves a three-tier structure of self-governing bodies at the village, block and district levels which are known as the 'Gram Panchayat', 'Block Panchayat' or 'Panchayat Samiti' and 'Zila Parishad' respectively. In large towns and cities, the local self-governing bodies are the Municipality, or the Municipal Corporation, Committee or Board.

The Judiciary is a single, integrated, hierarchical system, with the Supreme Court at the top, the High Courts at the state level and lower courts at the district and local levels. The Supreme Court is the ultimate interpreter of the Constitution and of the laws of the land. Its jurisdiction is divided into three categories - Original,
Apellate and Advisory, and its decisions are binding on all the courts. The Chief Justice and a maximum of 13 other Judges of the Supreme Court are appointed by the President. At the village level, judicial bodies called the 'Nyaya Panchayat' try cases of minor offenses in many states. However, they have limited powers and may only impose moderate fines as punishments.

(6). ECONOMY:

India has a mixed economy having a small but important and growing public sector and a large private sector which contributes nearly 75% of the national income. The public sector owns the country's infrastructure, strategic resources, and basic heavy industry. The private sector includes a large small-scale industrial sector and the traditional sector which accounts for 75 to 80% of the population and 50 to 60% of the national product consisting mainly of a subsistence level agriculture and the household and village handicraft production. Surplus labour results in high rates of unemployment and under-employment. Vocational and training programmes are encouraged by the government to produce skilled manpower in order to support the growing industrial sector. Complete information on India's natural resource base is not available. Relatively large quantities of water for irrigation and hydro-electric power generation are potentially available. The annual growth of the Gross National Product at constant prices between 1961 and 1972 showed an average rate of about 4%. For the same period, Per Capita Income rose at an average rate of 3.7% annually.

(7). DEVELOPMENT PLANNING:

Two major objectives of the Fifth Five-Year Plan (1974-1979) are; removal of poverty and destitution - by raising the consumption standards of the lowest 30% of the population from Rupees 25 per capita per month to Rupees 40 per capita per month - and attainment of economic self-reliance. The plan aims at an accelerated growth of agricultural (4%) and industrial (10%) output with an overall average rate of growth of 5.5% in the national product. The plan's proposals, on a priority basis, are:

- speedy completion of the projects and programmes already underway and spilling over from the Fourth Plan; the fullest and the most rapid utilization of the capacity already created.
- achieve as soon as possible the minimum targets in the main sectors of the economy upon which development or utilization of capacity in other sectors is dependent.
- provide for the minimum level of: elementary education for children up to the age of 14, public health facilities including preventive medicines, adequate nutrition and family planning devices; safe drinking water for all villages; all-weather roads to villages with population of 1,500 and more; homesites for landless farmers; electrification for 30 to 40% of the rural population; and slum improvement.

(8). EDUCATION:

Under the provisions of the Constitution, education is primarily the responsibility of individual states, with some specific powers and responsibilities reserved for the Central government. This accounts for the lack of uniformity in the country's educational system. The predominant pattern of education is comprised of eight years of secondary education which is in turn followed by three years of university education leading to the first professional degree. A uniform pattern of ten years of primary and elementary education followed by two years of
secondary or, as it is sometimes called, 'higher secondary' - education, and three years of university education is being adopted in many states. Regional languages are the common media of instruction up to secondary education whereas English replaces them, for the most part, at the university level. In 1971, 29.45% of the total population, 39.45% of the males, and 18.70% of the females - including the 0 to 4 years age group - were literate.

A number of measures have been adopted by the Central and state governments to encourage education to adults and women. Vocational and training programmes have been introduced to lower the currently unsatisfactorily high ratio of liberal arts graduates to technically trained personnel.

