

RURAL/URBAN DWELLING ENVIRONMENTS: GUJARAT STATE, INDIA

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Submitted to the Department of Architecture
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ABSTRACT

The study identifies and evaluates the existing patterns and conditions of rural and low income urban dwelling environments in Gujarat State, India. It focuses on dwelling systems in Nikora Village in Bharuch District and in Adhmedabad City through one rural and six urban case studies. The physical environments of each of the dwelling systems is analyzed at four levels: the locality, selected segment(s) of the locality, a selected block of the segment, and a typical dwelling unit. They emphasize the relationship between the efficiency of settlements and physical layouts through a comparative analysis/evaluation of land utilization, land subdivision, services and utilities, and density patterns.

An Urbanization Model is proposed based upon the analysis and evaluations. It demonstrates an alternative process of future urban growth in a comprehensive manner. It optimizes land utilization and infrastructure networks through efficient layout design.

The study is intended to serve as a reference and a tentative set of guidelines for those involved in planning of residential area and formulating housing policies. It provides a comparative framework for analysis and evaluation of existing and proposed low income housing developments, and a model for identification of dwelling environments in any urban context in India.

The study is derived from field research carried out by the authors primarily during the summer of 1976. The analysis and evaluations were carried out in the Urban Settlement Design Program, School of Architecture and Planning, M.I.T., during the academic years 1975-76 and 1976-77.

Thesis Supervisor: Horacio Caminos, Professor of Architecture

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RURAL/URBAN DWELLING ENVIRONMENTS: GUJARAT STATE, INDIA

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to the memory of Shashi

PREFACE

This study is derived from field research we have carried out since 1974, particularly during the summer of 1976. The surveys included physical and socio-economic aspects of rural/urban dwelling environments in Gujarat State. The analysis and evaluations were carried out in the Urban Settlement Design in Developing Countries Program, School of Architecture and Planning, M.I.T., during the academic years 1975-76 and 1976-77.

Due to lack of information from any single source, the data were based upon maps, reports, studies, photographs, and site surveys, and therefore the quality of information in the locality and segment plans in some cases is approximate. However, the basic pattern, land use, density and availability of services fairly represent the existing situations. Some of the data on Urban Context, case studies of Walled City, Navrangpura Lakhudi, and similar dwelling system of Co-operative Society are taken from "Urban Dwelling Environments: Ahmedabad, India" (Nimish Patel, 1976). The case study analysis is based on a methodology developed in the Urban Settlement Design in Developing Countries Program under the direction of Professor Horacio Caminos.

We gratefully acknowledge the guidance and kind support of Professor Horacio Caminos during the two years of the study. We are also grateful to Reinhard Goethert for his criticism and personal assistance at various stages of this work, and members of the Classes of 1975-77 and 1976-78 for their comments. We extend our thanks to Nikora Gram Panchayat, Town Development and Housing Offices of Ahmedabad Municipal Corporation, the Gujarat Housing Board, and the Ahmedabad Study Action Group for providing necessary information material; The

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Finally, our debt to our parents for their love, encouragement and support is beyond the means of expression.

COVER PHOTOGRAPH: A squatter settlement in Ahmedabad.

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INTRODUCTION

India faces an unprecedented urbanization crisis with over 20% of its total population (about 600 million) living in cities today. The total population continues to grow at an annual rate of 2.5%; some of the larger cities are growing at annual rates between 3 and 4.5%. This has given rise to manifold socio-economic and physical problems. In the process, the low and very low income groups, constituting a great majority of the population, are affected adversely. They are socially and economically insecure; their basic needs of food, shelter, medical care, and education are not met.

80% of the country's population lives in rural areas. A large section of this population lives in environments which are in deteriorating physical conditions; their dwellings are semi-permanent and lack basic amenities. Nearly a half of the urban population belongs to the low income groups. Due to their limited financial resources, shelter is only a secondary priority for them.

The private sector is the major contributor of housing in India; however it is limited to mainly the middle and high income groups. The public sector alone with its limited resources can not alone cope with the problem of providing housing to the low income groups. The basic weakness in the government approach is its piecemeal solution to immediate needs and problems rather than approaching the fundamental issues and considering long range implications. However, the government must efficiently utilize its scarce resources: land and finance. It is not only a matter of providing housing, but also the process and the overall framework within which they are provided which are particularly important. The consequence of an absence of a national

policy for physical development and housing can be seen in haphazard, unplanned growth of the urban areas and undeveloped, deteriorating physical environments of the rural areas. With scarce resources and increasing population, physical planning has a critical role to play. The improvement of existing settlements, although very necessary, is costly and is further complicated because of inefficient layouts. The physical planning of residential areas calls for a new approach to optimize the resource utilization and must provide for the various socio-cultural needs of the Indian society.

This study concentrates on the existing patterns and conditions of rural and urban dwelling environments in Gujarat State. The selected case studies are:

- Nikora Village in the Bharuch District. The village is in the process of relocation on a site adjacent to the existing location of the village. It offers a comparative study of a traditional rural environment as well as a new layout prepared by the Zila Panchayat, a district level administrative body.
- Ahmedabad City. The six cases analyzed focus on very low to middle income housing systems. Similar dwelling systems are included to supplement three of the case studies.

The cases are analyzed at four scales: the locality, selected segment(s) of the locality, a selected block of the segment, and a typical dwelling unit. The dwelling systems emphasize the relationship between the efficiency of settlements and physical layouts through a comparative analysis/evaluation of:

- Land utilization, in terms of proportion of public and private areas which determine maintenance responsibility and controls.

- Population densities.

- Service infrastructure and community facilities.

Based upon the analysis and evaluations of the case studies, an Urbanization Model is proposed. The model considers an alternate process of physical planning for urbanization in a comprehensive manner. It optimizes land utilization and infrastructure networks through an efficient layout design. The proposal focuses on a residential site development and includes a physical plan, circulation plan, land use plan, infrastructure layout, and land/lot subdivision.

The study is intended to serve as a reference and a tentative set of guidelines for those involved in planning of residential developments and formulation of housing policies. It provides a comparative framework for the analysis and evaluation of existing and proposed low income housing developments. It also provides a model for identification of dwelling environments in any urban context in India.

INDIA

NATIONAL CONTEXT

1. PRIMARY INFORMATION

Country:	Republic of India
Capital:	New Delhi
Population:	547,949,809 (1971)
	20% urban, 80% rural
Population growth:	2.48% per year
Area:	3,280,483sq.km.
Languages:	Hindi, English; there are 14 other official languages.
Currency:	Rupee (8.90 Rupees = U.S. \$ 1, 1976)
Per Capita Income:	Rs. 338 (1973)
Religion:	84% Hindu, 11% Muslim
Government:	Democracy
Major Cities:	Calcutta 7,005,362*
(1971)	Bombay 5,968,546
	Delhi 3,629,842
	Madras 2,470,288
	Hyderabad 1,798,910
	Bangalore 1,648,232
	Ahmedabad 1,585,544
	Kanpur 1,273,016

* Inside municipality boundaries.

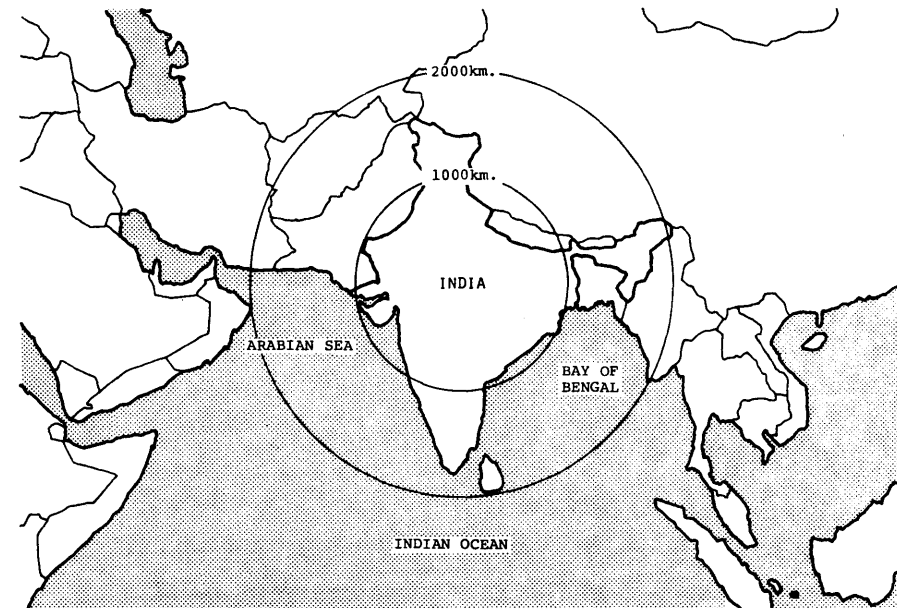
2. GEOGRAPHY:

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 3,214km. north to south and 2,933km. east to west, has a land frontier of 15,200km. and a coastline of 6,083km. 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 tableland 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.

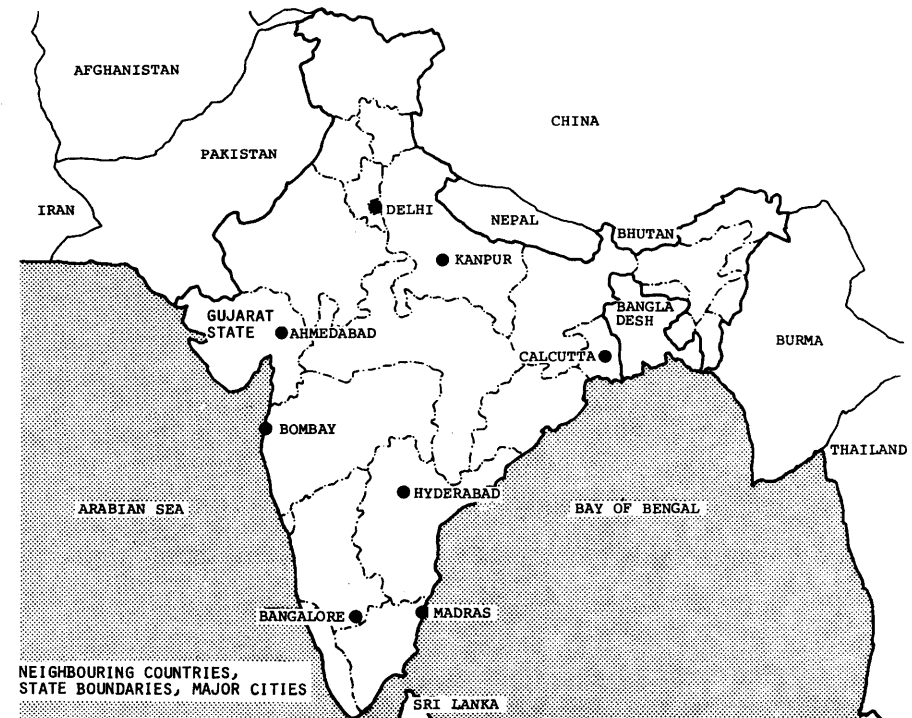
The climate varies from tropical in the south to temperate in the north. Four seasons are recognized south of the Himalayas: a relatively cool, dry period from December through February; a dry, hot season from March through May, and a rainy season or southwest monsoon period from June through September 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 1,000cm. annually in the northeast (Assam Hills) to less than 12cm. in the northwest (Rajasthan Desert).

3. PEOPLE:

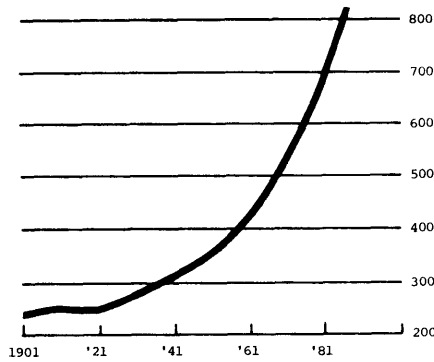
Two major ethnic groups predominate in India: Indo-Aryan in the north and Dravidian in the South. The aboriginal tribal people live in the central forests and mountains, and some Mongoloid people live in the far northern regions. 84% of the people are Hindus, 11% Muslims, and the rest are Christians, Sikhs, Jains, Parsis, Buddhists, etc. The caste system, based on employment/occupation related categories, ranked on a theoretically defined hierarchy, is gradually breaking



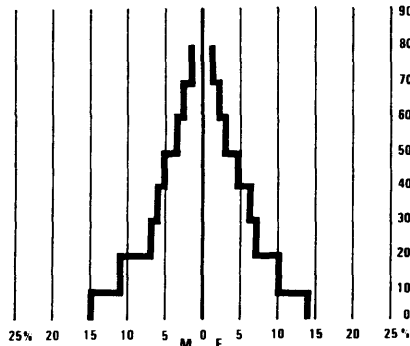
LOCATION OF INDIA



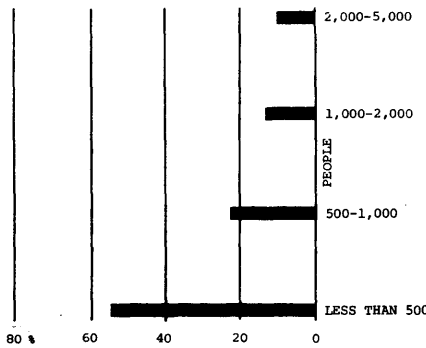
NEIGHBOURING COUNTRIES, STATE BOUNDARIES, MAJOR CITIES



NATIONAL POPULATION GROWTH
horizontal: dates vertical: population in millions
Source: INDIA, A Reference Annual, 1974
Government of India



NATIONAL POPULATION DISTRIBUTION (1971)
horizontal: percentage vertical: ages
Source: INDIA, A Reference Annual, 1974
Government of India



RURAL POPULATION DISTRIBUTION
horizontal: percentage vertical: village population
Source: INDIA, A Reference Annual, 1974
Government of India

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.

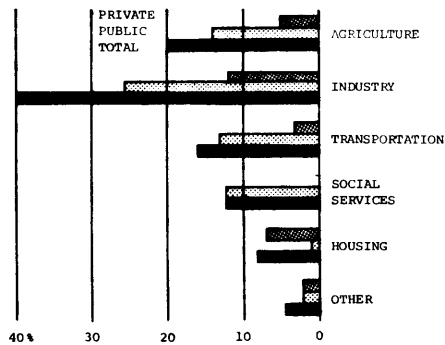
5. GOVERNMENT:

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 non-confidence. The Rajya Sabha consists of a maximum of 250 representatives, 13 of whom are nominated by the President and the rest are elected 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

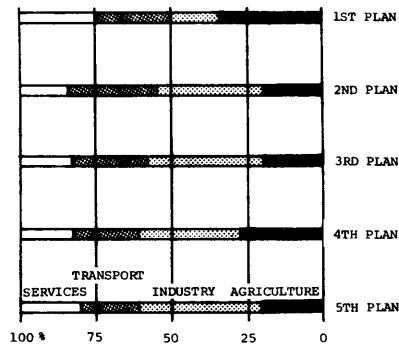
at the state level is similar to that of the Central government. The President appoints a Governor for a five-year term, who is aided and advised by a Cabinet of Ministers headed by a Chief Minister. Subject to legislation by the Parliament, the President governs the Union Territories through appointed 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 'Panchayati 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 Panchayat' or '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, Appellate 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:

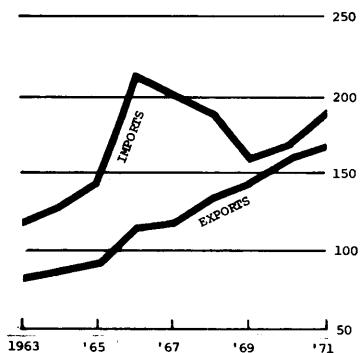
India has a mixed economy having a small but important and growing public sector and a large private sector which contributes nearly 75% of the national income. The public sector owns the country's infrastructure, strategic resources, and basic heavy industry. The private sector includes a large small-scale 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



FIFTH FIVE YEAR PLAN INVESTMENT
 horizontal: percentage vertical: sector
 Source: INDIA, A Reference Annual, 1974
 Government of India



PUBLIC SECTOR INVESTMENT
 horizontal: percentage vertical: development plans
 Source: INDIA, A Reference Annual, 1974
 Government of India



IMPORTS AND EXPORTS
 horizontal: year vertical: million Rupees
 Source: Area Handbook for India,
 Nyrop R. F., 1975

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 upto 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 elementary education, followed by three 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 upto 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:

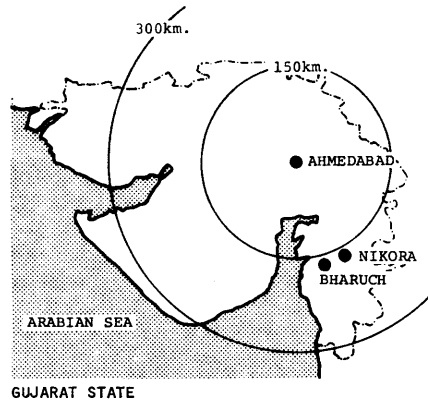
Consumer goods and preferences vary widely throughout the country. For a large sector of the population, particularly rural and urban poor, little money is left after expenditures for food, clothing and shelter, which are mostly obtained from what is locally produced and available. However, with increasing 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, sewage disposal and electricity are inadequate in both rural for urban areas. Poor environmental conditions 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.

1 NIKORA Village

PRIVATE/PUBLIC, LOW/MIDDLE INCOME,
TRADITIONAL RURAL ROW HOUSE

Bharuch Dist.



RURAL CONTEXT

1. LOCATION:

Nikora is located on the banks of Narmada river in the Bharuch district, approximately 170km. south of Ahmedabad and 20km. east of Bharuch; the major city of the district. The village is connected to Bharuch by a state highway and a state bus service.

2. HISTORY:

The exact date of origin of Nikora is not known. Like many of the villages along the banks of Narmada, Nikora is said to have developed as an important religious place in the past. Closeness to the river for irrigation and fertile land probably also contributed to the growth of the village.

3. ECONOMY:

The economy of the village, like the majority of Indian villages, is based on agriculture. In 1971, the working population of the village represented 39% of total; 29%

were farmers, 59% were farm workers, 3% were involved in cottage industries, and 9% were employed in other jobs. The major cash-crops of the village are tobacco, cotton, and vegetables. Bharuch is the nearest marketing and trading centre. Milk produced in Nikora is collected and transported to dairies in Bharuch.

Since 1968, the economy of the village is in a poor state because of crop failure due to recurring floods. The agricultural land is becoming less fertile because of the sand deposited by the floods. Furthermore, the village is losing land due to erosion of the river banks. Compensation equivalent to the value of the land is given by the government but alternate land is unavailable.

4. GOVERNMENT:

The village affairs are administered by "Gram Panchayat", a body of 12 members headed by a "Sarpanch"- a mayor. Sarpanch and the members are elected by a secret ballot for a five-year term. The Gram Panchayat is responsible for water supply, maintenance of streets and street lights, protection of crops, maintenance of school buildings, and issuing construction permits and maintaining records for tax purposes. The main sources of income for carrying out its duties are: a house tax, an electricity tax "octroi" duty (a tax on commodities brought into the village), water tax, a farm guard tax, and a share of land revenue collected by the state.

5. DEMOGRAPHY:

The village population in 1971 was 3437 persons, out of which 52% were males and 48% females. The population in 1951 and 1961 was 2823 and 3004 respectively. The average annual growth rate between 1951 and 1961 was 0.6%, and between 1961 and 1971 was 1.5%.

6. SOCIO-CULTURAL:

Like the majority of the Indian villages, Nikora has a strong base of traditions and cultural values. Social stratification and the caste system dominate social, economic and political activities. Religious beliefs, festivals, fairs and ceremonies play an important role in village life. The majori-

ty of the population are Hindus; one third belongs to tribal communities. Families of each caste or social group live together and are engaged in traditional occupations. Families belonging to several service communities such as potters, carpenters, tailors, smiths, and small traders are scattered throughout the village. Communities of higher social status live in better environments and in permanent houses in the centre of the village. Tribal communities who are generally farm workers, live in huts on the village periphery.

7. SOCIO-ECONOMIC:

Information about income groups and their respective income brackets is unavailable. More than half of the total population are farm workers and their dependents belonging to low and very low income groups. Large numbers of farmers own small and medium size agricultural land; 46% own less than 5 hectares, 51% between 5 and 10 hectares, and 3% more than 10 hectares.

8. HOUSING:

Housing is the responsibility of the users. A large part of the dwellings are self-built or artisan-built and self-finished. Low income groups live in substandard, self-built, mud-and-thatch dwellings with less than two rooms. Middle and high income people live in permanent dwellings of brick masonry with mud or lime mortar and clay tiles, galvanised iron or asbestos sheet roof. These are generally one or two story structures having a grain storage space and an animal-shed. Most of the dwellings in the village have inadequate light and ventilation. They are unserviced, or inadequately serviced, and poorly maintained. The role of the Gram Panchayat in housing activities is very marginal. It is limited to issuing permits and maintaining records of construction activities for taxation purposes only. Until 1976, Nikora had not benefited by rural housing and environment improvement programme sponsored by the state government.

9. UTILITIES AND COMMUNITY FACILITIES:

The utilities and community facilities are

inadequate and accessible only to a small privileged group.

- Water Supply: A network was installed in 1969 and it serves most of the village. The water is pumped directly from a tube-well into the network. Because of scarcity of "sweet" water, it is pumped for only 2 1/2 hours a day. The village is divided in three sectors and only one receives water at a time. Water for other than drinking purposes is fetched from the river by the women in most of the village.

- Sewage Disposal, Storm Drainage, and Garbage Collection: There is no sewage disposal and storm drainage network in the village. Most of the dwellings have pit privies. Storm drainage is provided in the paved streets which have a shallow "V" section forming a gutter in the centre to allow run-off. The section, however, is too shallow and frequently the streets become flooded. The garbage collectors are appointed by the Gram Panchayat, who collect from the houses and dump the refuse in specific locations on the periphery. The animal discharge is utilised as fuel and fertilizer.

- Electricity: Service was introduced in 1962. Most of the middle and high income dwellings have the connections. The street lights are maintained by the gram panchayat. - Education: The village has one kindergarten, one primary school each for boys and for girls, and a high school. They are run by the gram panchayat, the block panchayat, and the education inspector of the state respectively.

- Medical Care: There are four clinics operating in the village; three are private and one is run by a medical practitioner whose services are subsidized by the government. The majority of these services are offered by paramedical personnel.

- Commercial: Except for the very basic necessities, the village has to depend on markets in Bharuch, 20km. away. There is, however, a small, Government "Fair Price" retail shop selling food, grain, sugar, oil, and cloth at controlled prices. The only banking service available is offered by the government, administered through the post-office. An agricultural credit union, a farmers' co-operative, and a housing co-operative function in Nikora.

- Communication and Transportation: The nearest public telephone is in a village at

a distance of 3km. A telegraph office is in Bharuch. There are 150 bicycles, 3 scooters, one car, one tractor, and 124 carts in the village. The state bus service between Nikora and Bharuch (one hour's ride) operates on an average every one and a half hours. The agricultural products are transported by trucks hired from private operators.

- Police and Fire Protection: The police "out-post" is in a village 3km. away from Nikora. In case of fire, the fire department in Bharuch is alerted by telephone and generally the service is made available within one and a half hour. The expenses are borne by the Gram Panchayat. Fortunately, fires are infrequent.

10. VILLAGE RELOCATION:

After one of the most devastating floods in 1968, where many of the villages on the banks of Narmada river were destroyed and damaged, the Gujarat Government initiated a large scale relocation programme. Non-agricultural wasteland on favourable locations near the existing villages were selected as new village sites. When such lands were unavailable, the state government acquired land after giving compensation to private holders. The layouts were prepared and the work was executed by the district panchayat or voluntary social agencies. The low income families were provided with a 150-200 sq.m. lot and an unfinished dwelling. The middle and high income people were given a lot which was equal to their lot in the village but not larger than 500sq.m. They were also given low interest loans by the state. with a maximum upto Rs.5,000 (U.S. \$590), payable in 20 years.

In the case of Nikora, it is in the process of shifting to a new site, across the state highway. The new site has a slightly higher elevation and is almost two times larger than the existing site. As the river bank erodes, the dwellers are forced to shift to the new site. The dwellings are dismantled and most of the building components and material is reused to construct the new dwelling. Therefore, the new buildings follow nearly the same pattern as the previous ones.

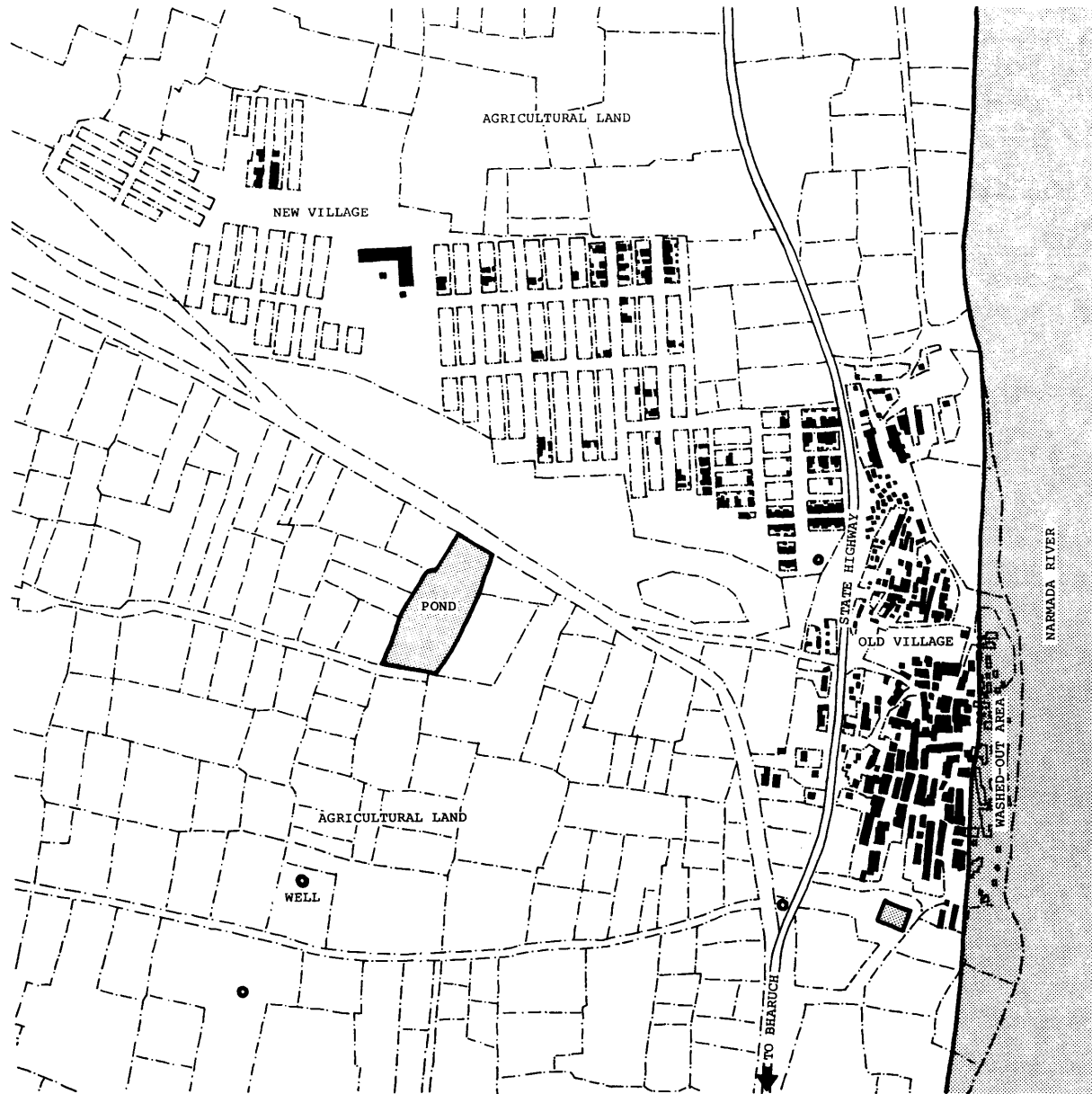
NIKORA VILLAGE: The houses are permanent in nature and are in fair physical condition. Provision of basic services should get higher priority in improving rural environments. In this case, electricity and water are provided.





NIKORA VILLAGE: (top) A front street in a cluster providing access to the houses of the farmers in the original village. Most of the streets are unpaved and restrict movement especially during the monsoon months.

(bottom) A street in front of farmworkers' dwellings in the new village. The dwellings are semi-permanent and poorly maintained in this case. A platform in front of the house is a common feature irregardless of the income groups.



LAYOUT: The existing village has grown along the river banks. The river and the state highway define its east and west boundaries. Agricultural land surrounds its north and south. Most of the residential streets or clusters have grown parallel to the river with the short sides of the lots facing the streets. The dwellings are row houses. Small platforms extending from the dwellings, and a wall or a fence define front and back boundaries of the lots. Each street or cluster houses people from common social groups: through religion, caste, or occupation. The tribal communities are grouped on small, scattered lots on the north. The new village site is defined by the state highway on the east, agricultural land on the north and west, and the village grazing land on the south. The site has an irregular shape. The layout follows a grid-iron pattern with 15 meters wide streets and 4.5 meters wide service alleys between two rows of the lots. The existing high school, playground, and an open air theatre are located on large open space in the middle of the new site. This open space will further accommodate the community facilities such as primary schools, a library, shops and a community centre.





VILLAGE PLAN





LAND USE: Approximately 60% of the land within the village boundaries is agricultural land. The existing village covers less than 1.5% of the total land and has a low residential density. Approximately 30 very small shops and 17 temples are scattered throughout the village. The community facilities are inadequate, therefore it has to depend on nearby villages and the larger city of Bharuch. The new site, when fully developed, will occupy 2.5% of the total land, and will have a low population density.

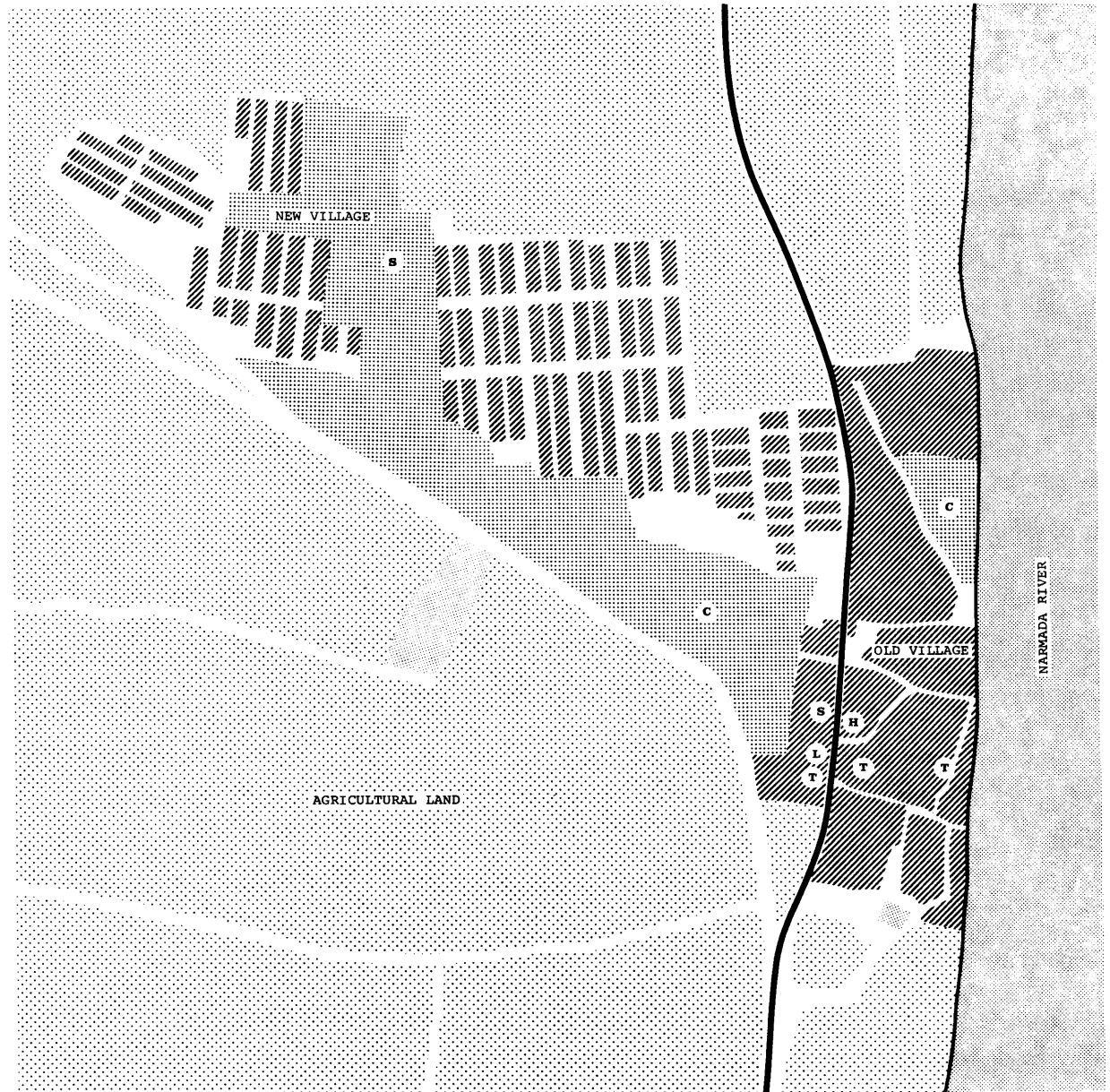
CIRCULATION: The state highway, which passes between the old and the new village sites is the only vehicular road. In the existing village, two east-west streets serve as major internal streets. There is a regular movement of carts, and occasionally trucks and tractors pass through the village. Unpaved internal streets restrict all movement during the monsoon. The extensive front streets and back alleys in the proposed layout appear to be too extravagant for the future pedestrian and light vehicular movement. The alleys are not used and, moreover, become a waste of land; they are also a health hazard due to garbage thrown behind the lots.

AREAS

-  RESIDENTIAL
-  COMMERCIAL
-  AGRICULTURAL
-  OPEN AREAS

KEY

- Pk** Parking
- P** Police
- F** Fire Department
- S** School
- T** Temple
- Mq** Mosque
- Ch** Church
- R** Recreation
- L** Library
- U** University
- H** Health
- PO** Post Office
- SS** Social Services
- M** Market
- C** Cemetery
-  Bus
-  Rapid Transit

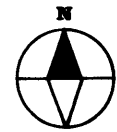


VILLAGE LAND USE PATTERN

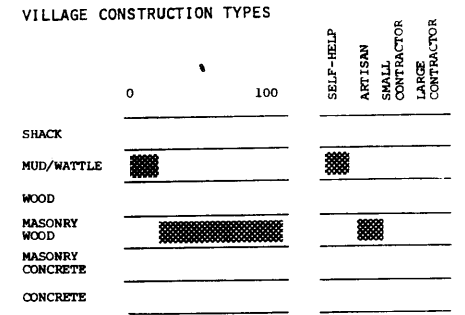


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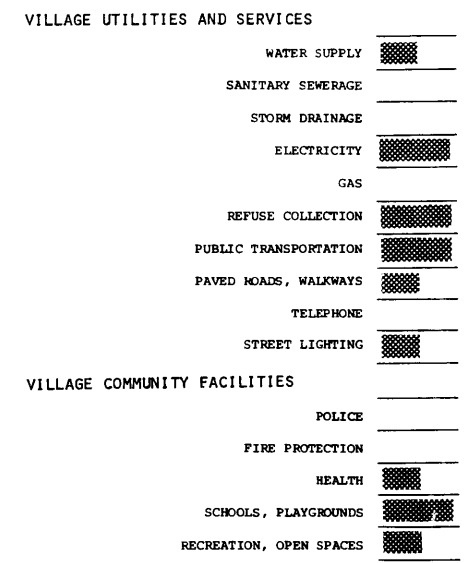




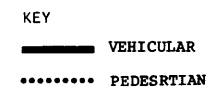
VILLAGE CIRCULATION PATTERN



The chart shows (1) approximate percentage of each construction type within the total number of dwellings and (2) building group that generally produces each type.
Quality of information: Approximate



The chart illustrates the approximate availability of utilities, services, and community facilities at three levels: NONE, LIMITED, ADEQUATE.
Quality of information: Approximate





OLD VILLAGE LAND UTILIZATION DATA

DENSITIES	Total Number	Area Hectares	Density N/ha
LOTS	-	17	-
DWELLING UNITS	617	17	36
PEOPLE	3440	17	202

AREAS	Hectares	Percentages
PUBLIC (streets, walkways, open spaces)	7.42	44
SEMI-PUBLIC (open spaces, schools, community centers)	0.41	2
PRIVATE (dwellings, shops, factories, lots)	9.17	54
SEMI-PRIVATE (cluster courts)	-	-
TOTAL	17.00	100

VILLAGE SEGMENT PLAN



1:2500

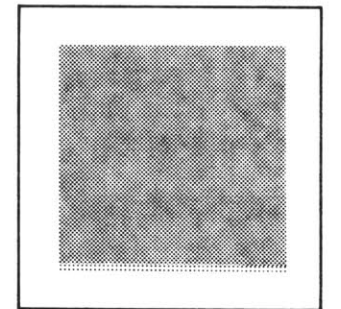
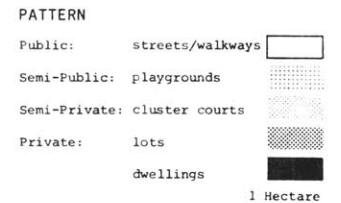
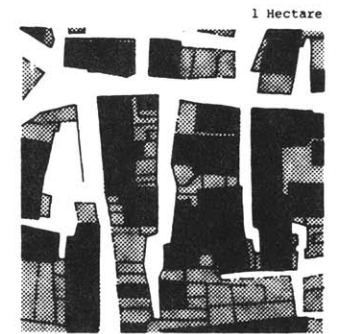




BLOCK PLAN

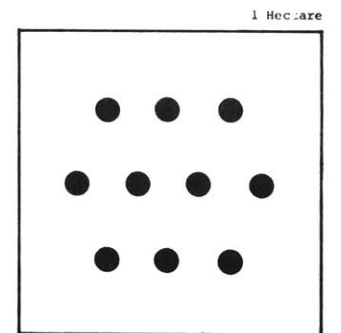


LAND UTILIZATION DIAGRAMS



PERCENTAGES

Streets/walkways	44%
Playgrounds	2
Cluster Courts	-
Dwellings/Lots	54



DENSITY

Persons/Hectare	202
-----------------	-----

● 20 Persons



NEW VILLAGE LAND UTILIZATION DATA

DENSITIES	Total Number	Area Hectares	Density N/Ha
LOTS	680	33.65	20
DWELLING UNITS	680	33.65	20
PEOPLE	4080	33.65	121

AREAS	Hectares	Percentages
PUBLIC (streets, walkways, open spaces)	14.97	44
SEMI-PUBLIC (open spaces, schools, community centers)	5.04	15
PRIVATE (dwellings, shops, factories, lots)	13.64	41
SEMI-PRIVATE (cluster courts)	-	-
TOTAL	33.65	100

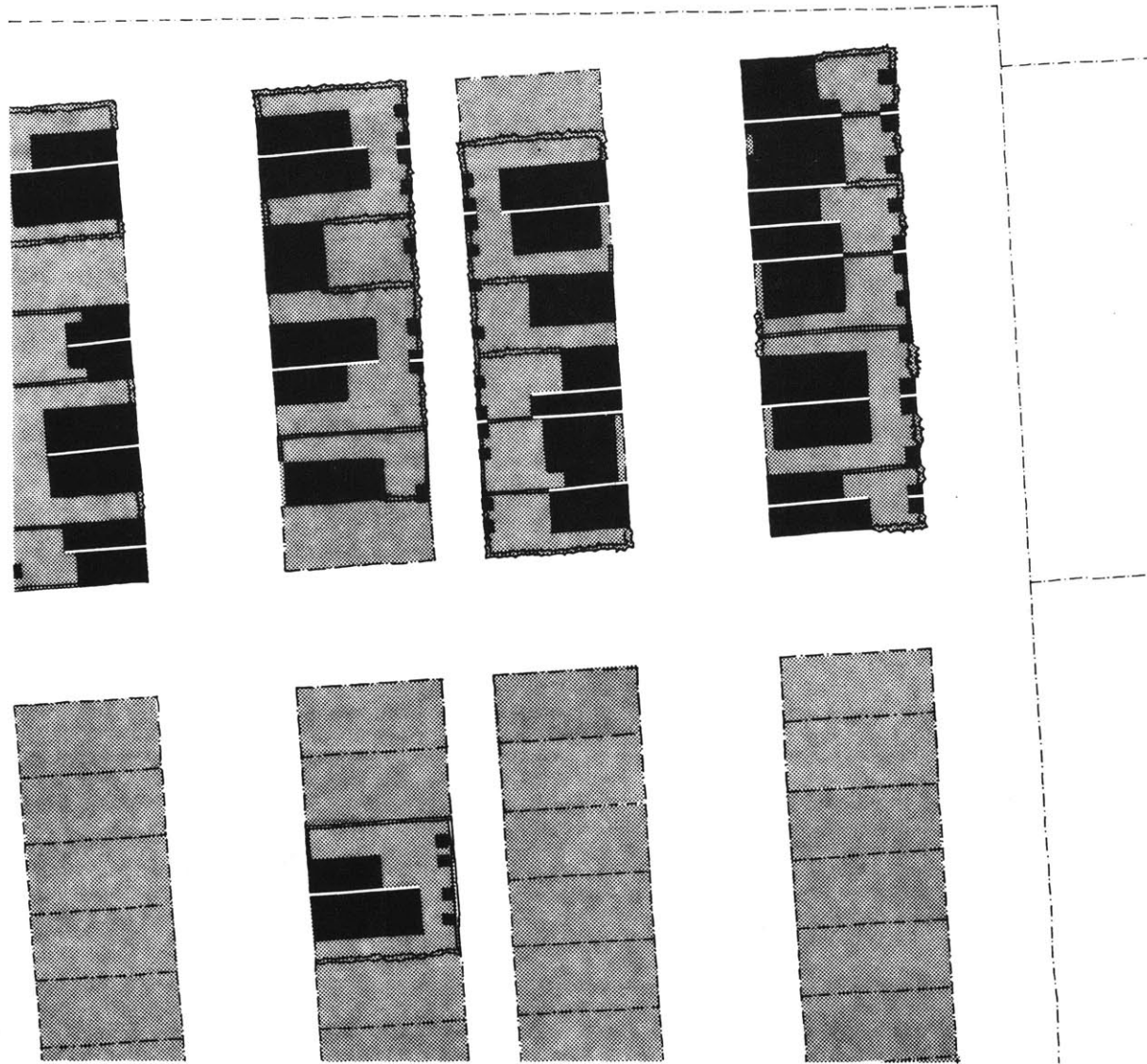
NEW VILLAGE SEGMENT PLAN



1:2500



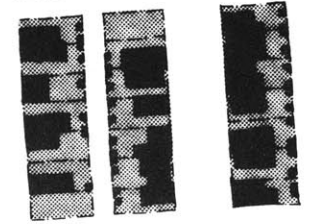
LAND UTILIZATION DIAGRAMS



BLOCK PLAN



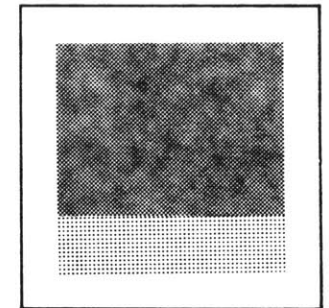
1 Hectare



PATTERN

- Public: streets/walkways
- Semi-Public: playgrounds
- Semi-Private: cluster courts
- Private: lots
- dwellings

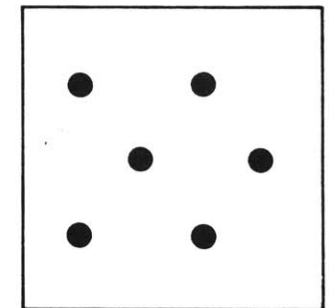
1 Hectare



PERCENTAGES

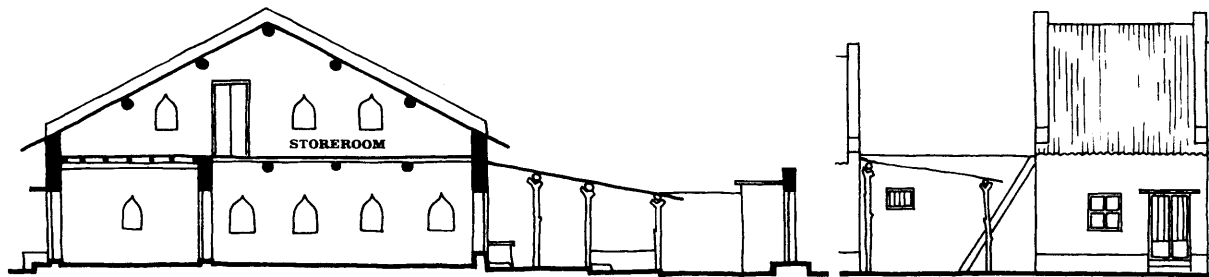
Streets/walkways	44%
Playgrounds	15
Cluster Courts	-
Dwellings/Lots	41

1 Hectare



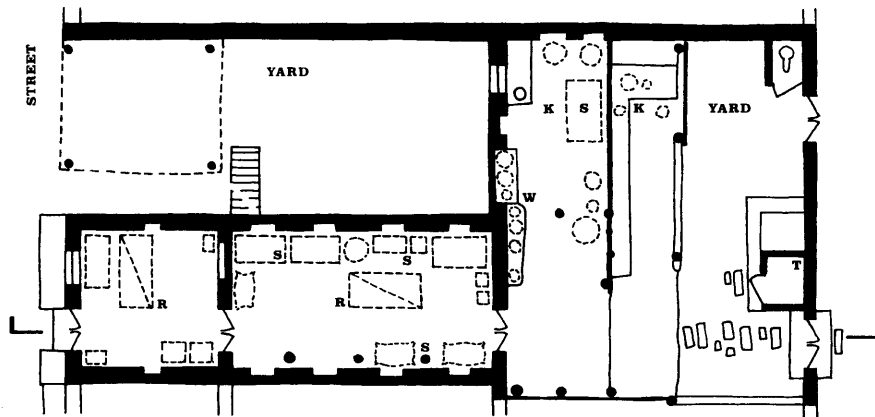
DENSITY Persons/Hectare 121

20 Persons



SECTION

ELEVATION



PLAN

KEY

- LR Living Room
- D Dining/Eating Area
- BR Bedroom
- K Kitchen/Cooking Area
- T Toilet/Bathroom
- L Laundry
- C Closet
- S Storage
- R Room (multi-use)

PHYSICAL DATA

(related to dwelling and land)

DWELLING UNIT
 type: HOUSE
 area (sq m): 205
 tenure: LEGAL OWNERSHIP

LAND/LOT
 utilization: PRIVATE
 area (sq m): 194
 tenure: LEGAL OWNERSHIP

DWELLING
 location: VILLAGE CENTRE
 type: ROW/GROUPED
 number of floors: 2
 utilization: MULTIPLE FAMILY
 physical state: FAIR

DWELLING DEVELOPMENT
 mode: INCREMENTAL
 developer: PRIVATE
 builder: ARTISAN
 construction type: MASONRY, WOOD
 year of construction:

MATERIALS
 foundation: BRICK
 floors: MUD
 walls: WOODEN COLUMNS, BRICK, MUD
 roof: G.I. SHEETS

DWELLING FACILITIES
 wc: 1
 shower: 1
 kitchen: 2
 rooms: 2
 other: STORAGE SPACE,
 CATTLE-SHADE, BACK YARD

SOCIO-ECONOMIC DATA

(related to user)

GENERAL: SOCIAL
 user's ethnic origin: HINDU
 place of birth: NIKORA
 education level: PRIMARY SCHOOL

NUMBER OF USERS
 married: 4
 single: 2
 children: 3
 total: 9

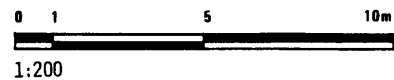
MIGRATION PATTERN

number of moves:
 rural - urban:
 urban - urban:
 urban - rural:
 why came to urban area:

GENERAL: ECONOMIC
 user's income group: MODERATELY LOW
 employment: FARMING
 distance to work: 3 KM.
 mode of travel: WALKING

COSTS
 dwelling unit:
 land - market value:

DWELLING UNIT PAYMENTS
 financing:
 rent/mortgage:
 % income for rent/mortgage:



NIKORA VILLAGE: The dwellings in the new and original villages. There are not enough openings to allow adequate light and ventilation in the dwellings.