(9). LIVING CONDITIONS:

Consumer goods and preferences vary widely throughout the country. For a large sector of the population, particularly rural and urban poor, little money is left after expenditures for food, clothing and shelter, which are mostly obtained from what is locally produced and available. However, with increasing communication and extensive transportation networks, wider distribution of consumer goods has been possible. Housing continues to be inadequate in all India. In 1969, government estimates showed a shortage of 84 million housing units; 12 million in urban areas, and 72 million in rural areas. Basic services; water supply, Electricity and Sewage disposal are inadequate in both rural and urban areas. Poor environmental conditions all over have created serious health hazards. The main objective of the national health programme is the control and eradication of communicable diseases. The overall medical economy is a mixed one, having a general system of private practice and an extensive national and state support of medical facilities, training and specialized programmes. The ratios of doctors to population were 1:5, 150 in 1968, 1:4, 550 in 1972, and 1:4, 300 estimated by the end of 1974. In addition to several medical facilities following the western pattern, several highly developed indigenous systems of medicine exist and serve an unknown but probably substantial number of tradition-oriented Indians.
EXISTING PROJECT PROGRAM

City Population: 100,00 persons
Designer: Govt. of Gujrat State
The office of the Chief Architect and the Chief Town Planner.
Selected Site: Sector 21
Total Area: 86 Hectares
Site Conditions: Level, well drained, gentle slope.
Soil: Sandy loam - suitable for construction.
Income Groups:
Upto $15 per month to $200 per month.
Project Cost:
Development: Not available
Level of Services: Progressive Standard
Population: 12,000
Density: Gross: 160 persons/Hectare
Areas of Land Utilization:
Private and Semiprivate 39%
Public 45%
Semipublic 16%
Length of public circulation: 400m/hectare

EXISTING DWELLINGS

The dwellings in the existing situation are divided into various categories - for different levels of govt. employees, based on the income and social status differences. These categories for the govt. employees are named J, CHH, CH, GH and Category 3. They are quarters and 6% of the basic salary is recovered as the Tenure. They do not get converted into "Ownership" even after a long span of time. The retired or transferred employee has to vacate the house. The other categories of Private Housing are named A, B, C, D and few others. These plots are auctioned in public. The owner is given the freedom to design, within the general framework of byelaws and the approval.
In the shopping area, either the owners reside on the upper floors, or the owner lets out the upper floors for other commercial activities. These shops are privately owned.
<table>
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<tr>
<th>INCOME MONTHLY</th>
<th>GOVT. HOUSING</th>
<th>PRIVATE HOUSING</th>
</tr>
</thead>
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</table>

**Total**

| GOVT. HOUSING | 1114 | 5570 | PRIVATE HOUSING | 1210 | 6350 |

**PROGRAM OF EXISTING DWELLINGS**
DESIGN STAGES

This is a brief description of the stages through the design process, for the proposed layout. Each stage with clear objective and policies would lead to another to arrive at the final result. Though the "overlaps" cannot be ignored.

INITIAL STAGES:

These three stages are mainly the collecting and tabulating the data.

1. Determining the Tentative Program of Project:
   Written information regarding the location, areas, site condition, numerical information of population, lots, costs, the designer and the existing areas of Land Utilization.

2. Identifying the Urban Parameters:
   Written information and a layout plan at the urban scale. The urban circulation network, existing and proposed roads are shown. Approaches and Accesses are identified.

3. Identifying the Site Parameters:
   The written information together with a layout plan at the "Site Scale".

   After these initial stages, the next stages are a gradual progress towards a design solution explained as stages A to F with schematic illustrations on page 36.

STAGE A:
IDENTIFYING MAIN URBAN CIRCULATION NETWORK AND ACCESSES AFFECTING THE SITE.

Using the output from three initial stages the priorities are established. Existing and projected main urban circulation network is identified and the accesses are marked on the plan.

Major Policy: Frequency of main urban circulation network: 1000 to 2000m approx.

STAGE B:
DETERMINING PRIMARY SITE CIRCULATION.

The accesses from the previous stage are linked in the convenient manner.

Major Policy: Coverage from primary circulation. Keeping minimum distance 100m and maximum distance 100m. Arriving at the shortest distance.

STAGE C:
IDENTIFYING AREAS OF THE MAJOR COMMERCIAL POTENTIAL/LAND VALUES.

Priorities are established to identify the areas of high, medium and low values of commercial potential.

Major Policy: High commercial potential/land value areas are adjacent to the primary circulation/public transportation. Lower commercial potential areas are farther from the primary site circulation.

STAGE D:
IDENTIFYING AREAS FOR SCHOOLS AND PLAYGROUNDS.

Major Policy: As the plaza, markets and commercial areas are located on the higher land values, schools and playgrounds are placed on low value land. The land utilization of private, semiprivate, public, and semipublic are considered.