CASE STUDY SOURCES

Plan: (approximate) Bharuch District Land Survey Office, Nikora Gram Panchayat, 1970.
 Land Use Pattern: (approximate) IBID.
 Circulation Pattern: (approximate) Field Survey, A. and V. Chavda, 1976.
 Segment Plans: (approximate) Bharuch District Land Survey Office, Nikora Gram Panchayat, 1970.
 Block Plans: (approximate) IBID.
 Block Land Utilization: (approximate) IBID.
 Typical Dwelling: (approximate) Field Survey, A. and V. Chavda, 1976.
 Physical Data: (approximate) IBID.
 Socio-Economic Data: (approximate) IBID.
 Photographs: A. and V. Chavda, 1976.
 General Information: Census, 1971.

AHMEDABAD, INDIA

URBAN CONTEXT

1. PRIMARY INFORMATION:

Ahmedabad, the seventh largest city in India and the largest in Gujarat State, is situated about 560km. north of Bombay, in western India. The city is located 52m. above sea level on 23°4' north latitude and 72°38' east longitude. It is connected to other parts of the country by extensive railway, highway, and air route networks. There are no physical features defining its boundaries and it is situated on almost flat land. The city is characterized by its hot-dry climate; summer temperatures go as high as 44°C, with hot winds and occasional sandstorms. The four coldest months (November-February) are mild with temperatures reaching 6°C. Monsoon occur during June to October result in an average annual rainfall of 825mm. The Sabarmati river runs north-south through the city but remains dry except during the monsoon months.

2. HISTORY:

Ahmedabad was found in 1141 A.D. by King Ahmed Shah of Gujarat on a site close to the much older trading centre of Asval. He encouraged merchants, weavers, and skilled craftsmen to come to Ahmedabad, which resulted in a flourishing commercial and industrial city. The ruling power of Ahmedabad passed hands from the Mughals to the Marathas, to the British, before independence of India in 1947. It was a part of Bombay State until the separation of Gujarat State in 1960. The introduction of the textile industry in 1861 was one of the major phases of development. In 1930's, the textile industry and commercial activities expanded to a considerable extent which resulted in mass migration from adjoining regions with the population nearly doubling in that decade.

In 1960's, Ahmedabad grew still further as the temporary capital of the new state of Gujarat.

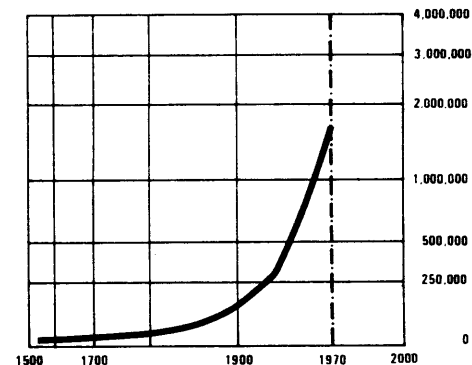
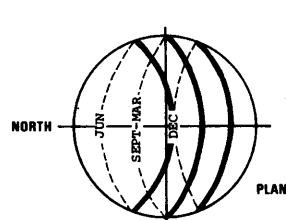
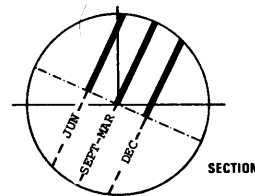
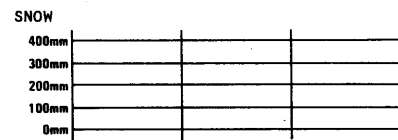
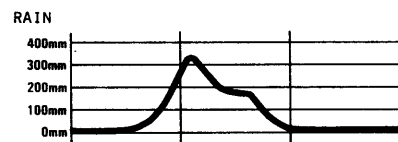
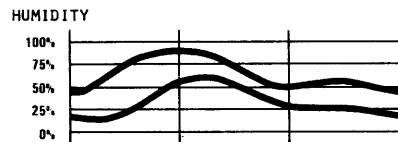
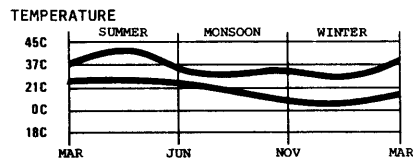
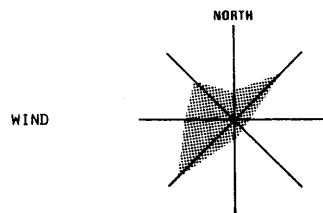
3. ECONOMY:

It is the major industrial and commercial city in the state. The textile industry and small scale industries such as manufacturing of machinery, processing of foodstuff and beverages, metal products like nuts and bolts, chemicals, etc. are the economic backbone of the city. In 1971, 28% of the city's population was economically active, out of which 7% was female. 47% of the working population was employed in industries, 22% in the administrative and services sector, 20% in trade and commerce, 7% in transportation and communication, and 3% in the building industry. A part of the non-working population is self-employed as vendors, hand cart pullers, etc.

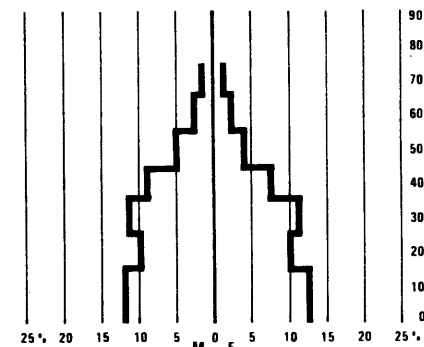
4. GOVERNMENT:

The Ahmedabad Municipal Corporation (AMC) is headed by a mayor elected by the members of a council who are elected representatives from political wards (33 in 1976). The executive power of the municipality vests in a commissioner who is also responsible for prescribing duties of various establishments and supervision of their work. The municipality administers and executes functions relating to taxation and finance, engineering works, transportation, health, and education. An engineering office, a town development office, and a planning office of the municipality are responsible for the provision of services, authorization of land subdivisions, issuing building licences and building inspection.

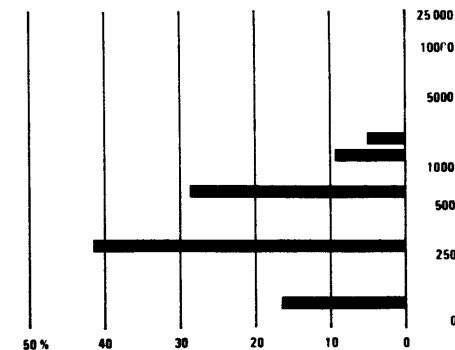
AHMEDABAD 23°04' N



URBAN POPULATION GROWTH
horizontal: dates vertical: population
Source: Nimish Patel, M.I.T. Thesis, 1976.

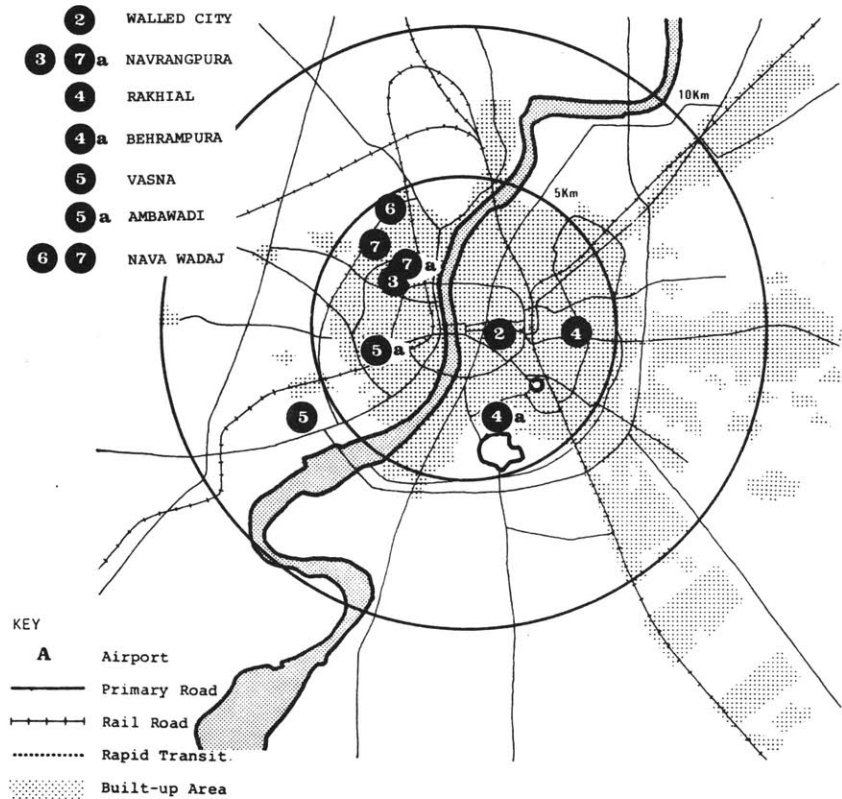


URBAN POPULATION DISTRIBUTION
horizontal: percentages vertical: ages
males: M females: F
Source: Nimish Patel, M.I.T. Thesis, 1976.



URBAN ANNUAL INCOME DISTRIBUTION
horizontal: percentages vertical: dollars
Source: Nimish Patel, M.I.T. Thesis, 1976.





URBAN TOPOGRAPHY/CIRCULATION

5. DEMOGRAPHY:

The population of the Ahmedabad Urban Agglomeration was 1,741,522 in 1971, out of which 1,585,544 lived in Ahmedabad proper. The population represents an increase of 44.4% and 37.8% respectively in the last decade. Approximately 50% of the population was born outside of the city. 45.4% of the population was female. The literacy rate was 59%. The population can be broadly divided into the following age groups: 39% below 14 years, 58% between 15-59 years; and 3% above 60 years.

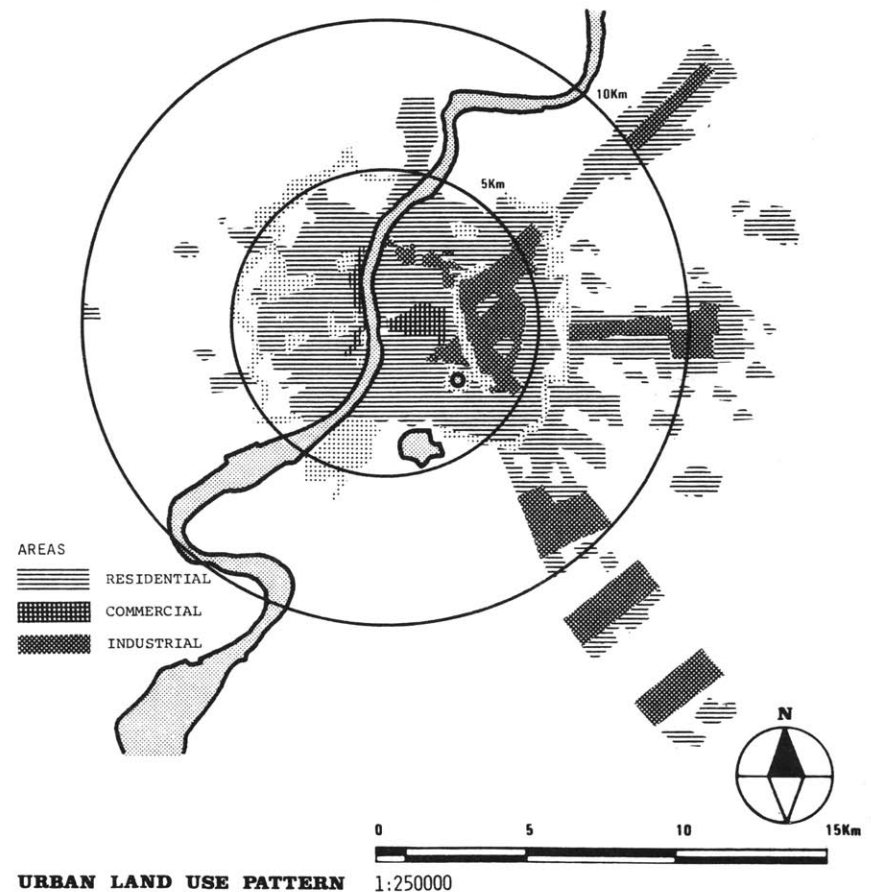
6. SOCIO-CULTURAL:

Like most of the cities in India, Ahmedabad

has people from diversified ethnic origins, religions, socio-cultural backgrounds, occupations, and castes. Each group has its own way of life. Expression of their living pattern is frequently found in their dwelling environments through uses of areas and spaces of varying character: verandahs, front and back yards, "chawk"- a centrally located open area where rooms or dwellings lead to in a house or a cluster.

7. SOCIO-ECONOMIC:

47% of the city's population, the low and very low income people who earn less than Rs,3,600 (U.S. \$425) per year, live below minimum subsistence level. 25% consists of



URBAN LAND USE PATTERN 1:250000

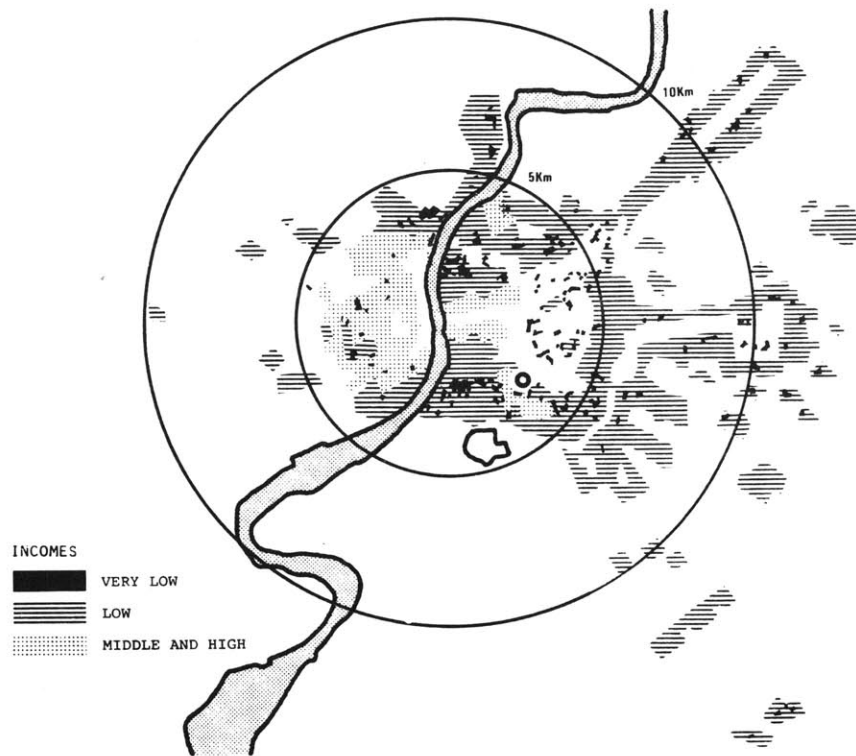
moderately low and lower middle income group earning upto Rs.10,800 (U.S. \$1,700) per year. The rest comprise the middle and high income groups. The low and very low income population is concentrated in the eastern part of the city in the industrial areas and in small pockets scattered throughout the city. A large portion of middle income group lives in the original walled city. The majority of the remaining population is housed in the western part.

8. URBAN DEVELOPMENT:

In a span of 75 years, from 1901 to 1975, the population of Ahmedabad increased 8.5 times and the municipal area 6.5 times (In

1975, 93 sq.km. was within municipal boundaries and approximately 150 sq.km. comprised the entire Ahmedabad Urban Agglomeration area).

One of the earliest comprehensive development plans was prepared in 1961. The city outside of the fort wall has been divided into 36 development zones or town planning schemes. Under these schemes the city's undeveloped land has been subdivided into smaller areas and a circulation network based on lot characteristics, projected land development plans, and existing circulation and infrastructure networks. Zoning regulations, municipal building bye-laws, and other ordinances controlling the urban growth have existed for a long time but have not been success-



INCOMES

VERY LOW
LOW
MIDDLE AND HIGH

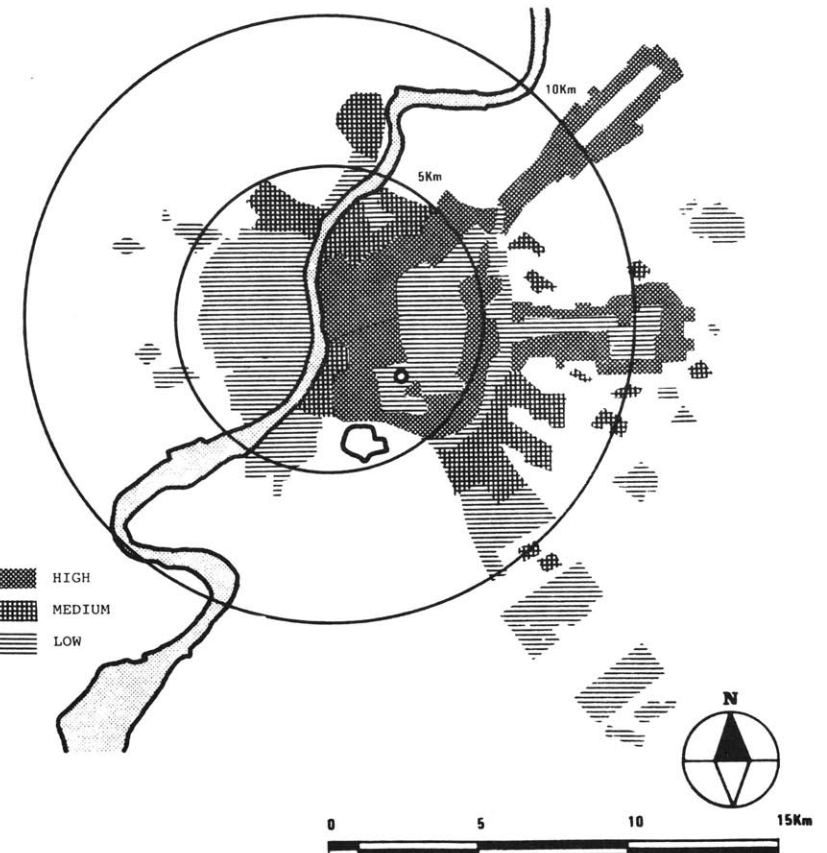
URBAN INCOME PATTERN

fully implemented or enforced. As a result the city has grown haphazardly with a concentration of commercial and business activities in the centre and industries on the east. The circulation network is improperly linked and unbalanced in terms of the needs. In 1961, 36% of the land within the city boundaries was in residential use, 2% commercial use, and 13% industrial use. The rest consisted of circulation areas, parks, playgrounds and undeveloped land. In the same year the city had a gross density of 170 persons per hectare.

9. HOUSING:

A large part of the city's population

lives in housing classified by authorities as substandard or unfit. 58% of the population lives in one room dwellings shared by 6 persons on average. In 1961, 82% lived in rental housing; in 1971, 76% did so. Approximately 30% of the population lives in traditional housing in the walled city; 27% in squatter settlements; 35% in housing by the private sector; and 8% in government housing projects. According to estimated housing shortages in the city in 1970, about 84% was among the low income people. The public sector involvement has been very marginal. The city lacks realistic urban development and housing policies. The housing development efforts are very small scale, scattered and only in response to



KEY

HIGH
MEDIUM
LOW

URBAN DENSITY PATTERN

1:250000

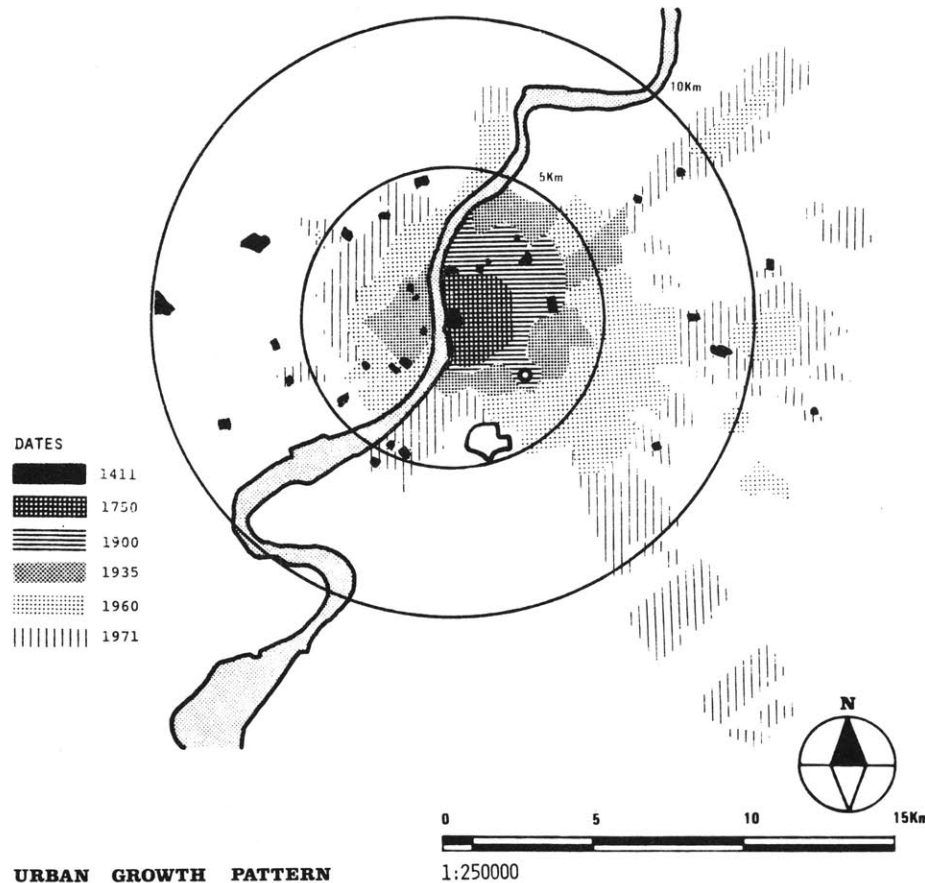


immediate needs. The type of housing options and the size of individual units varied according to the needs and economic constraints of the past years. The following overview of housing systems developed in the past fifty years illustrate the present conditions and future needs.

CHAWL: (See Case Study 4)

During the 1930's as a consequence of expansion of the textile industry, the city's population nearly doubled creating a strong demand for housing. "Chawl", a private sector housing system, was introduced during that period to house the industrial workers. They are generally very high density developments consisting of rows of one room or one room and a fronting verandah. They have

limited or inadequate communal facilities: water supply and toilets. They were developed as rental housing by individuals or by industries for their workers in the industrial areas. High demand and low supply of housing supported speculation in chawls until the rents were frozen and controlled by introducing local rent controls in 1940. As a result the chawls remained unmaintained for years since they have become an uneconomical burden to the owners. In some instances the chawls have been sold to the occupants and the physical conditions of the housing have been improved by them. In the last 15 years, the physical conditions of the chawls have generally improved by introduction of basic services.



URBAN GROWTH PATTERN

The costs of installing a sewage disposal network in some cases were shared by the municipality and the owners. In most of the chawls the municipality installed the water supply and electricity networks and the occupants paid for connections charges. There are 1476 chawls (within municipal boundaries) with an average size of 400 to 450 rooms housing about 59,500 families or 20% of the city's population. 80% of the chawls are rental units owned by industries, 6% are owner occupied. Minimum area and utility requirements in the recent building bye-laws discourage further development of chawls.

SQUATTER SETTLEMENTS: (See Case Study 3)

During the 1930's, with inability to cope

with the high demand for housing by the job-seeking migrants, squatting became prevalent on open land in the city. The settlements developed as rural pockets in the urban areas with physical environments resembling the villages. These illegal settlements lack basic services. The quality of housing, material and technology used for construction depend on the age of the settlement. The newer settlements have small dwellings made from assorted salvage materials. The dwellings in the older settlements are consolidated using mud or brick walls and clay tile or galvanized iron roofs. They are spacious having one or two rooms and a verandah in the front. In general the settlements have substandard living

conditions with high population densities. In 1971, 80,000 families, or 27% of the city's population lived in the squatter settlements. 48% of squatters were self-employed: cattle breeding, crafts, etc. 27% were labourers: cart pullers, construction and casual labourers. 15% were textile workers and 10% were employed at the lowest level in the public sector.

Communal water supply and water closets have been provided by the municipality in recent years, but the facilities are highly inadequate because of limited number.

CO-OPERATIVE HOUSING SOCIETIES

(Condominiums): (See Case Study 6)

The condominiums, popularly known as co-operative housing societies, also started developing in the 1930's. Until the mid 1950's, the role of the co-operatives was to subdivide large lots and it was a responsibility of individual members or owners of the subdivided lot to construct the house. Fairly large houses were built having two or more bedrooms, a living room, kitchen, storeroom, bathroom, front verandah and back yard. They were on individual lots leaving 3-5 meters of setback around the building as required by the by-laws. This trend was popular among the upper middle and high income groups.

In the last 25 years, because of the pressure of increasing land costs, semi-detached houses (locally known as "tenements") and walk-up apartments have become popular among the co-operatives. The dwelling units became smaller in area and land costs were shared by a group of occupants, the members of the co-operatives. This was a viable housing option. The Gujarat Financing Corporation, a government agency, was started during the same period. It provided loans with low interest and on long terms for the co-operatives giving the moderately low and lower middle income groups an access to housing. The co-operatives of 25 to 50 apartments or semi-detached dwellings are continuing to expand very rapidly on the periphery of the city. Most of the single story semi-detached dwellings have added one or two additional floors for rental purposes to provide an extra, steady income. It is very common to rent one or two rooms which share the services in the same dwelling. This provides the major housing supply for middle income people. The housing options offered by the co-operatives have so far been appropriate for the

middle income groups. However, due to lack of comprehensive planning for the city and its surrounding areas, the co-operatives grow haphazardly and do not have community facilities such as schools, playgrounds, parks, medical care, etc., or at unnecessarily high costs. The developments are too small to support the facilities from their own resources both in cost and administrative capacities.

10. CONTRIBUTION OF PUBLIC SECTOR IN

HOUSING: (See Case Studies 5 and 7)

The public sector operates in the field of housing at various levels through different agencies by introducing laws, and sponsoring various schemes ("programmes"). The Housing and Urban Development Corporation of India (HUDCO), established in 1970, administers and finances, through a "Revolving Fund", a large part of the housing activities at the national level, while the state housing agencies and the local governing bodies implement the projects. The Town Planning and Valuation Department of Gujarat State, and the Town Development and Planning Offices of the municipality are directly involved in physical planning of the city. The Gujarat Housing Board and the Housing Office of the municipality are responsible for middle and low income housing. They provide one room row houses and walk-up apartments for the low income and 2-3 room walk-up apartments for the middle income people. The low income housing in most cases is partly subsidized by the government. A partial housing loan is available on a long term, low interest basis upon making a down payment. However, the housing provided for the low income remains beyond their financial means. As a result, a large number of units are occupied by unauthorised persons belonging to higher income groups.

The Slum Clearance and Environment Improvement Schemes are partly subsidized by the central government and implemented by the municipality. The aim of these schemes is to rehouse squatters on the same or alternate locations. The new accommodations consist of a one room apartment in three story buildings. However, these do not satisfy the socio-cultural needs of the people. Furthermore, inefficient physical layouts unnecessarily increase the costs of the projects. Under the Environment Improvement scheme the physical environment of settle-

ment is upgraded by providing communal services such as water supply, sewage disposal, and street lights. These are provided on a condition that the settlement would not be removed for the next ten years and that the land owner would not charge extra rent.

THE MUNICIPAL HOUSING POLICY:

According to the Ahmedabad Municipal Corporation's Revised Development Plan (Draft) for 1975-85, the population of the city is expected to grow at the rate of 4.7% every year reaching 2.45 millions by 1984. Including the housing backlog of 125,000 units, 200,000 units will be required to be constructed in the next ten years to cope with the demand. It is assumed that the housing demand for the middle and high income groups will be the responsibility of the private sector. The municipality plans to adopt a four tier strategy to deal with low income housing demand: controlling the growth of existing squatters, and introducing site and service projects, an environment improvement programme for slums and chawls, a programme of providing community facilities such as schools, medical facilities, community centre, etc. in the existing settlements, and constructing instant dwellings for the people of moderately low income level.

The strategy neglects the practical aspects of financing, administration, and planning. No implementation procedures are outlined.

AHMEDABAD: (top) General view. Note the low income squatters in the foreground in contrast with the high income privately developed high-rise apartments in the background.

(bottom) Low income public housing developed as a part of the Slum Clearance Scheme by the municipality.

URBAN CONTEXT SOURCES

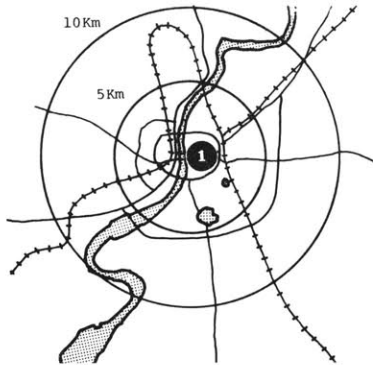
- Topography and Circulation:* (accurate) Nimish Patel, M.I.T. Thesis, 1976
- Land Use Pattern:* (approximate) IBID
- Income Pattern:* (approximate) IBID
- Density Pattern:* (approximate) IBID
- Growth Pattern:* (approximate) IBID
- Climate:* (accurate) IBID
- Photographs:* A. and V. Chavda, 1974,75,76.
- General Information:* REVISED DEVELOPMENT PLAN-1975-85 (Draft), Ahmedabad Municipal Corporation, 1975. SPECIAL REPORT ON AHMEDABAD CITY, Census of India, 1961. AHMEDABAD, Gillion, California, 1968. Nimish Patel, M.I.T. Thesis, 1976.



2 WALLED CITY

PRIVATE, MOD. LOW/MIDDLE INCOME,
TRADITIONAL URBAN HOUSE

Ahmedabad



LOCATION: This area in the city centre is bounded by a fort-wall built during the seventeenth and the eighteenth centuries. The fort spreads over approximately 5km. but the locality only includes 160Ha. The locality is defined by a part of the fort wall on the east and south-west, Sardar Patel Road on the south-west, and an extremely busy commercial street on the north: the Relief Road. A major railway line and the city railway station are on the east, and the city bus terminus on the west of the locality.

ORIGINS: Dating back to 1141 A.D., the locality was one of the first areas of the city. The king's palace, and the biggest mosque with the surrounding commercial areas were located on the major street (Gandhi Road) in this locality. The residential areas which branch off from main streets were nearly completely developed by the end of the eighteenth century. Overcongestion of commercial activities on the main Gandhi Road resulted in the construction of a parallel street, appropriately called "Relief Road", in the 1940's. Former inhabitants of high and upper middle income groups have moved out to suburbs in the last two decades.





They are being replaced by middle and low income groups.

LAYOUT: The entire layout is characterized by a geometrically arbitrary pattern of "pols", closed loops or dead-end streets terminating in form of a "chawk": an open area providing an access to dwellings around it. The dead-end pols with gates in the front were formed for the purpose of defence in early wars. The land subdivision within the pol is very irregular and in almost all cases the entire lot is covered by construction. The lots are narrow and the houses have common walls to avoid heating of walls by direct sun exposure. 3 to 5 story houses shade narrow streets as protection against the hot-dry climate. A central open court in most of the houses is a good source of light and ventilation. A temple or a mosque is shared by two or three pols.

LOCALITY PLAN



LAND USE: The locality has reached a saturation point with mixed land use of residential and commercial areas. The major retail shopping has grown along the important circulation routes. Banking and business offices are on the west, and wholesale trade centres, mainly supporting the textile industry, are on the east in the vicinity of the railway station. Wholesale and retail markets for foodgrains, vegetables, fruits, timber, building materials, etc. are grouped throughout the locality. There is a total absence of open recreational areas or parks. However, 12 to 15 cinemas are closely grouped creating traffic jams during the show hours. Parking facilities are very limited; open areas within the pols are very frequently used for parking.

CIRCULATION: Gandhi Road, Relief Road, and Sardar Patel Road are major circulation routes in the locality. The traffic varies enormously in speed and volume. It includes pedestrians, bicycles, hand-pulled carts, scooters, autorickshaws, cars, buses, and occasionally stray animals also. In 1972, to ease the traffic problem in the city centre, Gandhi Road and Relief Road were made one-way streets going east and west respectively, for all vehicles except bicycles and buses. This has increased traffic movements on narrow connecting links. This area is still dominated by slow moving traffic. The secondary streets branching off from the two major roads provide access to various pols.

KEY

Pk	Parking		
P	Police		
F	Fire Department		
S	School		
Ch	Church		
R	Recreation		
T	Temple		
U	University		
H	Health		
PO	Post Office		
SS	Social Services		
M	Market		
Mq	Mosque		
—	Bus		
■ ■ ■ ■	Rapid Transit		
		AREAS	
		▬▬▬▬	RESIDENTIAL
		▣▣▣▣	COMMERCIAL
		▤▤▤▤	INDUSTRIAL
		▧▧▧▧	OPEN SPACES



LOCALITY LAND USE PATTERN

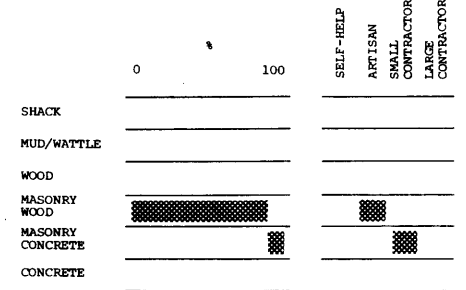




LOCALITY CIRCULATION PATTERN



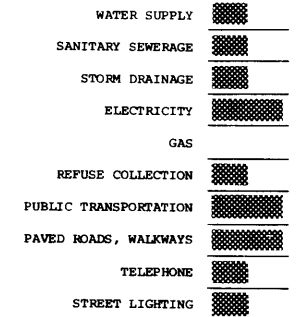
WALLED CITY CONSTRUCTION TYPES



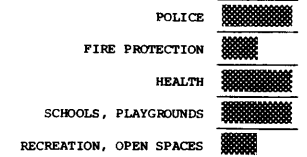
The chart shows (1) approximate percentage of each construction type within the total number of dwellings and (2) building group that generally produces each type.

Quality of information: Approximate

WALLED CITY UTILITIES AND SERVICES



WALLED CITY COMMUNITY FACILITIES



The chart illustrates the approximate availability of utilities, services, and community facilities at three levels: NONE, LIMITED, ADEQUATE.

Quality of information: Approximate

KEY

- ██████████ VEHICULAR
- PEDESTRIAN

POPULATION AND INCOME: In 1971, 30% of the city's population lived in the walled city. In the past, upper middle and high income extended families lived in the locality. Many of them have moved to suburbs, renting their houses to middle income people. A majority of the new occupants are connected to surrounding commercial areas. There is a great degree of cohesion and interaction resulting from grouping based on common interests. The annual family income ranges from U.S. \$800 to 2,000 (3 to 5 times the subsistence level), a large sector of the population has an average annual income of U.S. \$1,100.

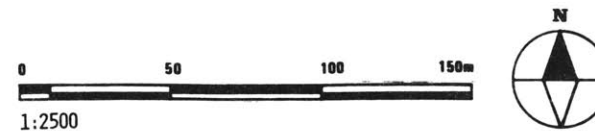


LOCALITY BLOCK LAND UTILIZATION DATA

DENSITIES	Total Number	Area Hectares	Density N/Ha
LOTS	109	1.21	90
DWELLING UNITS	123	1.21	102
PEOPLE	711	1.21	588

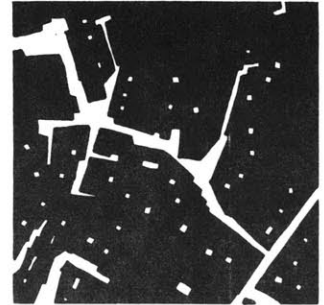
AREAS	Hectares	Percentages
PUBLIC (streets, walkways, open spaces)	0.19	16
SEMI-PUBLIC (open spaces, schools, community centers)	-	-
PRIVATE (dwellings, shops, factories, lots)	1.02	84
SEMI-PRIVATE (cluster courts)	-	-
TOTAL	1.21	100

LOCALITY SEGMENT PLAN



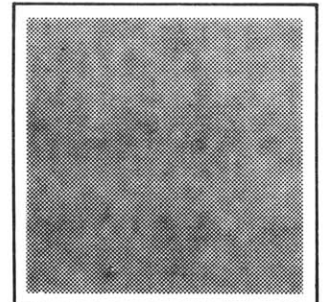
LAND UTILIZATION DIAGRAMS

1 Hectare



PATTERN

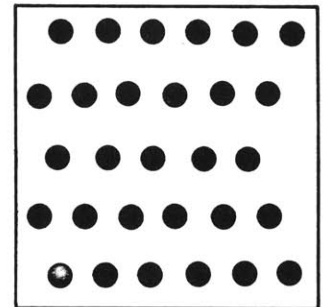
- Public: streets/walkways
 - Semi-public: playgrounds
 - Semi-private: cluster courts
 - Private: lots
 - dwellings
- 1 Hectare



PERCENTAGES

Streets/Walkways	16%
Playgrounds	-
Cluster Courts	-
Dwellings/Lots	84

1 Hectare



DENSITY

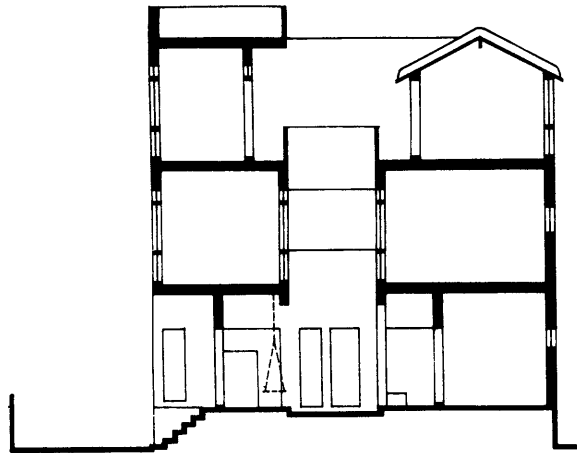
Persons/Hectare	588
-----------------	-----

20 Persons



LOCALITY BLOCK PLAN





SECTION



ELEVATION

PHYSICAL DATA

(related to dwelling and land)

DWELLING UNIT
 type: HOUSE
 area (sq m): 152
 tenure: LEGAL OWNERSHIP

LAND/LOT
 utilization: PRIVATE
 area (sq m): 67
 tenure: LEGAL OWNERSHIP

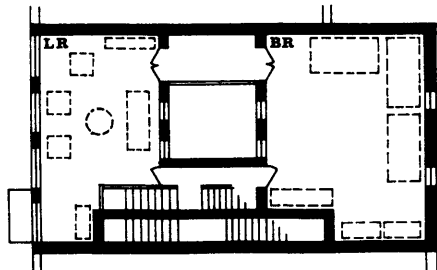
DWELLING
 location: CITY CENTRE
 type: ROW HOUSE
 number of floors: 3
 utilization: SINGLE
 physical state: FAIR

DWELLING DEVELOPMENT
 mode: INCREMENTAL
 developer: PRIVATE
 builder: ARTISAN
 construction type: MASONARY, WOOD
 year of construction: 1880

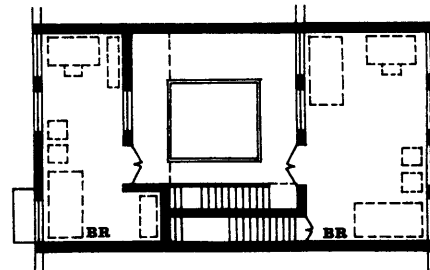
MATERIALS
 foundation: STONE
 floors: STONE
 walls: BRICK WITH WOODEN COLUMNS
 roof: WOOD

DWELLING FACILITIES

wc: 1
 shower: 1
 kitchen: 1
 rooms: 5
 other: INNER COURT



FIRST FLOOR PLAN



SECOND FLOOR PLAN

SOCIO-ECONOMIC DATA

(related to user)

GENERAL: SOCIAL
 user's ethnic origin: HINDU BANIA
 place of birth: AHMEDABAD
 education level: UNIVERSITY

NUMBER OF USERS

married: 2
 single: 3
 children: 2
 total: 7

MIGRATION PATTERN

number of moves: 1
 rural - urban:
 urban - urban: BEFORE 1930
 urban - rural:
 why came to urban area: EMPLOYMENT

GENERAL: ECONOMIC

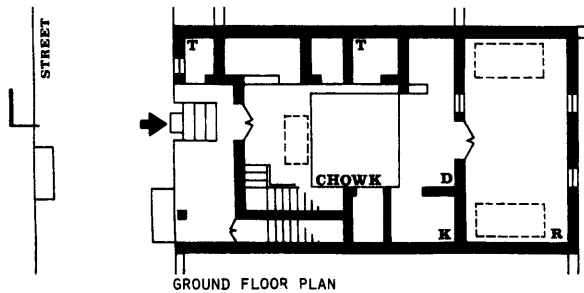
user's income group: MIDDLE
 employment: BUSINESS
 distance to work: 0.5 KM.
 mode of travel: WALKING

COSTS

dwelling unit:
 land - market value:

DWELLING UNIT PAYMENTS

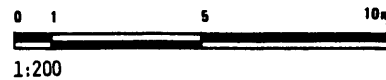
financing: PRIVATE
 rent/mortgage:
 % income for rent/mortgage:



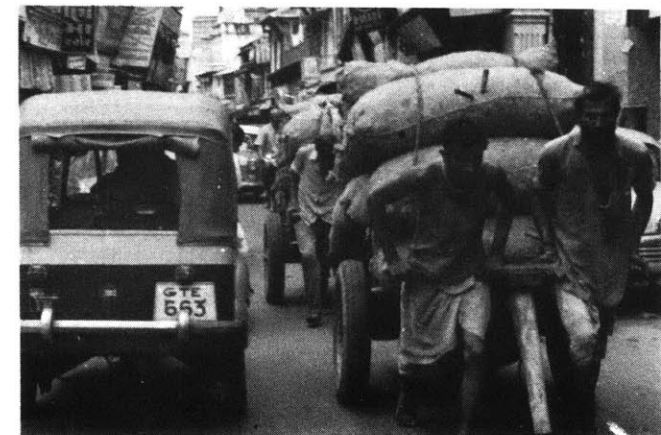
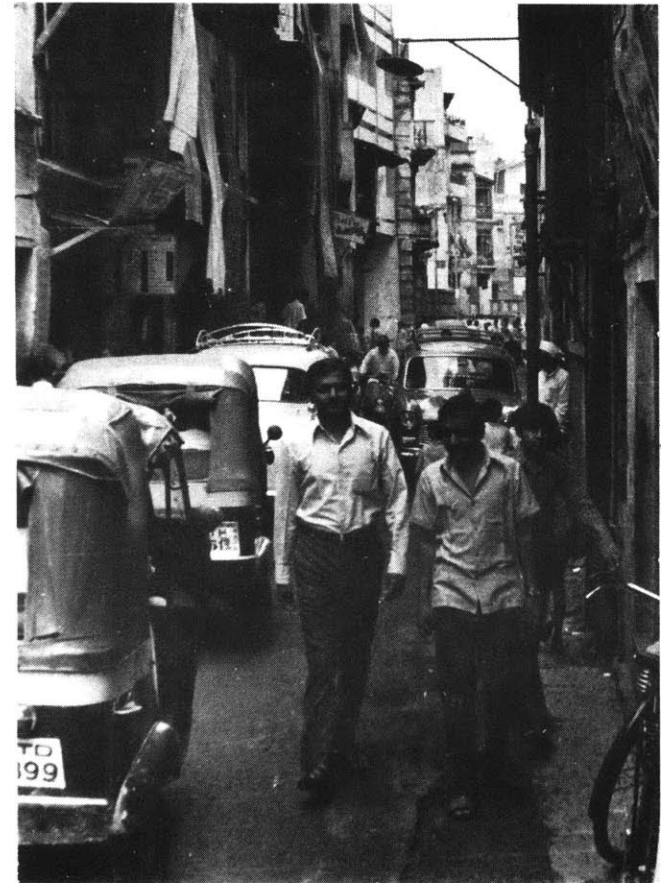
GROUND FLOOR PLAN

KEY

- LR Living Room
- D Dining/Eating Area
- BR Bedroom
- K Kitchen/Cooking Area
- T Toilet/Bathroom
- L Laundry
- C Closet
- S Storage
- R Room (multi-use)



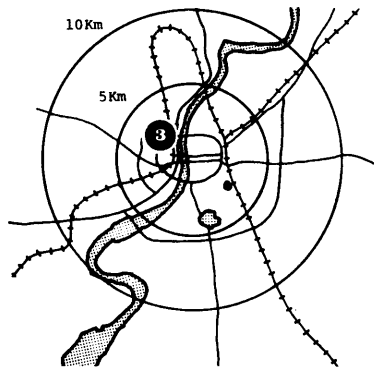
WALLED CITY: Secondary streets in the walled city providing access to "pols". Most of the secondary streets have extremely slow moving mixed traffic. In general they are all paved but do not have sidewalks. The houses on the ground floor are occupied by shops and very frequently the shoppers stand on the streets obstructing circulation.



CASE STUDY SOURCES

- Plan: (accurate) Nimish Patel, M.I.T. Thesis, 1976.
 Land Use Pattern: (approximate) IBID.
 Circulation Pattern: (accurate) IBID.
 Segment Plan: (accurate) IBID.
 Block Plan: (accurate) IBID.
 Block Land Utilization: (approximate) IBID.
 Typical Dwelling: (approximate) IBID.
 Physical Data: (approximate) IBID.
 Socio-Economic Data: (approximate) IBID.
 Photographs: A. and V. Chavda, 1973, 76.
 General Information: Nimish Patel, M.I.T. Thesis, 1976.

3 NAVRANGPURA Lakhudi POPULAR, V. LOW/LOW INCOME, SQUATTERS Ahmedabad



LOCATION: Navrangpura is located in north-western Ahmedabad. The city centre is approximately 5km. away, and the Gujarat University is at a distance of 2km.

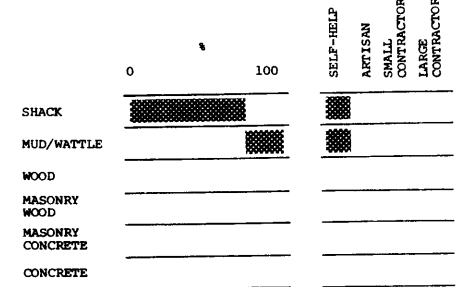
ORIGINS: With the economic growth of the city and the original walled city unable to provide further housing, the city expanded to the west side of the river. The area developed incrementally at a very slow rate; but, it has accelerated in the last decade. Upper middle and high income groups occupy most of the land. However, squatter settlements have formed pockets on vacant undeveloped lands.

LAYOUT, LAND USE, AND CIRCULATION: The locality grew over a long span without planning. The layout represents an arbitrary pattern with land wastage and excessive circulation areas. The locality is primarily a low density residential area with supporting commercial and recreational facilities. Middle income co-operative housing societies of 1-2 story detached houses are predominant. A city bus service connects the locality to the city centre.

The squatter settlements have grown over years without any controls. They accommodate high population densities. The utilities /services are provided at the community level, but are inadequate for the population they serve. The dwellings are generally shacks made of assorted salvage materials, and sometimes with brick and mud walls with tin sheet roofs. They enclose a small area serving mainly as storage space. Most of the activities take place outside in partly covered and open spaces. The squatters, as illegal occupants of the public land, live under constant threats of evacuation and demolition by the municipality. This insecurity prevents them from improving the physical conditions and consolidating their dwellings.

POPULATION AND INCOME: The squatters belong to the low and very low income strata. A large portion of the male population is employed in industry and some are self-employed. Women are employed by high income families in the surrounding areas as domestic help.

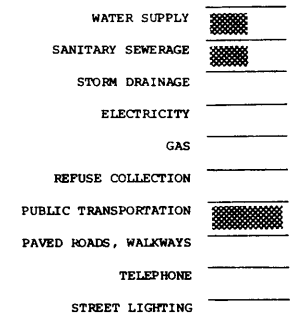
LAKHUDI CONSTRUCTION TYPES



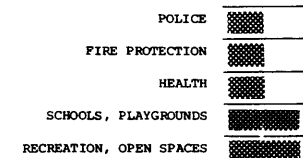
The chart shows (1) approximate percentage of each construction type within the total number of dwellings and (2) building group that generally produces each type.

Quality of information: Approximate

LAKHUDI UTILITIES AND SERVICES



LAKHUDI COMMUNITY FACILITIES



The chart illustrates the approximate availability of utilities, services, and community facilities at three levels: NONE, LIMITED, ADEQUATE.

Quality of information: Approximate

Photograph, opposite page:

SQUATTERS: The photograph shows a semi-private space in a squatter settlement. All private and semi-private activities including "chit-chatting", relaxing, cleaning utensils, etc. take place in this space. In general such spaces are large enough to accommodate the activities yet small enough to be maintained by the occupants. The space allow one or two rows of "Charpai", Indian beds, and leave enough space for circulation.





LAKHUDI LAND UTILIZATION DATA

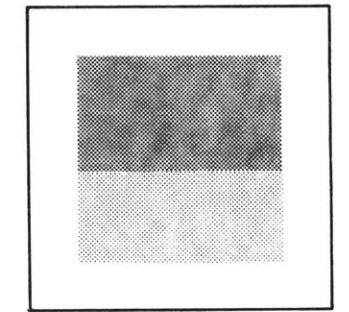
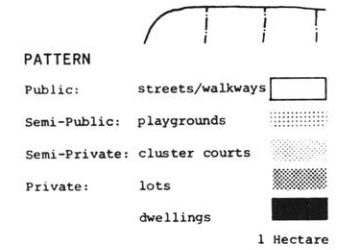
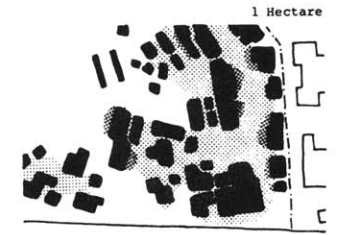
DENSITIES	Total Number	Area Hectares	Density N/Ha
LOTS	-	1.47	-
DWELLING UNITS	170	1.47	116
PEOPLE	835	1.47	568

AREAS	Hectares	Percentages
PUBLIC (streets, walkways, open spaces)	0.84	57
SEMI-PUBLIC (open spaces, schools, community centers)	-	-
PRIVATE (dwellings, shops, factories, lots)	0.38	26
SEMI-PRIVATE (cluster courts)	0.25	17
TOTAL	1.47	100

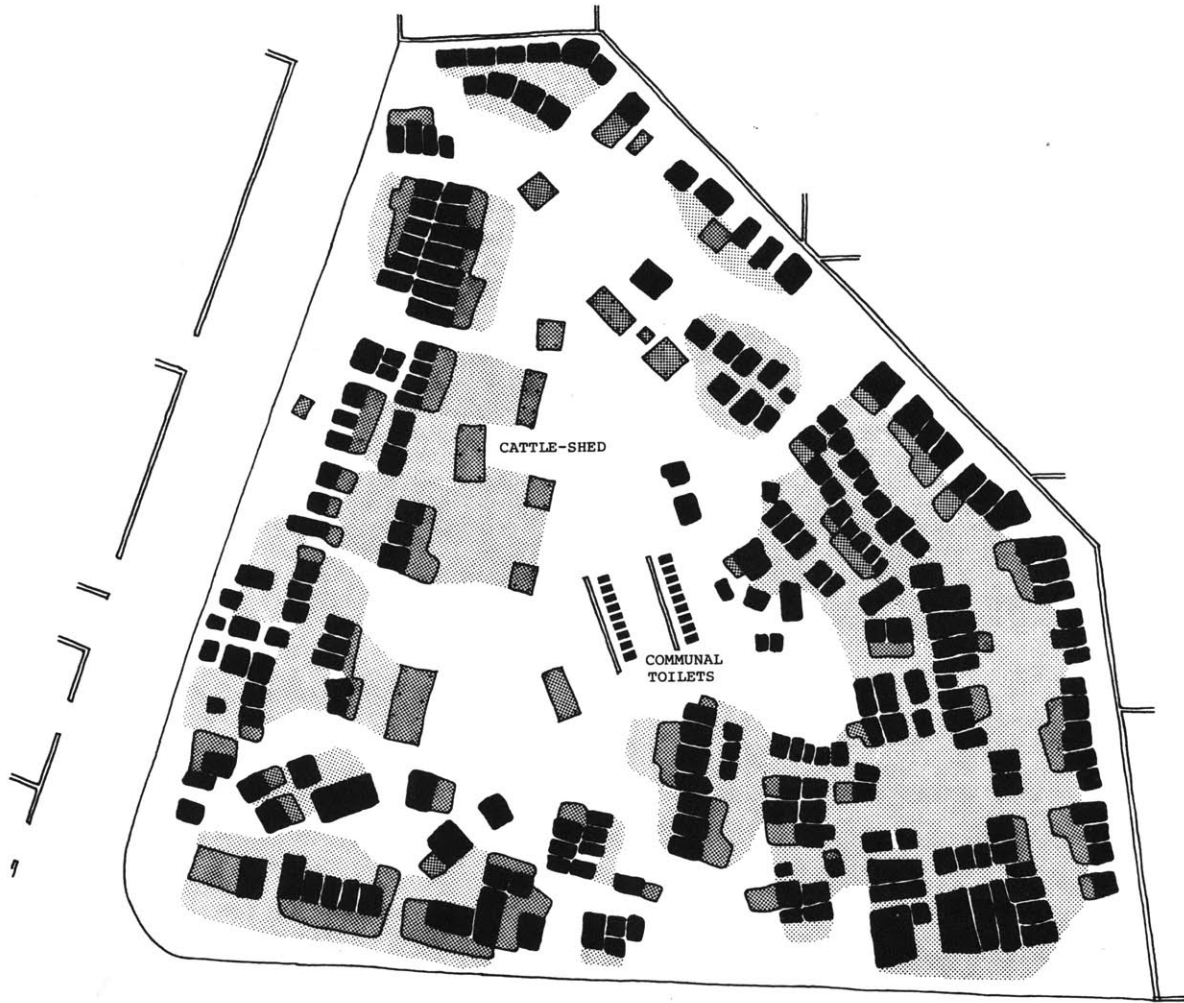
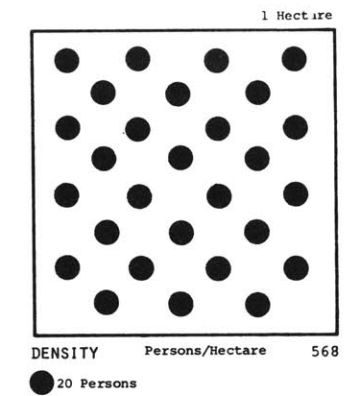
LOCALITY SEGMENT PLAN



LAND UTILIZATION DIAGRAMS



PERCENTAGES	Streets/walkways	57%
	Playgrounds	-
	Cluster Courts	17
	Dwellings/Lots	26



1:1000



BLOCK PLAN

PHYSICAL DATA
(related to dwelling and land)

DWELLING UNIT
 type: SHANTY
 area (sq m): 12
 tenure: LEGAL OWNERSHIP

LAND/LOT
 utilization: PRIVATE
 area (sq m): N.A.
 tenure: EXTRALEGAL OWNERSHIP

DWELLING
 location: INNER RING
 type: SEMI-DETACHED/DETACHED
 number of floors: 1
 utilization: SINGLE
 physical state: POOR

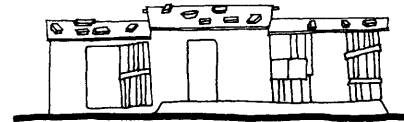
DWELLING DEVELOPMENT
 mode: INCREMENTAL
 developer: POPULAR
 builder: SELF-HELP
 construction type: SHACK
 year of construction: 1970

MATERIALS
 foundation: COMPACTED EARTH
 floors: EARTH
 walls: MUD, WOOD
 roof: CORRUGATED IRON SHEETS

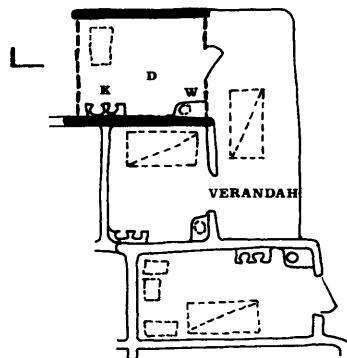
DWELLING FACILITIES
 wc: 1 PER 17 FAMILIES
 shower: NONE
 kitchen: NONE
 rooms: 1
 other: OPEN PLATFORM



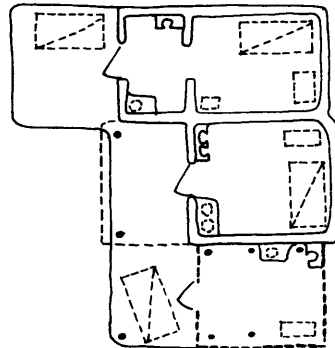
SECTION



ELEVATION



PLAN



KEY

- LR Living Room
- D Dining/Eating Area
- BR Bedroom
- K Kitchen/Cooking Area
- T Toilet/Bathroom
- L Laundry
- C Closet
- S Storage
- R Room (multi-use)

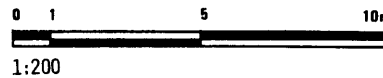
SOCIO-ECONOMIC DATA
(related to user)

GENERAL: SOCIAL
 user's ethnic origin: HINDU, RAJPUT
 place of birth: NEIGHBOURING STATE
 education level: INCOMPLETE PRIMARY SCHOOL

NUMBER OF USERS
 married: 2
 single: 3
 children: 3
 total: 5

MIGRATION PATTERN
 number of moves: 1
 rural - urban: 1970
 urban - urban:
 urban - rural:
 why came to urban area: EMPLOYMENT

GENERAL: ECONOMIC
 user's income group: VERY LOW
 employment: PEON
 distance to work: 4 KM.
 mode of travel: BICYCLE



TYPICAL DWELLING

COSTS
 dwelling unit:
 land - market value:

DWELLING UNIT PAYMENTS
 financing: SELF FINANCED
 rent/mortgage:
 % income for rent/mortgage:

SQUATTERS: (top) A squatter settlement. Generally, the squatter settlements develop as pockets in middle and high income residential areas; on open land left for speculation or on land reserved for public activities. The dwelling on the left is in the process of adding one more room.

(bottom) The physical condition of dwellings improve with time. The dwelling on the left is in initial stage. The dwelling on the right has already improved in the quality of construction.



CASE STUDY SOURCES

Plan: (approximate) Nimish Patel,
M.I.T. Thesis, 1976
Land Use Pattern: (approximate) IBID.
Circulation Pattern: (approximate) IBID.
Segment Plan: (approximate) IBID.
Block Plan: (approximate) IBID.
Block Land Utilization: (approximate) IBID.
Typical Dwelling: (approximate) IBID.
Physical Data: (approximate) IBID.
Socio-Economic Data: (approximate) IBID.
Photographs: A. and V. Chavda, 1975, 76.
General Information: Field survey,
A. and V. Chavda, 1976.
Nimish Patel, M.I.T. Thesis,
1976.

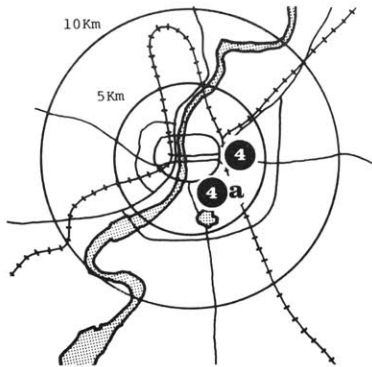
4 RAKHIAL Chawl

PRIVATE, V. LOW/LOW INCOME, ROOM

4a BEHRAMPURA Chawl

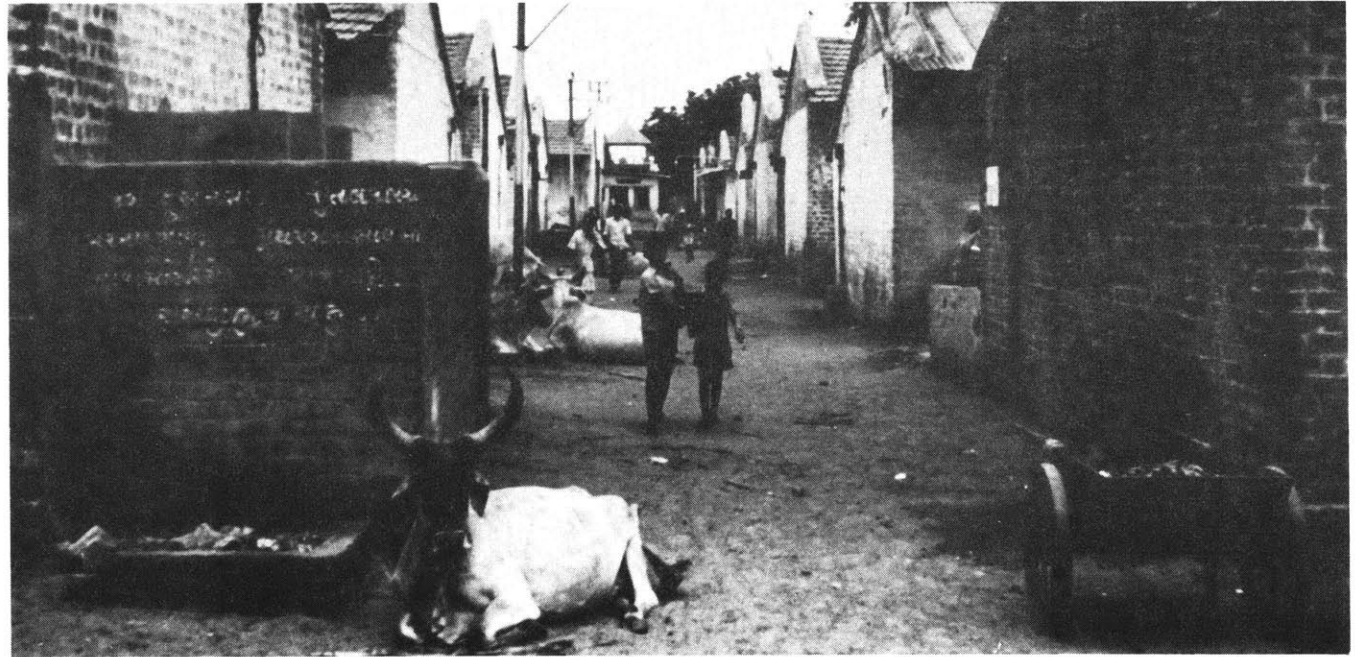
PRIVATE, V. LOW/LOW INCOME, ROOM

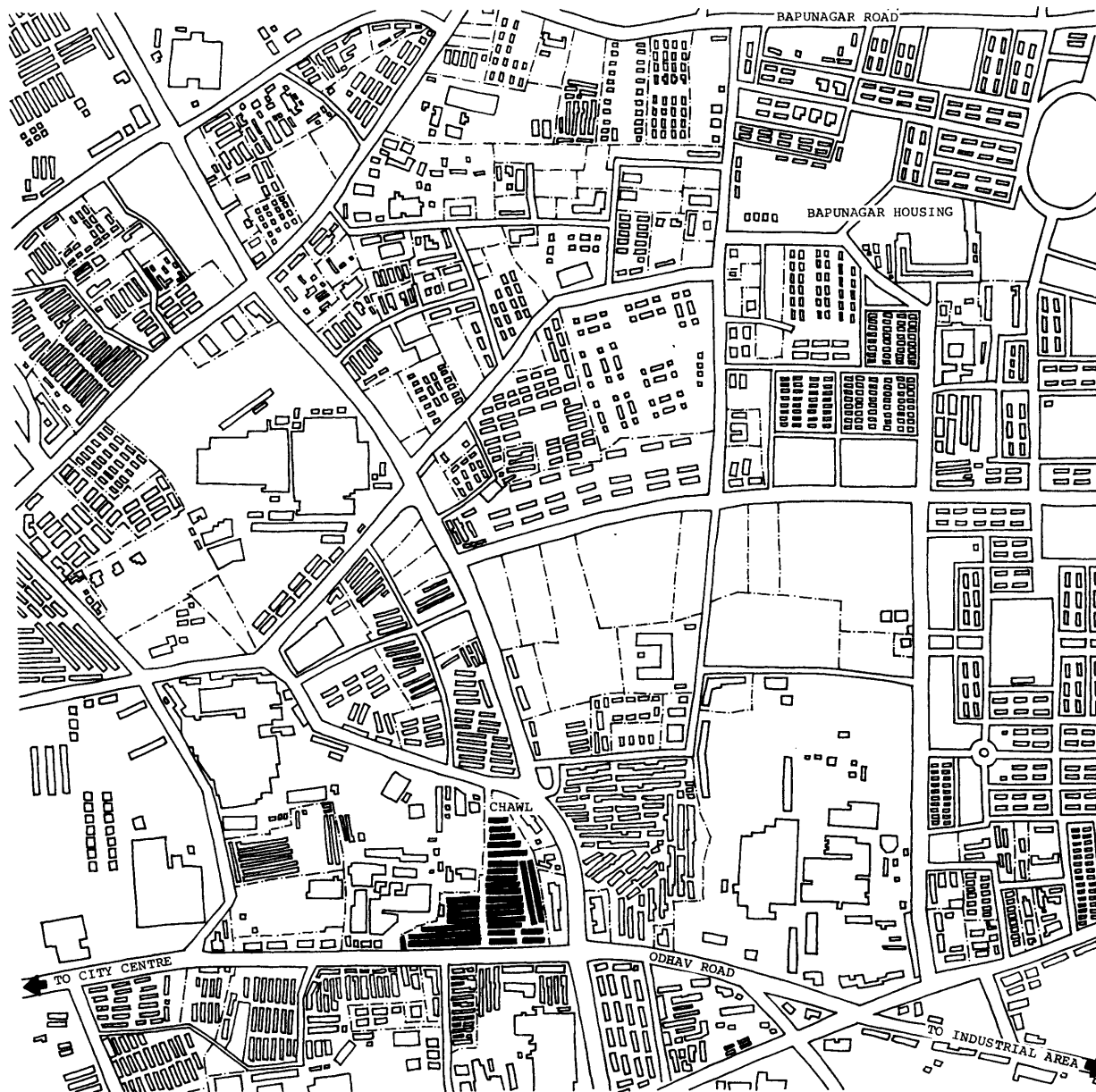
Ahmedabad



LOCATION: Rakhial is an industrial area located approximately 5km. away from the city centre. It is located on a major road running east-west connecting the industrial area to the city centre.

ORIGINS: With the expansion of the textile industry in the 1930's, the eastern part of the city was rapidly developing as a major industrial area. During this period a housing system popularly known as 'chawl' was introduced for industrial workers. Most of the chawls were developed as rental housing on the land leased for a long period of 99 years. These are small-scale, less than 1Ha., high-density private developments, scattered throughout the industrial area. They are generally rows of one room, or one room and a varandah (porch) in front, with inadequate communal services. Introduction of a local Rent Control Act in 1940, and minimum area and utilities requirements in the recent municipal building bye-laws discourage further





development of the chawls. Government-built housing and small co-operative housing societies for low income groups are now being developed in this area.

LAYOUT: This locality layout is typical for the industrial areas developed during the 1930's. Irregular land subdivision and street pattern, and haphazard location of industries with interspersed residential areas indicate unplanned growth of the locality. Large lots for industrial and small lots for residential development predominate the area. On east side of the locality, the Gujarat Housing Board developed housing in a grid-iron pattern in the 1950's. A combination of row and semi-detached one to three story brick masonry dwellings predominates both the chawls and the housing co-operatives.

Photographs; opposite page:

CHAWL: (top) The major circulation area providing access from the main street to the rows of rooms. It is the only open area in the chawl where semi-private activities including religious ceremonies, festival celebration and movie shows, etc. take place. This space is co-operatively maintained by the occupants.

(bottom) Open/partly covered platforms and semi-private open areas in front of the rooms are very intensively utilized. The width of the semi-private areas varies between 3 to 5 meters and is generally the minimum required by the municipal building by-laws.





LOCALITY PLAN





LAND USE: A concentration of textile industries dominates in the south-east and west parts of Rakhial. There are several other small industries scattered throughout the residential area. Supporting commercial activities are spread along the major roads. Lack of basic services and community facilities, overcrowding, and pollution by industries make the environment substandard. The chawl is located in the middle of a major industrial sector which readily provides employment.

CIRCULATION: Odhav Road running east-west is the major road connecting the industrial area to the city centre. It is the only road with heavy vehicular traffic. Majority of the streets are dominated by pedestrians and bicycles. The locality is well connected to the city centre by a city bus service; it takes approximately 40 minutes and is relatively expensive.

AREAS

-  RESIDENTIAL
-  COMMERCIAL
-  INDUSTRIAL
-  OPEN SPACES

KEY

- Pk** Parking
- P** Police
- F** Fire Department
- S** School
- T** Temple
- Mq** Mosque
- Ch** Church
- R** Recreation
- L** Library
- U** University
- H** Health
- PO** Post Office
- SS** Social Services
- M** Market
- C** Cemetery
-  Bus
-  Rapid Transit

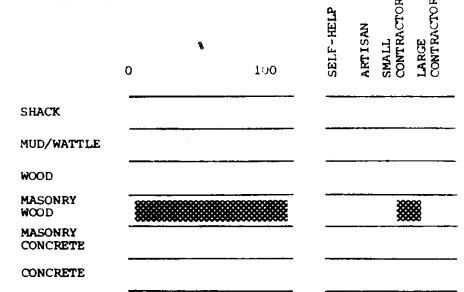


LOCALITY LAND USE PATTERN





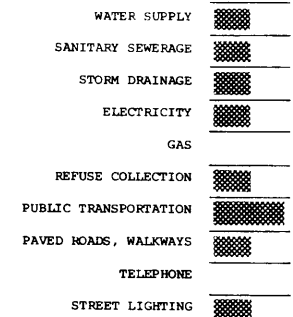
CHAWL CONSTRUCTION TYPES



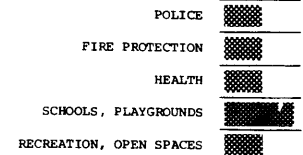
The chart shows (1) approximate percentage of each construction type within the total number of dwellings and (2) building group that generally produces each type.

Quality of information: Approximate

CHAWL UTILITIES AND SERVICES



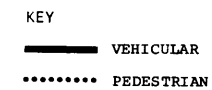
CHAWL COMMUNITY FACILITIES



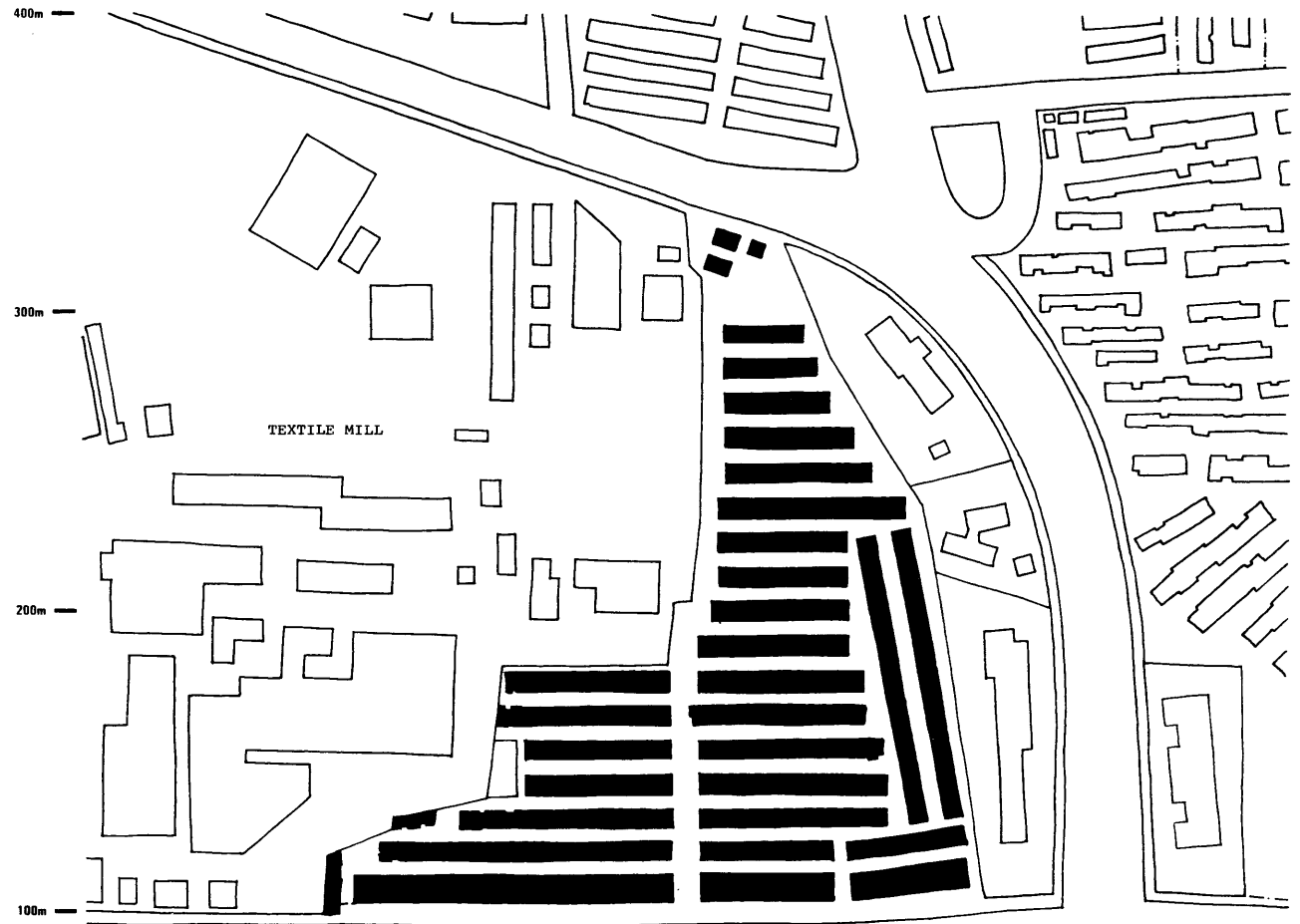
The chart illustrates the approximate availability of utilities, services, and community facilities at three levels: NONE, LIMITED, ADEQUATE.

Quality of information: Approximate

LOCALITY CIRCULATION PATTERN



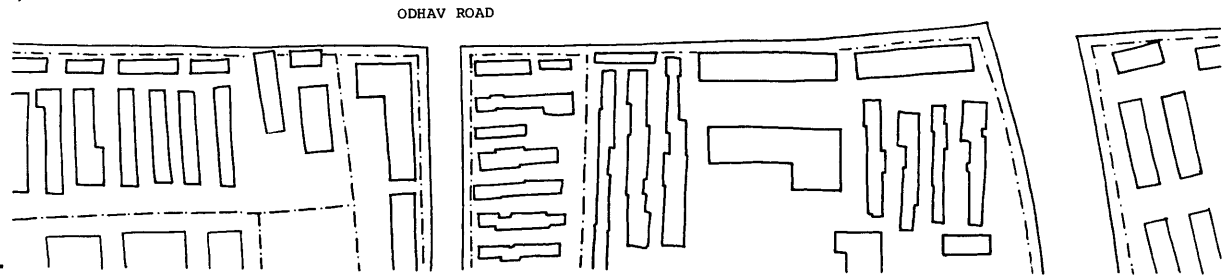
POPULATION AND INCOME: Majority of the population are urban poor and rural migrants belonging to low and very low income strata. The working population is primarily employed in industries. There are some casual labourers and also some self-employed as mechanics, carpenters, cart-pullers, etc. The population belongs to diverse social, religious, ethnic and occupational backgrounds. The people from a common backgrounds live together. Overcrowded dwellings and hot-dry climate force people to spend most of their time in the open. House rents in this area range from U.S. \$1-3 per month, approximately 10-15% of a family's monthly income.