STAGE E:
IDENTIFYING THE DIRECTION OF SECONDARY CIRCULATION

Secondary circulation network lines link residential areas with the primary circulation. The schematic direction are marked on the plan. One of the important implications of this stage is to determine the directions of drainage. In the present case, the drainage follows the circulation network.

STAGE F: COMPLETE PROJECT.

Considering adequate land utilization and circulation completeness. Project layout is developed. This divides the site into blocks.
EVALUATION: URBAN LAYOUT

DESIGN STAGES

STAGE A: MAJOR ACCESSES AFFECTING THE SITE

STAGE B: PRIMARY SITE CIRCULATION

STAGE C: AREAS OF MAJOR COMMERCIAL POTENTIAL AND HIGHER LAND VALUE

STAGE D: AREAS FOR SCHOOLS, PLAYGROUNDS

STAGE E: DIRECTIONS OF SECONDARY CIRCULATION

STAGE F: COMPLETE PROJECT

1:20000
GLOSSARY

The criteria for the preparation of the definitions have been as follows:

SECOND PREFERENCE: definitions from technical dictionaries, text books, or reference manuals.
THIRD PREFERENCE: definitions from the Urban Settlement Design Program (U.S.D.P.) Files. They are used when existing sources were not quite appropriate or satisfactory.

Words included for specificity and to focus on a particular context are indicated in parenthesis. Acronyms, symbols, and abbreviations are defined in parenthesis. (See also: REFERENCES).

ACCESS. The pedestrian/vehicular linkages from to the site to/from existing or planned approaches (urban streets, limited access highways, public transportation systems, and other systems such as: waterways, airlines, etc.)

AMENITY. Something that conduces to physical or material comfort or convenience, or which contributes satisfaction rather than money income to its owner. (Merriam-Webster, 1971)

APPROACHES. The main routes external to the site (pedestrian/vehicular) by which the site can be reached from other parts of the urban context. (U.S.D.P.)

BARRIER. A boundary as a topographic feature or a physical or psychological barrier that tends to separate or restrict the free movement (to and from the site). (Merriam-Webster, 1971)

BLOCK. A block is a portion of land bounded and served by lines of public streets. (U.S.D.P.)

BOUNDARY. Something (a line or area) that fixes or indicates the limits or extent (of the site). (Merriam-Webster, 1971)

CIRCULATION. System(s) of movement/passage of people, goods from place to place: streets, walkways, parking areas. (U.S.D.P.)

CLIMATE. The average conditions of the weather at a particular place over a period of years as exhibited by temperature, wind, precipitation, sun energy, humidity, etc. (Merriam-Webster, 1971)

COLLECTION SYSTEM. The system of pipes in a sewage network that includes: collection lines, manholes, laterals, mains. (U.S.D.P.)

COMMUNITY. The people living in a particular region: the region itself, any population cluster. (U.S.D.P.)

COMMUNITY FACILITIES/SERVICES. Facilities/services usually used in common by a number of people. It can include schools, health, recreation, police, fire, public transportation, community center, etc. (U.S.D.P.)

COMMUNITY RECREATION FACILITIES. Facilities for activities voluntarily undertaken for pleasure, fun, relaxation, exercise, self-expression, or release from boredom, worry, or tension. (U.S.D.P.)

COMPONENT. A constituent part of the utility network (U.S.D.P.)

CONDOMINIUM. Condominium is a system of direct ownership of a single unit in a multi-unit whole. The individual is the owner of the separate interest in the same manner as if it were a single family dwelling; he holds direct legal title to the unit and a proportionate interest in the common land and areas. Two types of condominiums are recognized: horizontal: detached, semi-detached, row-group. VERTICAL: walk-up, high-use dwelling types. (U.S.D.P.)

COSTS OF URBANIZATION. Include the following: CAPITAL: cost of land and infrastructure; OPERATING: cost of administration, maintenance, etc.; SURPLUS: capital and operating costs; INDIRECT: include environmental and personal effects. (U.S.D.P.)

DESIGN. 1) The arrangement of elements that make up a work of art, a machine or other man-made object. 2) The process of selecting the means and combining the elements, steps, and procedures for producing what will adequately satisfy some need. (Merriam-Webster, 1971)

DETACHED SMELLING. Individual dwelling unit, separated from others. (U.S.D.P.)