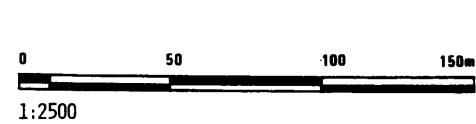
CHAWL LAND UTILIZATION DATA

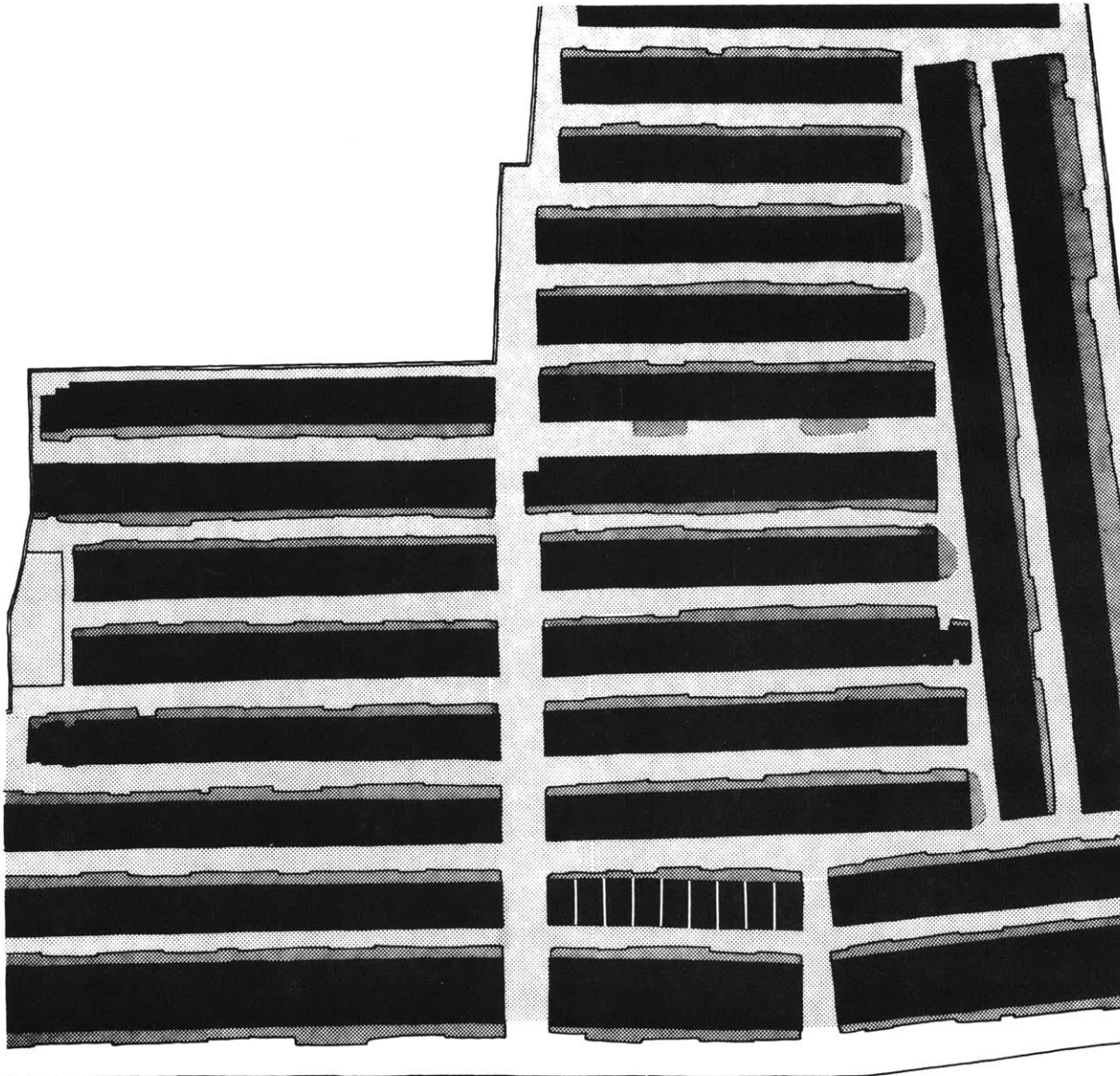
DENSITIES	Total Number	Area Hectares	Density N/Ha
LOTS	511	3.09	165
DWELLING UNITS	511	3.09	165
PEOPLE	3589	3.09	1160

AREAS	Hectares	Percentages
PUBLIC (streets, walkways, open spaces)	0.42	14
SEMI-PUBLIC (open spaces, schools, community centers)	-	-
PRIVATE (dwellings, shops, factories, lots)	1.50	48
SEMI-PRIVATE (cluster courts)	1.17	38
TOTAL	3.09	100



LOCALITY SEGMENT PLAN





ODHAV ROAD



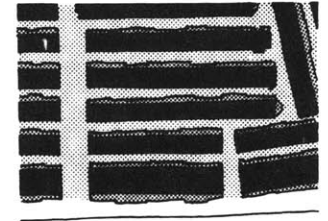
1:1000



BLOCK PLAN

LAND UTILIZATION DIAGRAMS

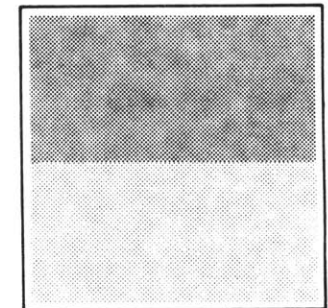
1 Hectare



PATTERN

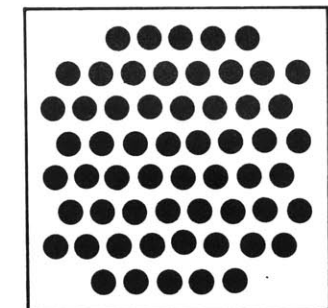
- Public: streets/walkways
- Semi-Public: playgrounds
- Semi-Private: cluster courts
- Private: lots
- dwellings

1 Hectare

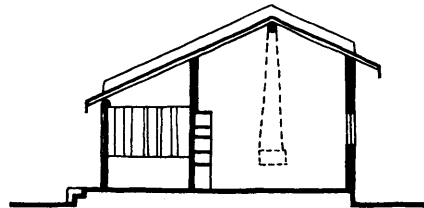


PERCENTAGES	Streets/walkways	14%
	Playgrounds	-
	Cluster Courts	38
	Dwellings/Lots	48

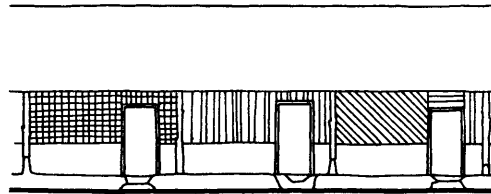
1 Hectare



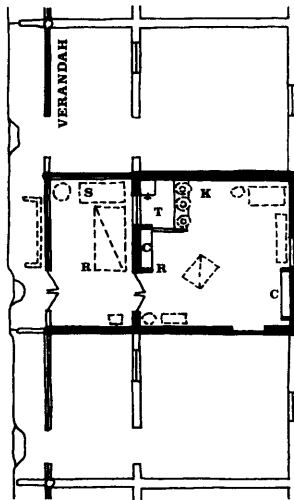
DENSITY	Persons/Hectare	1160
	20 Persons	



SECTION



ELEVATION



PLAN

KEY

- LR Living Room
- D Dining/Eating Area
- BR Bedroom
- K Kitchen/Cooking Area
- T Toilet/Bathroom
- L Laundry
- C Closet
- S Storage
- R Room (multi-use)

PHYSICAL DATA

(related to dwelling and land)

DWELLING UNIT
 type: ROOM
 area (sq m): 27
 tenure: LEGAL RENTAL

LAND/LOT
 utilization: SEMI-PRIVATE
 area (sq m): 30
 tenure: LEGAL RENTAL

DWELLING
 location: INNER RING
 type: ROW ROOMS/CHAWL
 number of floors: 1
 utilization: MULTIPLE FAMILY
 physical state: POOR

DWELLING DEVELOPMENT
 mode: INSTANT
 developer: PRIVATE
 builder: SMALL CONTRACTOR
 construction type: MASONRY
 year of construction: 1940

MATERIALS
 foundation: BRICK
 floors: CEMENT PLASTER
 walls: BRICK
 roof: G.I.SHEETS

DWELLING FACILITIES
 wc: 1 FOR 21 FAMILIES
 shower: -
 kitchen: -
 rooms: 1
 other: VERANDAH

SOCIO-ECONOMIC DATA

(related to user)

GENERAL: SOCIAL
 user's ethnic origin: HINDU
 place of birth: MAHARASHTRA
 education level: NONE

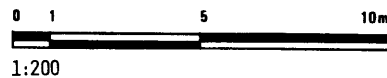
NUMBER OF USERS
 married: 2
 single: -
 children: 4
 total: 6

MIGRATION PATTERN
 number of moves: NONE
 rural - urban:
 urban - urban:
 urban - rural:
 why came to urban area:

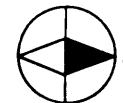
GENERAL: ECONOMIC
 user's income group: MODERATELY LOW
 employment: INDUSTRIAL WORKER
 distance to work: 0.5 KM.
 mode of travel: WALKING/BICYCLE

COSTS
 dwelling unit:
 land - market value:

DWELLING UNIT PAYMENTS
 financing:
 rent/mortgage: \$2-3/MONTH
 % income for rent/mortgage: 7%



1:200

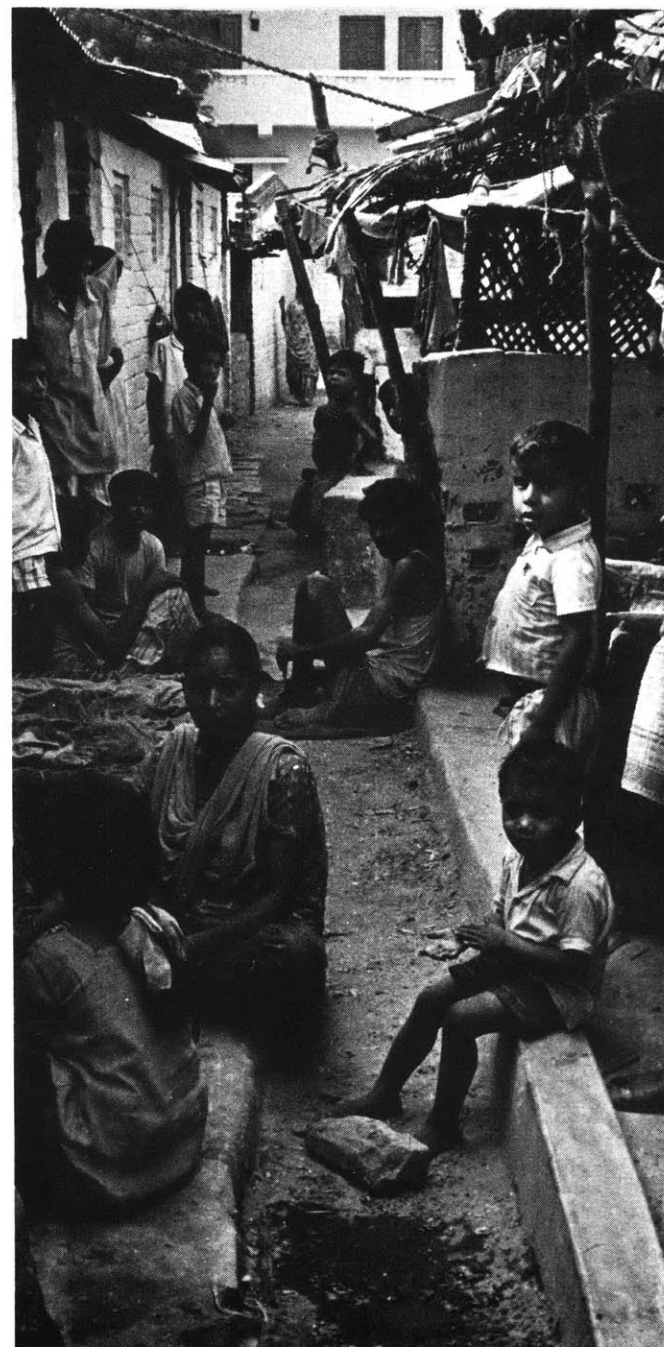


TYPICAL DWELLING

CHAWL: (left top) In some cases, the ownership of chawls has been transferred to the occupants who have added alcoves in front of their dwellings serving as a bathroom and washing place.

(left bottom) They have improved the condition of their dwellings and even added an extra floor.

(right) Semi-private space between two rows of rooms



CASE STUDY SOURCES

- Plan: (approximate) A.M.C. Office, 1975.
- Land Use Pattern: (approximate) IBID.
- Circulation Pattern: (approximate) IBID.
- Segment Plan: (accurate) IBID.
- Block Plan: (accurate) IBID.
- Block Land Utilization: (approximate) Field Survey, A. and V. Chavda, 1976.
- Typical Dwelling: (approximate) IBID.
- Physical Data: (approximate) IBID.
- Socio-Economic Data: (approximate) IBID.
- Photographs: A. and V. Chavda, 1976.
- General Information: A.M.C. Report, 1975, Field Survey, A. and V. Chavda, 1976

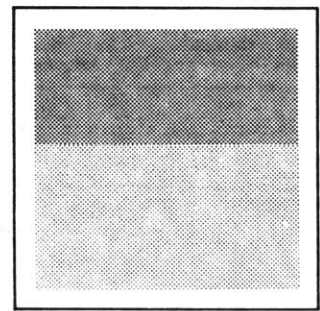
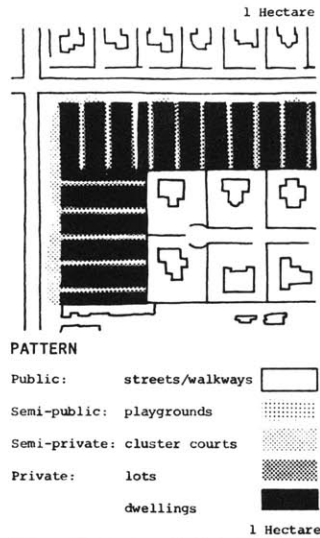
SIMILAR DWELLING SYSTEM

4a BEHRAMPURA Chawl

This illustration of a chawl represents extreme physical conditions. Rows of 3m.x3m. rooms separated by a 2.5m. passage provide an extremely small enclosed area for the average size family in this income group. Only minimal circulation area is left between the two rows and the rest is an extension of the dwelling units in the form of platforms. The inhabitants often make use of the roof for sleeping. The back to back arrangement of the dwelling units leaves only one side as a source of light and ventilation inside the units.

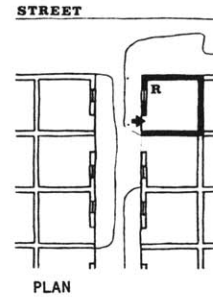
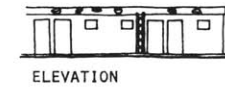
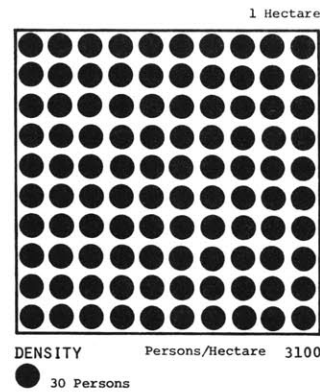
The settlement is provided with communal water taps. They make use of toilet facilities in nearby chawls 250 to 300m. away. A proposal for providing communal toilets was ruled out because surrounding middle income communities doubted proper maintenance of the toilets and objected to the proposal.

LAND UTILIZATION DIAGRAMS

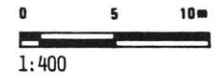


PERCENTAGES

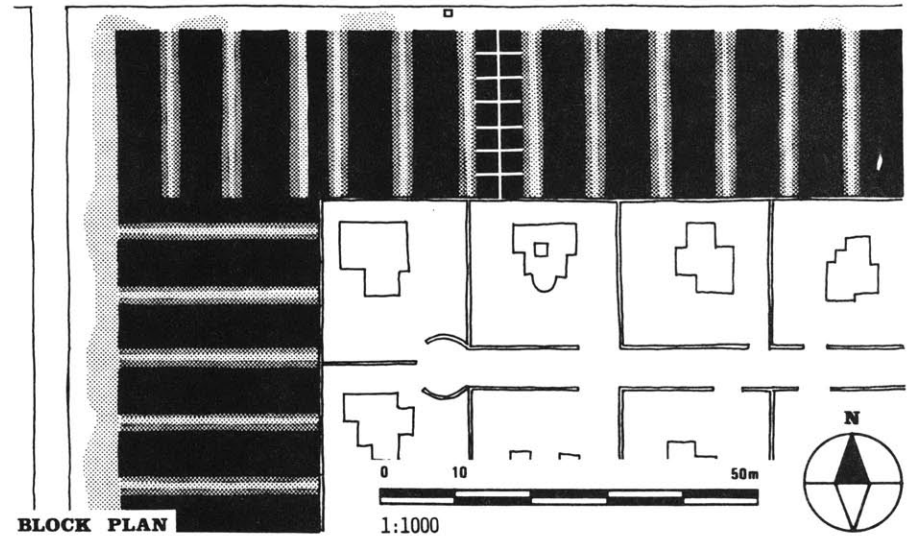
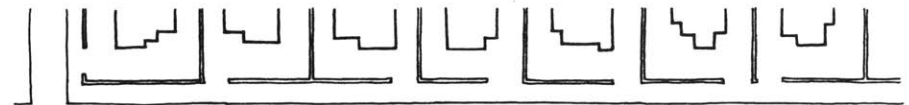
Streets/Walkways	27%
Playgrounds	-
Cluster Courts	40
Dwellings/Lots	33



- KEY**
- LR Living Room
 - D Dining/Eating Area
 - BR Bedroom
 - K Kitchen/Cooking Area
 - T Toilet/Bathroom
 - L Laundry
 - C Closet
 - S Storage
 - R Room (multi-use)



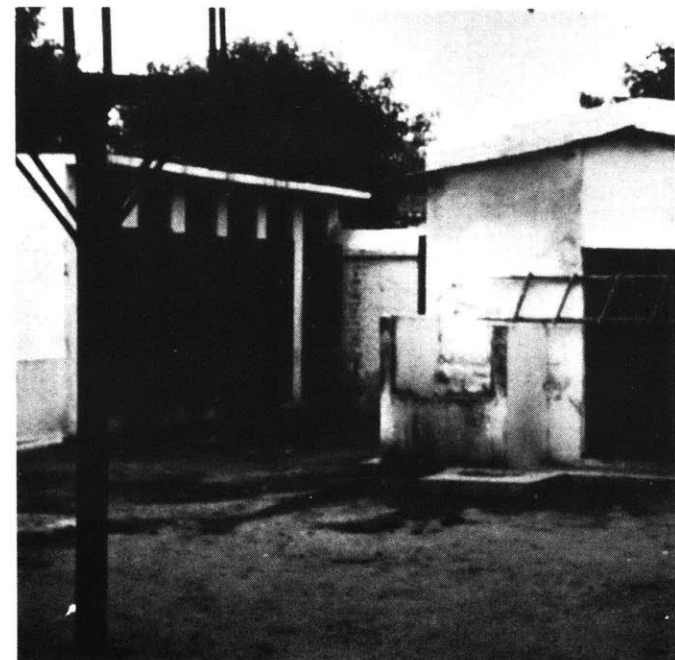
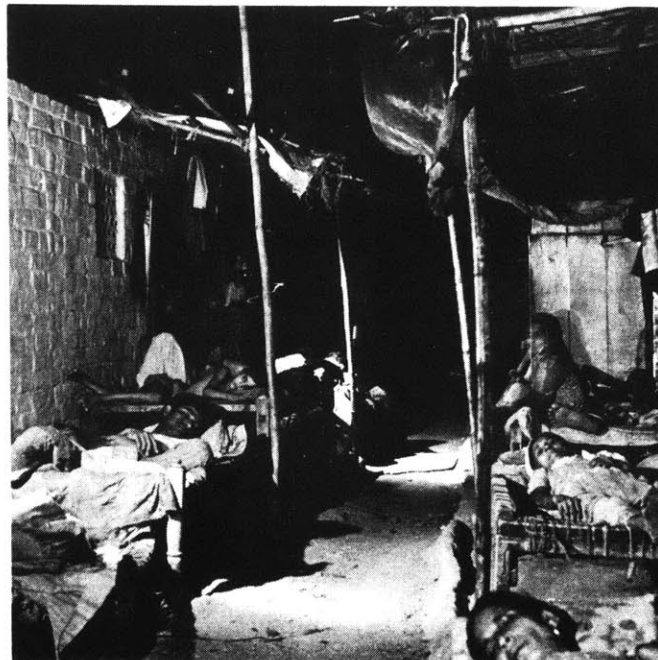
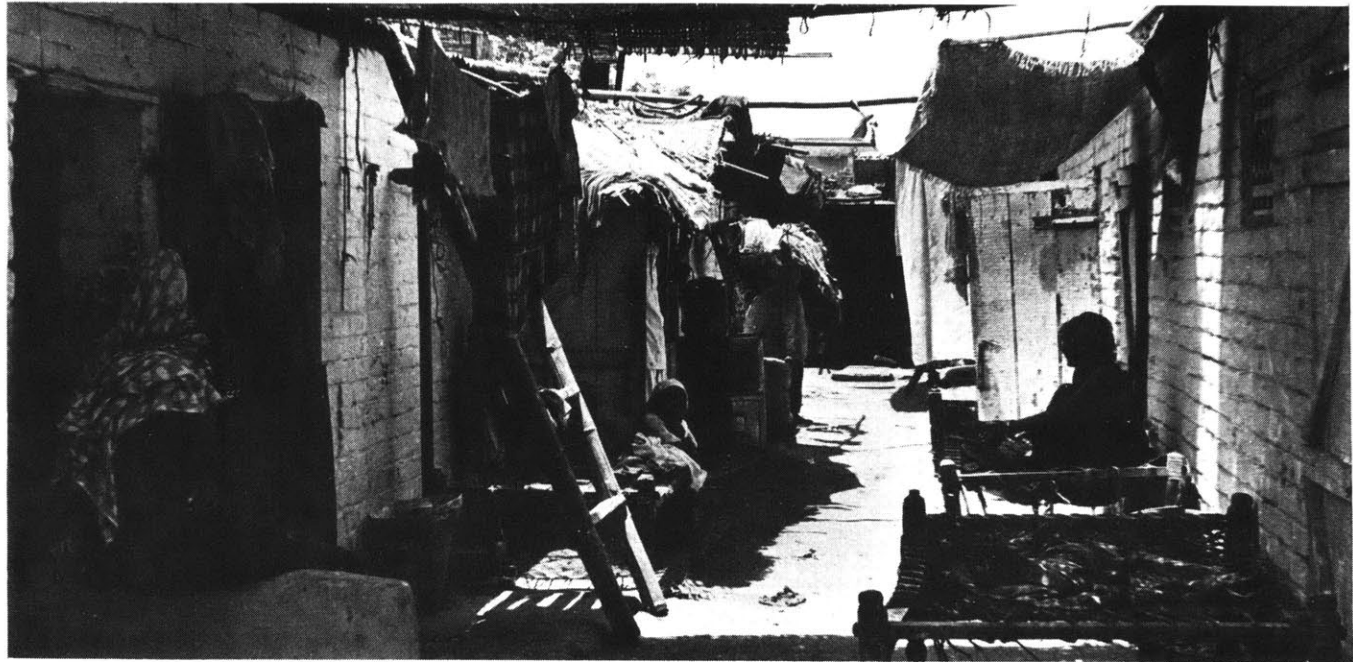
TYPICAL DWELLING



CHAWL: (top) In some chawls, rooms directly open on the semi-private space. People spend most of their time in this covered semi-private space. The dwellings are extremely small and force the people to use the roof-tops to dump their belongings and even for sleeping at night.

(bottom left) A view of semi-private space at night.

(bottom right) Communal toilets in a chawl.



CASE STUDY SOURCES

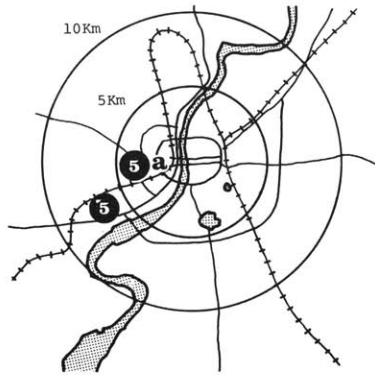
Block Plan: (approximate) Field Survey,
A. and V. Chavda, 1974.
Block Land Utilization: (approximate) IBID.
Typical Dwelling: (approximate) IBID.
Photographs: A. and V. Chavda, 1974
General Information: Field Survey,
A. and V. Chavda, 1974.

5 VASNA Vasna

PUBLIC, VERY LOW/LOW INCOME, ROOM

5 a AMBAWADI Harijanwas Ahmedabad

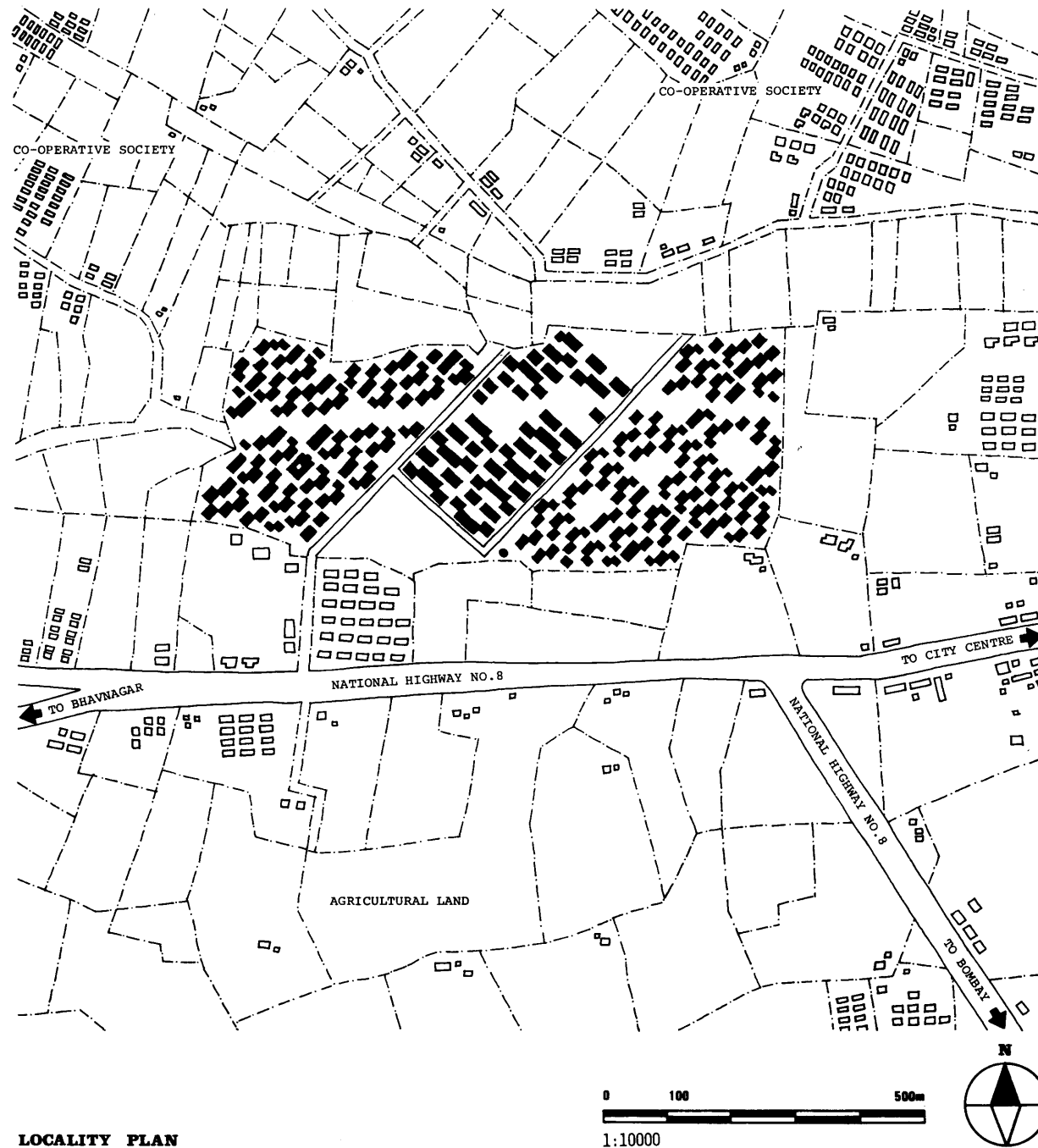
PUBLIC, VERY LOW/LOW INCOME, ROOM



LOCATION: The site is located 7km. southwest from the city centre, outside of the Ahmedabad municipal boundaries. It was formerly used for agriculture. In the last couple of years co-operative societies have been developing housing in this area. The site is approached by National Highway No.8 connecting it to the city centre.

ORIGINS: This project originated in 1973 to resettle about 11,000 squatters displaced by heavy floods in the Sabarmati river. It was the first large scale, low income public housing project in Ahmedabad. It was initiated and executed by a private agency, and financed by the Ahmedabad Municipal Corporation, Gujarat Government and OXFAM, a British philanthropic organization. 17.6 hectares of land was given free by the state government. The cost of installing service infrastructure and individual connections were borne by the municipality. 50% of the dwelling cost was in the form of subsidies and





LOCALITY PLAN

charity from the state and 50% was borne by the users for which they received low interest loans from the Housing and Urban Development Corporation of India. Housing construction was completed by August 1976 and 30% of the dwellings remained to be occupied.

Community facilities were a basic minimum—a small day care centre, a kindergarten, a workshop and few shops. It was derived as an 'integrated' development project with emphasis on upward social and economic mobility of the people. Workshops, skill-training and health courses were integrated into the project.

LAYOUT: The locality, basically farm land, is arbitrarily being developed as a residential area in recent years. Farms are being bought and subdivided by the private sector to accommodate co-operative housing societies for low and middle income groups. The layout of the public housing appears as an arbitrary pattern. Lots have been staggered to make open spaces considered to function as courtyards. The project is divided into three sectors by two paved streets. The central sector has the same dwellings but only a change in orientation. Undefined boundaries and lack of physical control make these courtyards meaningless and wasteful. A wide dry ditch running east-west through the site is proposed to be filled to accommodate community facilities. Community facilities are also proposed in some of the blocks and in the triangular space made by the two streets on the south of the site.

Photographs; opposite page:





VASNA: (top) General airview of area. With undefined land/lot boundaries, the open spaces between dwellings are not properly utilized. They become a liability to the city for the maintenance, and indicate wasteful utilization of land.

(bottom) A major street in the Vasna project. The street is partly paved. It is too wide for only pedestrian and bicycle movements and it is poorly maintained. An overhead water tank for the settlement is seen in the background.



LAND USE: Agriculture is the primary use of the land surrounding the site. However, residential areas are developing very rapidly. For supporting commercial activities and community facilities it has to depend on nearby areas within the city limits. Since the development of this public housing project marginal commercial facilities are available to its adjoining population also. In the Vasna project single story row houses are of brick masonry construction with asbestos sheet roofs. Detached and semi-detached, single and two story, brick masonry and concrete dwelling predominate in the rest of the area.

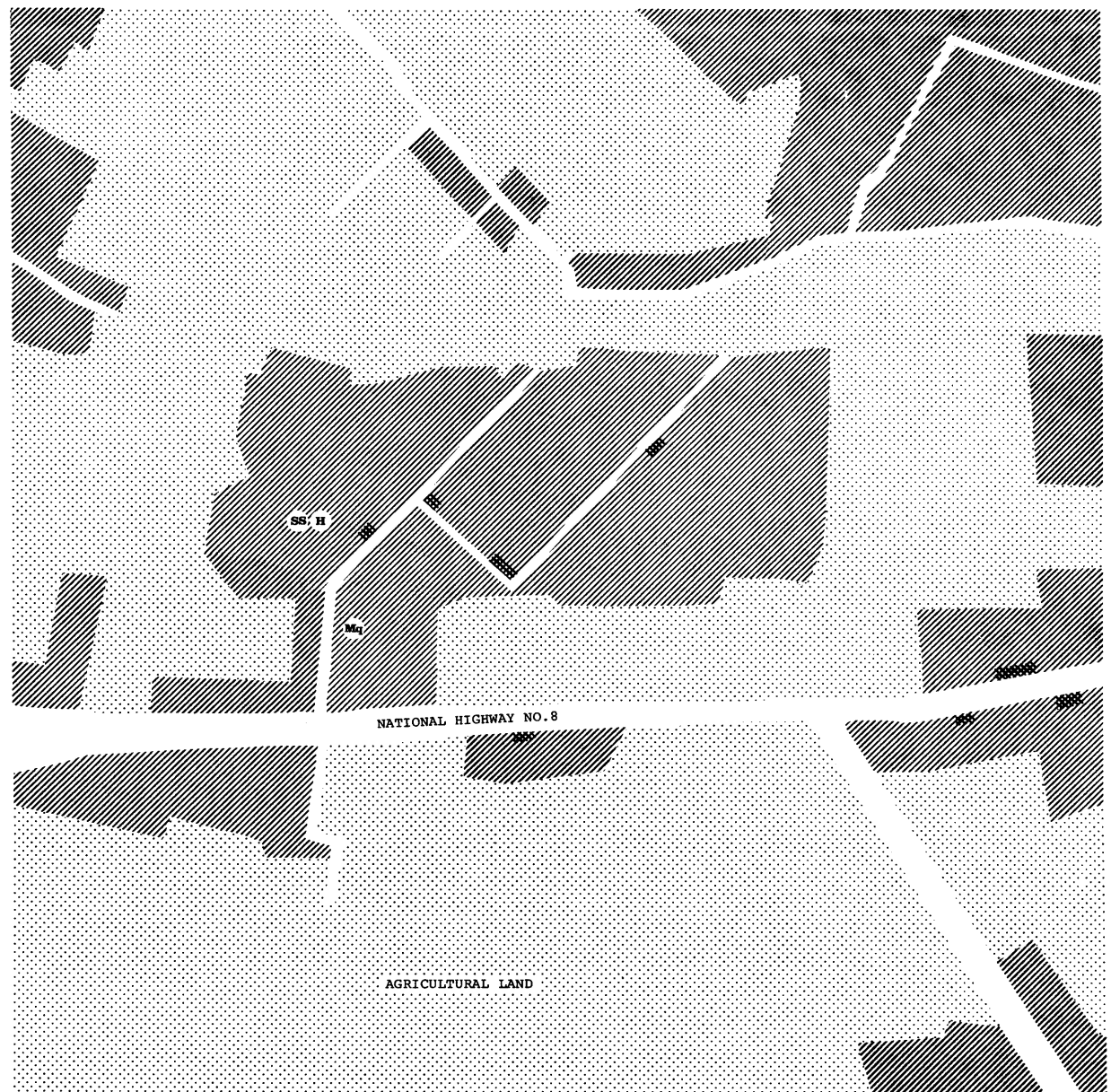
CIRCULATION: National Highway No.8 is the major vehicular route in the locality. Most of the traffic outside of the project as well as in the project consists of pedestrians and bicycles. The locality is connected to the city by the city bus service; it takes approximately 35 minutes and is relatively expensive.

AREAS

	RESIDENTIAL
	COMMERCIAL
	INDUSTRIAL
	AGRICULTURAL

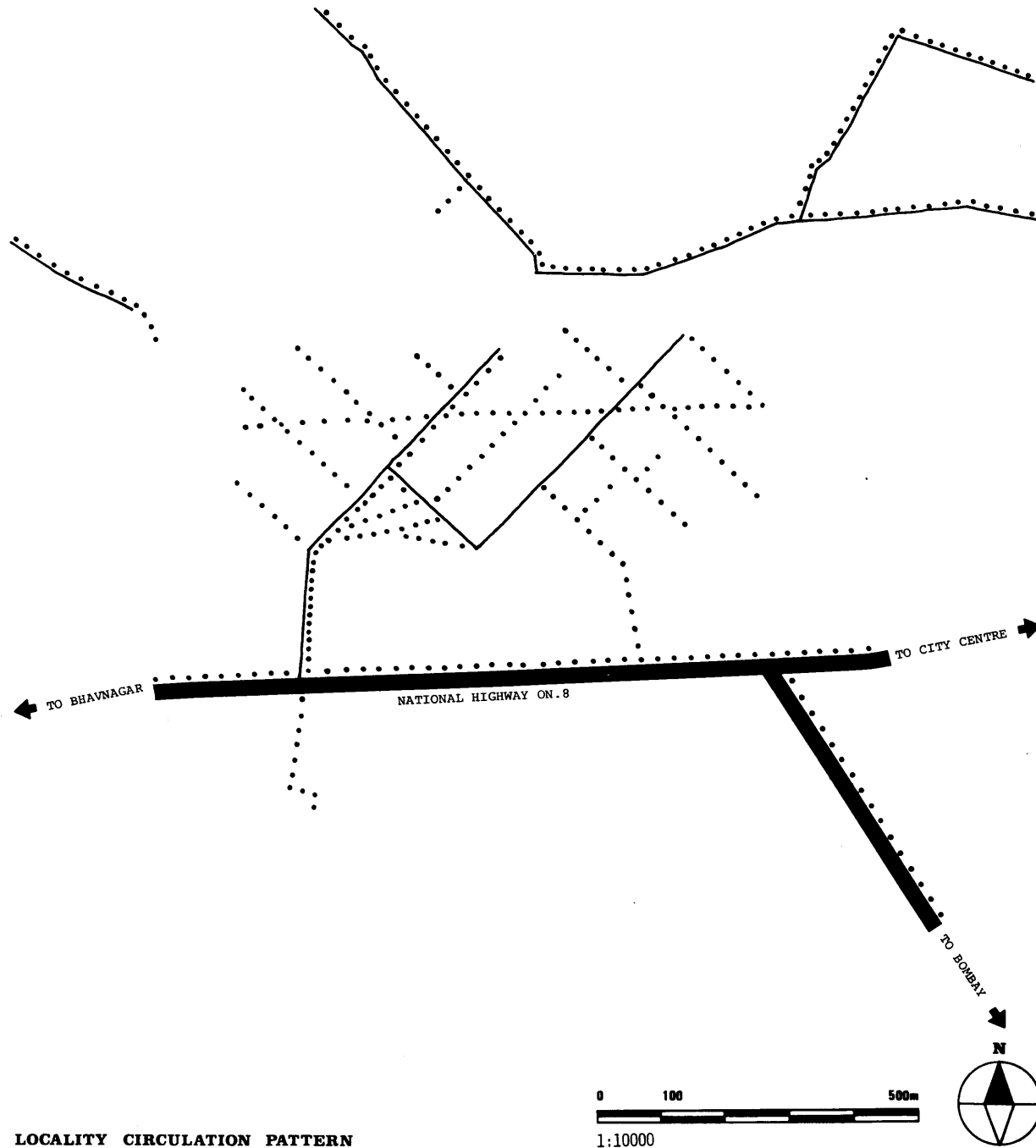
KEY

Pk	Parking
P	Police
F	Fire Department
S	School
T	Temple
Mq	Mosque
Ch	Church
R	Recreation
L	Library
U	University
H	Health
PO	Post Office
SS	Social Services
M	Market
C	Cemetery
	Bus
	Rapid Transit



LOCALITY LAND USE PATTERN





LOCALITY CIRCULATION PATTERN

VASNA CONSTRUCTION TYPES

	0	100	SELF-HELP	ARTISAN	SMALL CONTRACTOR	LARGE CONTRACTOR
SHACK	[Horizontal line]					
MUD/WATTLE	[Horizontal line]					
WOOD	[Horizontal line]					
MASONRY WOOD	[Horizontal line with diagonal hatching]					[Small square with diagonal hatching]
MASONRY CONCRETE	[Horizontal line with diagonal hatching]					[Small square with diagonal hatching]
CONCRETE	[Horizontal line]					

The chart shows (1) approximate percentage of each construction type within the total number of dwellings and (2) building group that generally produces each type.

Quality of information: Approximate

VASNA UTILITIES AND SERVICES

WATER SUPPLY	[Horizontal line with diagonal hatching]
SANITARY SEWERAGE	[Horizontal line with diagonal hatching]
STORM DRAINAGE	[Horizontal line with diagonal hatching]
ELECTRICITY	[Horizontal line]
GAS	[Horizontal line]
REFUSE COLLECTION	[Horizontal line with diagonal hatching]
PUBLIC TRANSPORTATION	[Horizontal line with diagonal hatching]
PAVED ROADS, WALKWAYS	[Horizontal line with diagonal hatching]
TELEPHONE	[Horizontal line]
STREET LIGHTING	[Horizontal line with diagonal hatching]

VASNA COMMUNITY FACILITIES

POLICE	[Horizontal line with diagonal hatching]
FIRE PROTECTION	[Horizontal line with diagonal hatching]
HEALTH	[Horizontal line with diagonal hatching]
SCHOOLS, PLAYGROUNDS	[Horizontal line with diagonal hatching]
RECREATION, OPEN SPACES	[Horizontal line with diagonal hatching]

The chart illustrates the approximate availability of utilities, services, and community facilities at three levels: NONE, LIMITED, ADEQUATE.

Quality of information: Approximate

KEY

- [Solid black line] VEHICULAR
- [Dotted black line] PEDESTRIAN

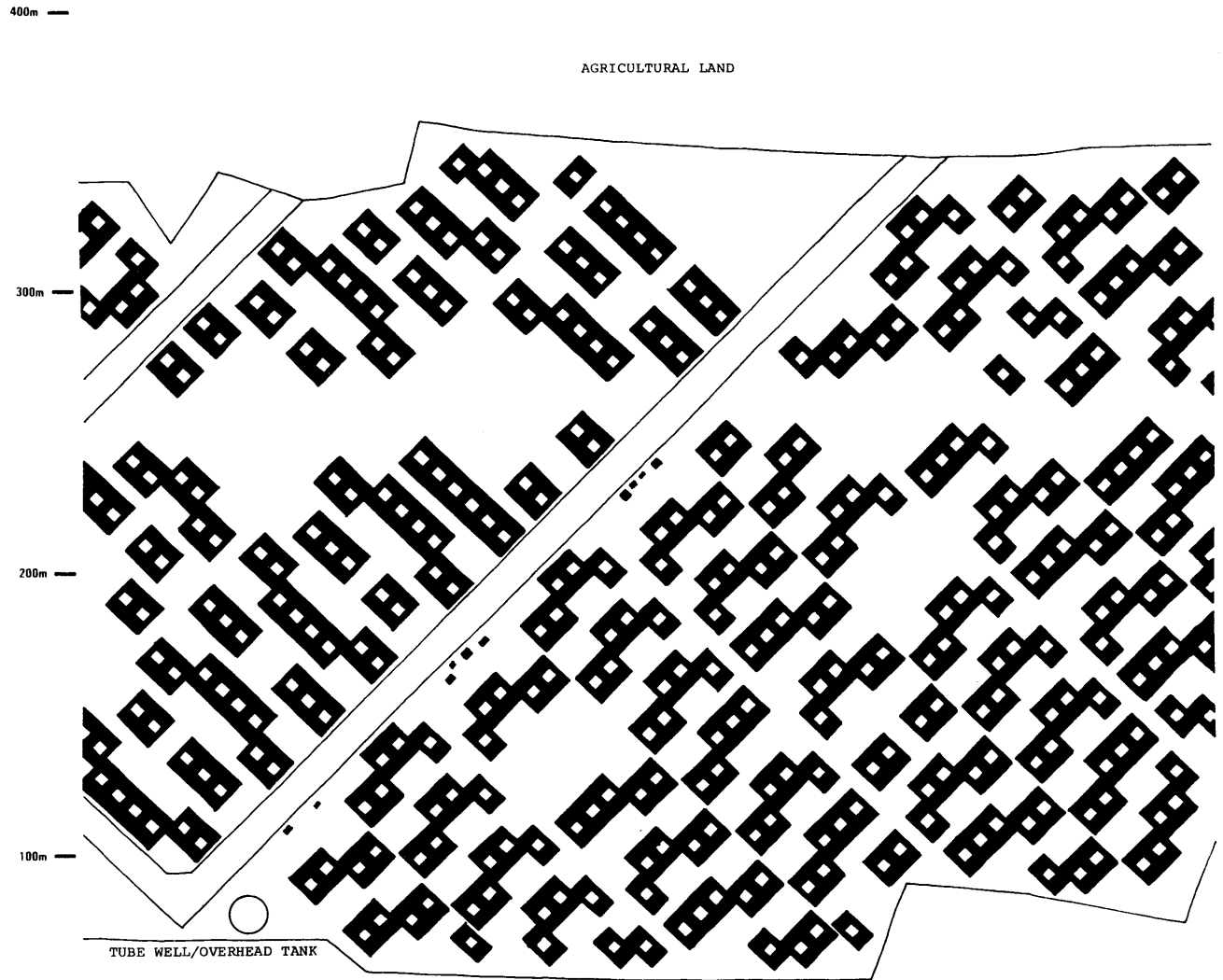
POPULATION: The Vasna project will accommodate a population of approximately 11,000. Children below 14 years constitute 43% of the total population. 79% are single family households. The average family size is 4.5 persons. The population in Vasna belongs to diverse social groups. Strong neighbourhood patterns that prevailed in their previous settlements on the river banks continue in the same way. These social and neighbourhood groups live together around an open space and in adjacent areas.