DEVELOPMENT. Gradual advance or growth through progressive changes; a developed tract of land (U.S.D.P.)

DISTANCE. The degree or amount of separation between two points or the length of the straight line joining them (paths of travel). (Merriam-Webster, 1971)

DRAINAGE. Interception and removal of ground water by surface flow, by artificial or natural means. (De Pina, 1972)

DST/DST. Fine dry pulverized particles of earth, grit, refuse, waste, litter, etc. (Merriam-Webster, 1971)

Dwelling. The general, global designation of a building/shelter in which people live. A dwelling contains one or more dwelling units. (U.S.D.P.)

Dwelling Density. The number of dwellings, dwelling units, people or families per unit hectares. Gross density is the density of the overall area (i.e. including lots, streets). Net density is the density of selected, discrete portions of an area (i.e. including only lots). (U.S.D.P.)

Dwelling Unit. A self-contained unit in a dwelling for an individual, a family, or a group. (U.S.D.P.)

Dwelling Unit Area. The dwelling unit area (m²) is the built-up, covered area of a dwelling unit. (U.S.D.P.)

EFFICIENCY. Capacity to produce desired results with minimum expenditure of energy, time, money or materials. (Merriam-Webster, 1971)

EXTERIOR CIRCULATION/ACCESSSES (SITE PLANNING). The existing and proposed circulation system/accesses outside but affecting the site. These include limited access highways as well as walking access to the surrounding area. Existing infrastructure/accesses are generally given conditions. (U.S.D.P.)

GRID BLOCKS. The block determined by a convenient public circulation and not by dimensions of lots. In grid blocks lots have indirect access to public streets. (U.S.D.P.)

GRID BLOCKS. The blocks determined by the dimensions of the lots. In grid blocks all the lots have direct access to public streets. (U.S.D.P.)

GRID LAYOUTS. The urban layouts with grid blocks. (U.S.D.P.)

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Illegal. That which is contrary to or violating a rule or requires having the force of law. (Merriam-Webster, 1971)

Income. The amount (measured in money) of gains from capital or labor. The amount of such gains received by a family per year may be used as an indicator of income groups. (U.S.D.P.)

Income Groups. A group of people or families within the same range of incomes. (U.S.D.P.)

INFRASTRUCTURE. The underlying foundation or basic framework of a region or society: streets, sewage system, water network; storm drainage, electrical network; interior circulation network (site planning). The pedestrian/vehicular circulation system inside the site. It should be based upon the exterior circulation/accesses and land development requirements. (U.S.D.P.)

INTERVAL. A space of time (or distance) between the occurrences of similar conditions or states. (Merriam-Webster, 1971)

Landing Cost. Price: the amount of money given or set as the amount to be given as a consideration for the sale of a public thing (the site). (Merriam-Webster, 1971)

LAND DEVELOPMENT COSTS. The costs of making raw land ready for development through the provision of utilities, services, accesses, etc. (U.S.D.P.)

LAND SUBDIVISION. The division of the land in blocks, lots and laying out streets. (U.S.D.P.)

LAND TENANCY. The t-enjoyor holding or holding of a parcel of land in common with others. (Merriam-Webster, 1971)

LAND UTILIZATION. A qualification of the land around a dwelling in relation to user, physical controls and responsibility. Public streets, walkways, open spaces: user-ownership/unlimited; physical controls -minimum; responsibility -public sector. SENIPUBLIC open spaces, parks: user-restricted group of people; physical controls -partial or complete; responsibility -user. PRIVATE (dwellings, lots): user -owner or tenant or squatter; physical controls -complete; responsibility -user. (U.S.D.P.)

LAND UTILIZATION. PHYSICAL CONTROLS. The physical/ legal means or methods of directing, regulating, and coordinating the use and maintenance of land by the owners/users. (U.S.D.P.)

LAND UTILIZATION: RESPONSIBILITY. The quality/state of being morally/legally responsible for the use and maintenance of land by the owners/users. (U.S.D.P.)

LEVELS OF SERVICES. Two levels are considered: MINIMUM, are admissible or possible levels below the standard; STANDARD, are levels set up and established by authorities, custom of general consent, as a model, example or rule for the measure of quantity, weight, extent, etc. (Merriam-Webster, 1971)

LOCATION. Situational: the article which something (the site) is placed in relation to its surroundings (the urban context). (Merriam-Webster, 1971)

LOT. A measured parcel of land having fixed boundaries and access to public circulation. (U.S.D.P.)