INCOME: The majority of the population in Vasna belongs to low and very low income groups. 32% of the population is self-employed, 23% is employed in service and transportation, 19% are casual labourers, 10% are employed by industry, 5% do household work in the nearby areas, 2% are construction workers, and 1% are recreation workers. Most of the working population commutes by buses and bicycles to the city to work. They pay 9% of their monthly income or U.S. \$2.50 as the installment of the house loan which is for 20 years.

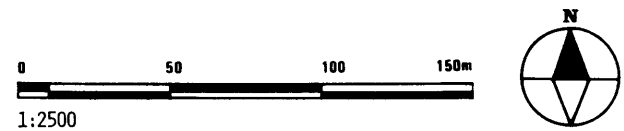
VASNA LAND UTILIZATION DATA

DENSITIES	Total Number	Area Hectares	Density N/Ha
LOTS	2248	17.57	130
DWELLING UNITS	2248	17.57	130
PEOPLE	10100	17.57	575

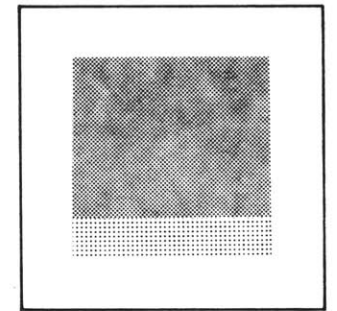
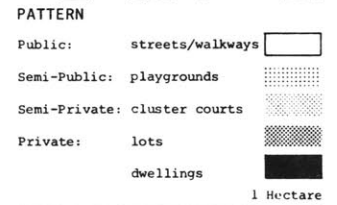
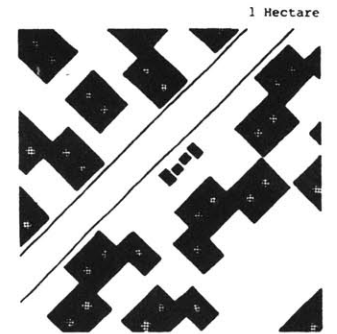
AREAS	Hectares	Percentages
PUBLIC (streets, walkways, open spaces)	10.23	58
SEMI-PUBLIC (open spaces, schools, community centers)	1.23	7
PRIVATE (dwellings, shops, factories, lots)	6.11	35
SEMI-PRIVATE (cluster courts)	-	-
TOTAL	17.57	100



LOCALITY SEGMENT PLAN

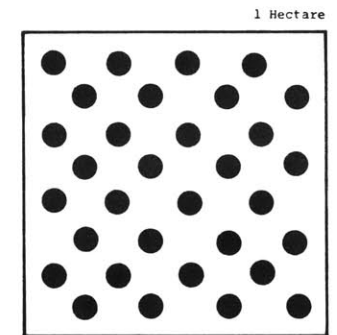


LAND UTILIZATION DIAGRAMS



PERCENTAGES

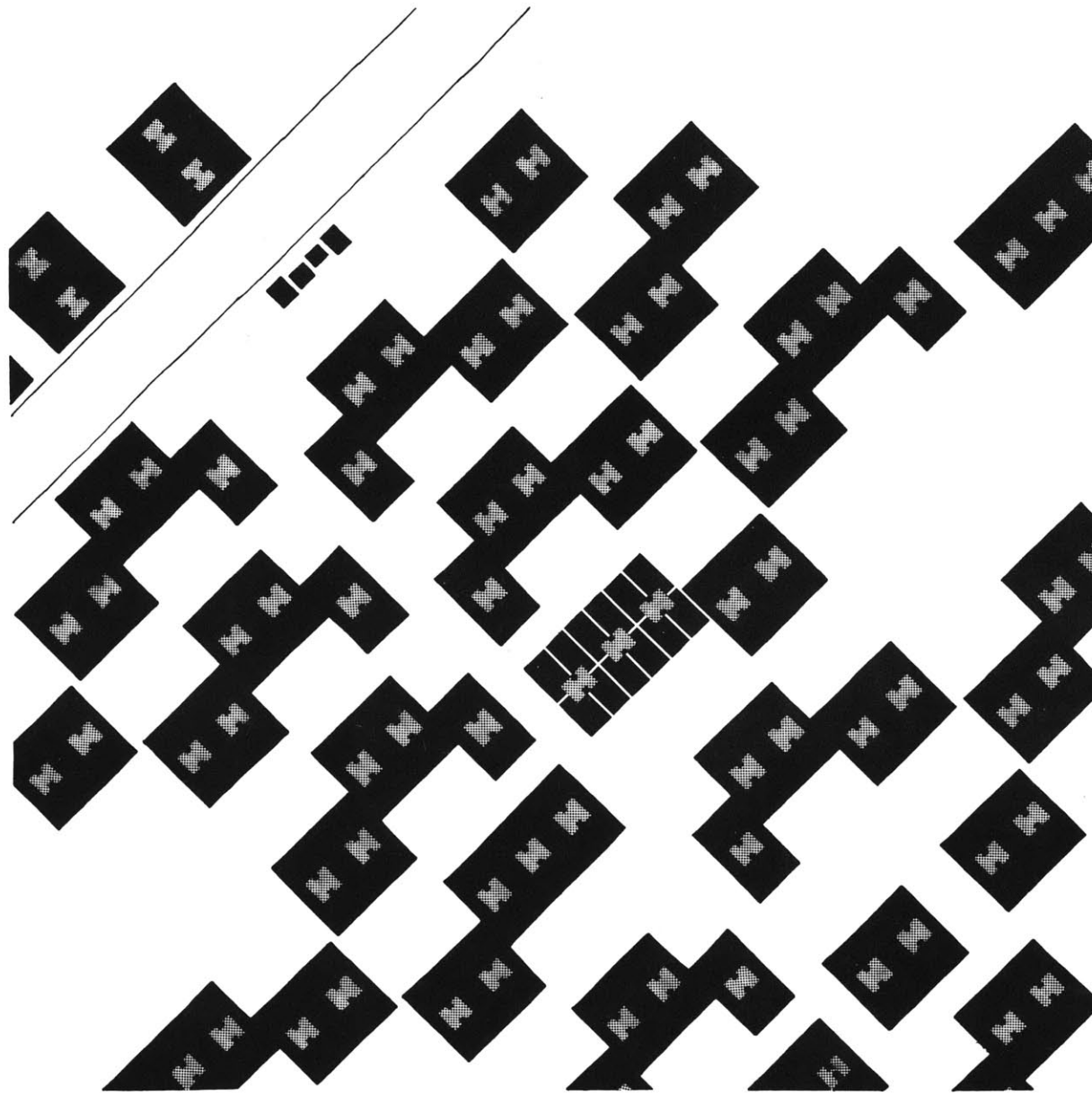
Streets/walkways	58%
Playgrounds	7
Cluster Courts	-
Dwellings/Lots	35



DENSITY

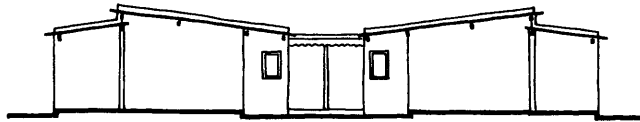
Persons/Hectare	575
-----------------	-----

● 20 Persons

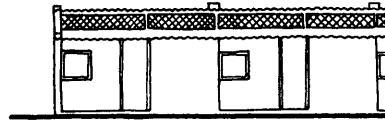


BLOCK PLAN

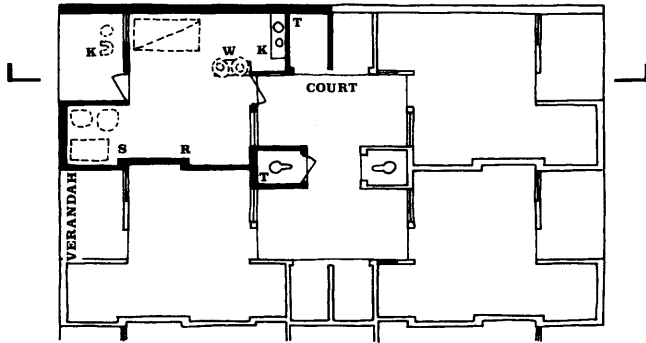




SECTION



ELEVATION



PLAN

KEY

- LR Living Room
- D Dining/Eating Area
- BR Bedroom
- K Kitchen/Cooking Area
- T Toilet/Bathroom
- L Laundry
- C Closet
- S Storage
- R Room (multi-use)

PHYSICAL DATA
(related to dwelling and land)

DWELLING UNIT
 type: ROOM
 area (sq m): 20.4
 tenure: LEGAL OWNERSHIP

LAND/LOT
 utilization: PRIVATE
 area (sq m): 26.4
 tenure: LEGAL OWNERSHIP

DWELLING
 location: PERIPHERY
 type: ROW/GROUPED
 number of floors: 1
 utilization: SINGLE FAMILY
 physical state: GOOD

DWELLING DEVELOPMENT
 mode: INSTANT
 developer: PUBLIC
 builder: SMALL CONTRACTOR
 construction type: MASONRY
 year of construction: 1975

MATERIALS
 foundation: BRICK
 floors: MUD/CEMENT PLASTER
 walls: BRICK
 roof: ASBESTOS SHEETS

DWELLING FACILITIES
 wc: 1 FOR 2 FAMILIES
 shower: 1
 kitchen: 1
 rooms: 1
 other: FRONT VERANDAH,
 BACK YARD

SOCIO-ECONOMIC DATA
(related to user)

GENERAL: SOCIAL
 user's ethnic origin: HINDU
 place of birth: AHMEDABAD DISTRICT
 education level: NONE

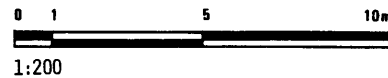
NUMBER OF USERS
 married: 2
 single:
 children: 5
 total: 7

MIGRATION PATTERN
 number of moves: 4
 rural - urban: 1958
 urban - urban: 1971, 73, 75
 urban - rural:
 why came to urban area: EMPLOYMENT

GENERAL: ECONOMIC
 user's income group: LOW
 employment: SELF-EMPLOYED
 distance to work: 7.5 KM.
 mode of travel: BUS/BICYCLE

COSTS
 dwelling unit: \$320
 land - market value:

DWELLING UNIT PAYMENTS
 financing: SUBSIDY/LOAN
 rent/mortgage: \$ 2/MONTH
 % income for rent/mortgage: 5%



1:200



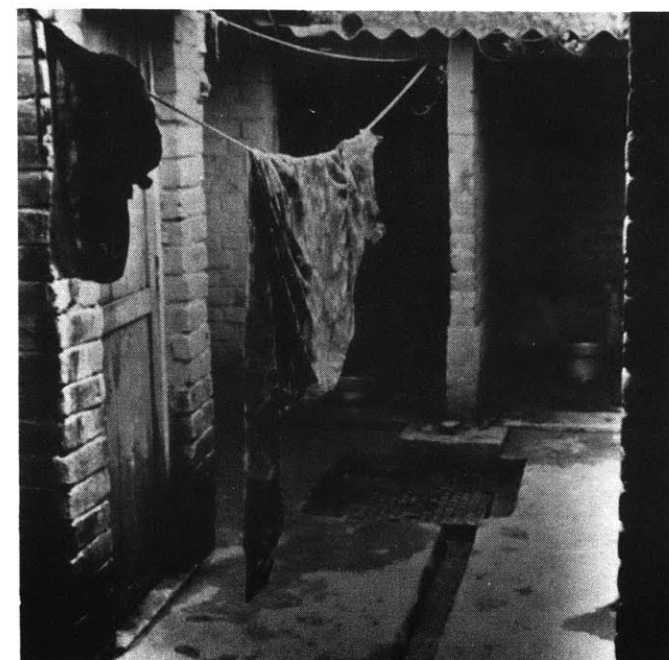
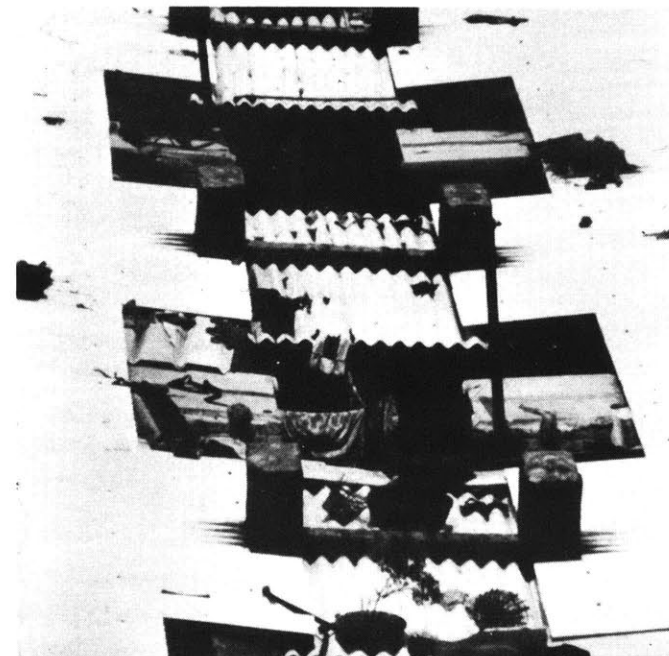
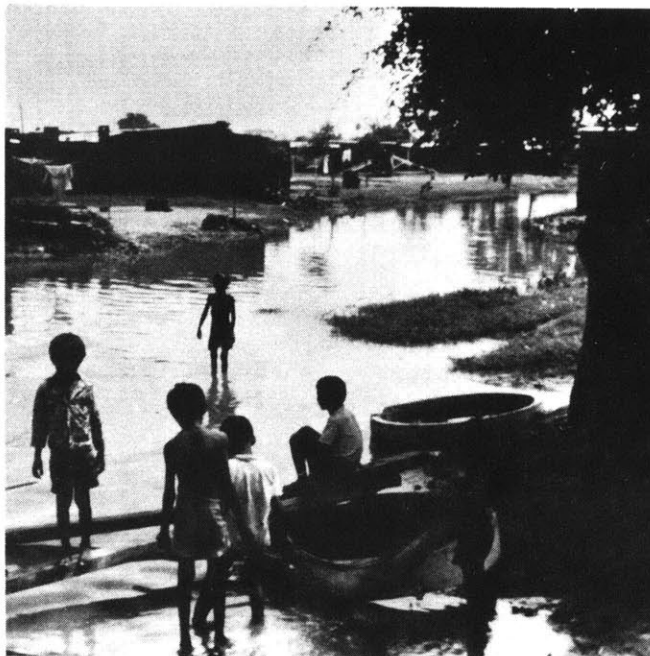
TYPICAL DWELLING

VASNA: (top left) A ditch passing through the site remains dry except during the monsoon months.

(top right) A top-view of back courtyards between four dwelling units. The courtyards are very small and people have covered them in many instances.

(bottom right) A back courtyard with a w.c. on the left with two washing places/showers in combination in the background. Already too small courtyards are further restricted in use due to the location of the manhole.

(bottom left) A view of a kitchen alcove. The physical configuration of the alcove does not allow flexibility during cooking. A "smokeless" stove provided with the dwelling consumes excessive fuel and therefore is not used in most of the cases. The arrangement of the dwelling does not allow privacy inside the dwellings



CASE STUDY SOURCES

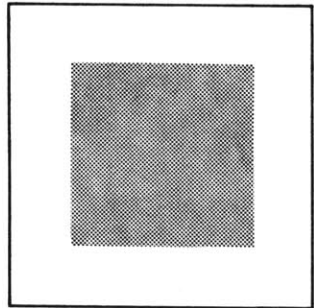
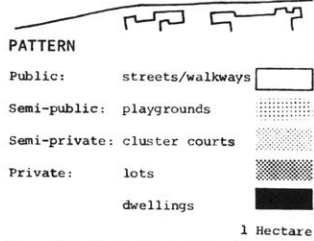
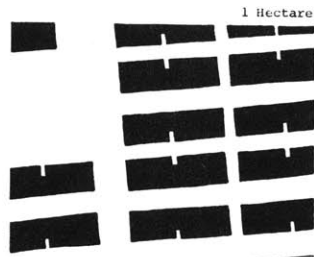
- Plan: (approximate) A.M.C. Office, A.S.A.G., 1975.
 Land Use Pattern: (approximate) Field Survey, A. and V. Chavda, 1976.
 Circulation Pattern: (approximate) IBID.
 Segment Plan: (accurate) A.S.A.G., 1975.
 Block Plan: (accurate) IBID.
 Block Land Utilization: (accurate) IBID.
 Typical Dwelling: (accurate) IBID.
 Physical Data: (approximate) Field Survey, A. and V. Chavda, 1976.
 Socio-Economic Data: (approximate) IBID.
 Photographs: A. and V. Chavda, 1976.
 General Information: A.S.A.G. Report, 1976.

SIMILAR DWELLING SYSTEM

**5a AMBAWADI
Harijanwas**

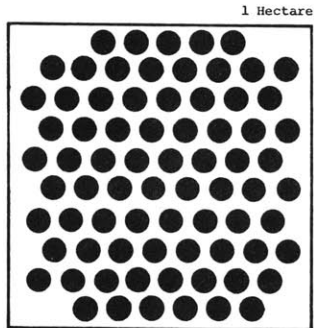
This is a typical example of public housing projects for low income people built in the last 25 years. They are generally 3-4 story buildings accommodating rooms/apartments of 8-40sq.m. The dwellings have no access to semi-private areas for extension of activities and are too small for families of 6 or more. Large open areas around the walk-ups are unutilized. Ambiguity in responsibility created by undefined lot boundaries lead to poor maintenance. A clear definition of lots may also tend to leave the areas in the similar state, because there is very little incentive among this income group to maintain an area which is not part of their dwelling. The lot, in most of the low income housing, is defined by the dwelling, and enclosed and open activity areas surrounding it. The contradictory situation of medium/high population densities achieved by the walk-ups and unutilized large open areas surrounding them clearly indicates that walk-ups are inappropriate dwelling system for this income groups.

LAND UTILIZATION DIAGRAMS



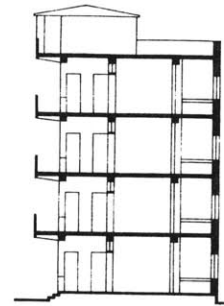
PERCENTAGES

Streets/Walkways	64%
Playgrounds	-
Cluster Courts	-
Dwellings/Lots	36

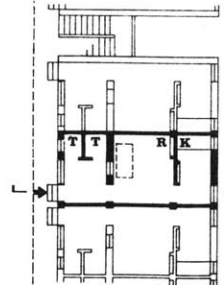


DENSITY

Persons/Hectare	1500
	20 Persons



SECTION



PLAN

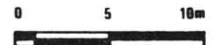
TYPICAL DWELLING



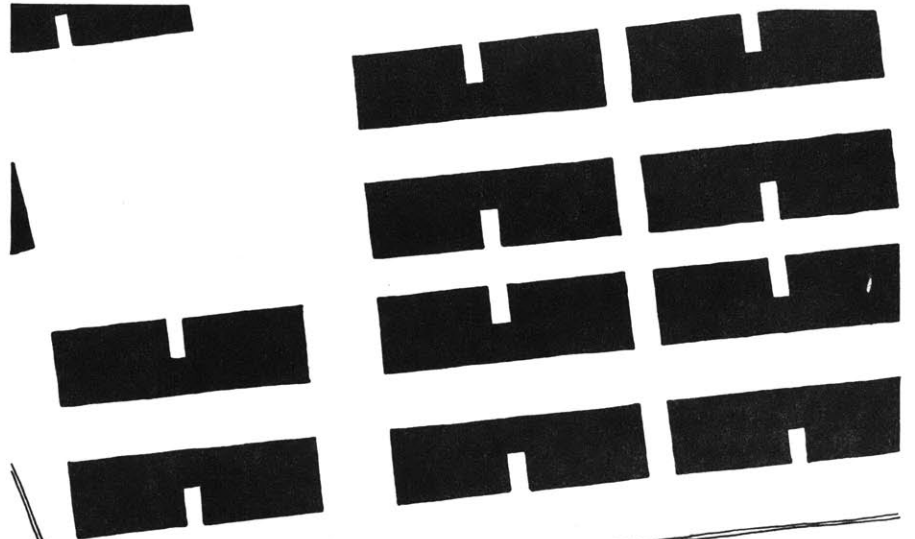
ELEVATION

KEY

- LR Living Room
- D Dining/Eating Area
- BR Bedroom
- K Kitchen/Cooking Area
- T Toilet/Bathroom
- L Laundry
- C Closet
- S Storage
- R Room (multi-use)



1:400



BLOCK PLAN

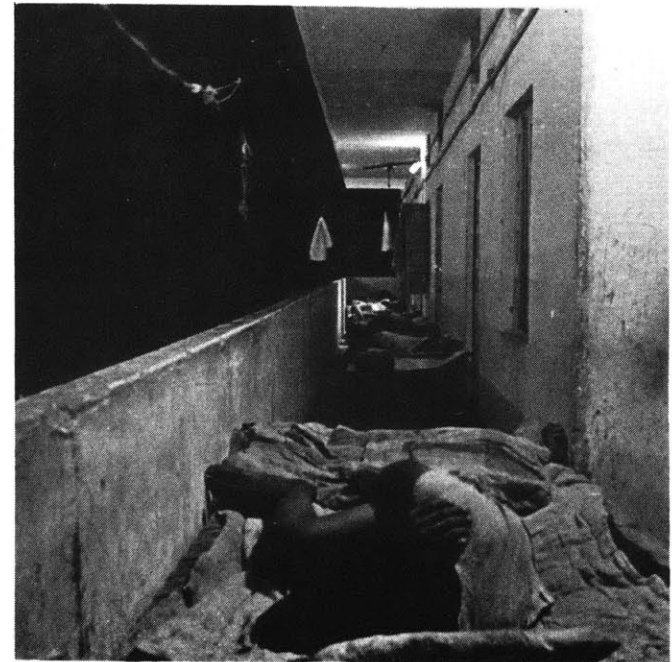


1:1000



PUBLIC WALK-UPS: (top row) A general view of low income walk-ups. Extremely small dwelling unit areas are in contradiction with the large unutilized, unmaintained open areas.

(bottom row) With the very small dwelling unit area and the hot climate, people sleep in the open; those on the upper floors use the passage area (right photo) and even the overhangs (left photo).



CASE STUDY SOURCES

Block Plan: (approximate) Nimish Patel,
M.I.T. Thesis, 1976
Block Land Utilization: (approximate) IBID.
Typical Dwelling: (approximate) IBID.
Photographs: A. and V. Chavda, 1971.
General Information: Field Survey,
A. and V. Chavda, 1971,
Nimish Patel, M.I.T. Thesis,
1976.

6 NAVA WADAJ Vijaynagar

PUBLIC, MIDDLE INCOME, APARTMENT

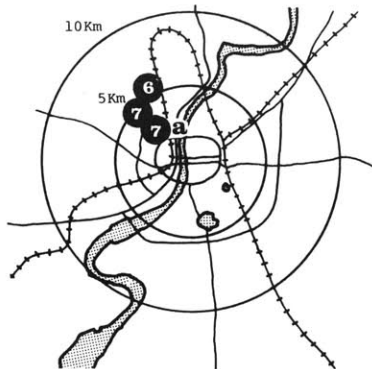
7 NAVA WADAJ Co-op. society

PRIVATE, MOD. LOW/MIDDLE INCOME,
SEMI-DETACHED HOUSE/APARTMENT

7a NAVRANGPURA Co-op. society

PRIVATE, HIGH INCOME, HOUSE

Ahmedabad



LOCATION: This is a newly developed area located on the fringe of the city, approximately 5 km. north-west of the centre.

ORIGINS: The Nava Wadaj area started developing as a residential area for middle income groups in the 1960's. The area developed gradually over several years, most of it through co-operative housing societies. A large section of this area was reserved for residential development by the Gujarat Housing Board for the middle income group. Parts of this section have been or are in the process of being developed.





LOCALITY PLAN



LAYOUT: There are no specific boundaries to this locality except for the railway tracks on the east. The locality developed without proper planning. A high tension line passing through the area has dominated the layout pattern in some parts. As the residential development progressed, the circulation network was extended. The former agricultural land was bought and subdivided by private developers to form small-scale co-operative housing developments. Because of high land costs, semi-detached dwellings on group-owned lots are predominant among the co-operatives. Walkup apartments and detached dwellings on individual lots are also common. Generally, the layout of the co-operatives is governed by the building bye-laws which require a certain minimum open space between two buildings. As a result, a large portion of the land remains unutilized or underutilized.

The public housing project represents an arbitrary layout with a very elaborate circulation pattern. Community facilities are proposed on open spaces scattered throughout the site. Basically, two dwelling types dominate: walk-up apartments built by the housing board, and detached and semi-detached dwellings built on lots sold by the housing board.

Photographs; opposite page:





NAVA WADAJ: (top) A general view of Vijaynagar, a public housing project for middle income groups.

(bottom) A general view of a sprawling development of co-operative housing societies on the periphery of the city.



LAND USE: The locality is predominantly a medium density residential area. Commercial activities have grown along intersections of major roads. The community facilities such as schools, playgrounds, recreation, and community centre are limited, therefore, the people have to depend on the adjoining localities and the central business district. The majority of dwellings are one to three story self-owned dwellings. Renting of a part of the dwelling is very common in this area.

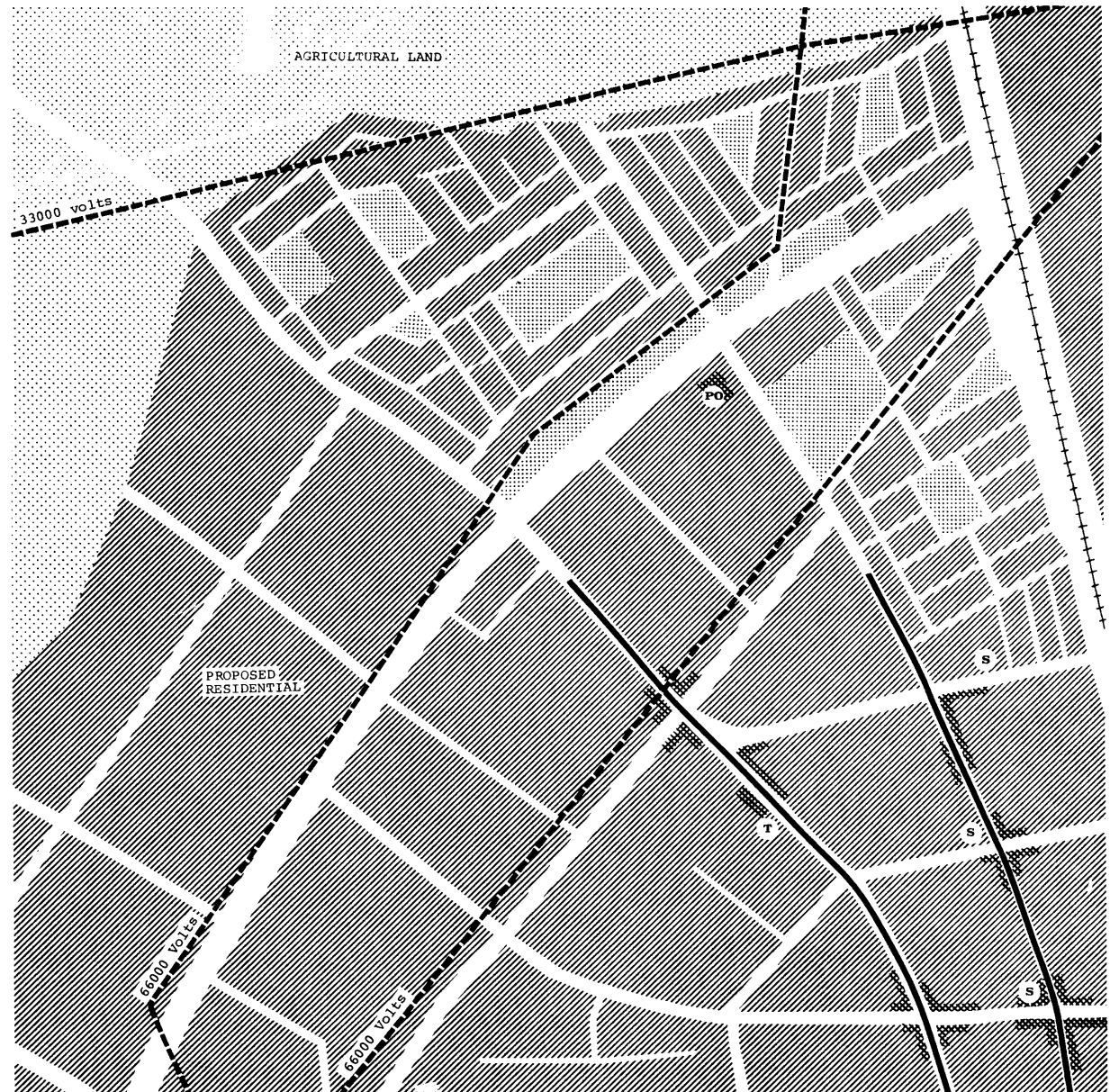
CIRCULATION: Ghatlodia Road and Vijaynagar Road are the major vehicular routes linking the locality to the adjoining areas. The proposed ring road will connect the locality to the university campus. The traffic movement is mainly pedestrian and light vehicular. The city bus service operates on the two major roads. Excessive circulation areas in the public projects increase installment and maintenance expenses for the public sector.

AREAS

	RESIDENTIAL
	COMMERCIAL
	AGRICULTURAL
	OPEN SPACES

KEY

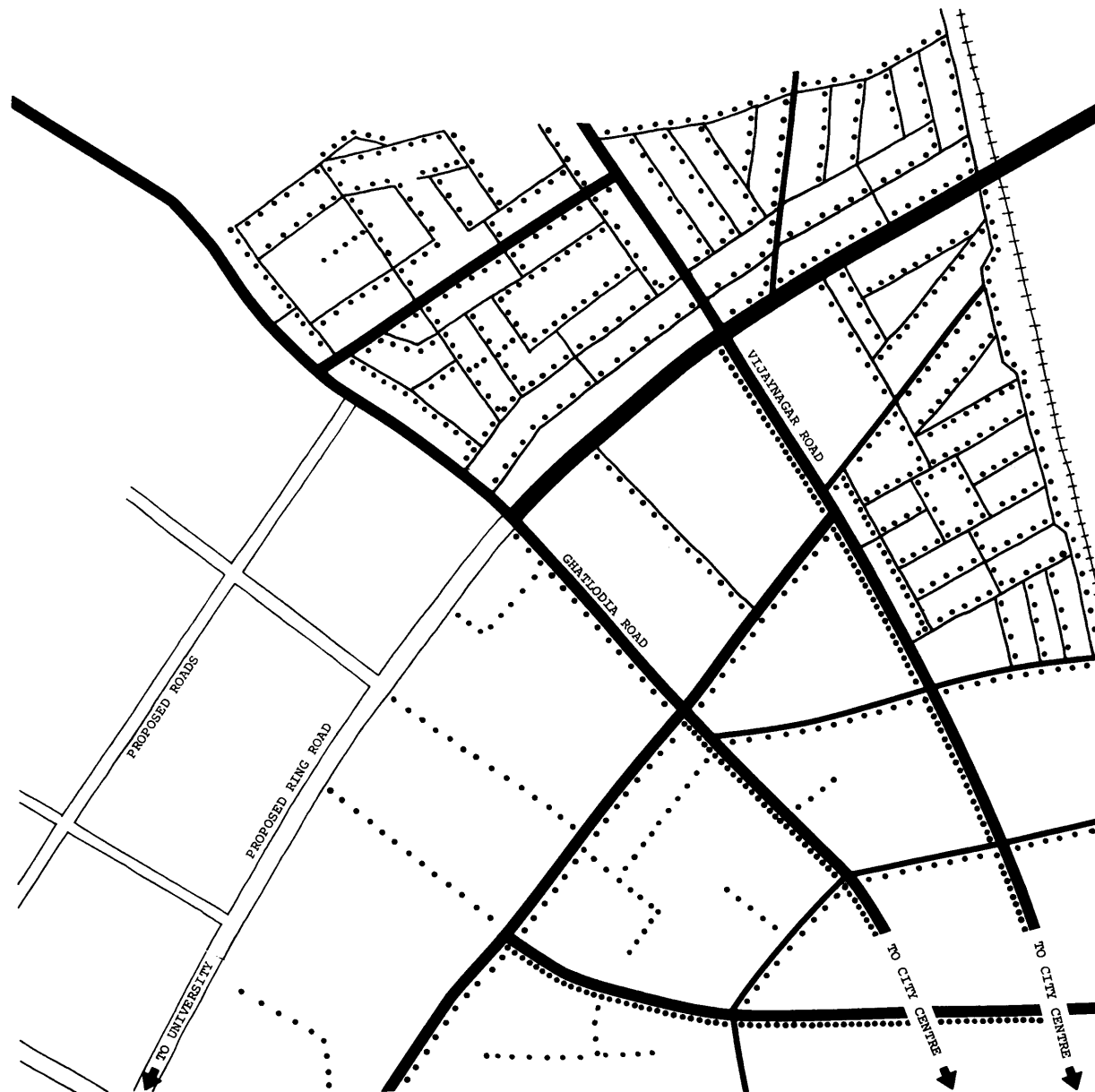
Pk	Parking
P	Police
F	Fire Department
S	School
T	Temple
Mq	Mosque
Ch	Church
R	Recreation
L	Library
U	University
H	Health
PO	Post Office
SS	Social Services
M	Market
C	Cemetery
	Bus
	ELECTRICAL TRANSMISSION LINE



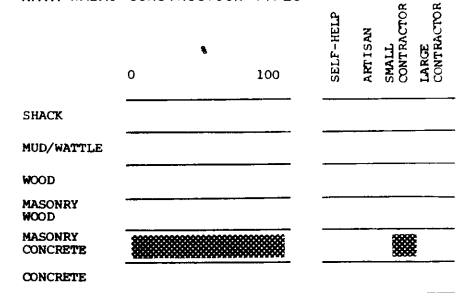
LOCALITY LAND USE PATTERN

0 100 500m
1:10000





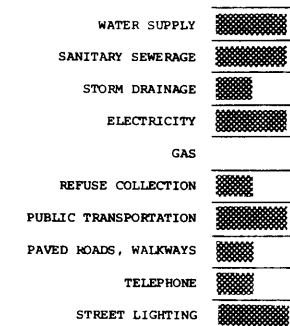
NAVA WADAJ CONSTRUCTION TYPES



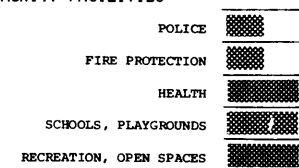
The chart shows (1) approximate percentage of each construction type within the total number of dwellings and (2) building group that generally produces each type.

Quality of information: Approximate

NAVA WADAJ UTILITIES AND SERVICES

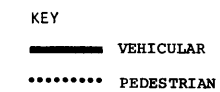


NAVA WADAJ COMMUNITY FACILITIES



The chart illustrates the approximate availability of utilities, services, and community facilities at three levels: NONE, LIMITED, ADEQUATE.

Quality of information: Approximate



LOCALITY CIRCULATION PATTERN



POPULATION AND INCOME: The population in the Nava Wadaj area belongs to lower middle and middle income strata (approximately 2-3 times the subsistence level, \$900-\$1350 per year). From an occupational standpoint, this is a very heterogeneous population. They are bank clerks and managers, public and private sector employees, businessmen, and professionals. The majority of the co-operative members have received long term loans from the Gujarat Co-operative Financing Corporation. Generally, 15-25% of the monthly family income, or U.S. \$12-\$30 per month, is paid as house rent or loan installment.

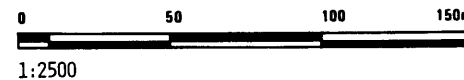


VIJAYNAGAR LAND UTILIZATION DATA

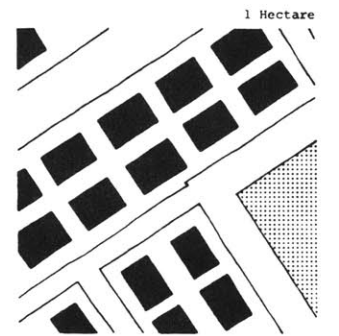
DENSITIES	Total Number	Area Hectares	Density N/Ha
LOTS	-	56.33	-
DWELLING UNITS	4231	56.33	75
PEOPLE	27730	56.33	492

AREAS	Hectares	Percentages
PUBLIC (streets, walkways, open spaces)	30.51	54
SEMI-PUBLIC (open spaces, schools, community centers)	9.03	16
PRIVATE (dwellings, shops, factories, lots)	16.79	30
SEMI-PRIVATE (cluster courts)	-	-
TOTAL	56.33	100

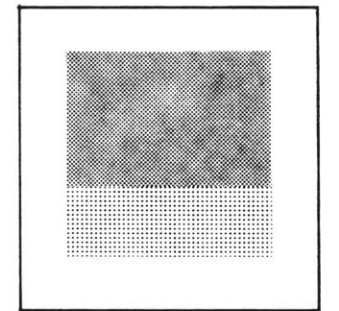
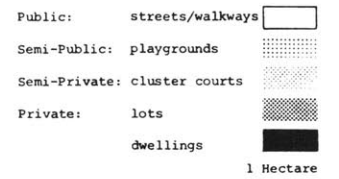
LOCALITY SEGMENT PLAN (VIJAYNAGAR)



LAND UTILIZATION DIAGRAMS

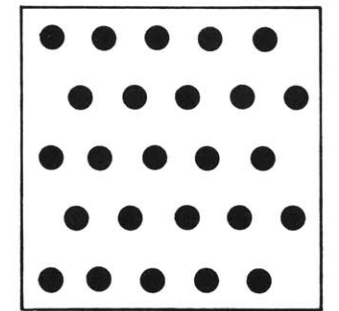


PATTERN



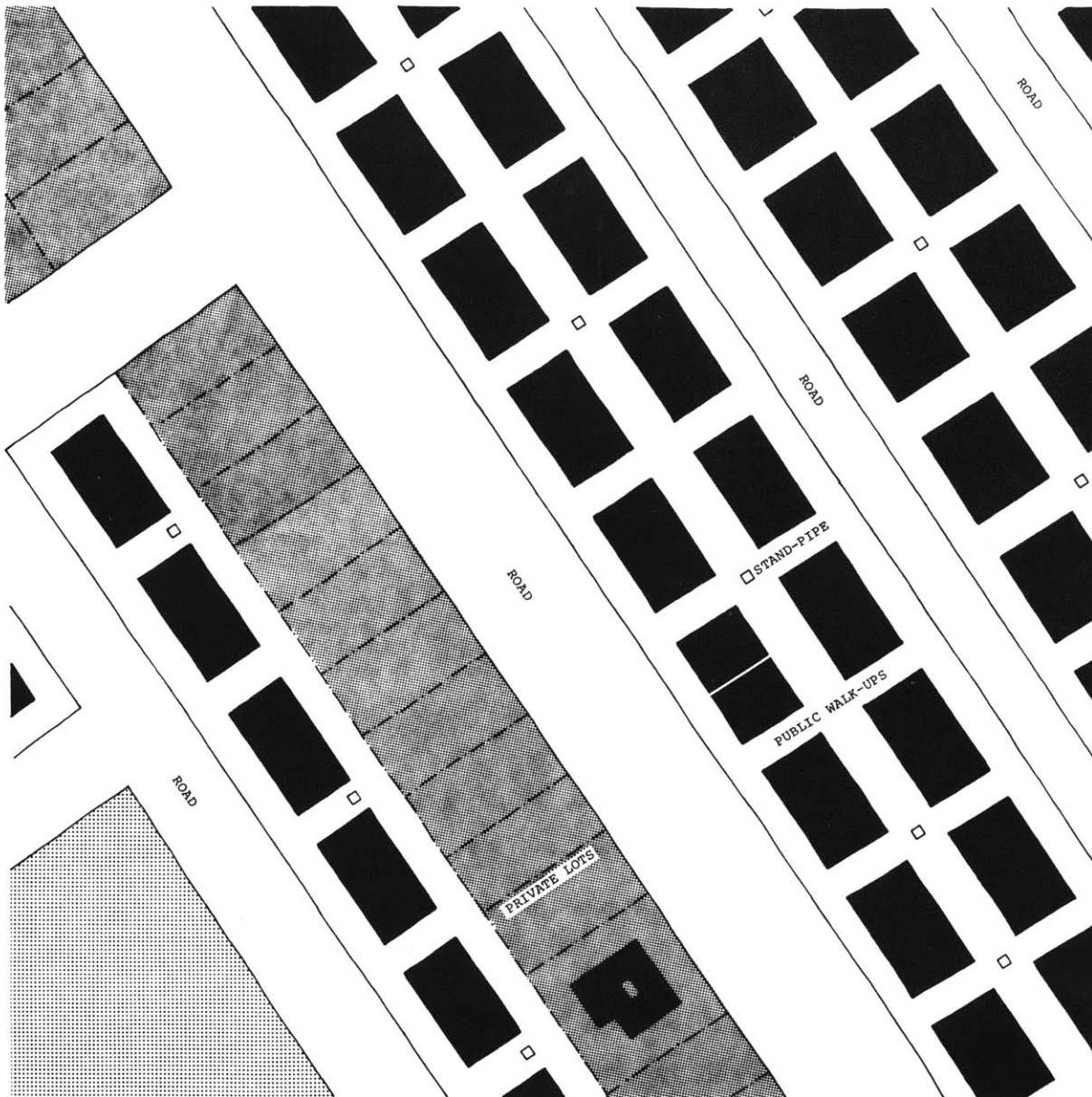
PERCENTAGES		
Streets/walkways	54%	
Playgrounds	16	
Cluster Courts	-	
Dwellings/Lots	30	

1 Hectare



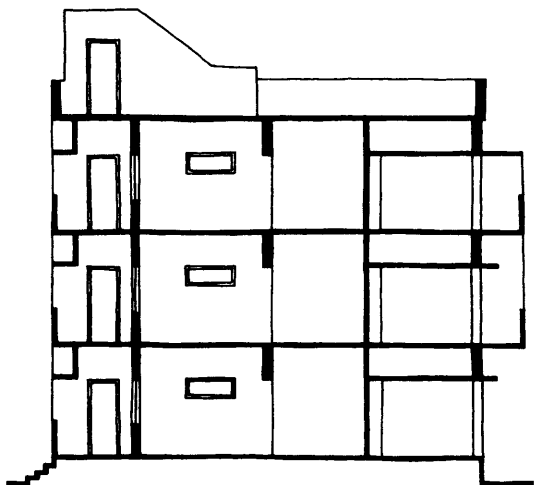
DENSITY Persons/Hectare 492

● 20 Persons

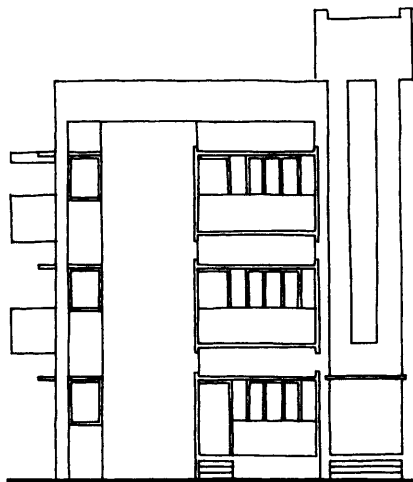


BLOCK PLAN

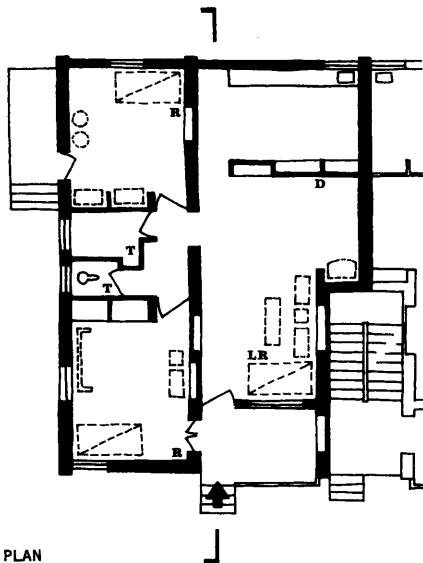




SECTION



ELEVATION

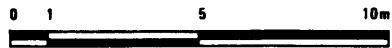


PLAN

TYPICAL DWELLING

KEY

- LR Living Room
- D Dining/Eating Area
- BR Bedroom
- K Kitchen/Cooking Area
- T Toilet/Bathroom
- L Laundry
- C Closet
- S Storage
- R Room (multi-use)



1:200

PHYSICAL DATA
(related to dwelling and land)

DWELLING UNIT
 type: APARTMENT
 area (sq m): 90
 tenure: LEGAL OWNERSHIP

LAND/LOT
 utilization: PUBLIC
 area (sq m): N.A.
 tenure: LEGAL OWNERSHIP

DWELLING
 location: PERIPHERY
 type: WALK-UP
 number of floors: 3
 utilization: MULTIPLE FAMILIES
 physical state: GOOD

DWELLING DEVELOPMENT
 mode: INSTANT
 developer: PUBLIC
 builder: LARGE CONTRACTOR
 construction type: MASONRY/CONCRETE
 year of construction: 1972

MATERIALS
 foundation: BRICK
 floors: BRICK, CEMENT TILES
 walls: MASONRY,
 roof: REINFORCED CONCRETE

DWELLING FACILITIES
 wc: 1
 shower: 1
 kitchen: 1
 rooms: 3
 other: VERANDAH

SOCIO-ECONOMIC DATA
(related to user)

GENERAL: SOCIAL
 user's ethnic origin: HINDU
 place of birth: SAURASHTRA
 education level: SECONDARY SCHOOL

NUMBER OF USERS
 married: 2
 single: 3
 children: 2
 total: 7

MIGRATION PATTERN
 number of moves: 3
 rural - urban:
 urban - urban: 1960, 70, 73
 urban - rural:
 why came to urban area:

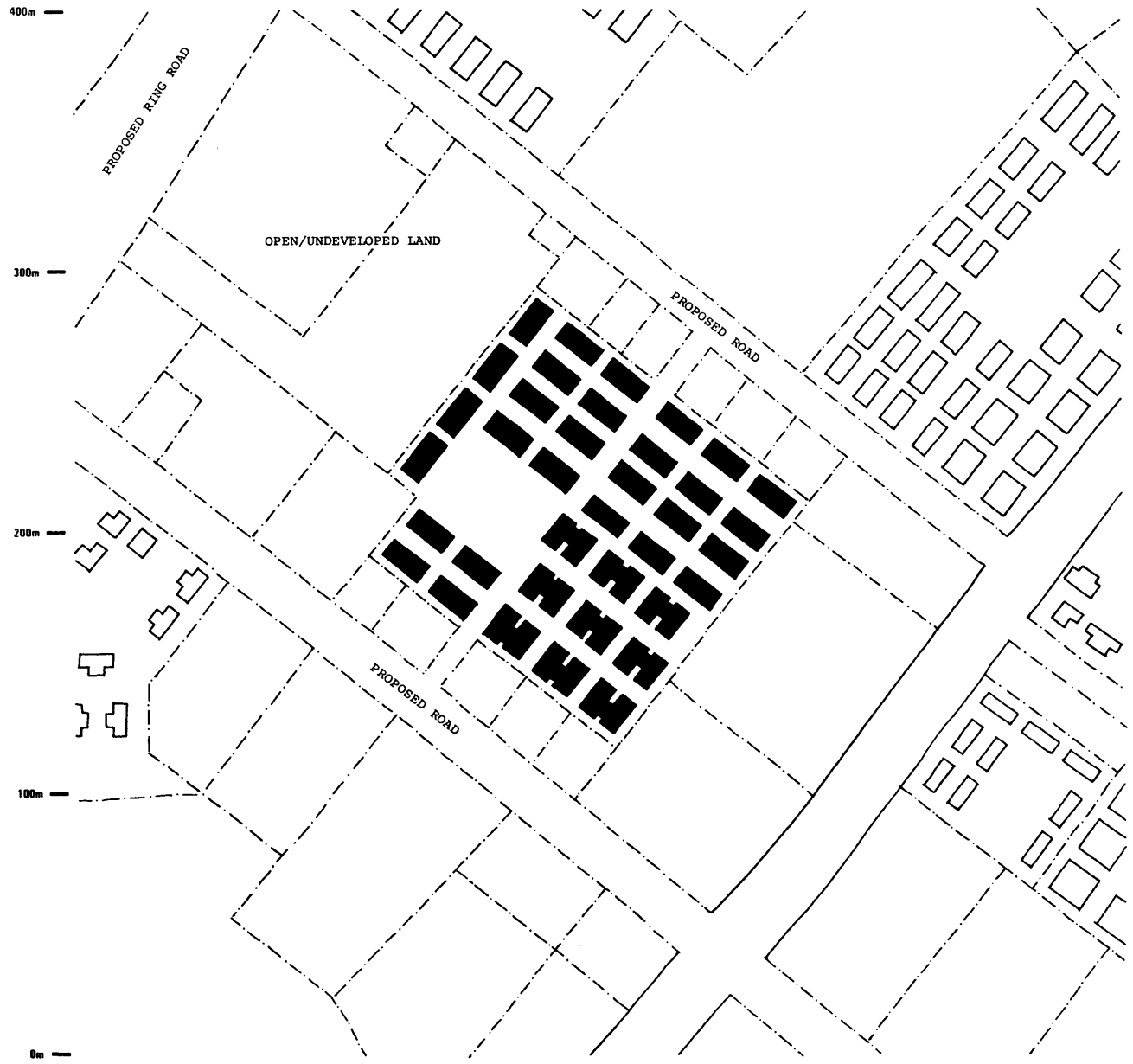
GENERAL: ECONOMIC
 user's income group: MIDDLE
 employment: BUSINESS
 distance to work: 12 KM.
 mode of travel: SCOOTER

COSTS
 dwelling unit: \$2,950
 land - market value:

DWELLING UNIT PAYMENTS
 financing: SELF/LOAN
 rent/mortgage: \$30/MONTH
 % income for rent/mortgage: 18%

VIJAYNAGAR: The photographs indicate that undefined land/lot boundaries result in wasteful utilization of land. Neither the users nor the city maintain these areas. In some cases back alleys have been fenced (bottom right) only for security purposes.





CO-OPERATIVE SOCIETY LAND DATA

DENSITIES	Total Number	Area Hectares	Density N/Ha
LOTS	16	1.26	13
DWELLING UNITS	31	1.26	25
PEOPLE	170	1.26	135

AREAS	Hectares	Percentages
PUBLIC (streets, walkways, open spaces)	0.47	27
SEMI-PUBLIC (open spaces, schools, community centers)	-	-
PRIVATE (dwellings, shops, factories, lots)	0.79	63
SEMI-PRIVATE (cluster courts)	-	-
TOTAL	1.26	100

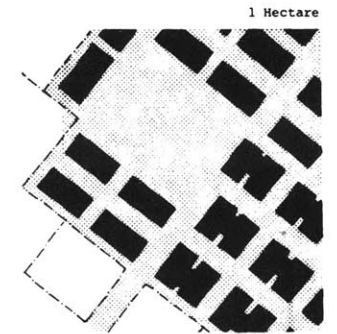
LOCALITY SEGMENT PLAN (CO-OPERATIVE SOCIETY)



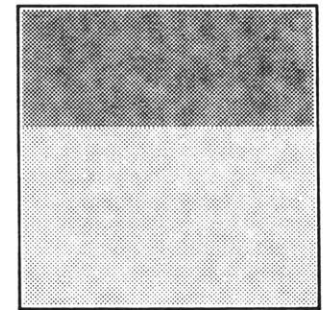
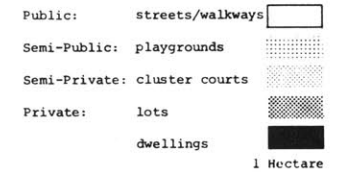
1:2500



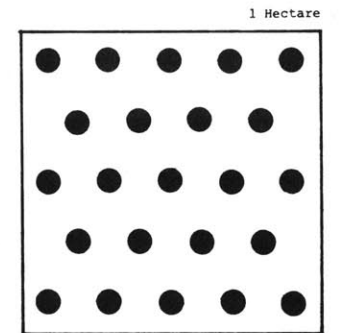
LAND UTILIZATION DIAGRAMS



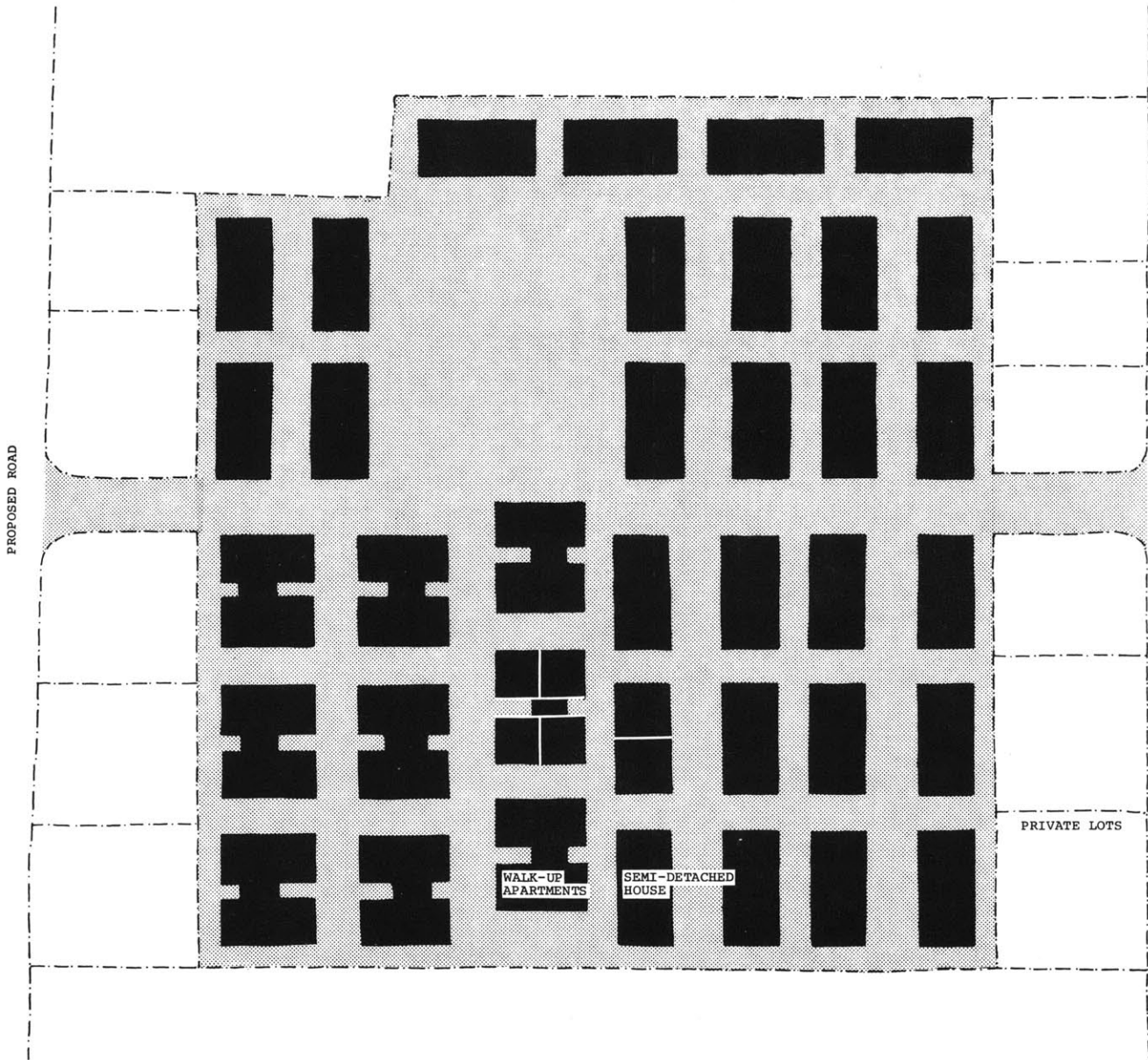
PATTERN



PERCENTAGES	Streets/walkways	1%
	Playgrounds	-
	Cluster Courts	60
	Dwellings/Lots	39

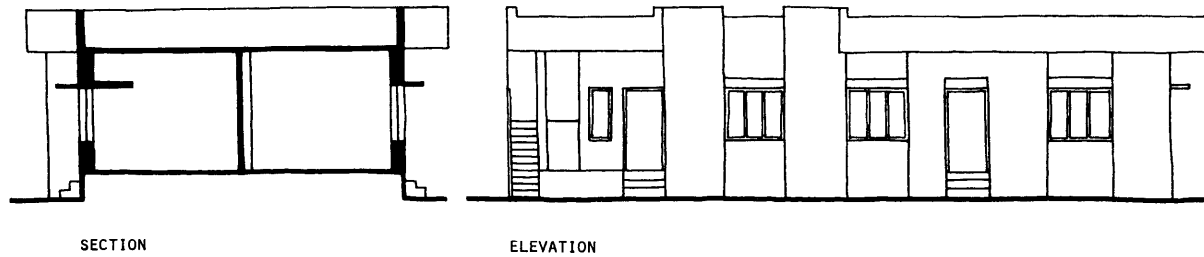


DENSITY	Persons/Hectare	450
	20 Persons	



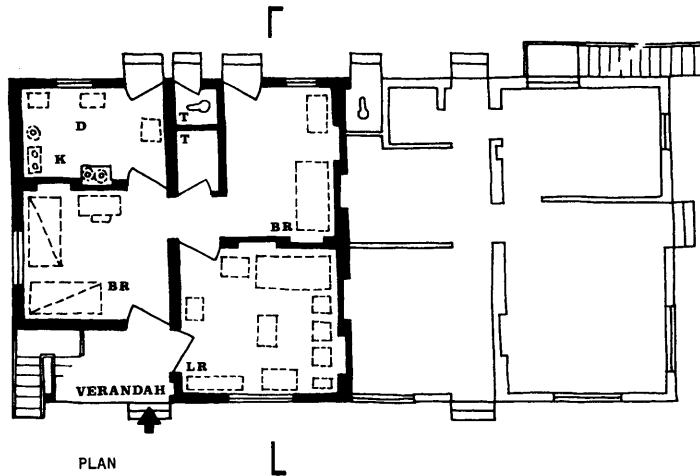
BLOCK PLAN





SECTION

ELEVATION



PLAN

KEY

- LR Living Room
- D Dining/Eating Area
- BR Bedroom
- K Kitchen/Cooking Area
- T Toilet/Bathroom
- L Laundry
- C Closet
- S Storage
- R Room (multi-use)

PHYSICAL DATA
(related to dwelling and land)

DWELLING UNIT
 type: HOUSE
 area (sq m): 81
 tenure: LEGAL OWNERSHIP

LAND/LOT
 utilization: SEMI-PRIVATE
 area (sq m): N.A.
 tenure: LEGAL OWNERSHIP

DWELLING
 location: PERIPHERY
 type: SEMI-DETACHED
 number of floors: 1
 utilization: SINGLE FAMILY
 physical state: GOOD

DWELLING DEVELOPMENT
 mode: INSTANT
 developer: PRIVATE
 builder: SMALL CONTRACTOR
 construction type: MASONRY, CONCRETE
 year of construction: 1976

MATERIALS
 foundation: BRICK
 floors: BRICK, CEMENT
 walls: BRICK
 roof: REINFORCED CONCRETE

DWELLING FACILITIES
 wc: 1
 shower: 1
 kitchen: 1
 rooms: 3
 other: VERANDAH

SOCIO-ECONOMIC DATA
(related to user)

GENERAL: SOCIAL
 user's ethnic origin: HINDU
 place of birth: AHMEDABAD DISTRICT
 education level: PRIMARY SCHOOL

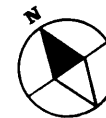
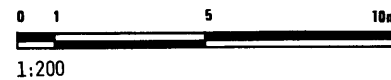
NUMBER OF USERS
 married: 4
 single: 5
 children: 1
 total: 10

MIGRATION PATTERN
 number of moves: 1
 rural - urban: 1975
 urban - urban:
 urban - rural:
 why came to urban area: EDUCATION

GENERAL: ECONOMIC
 user's income group: MIDDLE
 employment: BUSINESS
 distance to work: 26 KM.
 mode of travel: SCOOTER/BUS

COSTS
 dwelling unit: \$3,700
 land - market value:

DWELLING UNIT PAYMENTS
 financing: SELF/LOAN
 rent/mortgage: \$30/MONTH
 % income for rent/mortgage: 25%


TYPICAL DWELLING

CO-OPERATIVE SOCIETY: The housing co-operatives of one or two story dwellings are very common. The staircases projecting from the dwellings are a very typical feature in these developments (top right). The stairs facilitate extensions on the second floor and allow a separate entry for subletting. They are provided on the exterior instead of the interior to maximize the internal dwelling area which is limited by the municipal bye-laws.



CASE STUDY SOURCES

- Plan: (approximate) A.M.C. Office, Gujarat Housing Board, 1975.
- Land Use Pattern: (approximate) IBID.
- Circulation Pattern: (approximate) IBID.
- Segment Plans: (accurate) Gujarat Housing Board, 1975, A. Gajjar, 1975.
- Block Plans: (accurate) IBID.
- Block Land Utilization: (accurate) IBID.
- Typical Dwellings: (accurate) IBID.
- Physical Data: (approximate) Field Survey,
- Socio-Economic Data: A. and V. Chavda, 1976.
- Socio-Economic Data: (approximate) IBID.
- Photographs: A. and V. Chavda, 1976.
- General Information: A.M.C. Reports, Gujarat Housing Board Reports, 1975.

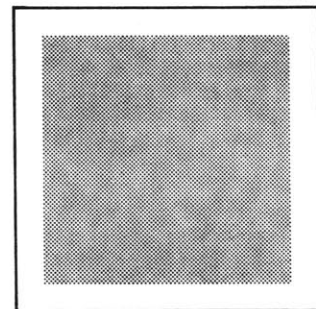
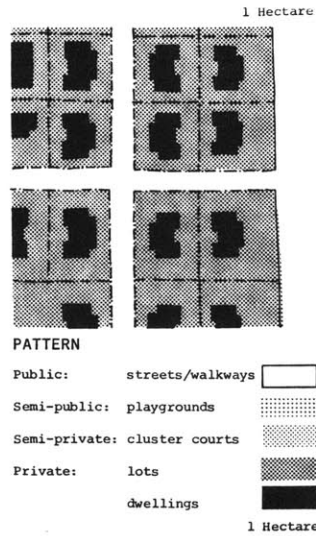
SIMILAR DWELLING SYSTEM

**7a NAVRANGPURA
Co-op. society**

Initially the major function of the housing co-operatives was to buy and subdivide land to accommodate detached houses. Such residential developments, largely a characteristic of western Ahmedabad, is one of the most wasteful developments in the city. The lot size and configuration are governed by set-back regulations. Most of the lots being square, and the building bye-laws requiring a set-back of 4.5m. fronting a street and 3m. on the other sides, result in inefficient utilization of the area within the lots. The excessive circulation areas serving a very low density of population puts an additional burden on the city's resources.

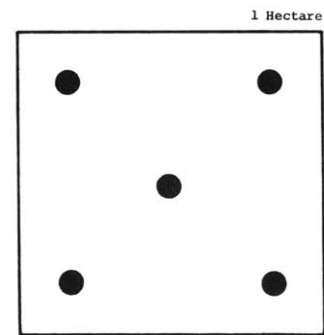
One or two story owner-occupied houses include a living room, kitchen, two or more bedrooms with/without attached bathroom, storage room, front verandah and backyard.

LAND UTILIZATION DIAGRAMS



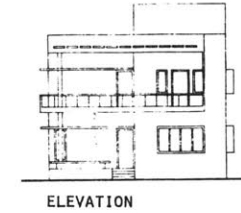
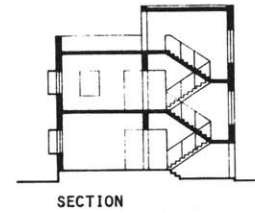
PERCENTAGES

Streets/Walkways	27%
Playgrounds	-
Cluster Courts	-
Dwellings/Lots	63



DENSITY Persons/Hectare 135

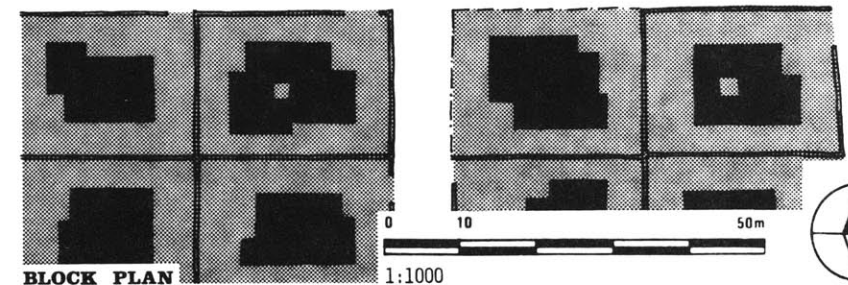
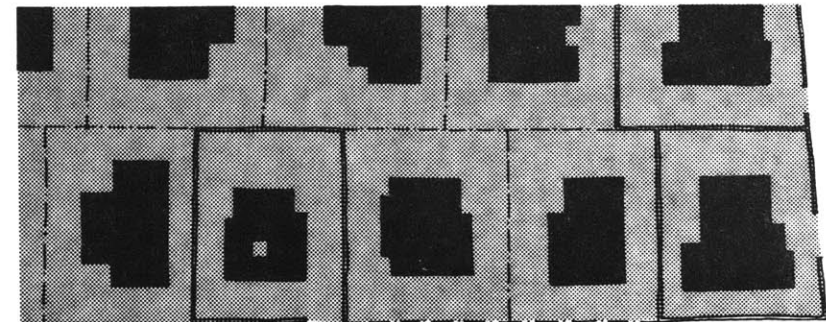
● 20 Persons



- KEY**
- LR Living Room
 - D Dining/Eating Area
 - BR Bedroom
 - K Kitchen/Cooking Area
 - T Toilet/Bathroom
 - L Laundry
 - C Closet
 - S Storage
 - R Room (multi-use)



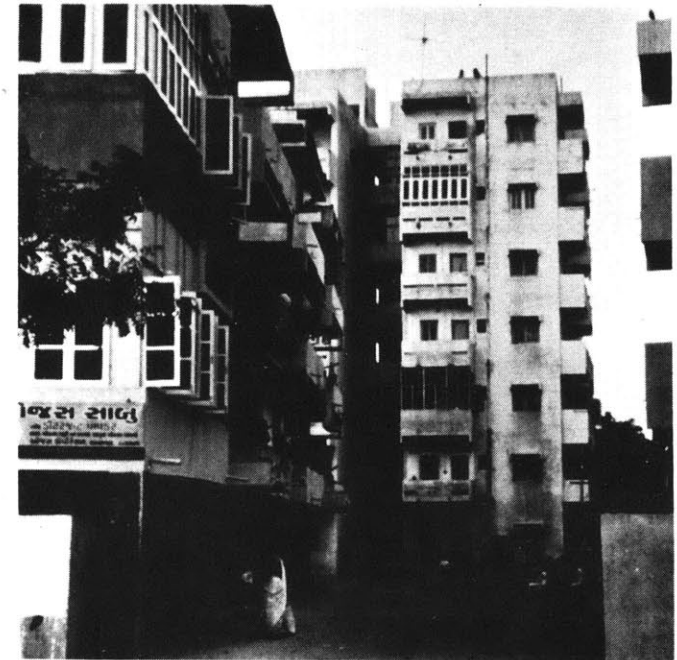
TYPICAL DWELLING



CO-OPERATIVE SOCIETY: (top left) Expansion of dwelling by the owner in a co-operative. Note the elevated facade.

(top right) Walk-up and high-rise apartments to a lesser degree, are also built by housing co-operatives.

(bottom) A back space in some cases is very well maintained and extensively used for semi-private activities.



CASE STUDY SOURCES

Block Plan: (approximate) Nimish Patel,
M.I.T. Thesis, 1976
Block Land Utilization: (approximate) Nimish Patel,
M.I.T. Thesis, 1976
Typical Dwelling: (approximate) Nimish Patel,
M.I.T. Thesis, 1976
Photographs: A. and V. Chavda, 1976
General Information: Field Survey,
A. and V. Chavda, 1976,
Nimish Patel, M.I.T. Thesis,
1976

EVALUATIONS

PHYSICAL DATA MATRIX

Category	Population per Category	% of Total Population	LOCALITIES, CASE STUDIES	USER		DWELLING UNIT				LAND/LOT			DWELLING				DWELLING DEVELOPMENT						
				5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
				Income	Type	Area	Tenure	Rent/Mort.	Utilization	Area	Tenure	Location	Type	No. Floors	Utilization	Phy. State	Mode	Developer	Builder	Construction Type	Date	Urbanity	
			Very Low Low Moderately low Middle High	Shanty Room Apartment House	50m ² or less 51 - 101m ² 101m ² or more	Legal Rental Legal Ownership	20% or less of income 20% or more of income	Public Semi-Public Semi-private Private	m ²	Extralegal Rental Extralegal Ownership Legal Rental Legal Ownership	City Centre Inner Ring Periphery	Detached Semi-Detached Row/Group Walk-up High-Rise	1 2 3 or more	Single Multiple	Bad Fair Good	Incremental Instant	Popular Public Private	Self-Help Artisan Small Contractor Large Contractor	Shack Mud and Wattle Wood Masonry/Wood Masonry/Concrete Concrete	Year of Construction	People/Ha	Locality	
	3,437	100	1. NIKORA, Village	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	202/121	1	
AHMEDABAD CITY																							
A	475,800	30	2. WALLED CITY	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	1880	588	2
B	428,220	27	3. NAVRANPURA, Lakhudi	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	1964	568	3
C	317,200	20	4. RAKHIAL, Chawl	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	1940	1160	4
D	111,020	7	5. VASNA, Vasna	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	1975	575	5
E	253,760	15	6,7. NAVA WADAJ, Vijaynagar, Co-op.	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	1972	490	6
	1,586,000	100	TOTAL POPULATION	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	1976	450	7

The physical data of the seven case studies of dwelling environments, one in Nikora village and six in Ahmedabad city, are summarized in the physical data matrix and in the following comments. The physical data matrix permits: a) a comprehensive view of the spectrum of low income dwelling types, and b) a comparison and determination of trends and patterns.

The population figures represent those living within the municipality boundary and correspond to the inhabitants of similar dwelling systems in the city. The population per category are tentative estimates, and included here only to provide an approximate reference.

(1) CATEGORY

(2) POPULATION PER CATEGORY: Number of people

(3) PERCENTAGE OF TOTAL POPULATION

(4) NAME OF THE LOCALITIES AND CASE STUDIES:

The six urban case studies from five localities have been grouped in five categories, identifying different income groups, housing systems and selected physical characteristics. The five categories shown were identified as follows:

Cat./Income	Dwelling type	Developer
A Mod.low/Middle	Traditional house	Private
B Very low/Low	Shanty	Popular
C Very low/Low	Room	Private
D Very low/Low	Room	Public
E Mod.low/Middle/High	Apartment/House	Private/Public

Category A includes moderately low and middle income groups living in the traditional dwell-

ing system. It represents 30% of the city's population. Categories B, C, and D include very low and low income groups and represent 54% of the urban population. Category E includes moderately low, middle and high income groups representing 16% of the population.

(5) USER INCOME GROUP: The income level is taken as an indicator in the analysis of the dwelling systems. For low income groups, housing is a secondary priority. In fact, the dwellings are a little more than a storage place and most of the activities are carried on in adjacent open spaces and on circulation paths, whereas in higher income groups housing becomes a commodity or a service. Squatter settlement represents the lowest income group and co-operative societies the highest.

(6) DWELLING UNIT TYPE: A pattern is defined in terms of income groups; Shanty and Room: very low and low income, Apartment and House: moderately low, middle and high income.

(7) DWELLING UNIT AREA: It is observed to be a function of household income. In low income groups the dwelling usually consists of one room. Middle and high income dwellings are larger having two or more rooms, a kitchen, and a bathroom. The dwelling unit area ranges from 10sq.m. in chawl and squatters to 210 sq.m. of a detached house in a co-operative society.

(8) DWELLING UNIT TENURE: Three situations are found among very low and low income groups: a) extralegal ownership/rental;

generally a characteristic of fresh migrants in the existing pockets of squatter settlements within the city, b) legal rental c) legal ownership; both of which require payment in the form of rent to the government or a private party. In moderately low, middle and high income groups, only two situations exist: a) legal rental and b) legal owner ship; the latter of which is a characteristic of middle and high income groups whereas the former is found among migrants with stable income and institutional population.

(9) DWELLING UNIT-PERCENT INCOME FOR RENT/ MORTGAGE: A clear trend emerges from the surveys: Middle and high income groups pay more than 20% of income for rent while rents vary from 7.5% of income in the case of squatters to 15% in moderately low and middle income apartments.

(10) LAND/LOT UTILIZATION: The case studies show very clearly that wherever lot boundary has been defined clearly, the utilization remains private among all income groups. Where lot boundaries are not defined, the utilization is semi-public/public, without control/ responsibility, increasing the land wastage. In single story dwelling system for low income people, due to very little enclosed area available to accommodate an unusually large family, the dwelling is extended to cover the adjoining spaces, semi-public/public.

(11) LAND/LOT AREA: In case of low and middle income housing, the land/lot area is not always measurable since it is shared by several dwellers or because it has no physical limits. The lot area in very low and low income housing, by use, can be regarded as between 15 and 35sq.m. In moderately low to high income housing co-operatives, it ranges from 150sq.m. for semi-detached dwellings to 450sq.m. for detached houses.

(12) LAND/LOT TENURE: Extra-legal rental/ ownership is found among very low and low income in case of squatters. Legal rental is predominant in low, moderately low and middle dwelling type accommodating low, moderately low and middle income groups. Walk-ups are found in very low, low and middle income

groups. Due to inadequacy of dwelling size in relation to the number of occupants, they prove to be a failure in the former case. There are a few high-rise apartments in the city occupied by the middle and high income families.

(13) DWELLING LOCATION: The city centre is occupied by moderately low and middle income groups. Very low and low income groups are located mainly on the eastern periphery within the industrial areas, and some settlements in form of pockets within the middle and high income residential areas on the west of the river.

(14) DWELLING TYPES: Detached shanties are found among very low and low income squatter settlements. Detached and semi-detached dwellings are found among moderately low, middle and high income co-operative societies. The traditional housing in the walled city, private development of chawls, and some public projects represent row/grouped dwelling type accommodating low, moderately low and middle income groups. Walk-ups are found in very low, low and middle income public projects. Due to inadequacy of dwelling size in relation to the number of occupants, they prove to be a failure in the former two cases. There are a few high-rise apartments in the city, occupied by the middle and high income families.

(15) DWELLING FLOORS: Most of the dwelling in low income groups are single story structures. The detached/semi-detached dwellings in the housing co-operatives occupy single floor in initial stage, but they are added to by one or two floors. 3-4 story walk-ups are found in public and co-operative housing developments for middle income groups.

(16) DWELLING UTILIZATION: Low income population has single or multiple family utilization. Middle and high income groups generally have a single family utilization.

(17) DWELLING PHYSICAL STATE: The pattern is as follows: Bad state is a visible feature of very low and low income groups in

squatter settlements and chawl. No investment is put into the dwelling since owner/ tenants do not have stable income. Fair state is found in traditional dwellings in the walled city; and good physical state is typical of middle and high income dwellings.

(18) DWELLING DEVELOPMENT MODE: Incremental mode is used by very low and low income groups in squatter settlements. Instant mode of development is characteristic of housing co-operatives and public projects.

(19) DWELLING DEVELOPER: The popular development is generally found in the lowest income groups and particularly in the squatter settlements, since they lack financial resources and access to private or commercial housing. The government, through various agencies, provides residential accommodation to the low and middle income groups. But the supply is limited and available to a very small sector of the population. The private sector deals only with land subdivision/ housing for moderately low, middle and high income groups.

(20) DWELLING BUILDER: The expected pattern is obvious from the selected case studies: Self-help methods are employed by very low and low income groups to build their own houses. Small contractors are hired for moderately low, middle and high income dwelling construction. The public sector generally employs large contractors for construction of large projects.

(21) DWELLING CONSTRUCTION TYPE: Shacks are very common of very low and low income groups. The rest of the construction, barring the traditional, is brick masonry loadbearing walls and reinforced concrete slab, and occasionally concrete frames with masonry infill. The traditional system in the walled city has wooden frames with brick infill and stone floors. The roof is either terraced or tiled.

(22) DWELLING DEVELOPMENT-YEAR OF CONSTRUCTION: The walled city is the oldest part of the city. Its development spanned from the early 15th century to the 19th cen-

tury. The chawls- private development for low income population, squatter settlements, and co-operative housing societies started developing in the 1930's. The chronological order of dwelling construction follows that of the localities and case studies: Rakhial; chawl, Navrangpura; Lakhudi- squatters, Nava Wadaj; Vijaynagar- public project, Vasna; Vasna- public project, and Nava Wadaj; housing co-operative.

(23) DWELLING DEVELOPMENT-DENSITY: Population densities are intended as indicator for each dwelling system. The densities are estimated on the basis of a selected representative project/development within each of the localities and include dwellings, lots, circulation areas, and semi-public spaces. Higher densities are generally indicative of low income groups occupying shanties/rooms/ row houses and low densities indicate middle and high income groups living in apartments/ houses. The traditional dwelling system has high densities but are occupied by moderately low and middle income groups. It should be noted that in the cases, due to unavailability of information, the densities are not always precisely computed but rather approximately estimated.

COMMUNITY FACILITIES, UTILITIES/SERVICES MATRIX

Category	Population per Category	% of Total Population	LOCALITIES, CASE STUDIES	COMMUNITY FACILITIES					UTILITIES AND SERVICES								Locality	
				Police	Fire Protection	Health	Schools, Playgrounds	Recreation	Water	Sewage	Storm Drainage	Electricity	Gas	Refuse Collection	Public Transportation	Paved Roads, Walkways		Telephone
	3,437	100	1. NIKORA, Village			■	■	■	■			■	■	■	■		■	1
AHMEDABAD CITY																		
A	475,800	30	2. WALLED CITY	■	■	■	■	■	■	■	■	■	■	■	■	■	■	2
B	428,220	27	3. NAVRANGPURA, Lakhudi	■	■	■	■	■	■	■	■	■	■	■	■	■	■	3
C	317,200	20	4. RAKHIAL, Chawl	■	■	■	■	■	■	■	■	■	■	■	■	■	■	4
D	111,020	7	5. VASNA, Vasna	■	■	■	■	■	■	■	■	■	■	■	■	■	■	5
E	253,760	15	6,7. NAVA WADAJ, Vijaynagar, Co-op.	■	■	■	■	■	■	■	■	■	■	■	■	■	■	6 7
	1,586,000	100	TOTAL POPULATION															

The matrix illustrates the approximate availability of community facilities, utilities and services in the seven case studies. Three levels are indicated as follows:

□	No provision at all
■	Limited or occasional
■	Adequate or normal

The matrix is indicative of the availability of basic services in relation to income levels. However, variables such as location and tenure among others, modify the initial relationship in urban areas.

The following observations are made from different urban case studies and are arranged in terms of income groups.

VERY LOW/LOW INCOME: Community facilities such as fire protection, police, and health for these income groups vary with location of their settlement and ability to purchase services of private physicians. Recreation areas are often proposed but rarely implemented leaving undeveloped and unmaintained lands for a long period of time until finally it is invaded by the squatters. Basic ser-

vices such as water, sewage disposal, electricity, and street lights exist in most of the localities, but are inaccessible to the low income settlements, particularly squatter settlements and chawls, for their extra-legal land tenure and inability to afford them. The same services in public housing developments are very poorly maintained. In almost all the low income settlements, circulation areas are undefined and can hardly be differentiated from other semi-public areas. Telephone service is not within the economic reach of this group.

The case of squatter settlements is even worse. Most of them have to wait for years before they get any services for they do not have legal possession of the land. The requirement of a title to the land for provision of services prevents the municipality

from taking any positive action. Recently, squatters with potential for economic upgrading are being legalized and others are being relocated. Common water taps and latrines are provided but are inadequate for the number of users.

MODERATELY LOW/MIDDLE/HIGH INCOME: Community facilities/utilities and services are available to these income groups and rate "limited" and "adequate". Facilities such as health and education are easily available because of their economic capacity to pay for them. Water supply is limited, in general, in the city. However, most of the co-operative societies have individual or collective water tanks. Sewage is adequate but is not well maintained.

Brief comments on each of the community facilities/utilities and services is provided below:

POLICE: Police protection is generally limited. Police stations are located in only the major urban areas irrespective of individual localities. Their area of operation varies considerably in size and was found to be inadequate in some localities.

FIRE PROTECTION: Fires are less frequent and, therefore, the fire stations are located at greater distances from each other. Their number is very low in the western part of the city.

HEALTH: Public and private facilities are generally available in the entire city. However, private clinics outnumber the public clinics and are scattered in the entire city. But, they are beyond the economic reach of the low income groups.

SCHOOLS, PLAYGROUNDS: Public and private schools are scattered throughout the urban areas. Education upto high school is free in public schools. Most of the schools are not adequately supported by playgrounds.

RECREATION: Cinemas are the major form of recreation and cinema houses are adequately available all over the city. Open spaces, although provided for all areas, except the walled city, generally remain undeveloped.

WATER: Almost the entire city is connected to the city water network. Water is available through three sources: surface water from the river during the monsoon months, infiltration wells in the river bed, and several tube-well stations located in various parts of the city. The supply through these sources is limited; therefore, the provision is restricted to 2-3 hours in the mornings and for the same period in the evenings. Most of the middle and high income dwellings have overhead water tanks. But, in low income settlements with common water taps, restricted supply creates many social

problems. At present, the water is supplied without any charges, except for some lump sum amount is charged to some of the industries.

SEWAGE DISPOSAL: Almost the entire city is connected to water-borne sewage disposal network. It was installed and extended through piece-meal efforts and is generally overloaded. Break-down due to choking and backing is very frequent. Most of the middle and high income dwelling systems are connected to the network. Low income settlements are generally devoid of such facilities.

STORM DRAINAGE: Storm drainage is found to be inadequate. Flooding of low lying areas during monsoon is very frequent.

ELECTRICITY: It is generally adequate, but expensive. In low income groups where possession of land is legal, electricity is available. However, economic reasons discourage the use; oil and kerosene lamps are commonly used by them.

GAS: Gas service network does not exist in the city. Gas is available in cylinders and is expensive as a fuel for cooking. Dry cowdung, wood and coal are the most common substitutes.

REFUSE COLLECTION: Most of the waste produced in residential areas is organic. Since no specific containers for refuse collection are provided by the city, waste is dumped along the road side to be picked up by the municipality trucks.

PUBLIC TRANSPORTATION: The bus service is operated by the municipality; and connects the entire urban area. It is adequate, but expensive for low income groups.

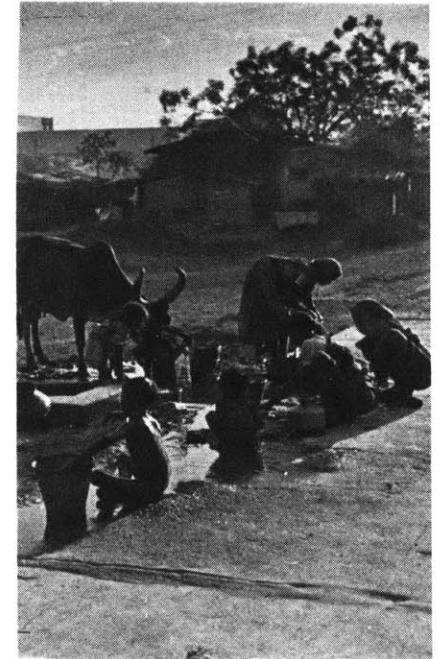
PAVED ROADS, WALKWAYS: Except for major streets, the internal streets are often unpaved in many parts of the city. Roads in public residential developments are generally paved. Walkways with compacted earth

surface are more frequent.