LOT CLUSTER. A group of lots owned individually around a public common court (owned in common). (U.S.D.P.)

LOT COVERAGE. The ratio of building area to the total lot area. (U.S.D.P.)

LOT PROPORTION. The ratio of lot width to lot depth. (U.S.D.P.)

MASTER PLAN. A comprehensive, long range plan intended to guide the growth and development of a city, town or region, expressing official contemplations on the course its transportation, housing and community facilities should take, and making proposals for industrial settlement, commerce, population distribution and other aspects of growth and development. (Abrams, 1971)

MODEL OF URBAN LAYOUT. A representation of an urban residential area illustrating circulation, land utilization, land subdivision, and utility network of a specific layout and lot. (U.S.D.P.)

PLANNING. The establishment of goals, policies, and procedures for a social or economic unit, i.e. city. (U.S.D.P.)

Plot/Lot. A measured parcel of land having fixed boundaries and access to public circulation. (U.S.D.P.)

POPULATION DENSITY. It is the ratio between the population and the area it is expressed in people per hectare. It can be: GROSS DENSITY: includes a kind of land utilization, residential, circulation, public facilities, etc. NET DENSITY includes only the residential land and does not include land for other uses. (U.S.D.P.)

POSITION. The point or area in space actually occupied by a physical object (the site). (Merriam-Webster, 1971)

PRIMER. A small introductory book on a specific subject. (U.S.D.P.)

PRIVATE LAND OWNERSHIP. The absolute tenure of land to a person and his heirs without restriction of time. (U.S.D.P.)

PROJECT. A plan undertaken: a specific plan or design. (U.S.D.P.)

PUBLIC CIRCULATION. The circulation network which is owned, controlled, and maintained by public agencies and is accessible to all members of a community. (U.S.D.P.)

PUBLIC FACILITIES. Facilities such as schools, playgrounds, parks, other facilities accessible to all members of a community which are owned, controlled, and maintained by public agencies. (U.S.D.P.)
PUBLIC SERVICES AND COMMUNITY FACILITIES. Includes: public transportation, police protection, fire protection, refuse collection, health, schools, and playgrounds, recreation and open spaces, other community facilities; business, commercial, small industries, markets. (U.S.D.P.)

PUBLIC SYSTEM (general). A system which is owned and operated by a local governmental authority or by an established public utility company which is controlled and regulated by a governmental authority. (HUD/AID, Minimum Standards, 1966)

PUBLIC UTILITIES. Includes: water supply, sanitary sewerage, storm drainage, electricity, street lighting, telephone, circulation networks. (U.S.D.P.)

RESIDENTIAL AREA. An area containing the basic needs/requirements for daily life activities: housing, education, recreation, shopping, work. (U.S.D.P.)

RIGHT-OF-WAY. A legal right of passage over another person's ground (land), the area or way over which a right-of-way exists such as: a path or thoroughfare which one may lawfully use, the strip of land devoted to or over which is built a public road, the land devoted to use for purposes of providing facilities. (Merriam-Webster, 1971)

ROADWAY (HIGHWAY). Portion of the highway included between the outside lines of gutter or side ditches, including all slopes, ditches, channels, and appurtenances necessary to proper drainage, protection, and use. (Defina, 1972)

ROW/GROUPED HOUSING. Dwelling units grouped together linearly or in clusters. (U.S.D.P.)

SETLEMENT. Occupation by settlers to establish a residence or colony. (U.S.D.P.)

SHAPE. Form/configuration of the site surface as defined by its perimeter/boundaries. (U.S.D.P.)

SHOPPING (Facilities for) searching for, inspecting, or buying available goods or services. (U.S.D.P.)

SITE. Land (that could be) made suitable for building purposes by dividing into lots, laying out streets and providing facilities. (Merriam-Webster, 1971)

SITE AREAS. Two types are considered: CROSS AREA: includes the whole site or the bounded piece of ground. GREEN AREA: includes only the portion of the site that can be fully utilized for buildings, streets, playgrounds, recreation facilities, gardens, or other structures. (U.S.D.P.)