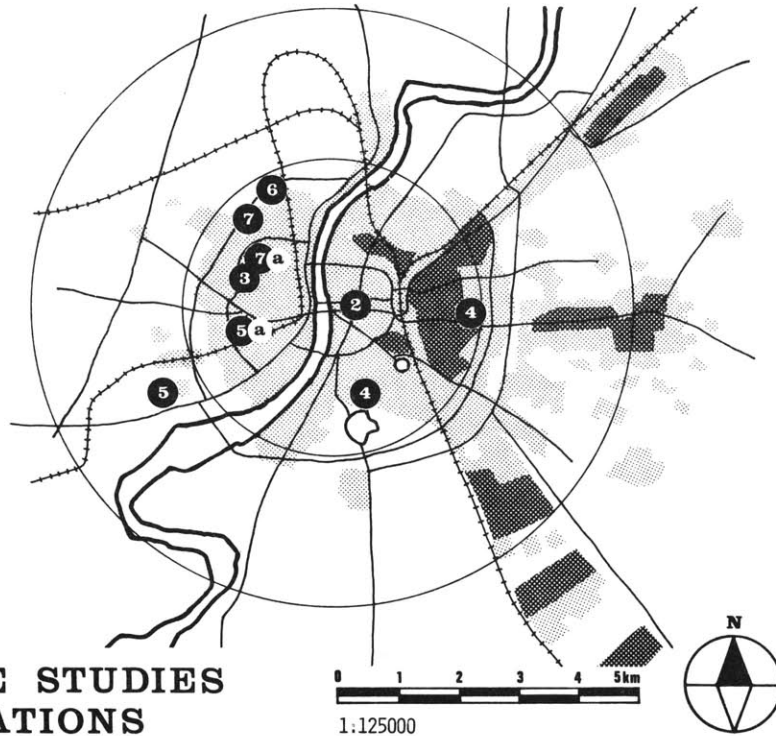
TELEPHONE: Its supply is so scarce that even high income groups acquire it with difficulty

STREET LIGHTING: The city in general has poor street lighting. It is adequate along the important circulation routes. It is provided in most of the public developments, but is often inadequate. Private developments, even among high income groups, are often observed to be without street lighting.

WATER SUPPLY: Communal water taps are provided on periphery of low income settlements. Generally functions such as bathing, cleaning utensils, and washing clothes take place near the stand-pipes on unpaved ground around them.



Land Utilization: Patterns, Percentages, Densities



CASE STUDIES LOCATIONS

- Built-up Area
 Industrial
- 2** WALLED CITY
3 NAVRANGPURA, Lakhudi
4 RAKHIAL, Chawl
4a BEHRAMPURA, Chawl
5 VASNA, Vasna
5a AMBAWADI, Harijanwas
6 NAVA WADAJ, Vijaynagar
7 NAVA WADAJ, Co-op. Society
7a NAVRANGPURA, Co-op. society

The different case studies are represented here in terms of land utilization (patterns, percentages and densities) in a format that allows comparison and evaluation of the physical layout of each of the dwelling systems. The criteria used in the evaluation of efficiency of physical layouts in the survey are:

LAND UTILIZATION PERCENTAGES: Proportion of public and private areas: they determine maintenance responsibility, user control and functional efficiency of a layout; e.g. a large percentage of land for circulation results in high costs of installation per person and extensive maintenance for the public sector, indicating an inefficient layout.

LAYOUT PATTERN: Lot configuration, blocks and circulation; they determine infrastructure network lengths; e.g. certain layouts have excessive network lengths or are very complicated, resulting in higher costs per person.

POPULATION DENSITY: Number of persons and dwelling units per hectare. This determines the intensity of land use; e.g. low densities mean higher costs of development per person.

The chart on the opposite page represents condition of land in front and/or around lots/dwellings; and compares/contradicts the actual land utilization (user) to responsibility, ownership and physical controls. The following relationships are observed in different dwelling environment case studies:

- The land utilization and responsible agent is private/semi-private; physical configuration allows partial/complete controls; in contradiction, ownership is public. Case Studies: Nikora; old village, Walled City.

- The land utilization is private/semi-private; but ownership is public and lot lines/physical controls undefined, as a result, it becomes a no-man's land and creates ambiguity in maintenance responsibilities. Case Studies: Navrangpura; Lakhudi, Nikora; new village, Vasna; vasna, Nava-wadaj; Vijaynagar.

- There is a coherent relationship among user, responsibility, physical controls and ownership; but the area is inadequate for the purpose or its distribution does not allow optimum utilization. Case Studies: Rakhial; chawl, Nava Wadaj; Co-operative Society.

Changes are proposed to normalize de facto situations; and establish a coherent relationship among user, responsibility, physical controls and ownership.

CONDITION OF LAND IN FRONT AND/OR AROUND LOTS/DWELLINGS

CASE STUDIES EXISTING				PROPOSED		
	USER	RESPONSIBLE AGENT	PHYSICAL CONTROLS	OWNER	SUGGESTED CHANGES	PURPOSE OF CHANGES
Nikora; Old Village Walled City	Individuals or small groups, Owners/ Tenants	User, Public	Configura- tion: Dead-end streets, Gates	Public	Ownership should be transferred to abutters as co-operative ownership (condominium).	To normalize a de facto situation. Responsibilities are taken from public sector and given to actual users.
Navrangpura; Lakhudi	Individuals or small groups, Squatters	User, Public	Fences, Platforms, Beds, Furniture	Public	Ownership should be transferred to abutters. Provide or encourage adequate physical controls.	Responsibilities are taken from public sector and given to actual users.
Nikora; New Village Vasna; Vasna	Individuals or small groups, Owners/ Tenants				Existing Case: Ownership should be transferred to abutters. Provide or encourage adequate physical controls.	Existing Case: Responsibilities are taken from public sector and given to actual users.
Nava Wadaj; Vijaynagar			No controls or occasional fences		Future Development: Physical configuration should define controls.	Future Development: To define/clarify controls and responsibilities.
Rakhial; Chawl	Individuals or small groups, Owners/ Tenants	User	Fences, Platforms, Beds, Furniture	Private, Co-operative Condominium	Existing Case: No change required. Future Development: Generous/adequate space should be provided.	Future Development: To provide adequate space for semi-private utilization.
Nava Wadaj; Co-operative Society					Existing Case: No change required. Future Development: Semi-private space should be efficiently distributed.	Future Development: To allow optimum utilization of semi-private areas.

**1 NIKORA
Old village**

Private, Low/Medium Income,
Traditional Rural Row House

Existing:
High percentage of land for streets and walkways not a true representation of land utilization. Ambiguity in utilization responsibility, physical controls and ownership of land in front and/or around lots/dwellings. Very low percentages of semi-public utilization. Low population density.



PATTERNS 1 Hectare

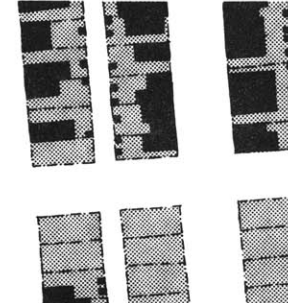
Proposed:
Normalize a de facto situation; Ownership of public land transferred to abutters as co-operative ownership; Responsibilities are taken from public sector and given to actual users; Reduced public utilization and increased private/semi-private utilization.



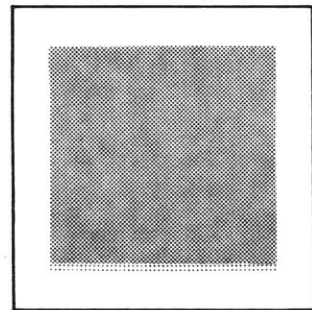
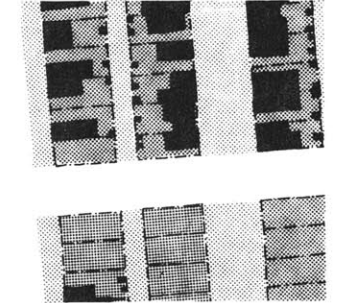
**NIKORA
New village**

Public, Low/Middle Income,
Traditional Rural Row House

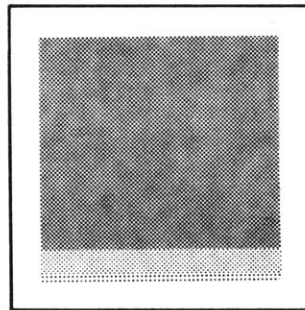
Existing:
High percentage of public and semi-public land; low percentage of private land; Excessive circulation areas; very low density make it a wasteful layout.



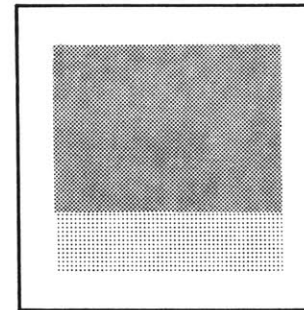
Proposed:
Ownership of front streets (partially) and back service alleys transferred from public sector to abutters as co-operative ownership; reduced public utilization and increased private/semi-private utilization.



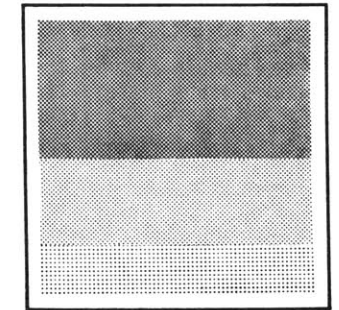
PERCENTAGES	
Streets/Walkways	44%
Playgrounds	2
Cluster Courts	-
Dwellings/Lots	54



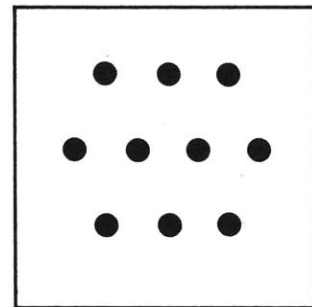
Streets/Walkways	37%
Playgrounds	2
Cluster Courts	7
Dwellings/Lots	54



Streets/Walkways	44%
Playgrounds	15
Cluster Courts	-
Dwellings/Lots	41



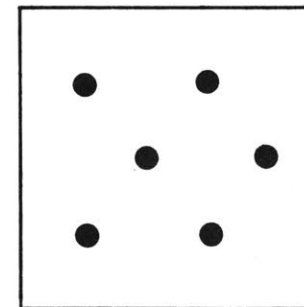
Streets/Walkways	19%
Playgrounds	15
Cluster Courts	25
Dwellings/Lots	41



DENSITY Persons/Hectare 202

● 20 Persons

(Same as Existing)



121

(Same as Existing)

2 WALLED CITY

Private; Moderately low/Middle Income; Traditional Urban House

Low percentage of land for streets and walkways; very high percentage of land for lots; high density. Deteriorating standards of services due to the layout pattern. An ambiguous relationship among responsibility, ownership, physical configuration and actual utilization.

Proposed: Normalize a de facto situation; ownership of public land: dead-end streets, transferred to abutters as co-operative ownership; responsibilities are taken from public sector and given to actual users.

3 NAVRANGPURA Lakhudi

Popular, Very Low/Low Income, Squatters

Percentage of land for streets and walkways not a true representation of utilization due to undefined lot lines/responsibility; low percentage of private/semi-private land; high density. Extra legal land/lot tenure.

4 RAKHIAL Chawl

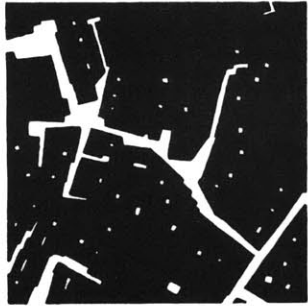
Private, Very Low/Low Income, Room

Low percentage of land for streets and walkways; high percentage of private/semi-private areas, very high density. Very low dwelling area; deteriorating physical conditions. Good solution if more/adequate dwelling/lot area and adequate services are provided.

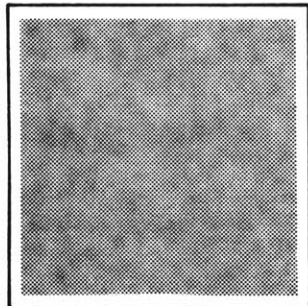
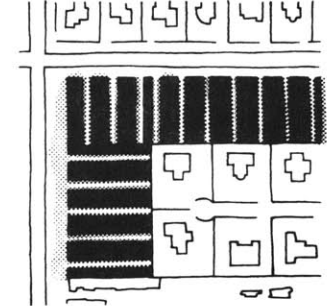
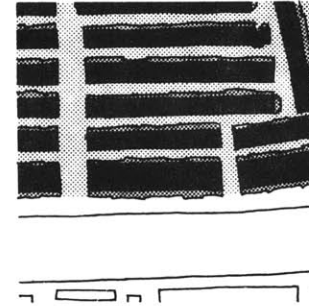
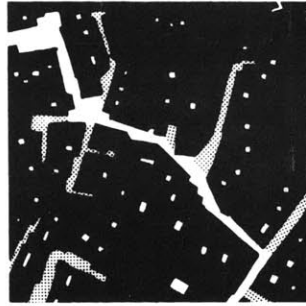
4a BEHRAMPURA Chawl

Private, Very Low/Low Income, Room

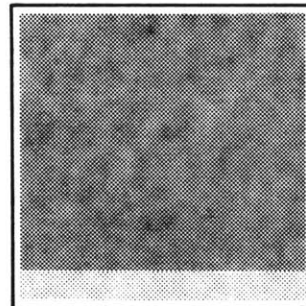
Adequate public utilization; high private/semi-private utilization; extremely low dwelling area; extremely high density. Deteriorating physical environments.



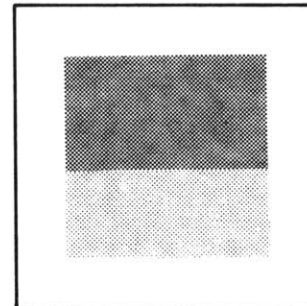
PATTERNS 1 Hectare



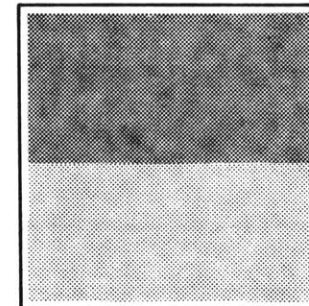
PERCENTAGES	Streets/Walkways	16%
	Playgrounds	-
	Cluster Courts	-
	Dwellings/Lots	84



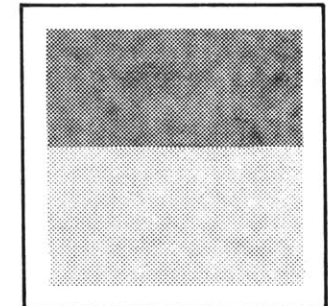
8%
-
8
84



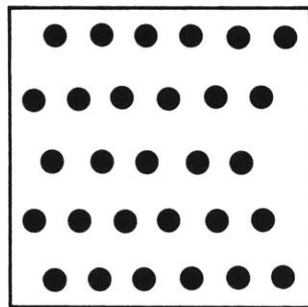
57%
-
17
26



14%
-
38
48



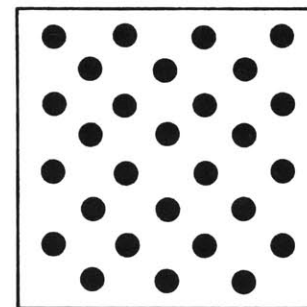
27%
-
40
33



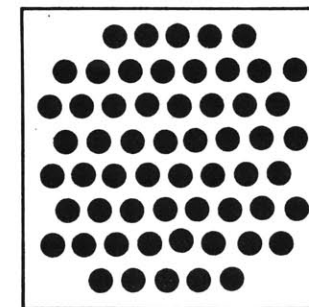
DENSITY Persons/Hectare 588

● 20 Persons

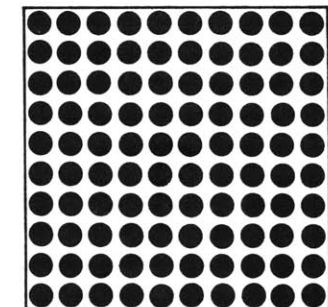
(Same as Existing)



568



1160



DENSITY Persons/Hectare 3100

● 30 Persons

5 VASNA
Vasna

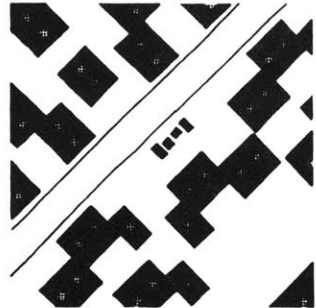
Public, Very Low/Low Income, Room

Existing:

High percentage of land for streets and walkways; low percentage of land for private use which is only the dwelling area; high density. Responsibility/physical controls undefined. Geometric layout pattern is wasteful; does not allow growth.

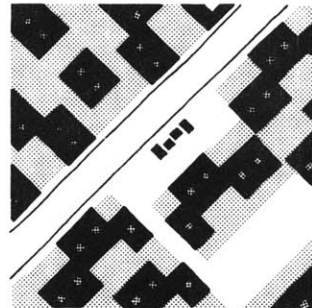
Proposed:

Minimizing public land by transferring ownership of land in front of dwellings to abutters as co-operative ownership. Responsibilities are taken from public sector and given to actual users.



PATTERNS

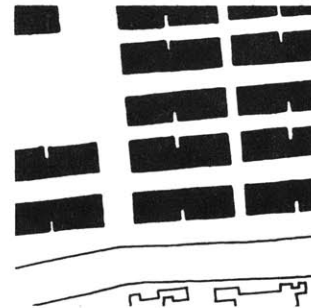
1 Hectare



5a AMBAWADI
Harijanwas

Public, Very Low/Low Income, Room

High percentage of public land; low percentage of private land; high density. Excessive public space does not recognize users' needs for private/semi-private open areas; layout is wasteful and a burden to the municipality.



6 NAVA WADAJ
Vijaynagar

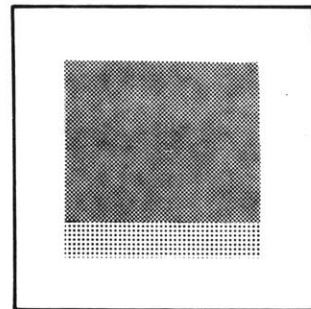
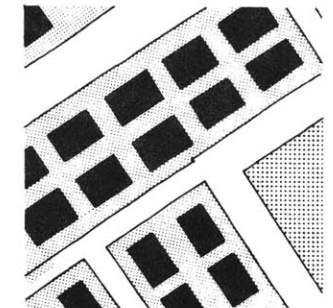
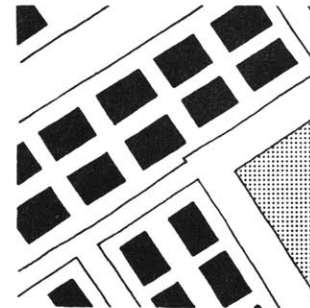
Public, Middle Income, Apartment

Existing:

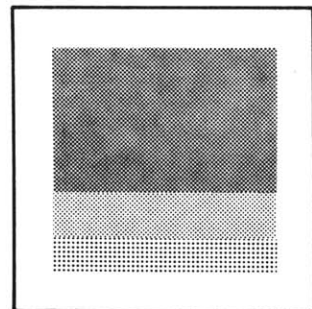
Very high percentage of land for street and walkways; medium density; undefined physical controls/responsibility make it a poor layout in terms of efficiency. It is a burden to the public sector.

Proposed:

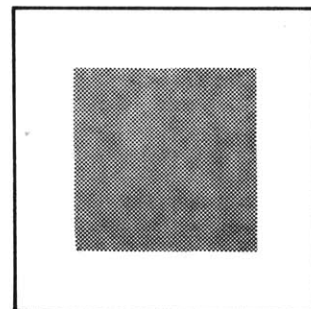
Land in front and/or around dwellings transferred to abutters as co-operative ownership; responsibilities are taken from public sector and given to actual users.



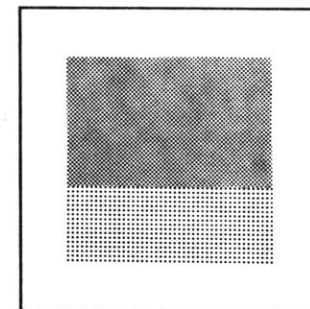
PERCENTAGES	Streets/Walkways	58%
	Playgrounds	7
	Cluster Courts	-
	Dwellings/Lots	35



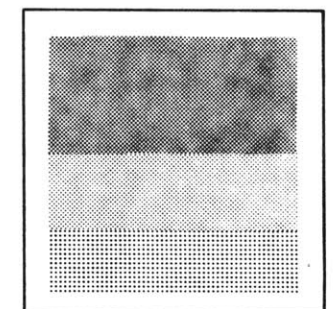
35%
7
11
47



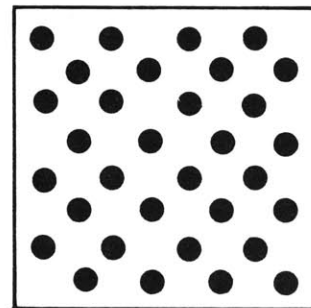
64%
-
36



54%
16
-
30



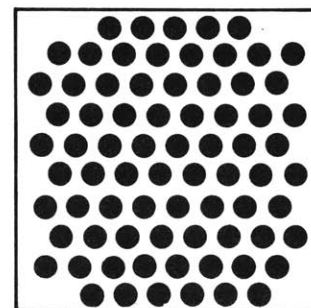
37%
16
21
30



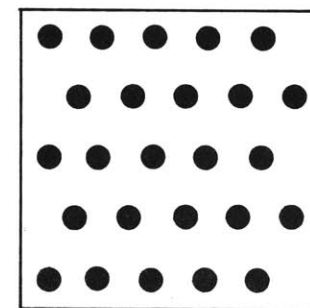
DENSITY Persons/Hectare 576

● 20 Persons

(Same as Existing)



1500



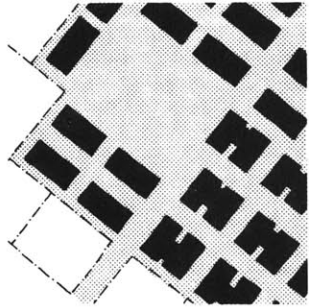
492

(Same as Existing)

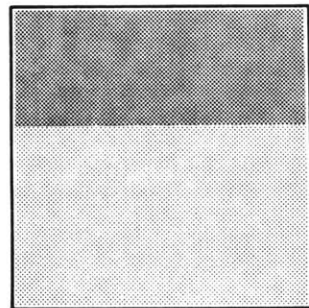
7 NAVA WADAJ
Coop. society

Private, Mod.Low/Middle Income,
Semi-detached House/Apartment

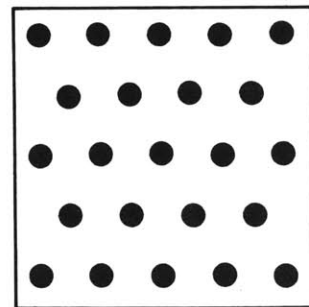
High percentage of private/semi-private land for dwellings/lots; low percentage of land for streets and walkways; medium density. Overall, a good layout if semi-private areas efficiently distributed.



PATTERNS 1 Hectare



PERCENTAGES		
Streets/Walkways	1%	
Playgrounds	-	
Cluster Courts	60	
Dwellings/Lots	39	



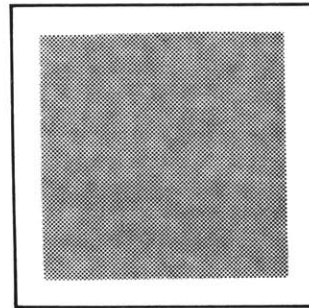
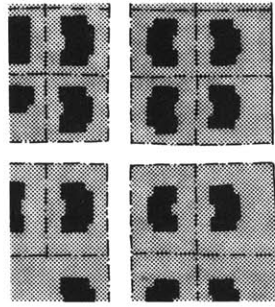
DENSITY Persons/Hectare 450

● 20 Persons

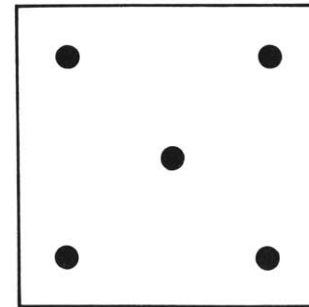
7a NAVRANGPURA
Co op. society

Private, High Income, House

High percentage of land for streets and walkways; medium percentage of private land. Despite these percentages, it is a burden to the municipality due to its low density and poor network efficiency.



Streets/Walkways	27%
Playgrounds	-
Cluster Courts	-
Dwellings/Lots	63

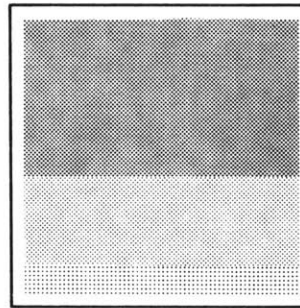
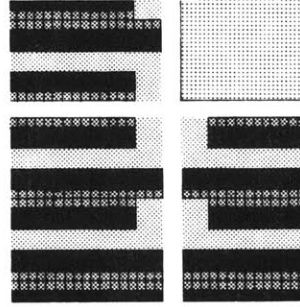


DENSITY 135

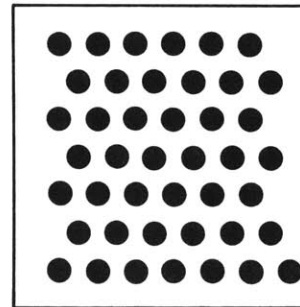
EQUIVALENT

Public/Private, Very Low/Low Income, Row Houses

Optimum percentage of land for streets and walkways, defined open areas; good percentage of land for private use; high population density; good network efficiency. The layout provides optimum land utilization. Due to its smaller lot size, the layout provides more semi-private and less private areas than the Proposed layout.



Streets/Walkways	16%
Playgrounds	9
Cluster Courts	25
Dwellings/Lots	50

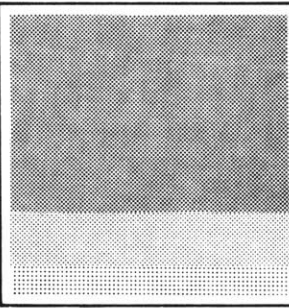
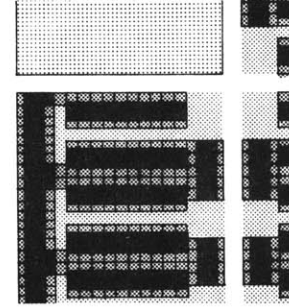


DENSITY 857

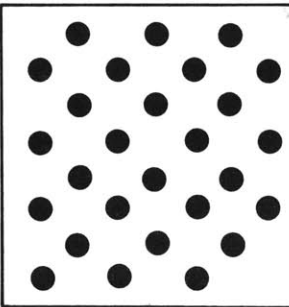
PROPOSED

Public/Private, Very Low/Low Income, Row Houses

Optimum percentage of land for streets and walkways, defined open areas; good percentage of land for private use; high/medium population density; good network efficiency. The layout provides optimum land utilization.



Streets/Walkways	14%
Playgrounds	10
Cluster Courts	16
Dwellings/Lots	60



DENSITY 540

URBANIZATION MODEL

INTRODUCTION

With the population growth rate of 3.8% for Ahmedabad city and 4.5% for the Ahmedabad Urban Agglomeration Area, the city is spreading very rapidly. Vacant land within the city and agricultural land on the periphery of the city are urbanizing at an accelerated rate. The physical development is arbitrary and piece-meal in nature, unconcerned about long range implications. An absence of planning policies/guidelines for comprehensive development is also responsible for the ad-hoc growth taking place outside of the city boundaries. Consequently, when service infrastructure is incorporated in these areas, the task not only becomes more difficult, but involves high expenses for both the city and the users.

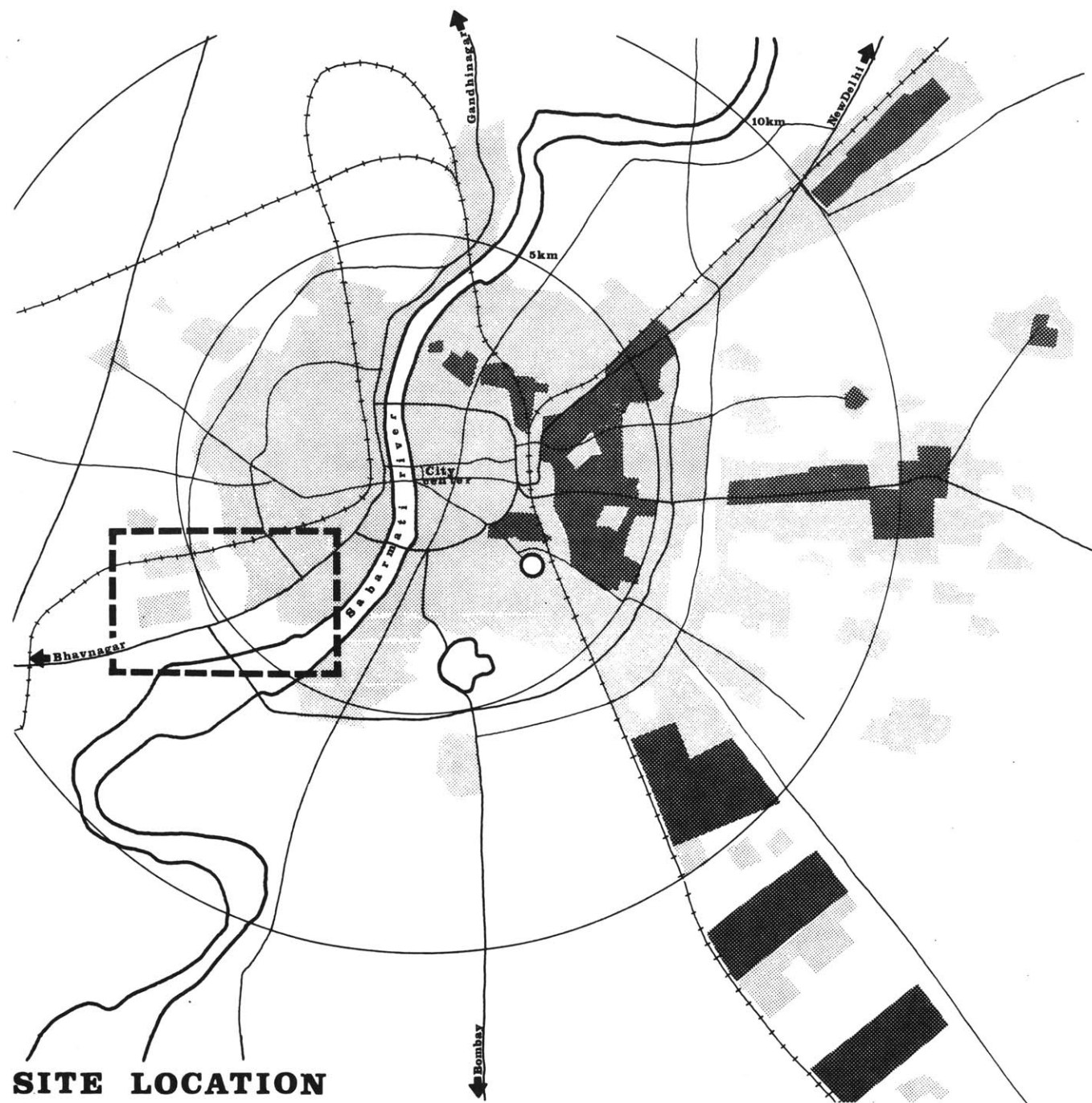
As illustrated in the dwelling environments in the typologies, small and scattered housing co-operatives developed by the private sector and poorly conceived public projects with inefficient layouts have resulted in wasteful utilization of land and resources. Most of these developments are lacking in certain amenities, but are too small to justify them in terms of financing and administrative capabilities. With its restricted resources the public sector can provide only limited services.

Therefore, the problem requires a solution in terms of a development process covering a wider range of issues and longer time span. It is necessary to anticipate a variety of land use functions initially and allow for other land uses in the future, based on new priorities.

The proposed Urbanization Model is intended to suggest/include:

- A process of urbanization focusing on physical layout and land subdivision.
- An alternative method of residential development reinforcing the positive and improving on the negative aspects of existing housing systems.
- An approach to the problem of low income housing, recognizing the limited resources of low income groups and the public sector; minimizing public responsibility of operation/maintenance and providing maximum amenities to the users.

The project is more properly a study for the development of a selected site. For the purpose of study/demonstration/possibility of comparative analysis/evaluation, a squatter relocation project (See Case Study 5) and its adjoining areas in Vasna have been selected as the site for the Urbanization Model. The model includes an overall physical plan with circulation, land use and infrastructure layouts, and land subdivision.



SITE LOCATION

KEY

- SITE
- INDUSTRIES
- ▨ BUILT-UP AREA
- MAJOR ROADS

0 1 2 3 4 5km
1:125000

BASIC SITE DATA

LOCATION

The site is located in Vasna on the south-west periphery of Ahmedabad; about 7km. from the city centre and 5km. from the industrial area near Sarkhej. It is adjacent to existing moderately low and middle income residential areas.

BOUNDARIES

The site is bounded by the National Highway No.8 on the south and a railway line on the north. An agriculture zone (green belt) separates the site from the existing residential areas. Due to lack of information, the boundary on the west remains undefined.

APPROACHES/ACCESS

National Highway No.8 is the primary route of approach from the city. A Proposed Ring Road passes through the site and will connect it to other areas of the city. A city bus service operates on the National Highway No.8.

TOPOGRAPHY

The site is plain with a slight elevation towards the north-west. It has several natural water run-offs which also serve as paths.

LAND TENURE

The land is privately held for agricultural purposes (seasonal planting). It is gradually being converted for residential use through speculation.

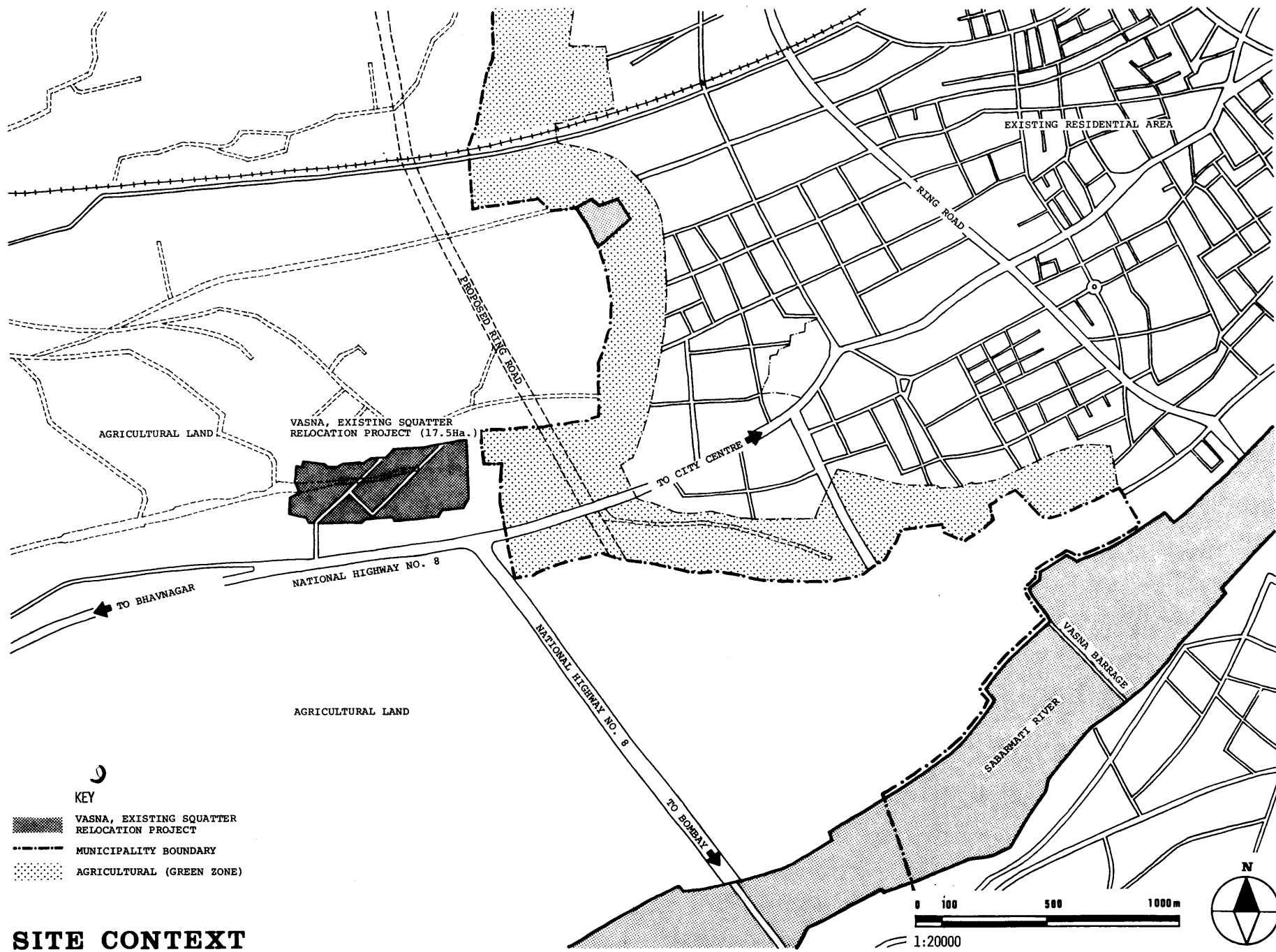
INFRASTRUCTURE/COMMUNITY FACILITIES

The site being outside of the city boundaries is devoid of any services, except electricity. Individual or co-operative tube wells and septic tanks are common-

ly used. It is assumed that the area would be subsequently incorporated within the city, and would be connected to the city networks. Community facilities are almost non-existent.

EXISTING STRUCTURES

The squatter relocation project is located in the middle of the site. Co-operative housing societies are sparsely scattered in the site, but information about their location and physical character is unavailable. Therefore, for the purpose of this study/project, they have not been considered.



SITE CONTEXT

BACKGROUND

Vasna, Ahmedabad

With the population growth and expansion of residential areas outside of the city boundaries, agricultural land in Vasna is gradually being converted for residential use. The area is developing in absence of long range development policies/guidelines. Moderately low and lower middle income co-operative housing societies on former farm land is predominant. The developments have only the electrical connections. Generally, each of the co-operative societies has its own tube well for water and septic tanks for waste disposal. They have access by unpaved paths. The area would continue to develop in this manner until it is finally incorporated within the city. Existing city networks would be extended or new networks would be installed connecting this area at unnecessarily high costs. Community facilities: school, playground, health centre, etc. are almost non-existent in Vasna and nearby areas.

In 1973, the municipality selected a site in Vasna outside the city boundaries for a squatter relocation project. The project site of 17.57 hectares was developed; infrastructure networks, particularly sewage networks were extended to serve the project (*See Case Study 5*).

The project in this study is intended to propose an urbanization process/guidelines/frameworks for Vasna, incorporating circulation, land use, infrastructure layout and land subdivision. It includes comparison of the following three layout:

- Existing Layout: As designed by the municipality.
- Equivalent Layout: With lot size and number the same as in the existing squatter relocation project.
- Proposed Layout: With site area the same as in

relocation project (17.57 hectares) and large lot sizes/options.

The following basic planning projections and policies are incorporated:

- Land Use: Vasna will continue to develop as moderately low/lower middle income residential area. The co-operative housing societies having detached/semi-detached houses and walk-up apartments will be the predominant dwelling system. Recognizing this fact, the overall layout should be flexible to allow/encourage similar development of housing co-operatives.
- National Highway No.8 will continue to maintain its character and importance. Existing paths will provide the circulation network on the site.
- Vasna will have population densities similar to those in the existing moderately low/lower middle income settlements (300 to 600 persons/hectare); lower densities initially and medium/high densities at saturation.

For the purpose of this study, the existing structures/development on the site are not considered due to unavailability of information about their location and physical character.

PLANNING POLICIES / GOALS

PRIMARY USE: RESIDENTIAL COMMUNITY

- The project will be primarily for residential use.
- Required supporting land uses will include commercial and community facilities: schools, parks, play-grounds, health centre and community centres. These facilities will be available to/shared by the exist-ing areas also.
- The public sector will build row houses for ownership for the squatter relocation project.

TARGET INCOME GROUPS: PREDOMINANTLY LOW INCOME GROUPS

- Development will aim at a community of very low/low/moderately low/lower middle income groups; income range will be Rs.300-900 (\$35-100) per month.

INTENSITY OF LAND USE: MEDIUM/HIGH DENSITY

- The range of gross densities planned for is 400-700 persons per hectare.
- 400 persons per hectare assumes predominantly one story construction.
- 700 persons per hectare assumes, in reality and over time, densities will be higher as a result of expansion to two or more floors and higher room occupancy due to subletting.

LAND TENURE: PRIVATE/CO-OPERATIVE OWNERSHIP, RENTAL

- The development will offer a variety of tenure options which will include, predominantly, private/co-operative ownership and rental.
- Horizontal cluster/condominiums will be provided.
- The cluster/condominium will allow flexibility in land subdivision.
- Rental options will be available for low income groups which will eventually convert into private ownership properties.

FINANCING: PUBLIC AND PRIVATE

- The magnitude of the project calls for both public and private financing.
- The land development and basic infrastructure network will be financed by the public sector.
- The private sector co-operative financing will be encouraged in construction of dwellings.

CIRCULATION: PREDOMINANTLY PEDESTRIAN

- The internal circulation will be predominantly pedestrian and light vehicular.
- Controls of traffic frequency, character and speed will be mainly established by the street layout and use.
- The internal circulation will be connected to the external circulation on the National Highway No.8 and Proposed Ring Road.

UTILITIES: EVENTUALLY CONNECTING TO THE CITY NETWORKS

- Initially water supply and waste disposal will be by internal private/co-operative tube wells and septic tanks, as generally practised.
- Eventually all utility networks will be incorporated into the city networks.

DEVELOPMENT MODE: INCREMENTAL GROWTH

- The site will be developed incrementally.
- Implementation will be staged into:
 1. Planning Design.
 2. Allocation of Lots, Construction.
 3. Habitation.
 4. Evaluation and Revision.
- Progressive improvement of the site and services areas will take place over a period of time.

CIRCULATION AND LAND USE PLAN

CIRCULATION PLAN:

The system of circulation forms one of the most important parts of the urban layout. It not only channels the pedestrian and vehicular movements but, it also determines patterns of land utilization, land subdivision and layout of utilities: water supply, sewage disposal, electricity, street paving, street lighting and storm drainage.

The existing pattern of circulation forms a necessary frame work for the proposed circulation network and site development. The network also provides utility lines throughout the site by providing continuous access for maintenance and control. It is considered to be under public control. The circulation layout is based upon:

- Recognition of predominant pedestrian mode of circulation within the site.
- Maximizing use of existing circulation.
- Minimizing infrastructure investment for the public sector.