SIZE. Physical magnitude or extent of the site), relative or proportionate dimensions of the site. (Merriam-Webster, 1971)

SLOPE. Degree or extent of deviation of the land surface from the horizontal. (Merriam-Webster, 1971)

SOIL. Soil structure: the arrangement of soil particles in various aggregates differing in shape, size, stability, and degree of adhesion to one another. (Merriam-Webster, 1971)

TENURE. Two situations of tenure of the dwelling units and/or the lot/land are considered: LEGAL: having formal status derived from law; EXTRALEGAL: not regulated or sanctioned by law. Four types of tenure are considered: RENTAL: where the users pay a fee (daily, weekly, monthly) for the use of the dwelling unit and/or the lot/land; LEASE: where the users pay a fee for long-term use (generally for a year) for a dwelling unit and/or the lot/land from the owner (an individual, a public agency, or a private organization); OWNERSHIP: where the users hold in freehold the dwelling unit and/or the lot/land which the unit occupies; EMPLOYER-PROVIDED: where the users are provided a dwelling unit by an employer in exchange for services, i.e. domestic live-in servant. (U.S.D.P.)

TOPOGRAPHY. The configuration of a (land) surface including its relief and the position of its natural and man-made features. (Merriam-Webster, 1971)

TRANSPORTATION. Means of conveyance or travel from one place (the site) to another (other parts of the urban context). (Merriam-Webster, 1971)

UNIT. A determinate quantity adopted as a standard of measurement for other quantities of the same kind. (Merriam-Webster, 1971)

URBANIZATION. The quality or state of being or becoming urbanized; to cause to take on urban characteristics. (U.S.D.P.)

USE TAX. The tax on land aimed primarily at enforcing its use or improvement. (U.S.D.P.)

USER INCOME GROUPS. Based upon the subsistence (minimum wage) income per year, five income groups are distinguished: LOW (below subsistence level); the income group with no household income available for housing, services, or transportation; MODERATE (1 x subsistence level); the income group that can afford no or very limited subsidized housing; MODERATE (2 x subsistence level); the income group that can afford limited housing and rent only with government assistance; HIGH (3 x subsistence level): the income utility/services. Includes: water supply, sanitary sewerage, storm drainage, electricity, street lighting, gas, telephone. (U.S.D.P.)

UTILITY/SERVICE. Utility or infrastructures for meeting the general need (as for water supply, wastewater removal, electricity, etc.) in the public interest. (U.S.D.P.)

VIEW. That which is revealed to the vision or can be seen from the site. (Merriam-Webster, 1971)

WALK-UP. Dwelling units grouped in two to five stories with stairs for vertical circulation. (U.S.D.P.)

WASTE PIPE. A pipe (in a dwelling) which carries waste from wash basins, sinks, and similar fixtures. (ROTC, 1953)

WATER SUPPLY. Source, means, or process of supplying water, (as for a community) usually involving reservoirs, pipelines, and often the watershed from which the water is ultimately drawn. (Merriam-Webster, 1971)
REFERENCES


Building and Communication Department Govt. of Gujarat - "GANDHINAGAR" 1981.


EXPLANATORY NOTES

QUALITY OF INFORMATION
The quality of information given in drawings, charts and descriptions has been qualified in the following manner:
Approximate: when deduced from different and/or not completely reliable sources.
Accurate: when taken from reliable or actual sources.
Tentative: when based upon rough estimates of limited sources.

QUALITY OF SERVICES, FACILITIES AND UTILITIES
None: when the existence of services, facilities and utilities are unavailable to a locality.
Limited: when the existence of services, facilities and utilities are available to a locality in a limit limited manner due to proximity.
Adequate: when the existence of services, facilities and utilities are available to a locality.

METRIC SYSTEM EQUIVALENTS
Linear Measures
1 centimeter = 0.3937 inches
1 meter = 39.37 inches or 3.28 feet
1 kilometer = 3,280.83 feet or 0.62137 miles
1 inch = 2.54 centimeters
1 foot = 0.3048 meters
1 mile = 1.60935 kilometers

Square Measures
1 square meter = 1,550 square inches or 10.7639 square feet
1 hectare = 2.4771 acres
1 square foot = 0.0929 square meters
1 acre = 0.4087 hectares

DOLLAR EQUIVALENTS
1 U.S. Dollar = 9.30 Indian Rupees (1976)