The following circulation modes are considered in the network:

- MODE I: Pedestrian walkways and cluster courts. Exclusive use by pedestrians.
- MODE II: Residential streets. Pedestrian and vehicles mixed, pedestrians dominate over vehicles. Used mainly as access to lots, clusters and community facilities.
- MODE III: Secondary streets. Vehicles and pedestrian mixed, vehicles dominate but do not control circulation.
- MODE IV: Primary streets (National Highway No.8 and Proposed Ring Road). Vehicles and pedestrian mixed, vehicles dominate, relatively high speed traffic with moderate volume. For the use of pedestrians and cyclists to and from employment centres.

LAND USE PLAN:

Land use plan for the entire area is conceived as a whole but will be implemented in stages. It shows the various land uses as follows:

RESIDENTIAL:

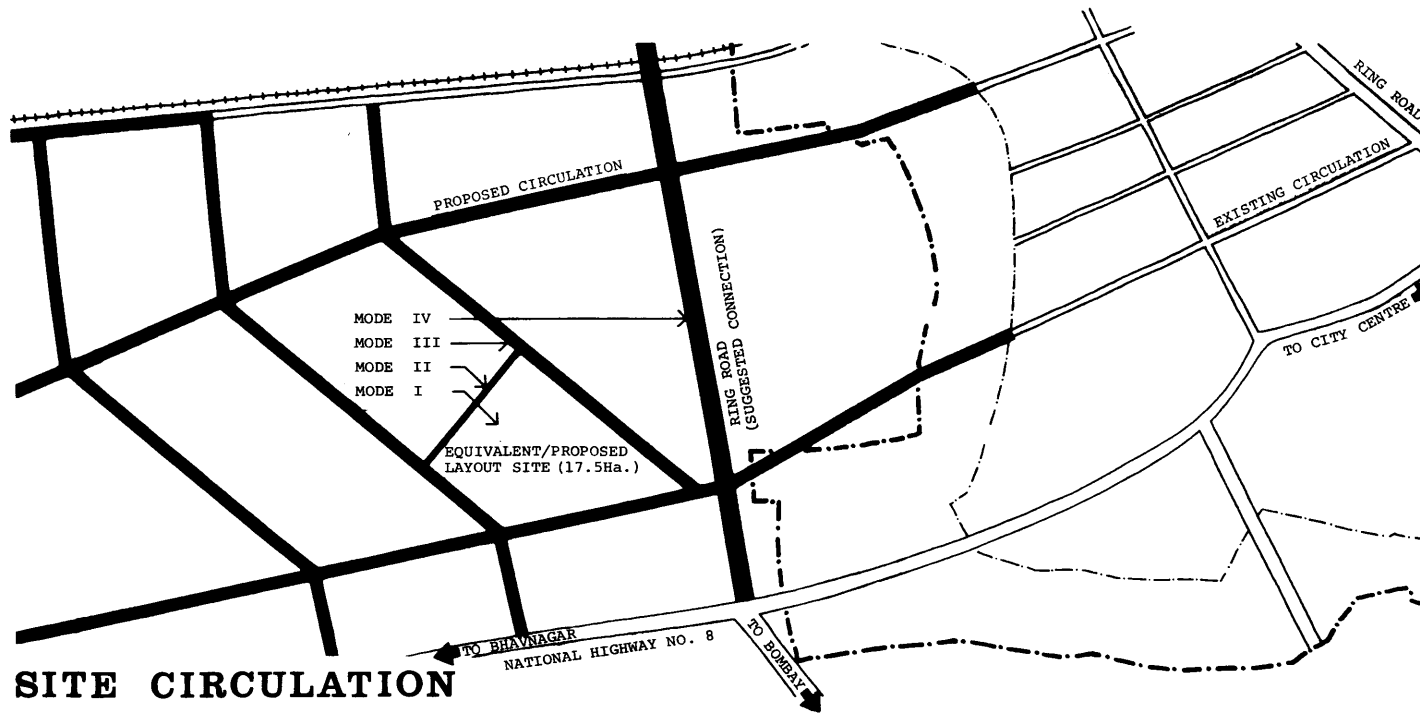
In order to make it an economically and functionally viable development, the site will accommodate a mixed income population. However, low and lower middle income groups will be predominant. It will be developed as a medium and high density area. To provide for socio-economic needs of different income groups, it will provide diversity of choice in land tenure, diversity in housing programmes/option, public and private development and funding.

COMMUNITY FACILITIES:

Community facilities such as secondary/high school, playground, park and health centre/hospital requiring large organization/space needs are located on/in vicinity of the green belt. These facilities will be shared by the site and the existing residential areas in order to minimize initial investment and maintenance/operational expenses for the public sector, and serve larger population. Other facilities: primary schools, kindergartens, community centres, etc. will be centrally located in the neighbourhood/residential blocks for easy accessibility.

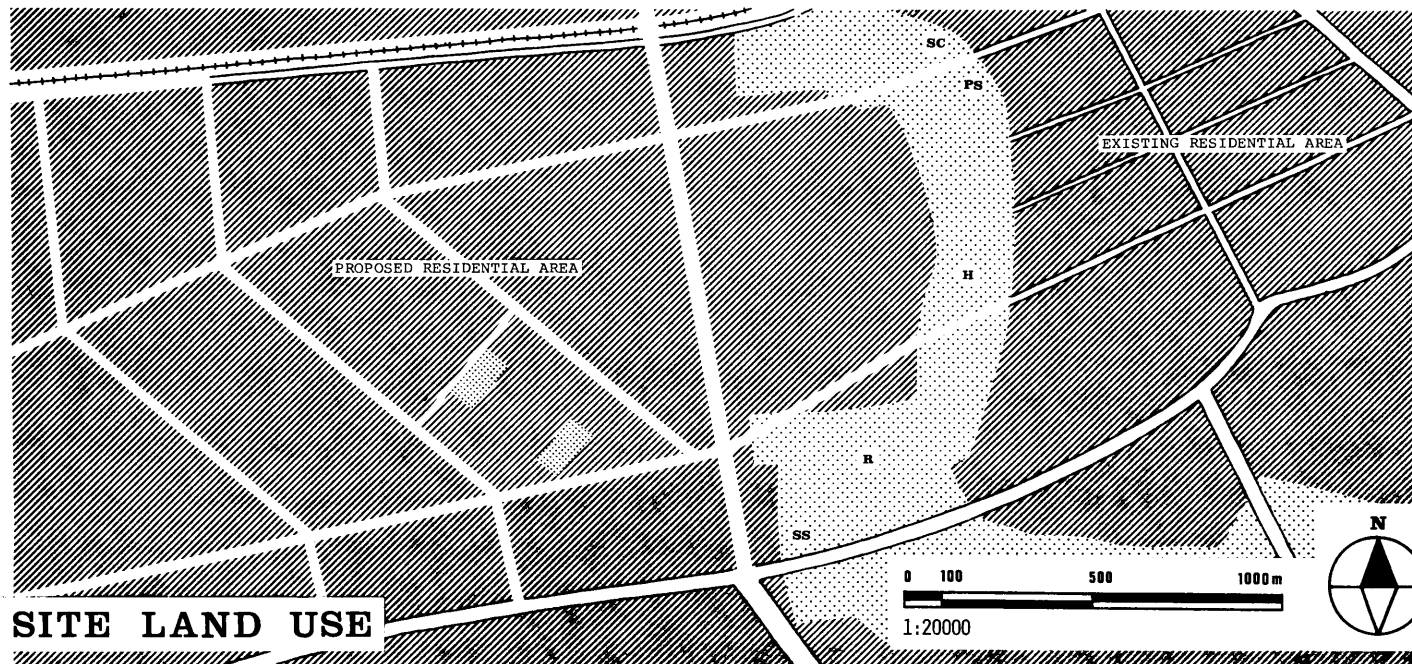
COMMERCIAL:

Major commercial areas are provided along the National Highway No.8 and Proposed Ring Road. Small-scale commercial activities will develop on secondary street junctions and within the neighbourhood/residential blocks for convenience in shopping.



PUBLIC CIRCULATION

- MODE I - 6m
- MODE II - 15m
- MODE III - 20m
- MODE IV - UNLIMITED



- H** Health
- SC** Secondary School
- PS** Primary School
- SS** Social Services
- R** Recreation

AREAS

- RESIDENTIAL
- COMMERCIAL
- OPEN SPACES
- AGRICULTURAL (GREEN ZONE)

BLOCKS, LOTS AND CLUSTER COURTS

For the purpose of comparative analysis/evaluation, the proposal includes comparison of the existing layout with the following:

- **EQUIVALENT LAYOUT:** Accommodates equivalent number of lots and the size required as in the existing squatter relocation project. However, it occupies a 12 hectare site against a 17.57 hectare site for the existing project.
- **PROPOSED LAYOUT:** Similar as the Equivalent layout but for a full site of 17.57 hectares, with various lot sizes options.

DEFINITIONS

- **BLOCK** is a portion of land bounded and served by lines of public streets and walkways.
- **LOT** is a measured parcel of land having fixed boundaries and access to public streets, walkways or cluster courts.
- **CLUSTER COURT** is a group of lots owned individually or in condominium around a semi-private common area.
- **CONDOMINIUM** is a group of dwelling units (owned individually) in a multi-unit structure around a semi-private common area.

The equivalent and the proposed layouts are based upon the following policy:

- **MINIMIZATION OF:** Public ownership of land, lengths of infrastructure per area served, public sector burdens, responsibility and services.
- **MAXIMIZATION OF:** Private responsibility and private ownership of land.

LAYOUT

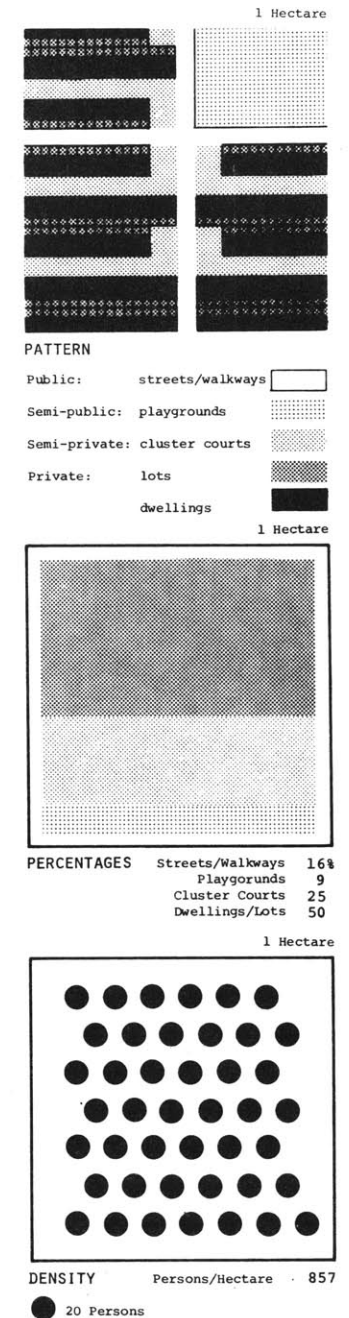
The above policy is demonstrated in the equivalent and the proposed layouts. Land utilization percentages are optimized: Public areas devoted to circulation, which are costly to begin with and must be maintained by the public sector, are kept to a minimum. This helps to stretch resources to benefit more people. Lowering the

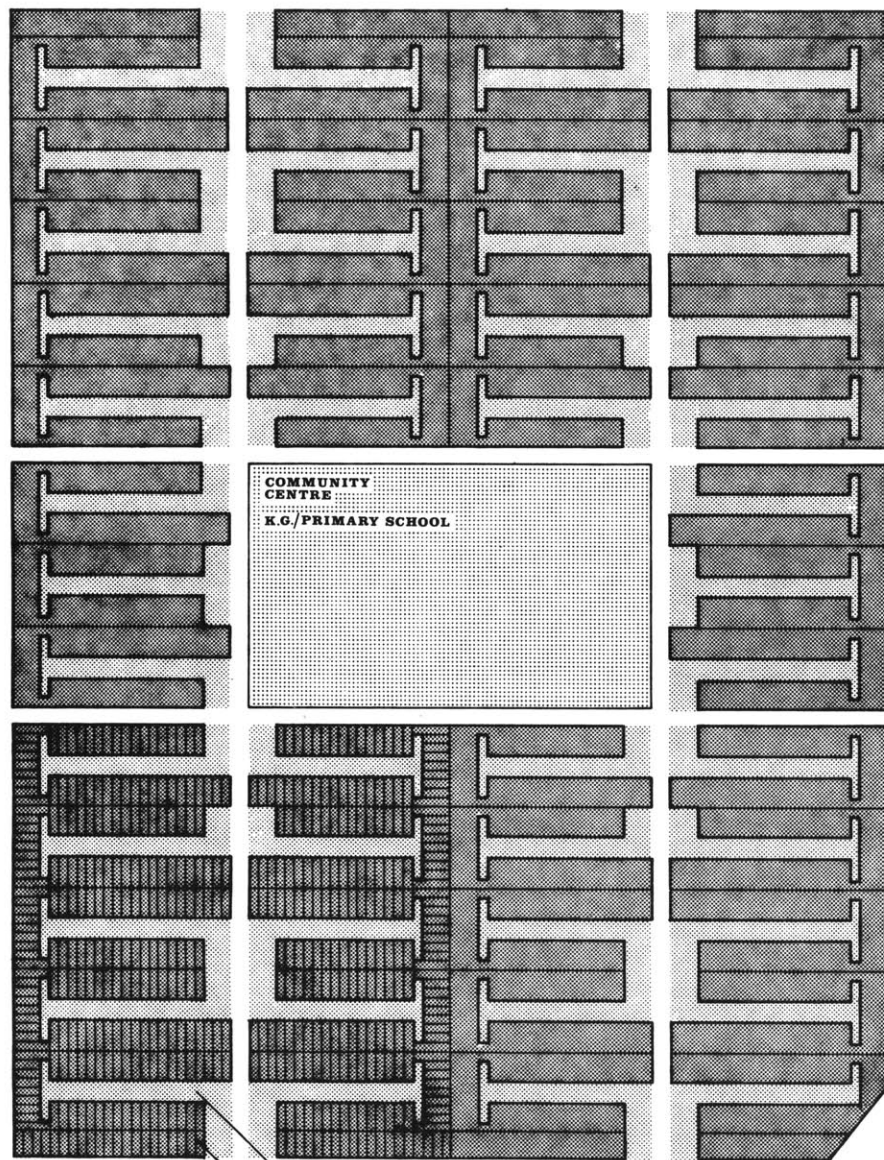
EQUIVALENT LAYOUT LAND UTILIZATION DATA

DENSITIES	Total Number	Area Hectares	Density N/Ha
LOTS	2284	12.0	190
DWELLING UNITS	2284	12.0	190
PEOPLE	10290	12.0	857

AREAS	Hectares	Percentages
PUBLIC (streets, walkways, open spaces)	1.94	16
SEMI-PUBLIC (open spaces, schools, community centers)	1.05	9
PRIVATE (dwellings, shops, factories, lots)	6.07	50
SEMI-PRIVATE (cluster courts)	2.94	25
TOTAL	12.00	100

LAND UTILIZATION DIAGRAMS





COMMUNITY CENTRE
K.G./PRIMARY SCHOOL

SURPLUS LAND

CLUSTER COURT LOTS

LAYOUT	LOT AREA m ²	LOT No.	DEN SITY GROSS	PUBLIC SEMI SEMI PRIVATE TOTAL				STREET LENGTHS			TOTAL m
				Ha. %	Ha. %	Ha. %	Ha. %	Ha.	I-II	III-IV	
EXISTING	26.4	2250	576	9.1 52	0.2 11	-	8.2 47	17.5	1822	990	2812
EQUIVALENT	30.0	2284	857	1.9 16	1.0 9	3.0 25	6.0 50	12.0	1740	290	2030

**EQUIVALENT LAYOUT
BLOCKS, LOTS AND CLUSTER COURTS**



ratio of circulation lengths per area served results in utility network becoming accessible to low income group groups. The simplicity of the design facilitates instant as well as progressive development of the site. Centralized semi-public area permits close grouping of community facilities: kindergarten, primary school and community centre. This arrangement allows overlapping of functions/organization/administration of the facilities optimizing resource input.

BLOCKS

In both the layouts, the blocks contain "cluster courts" where lots are grouped around a common area that provides access as well as a semi-private open space. The occupants share the use and responsibility for the maintenance of the court. The cluster court is initially one parcel of land which can be sub-divided publicly or privately/co-operatively. It offers flexibility in housing options: serviced dwelling lots, core dwellings and instant dwellings.

LOTS AND DWELLINGS

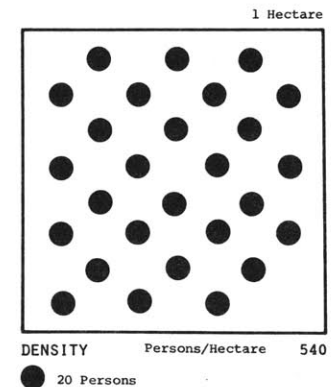
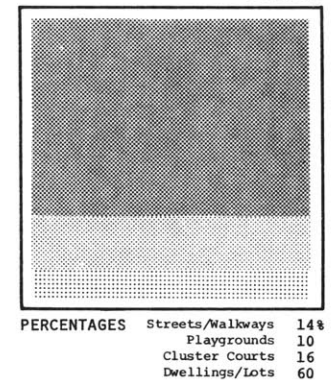
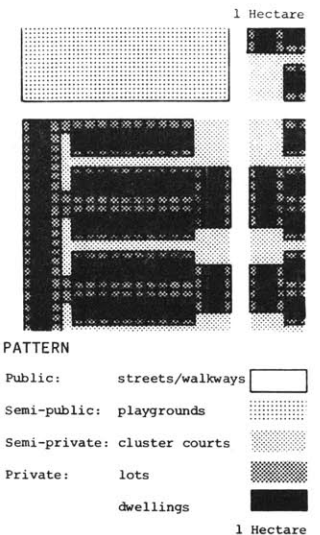
The lots in the equivalent layout are 30sq.m.; and in the proposed layout they are 36, 48, 56 and 64sq.m., where the large lots are located on the peripheral secondary streets and will accommodate shop/light industry/cottage industry-cum-residential units. In both the cases, the dwellings consist of a basic shell: wall and slab, and a service core in the back of the lot. The service core includes a bathroom/shower and a w.c. for two families. Its arrangement allows provision of individual w.c. in the future. In the equivalent layout, the dwelling encloses 24sq.m.; 80% of the lot area against 84% in the existing dwelling. It permits larger usable open area in the back as compared to the existing dwelling. The dwelling built-up area in the proposed layout varies with the lot sizes but, in general it complies with the municipal building bye-laws. The internal partitions in both the cases will be provided by the occupants themselves. It minimizes initial investment by the public sector and the users. The dwellings will be expanded to two floor units in the future by the occupants.

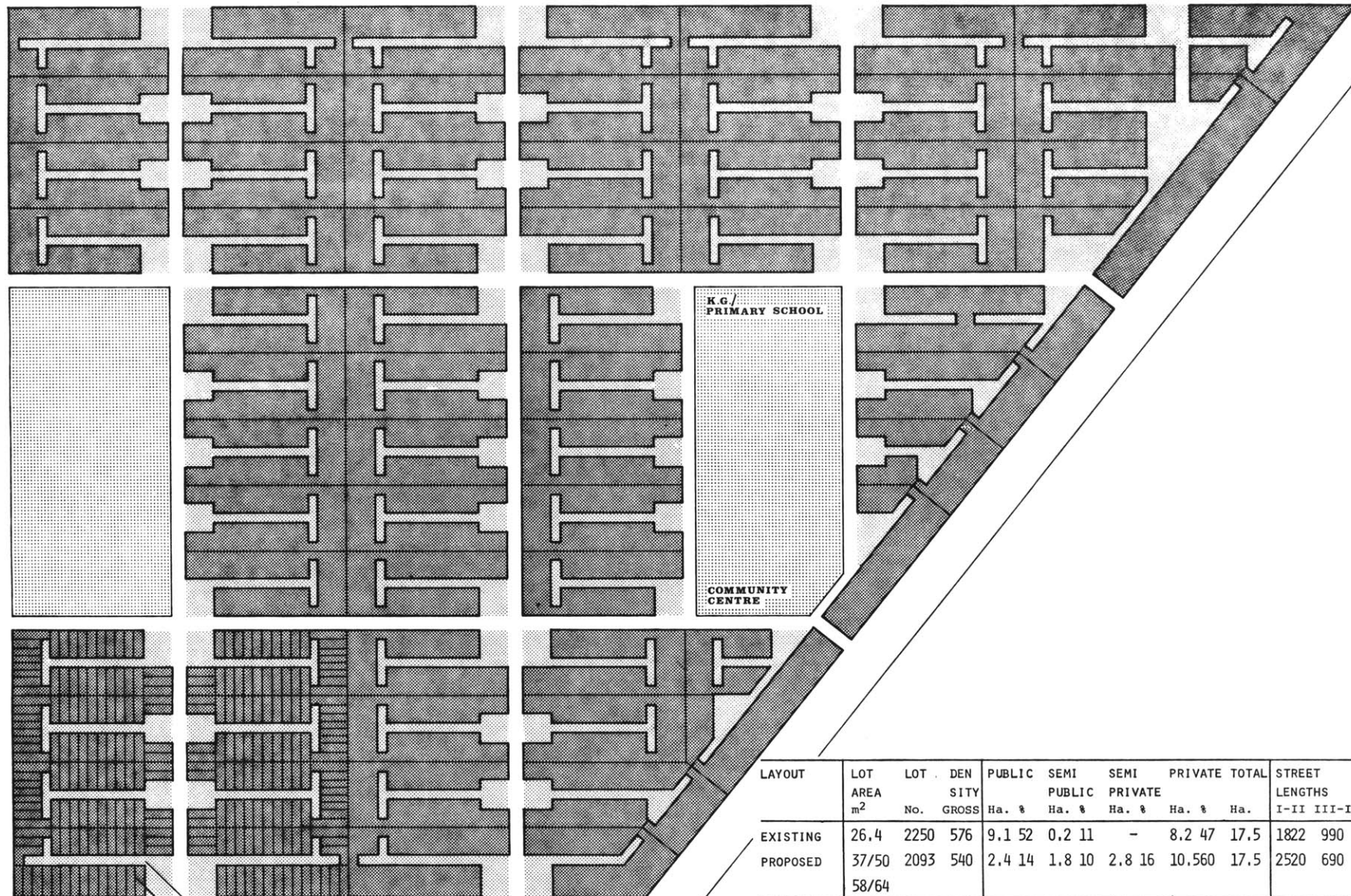
PROPOSED LAYOUT LAND UTILIZATION DATA

DENSITIES	Total Number	Area Hectares	Density N/Ha
LOTS	2093	17.5	120
DWELLING UNITS	2093	17.5	120
PEOPLE	9450	17.5	540

AREAS	Hectares	Percentages
PUBLIC (streets, walkways, open spaces)	2.4	14
SEMI-PUBLIC (open spaces, schools, community centers)	1.8	10
PRIVATE (dwellings, shops, factories, lots)	10.5	60
SEMI-PRIVATE (cluster courts)	2.8	16
TOTAL	17.5	100

LAND UTILIZATION DIAGRAMS

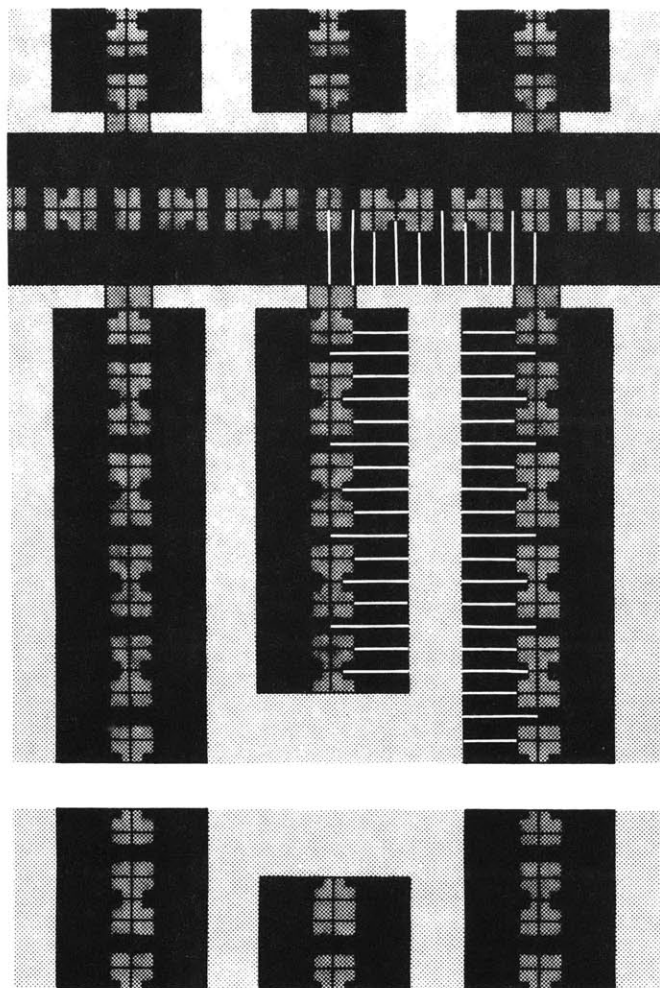








LAYOUT	LOT AREA m ²	LOT No.	DEN SITY GROSS	PUBLIC SEMI PRIVATE TOTAL				STREET LENGTHS			
				Ha. %	Ha. %	Ha. %	Ha. %	I-II	III-IV	m	
EXISTING	26,4	2250	576	9,1 52	0,2 11	-	8,2 47	17,5	1822	990	2812
PROPOSED	37/50	2093	540	2,4 14	1,8 10	2,8 16	10,560	17,5	2520	690	3210
	58/64										

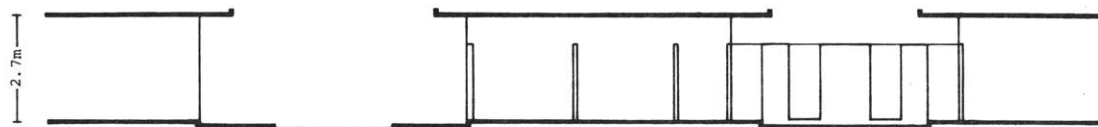
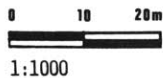
**PROPOSED LAYOUT
BLOCKS, LOTS AND CLUSTER COURTS**



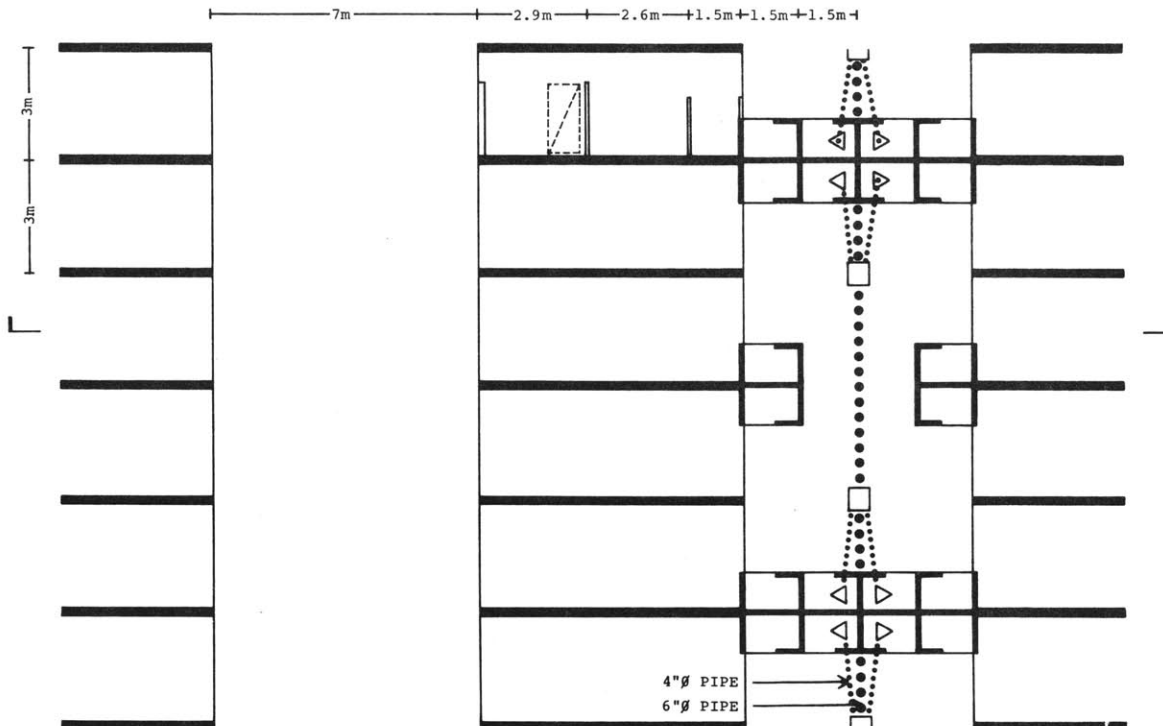


Public: streets/walkways 
 Semi-public: playgrounds 
 Semi-private: cluster courts 
 Private: lots 
 dwellings 

**EQUIVALENT LAYOUT
 LOTS AND
 CLUSTER COURTS**



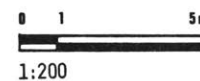
SECTION

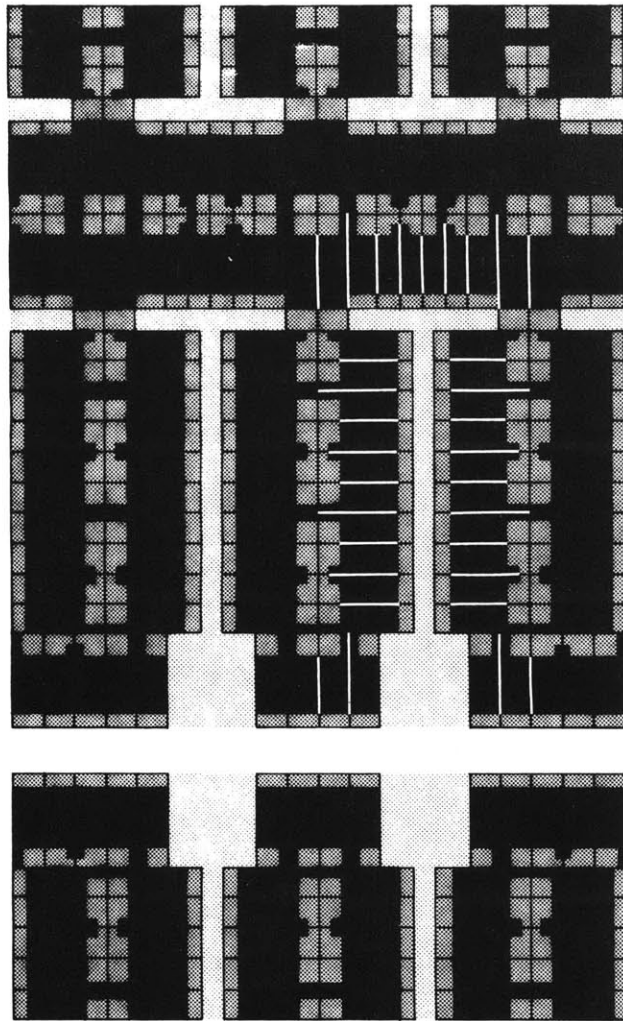







PLAN

NOTE: BATHROOMS ARE CONNECTED TO INSPECTION CHAMBERS BY OPEN DRAINS

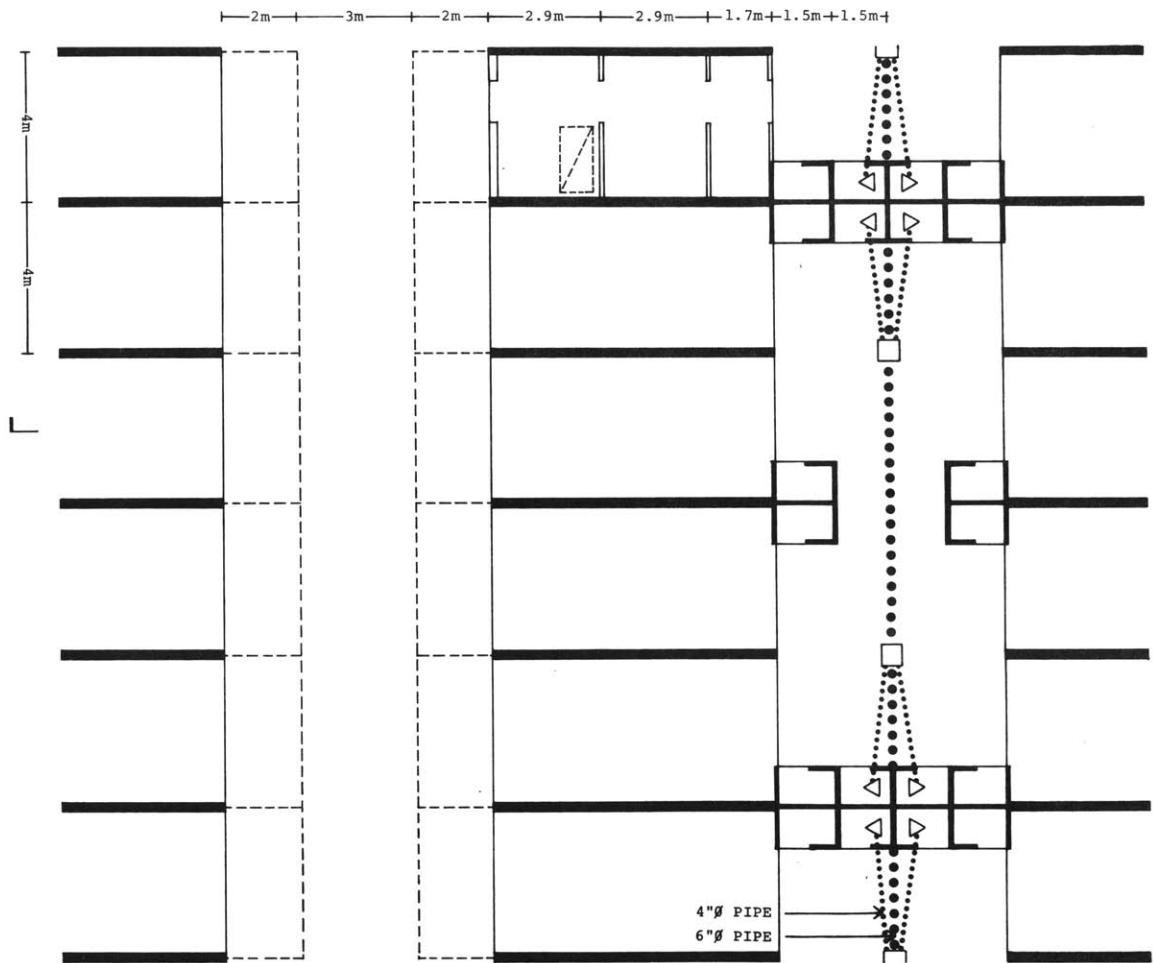
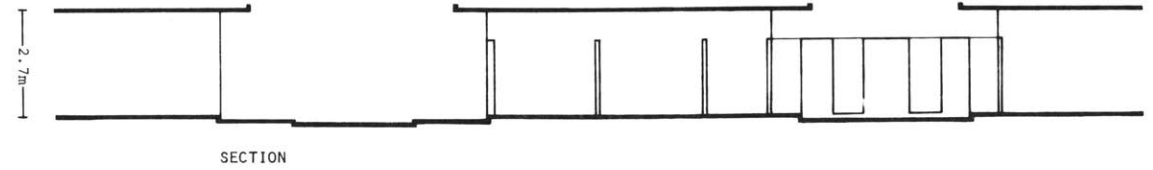
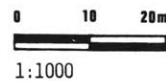
TYPICAL DWELLINGS





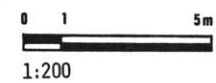
Public: streets/walkways 
 Semi-public: playgrounds 
 Semi-private: cluster courts 
 Private: lots 
 dwellings 

**PROPOSED LAYOUT
 LOTS AND
 CLUSTER COURTS**



PLAN

TYPICAL DWELLINGS



UTILITY LAYOUTS

Utility networks are one of the basic components of any physical development. They are permanent and generally inflexible, and represent high capital costs; they must be maintained by the public sector. An efficient, economical physical layout is necessary regardless of income groups serviced, dwelling type, administration methods of financing. In developments for low income groups where there is limited financial, technical, and administrative resources, an efficient layout becomes imperative.

The intent of this part of the project is to illustrate/analyze/evaluate efficiency of utility networks in the Existing squatter relocation project and the Equivalent and Proposed layouts. The analysis is limited to a schematic study of water supply, sewage disposal, and street lighting networks. The evaluation is based upon the lengths of pipes/lines and number of components: valves, manholes, poles and lamps. Lower figures for lengths/components represent higher efficiency and lower costs. However, functional qualities and simplicity for minimum costs in installment and operation should be primarily considered in determining overall efficiency of the networks.

The analysis/evaluation for the Existing project layout is based upon approximate information. Because city mains do not exist in this area, water is supplied from an internal tube well, stored in underground and overhead tanks, and provided through a network for the site only. The site sewage disposal network is connected to the city network. The site street lighting is provided through the existing external networks. Due to the inherent draw-backs of the layout, the utility layouts are complicated. Staggered dwelling

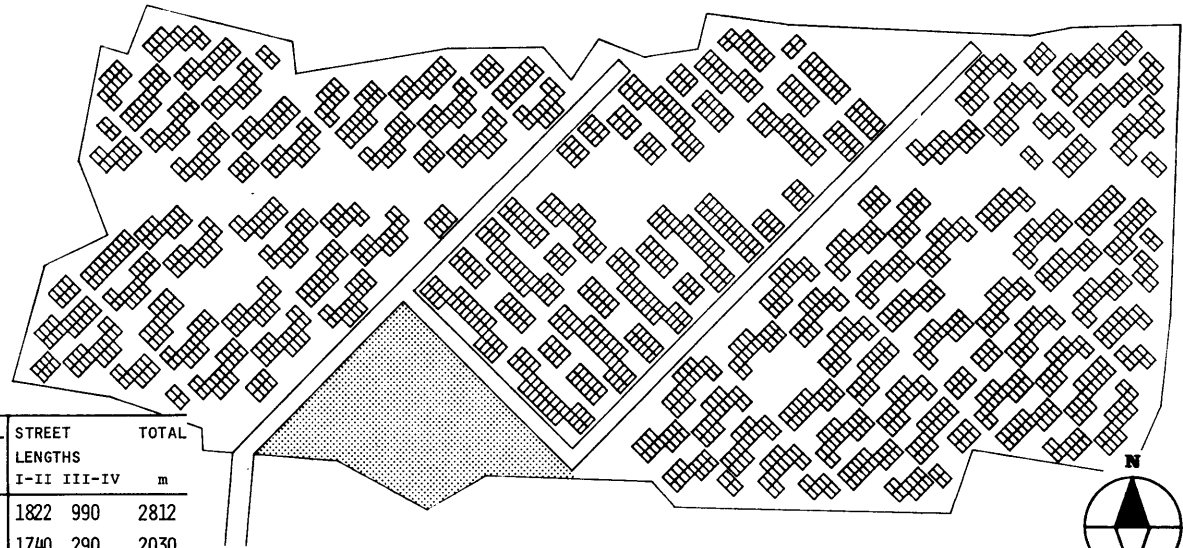
grouping requires excessive service lengths and components. Water supply and sewage disposal lines are provided in easement arrangement. Street lighting distribution is unbalanced.

The utility networks in the proposed projects are conceived as a part of a comprehensive development for a larger area covering a wider time perspective which would be installed in stages. The utility networks follow the circulation network in the primary (Mode IV) and secondary (Mode III) streets. The site networks in the Equivalent/Proposed layout are connected to external networks. Water supply and sewage disposal lines are provided in easements. Street lights are provided along the internal lines of circulation and in the cluster courts. The pipe sizes for water supply and sewage disposal networks are based upon approximate calculations of quantities.

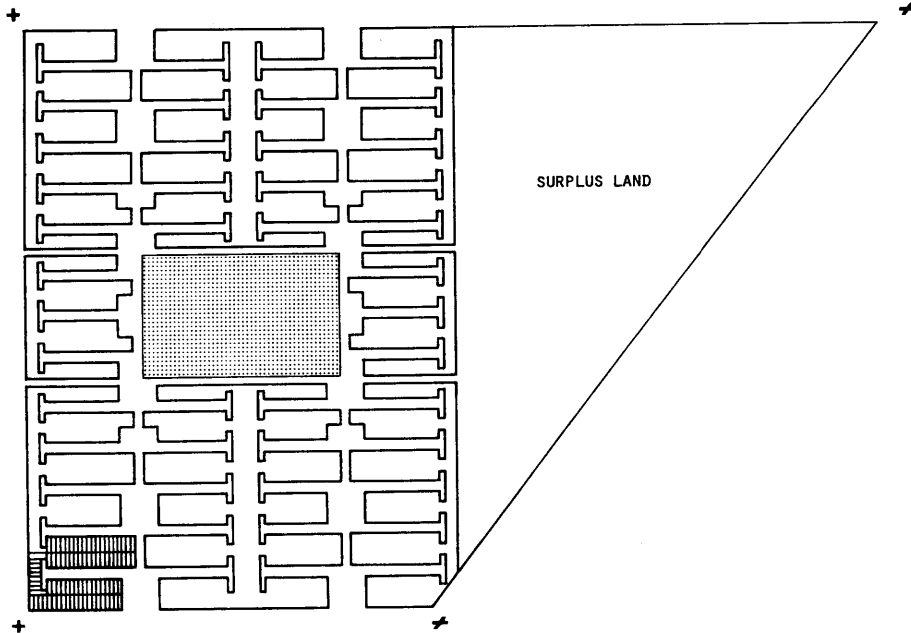
Basic Layouts

TABLE OF LAYOUTS, COMPONENTS AND QUANTITIES: The table shows that the Existing layout devotes more public land for circulation and undefined open area than the other two. The Equivalent and the Proposed layouts have reduced public land by providing semi-private cluster courts or condominiums. The Equivalent layout, which accommodates nearly the same number lots having equivalent lot area, and higher semi-private/semi-public areas, occupies only 12 hectares against 17.57 for the Existing. The Proposed layout offers wider lot size options.

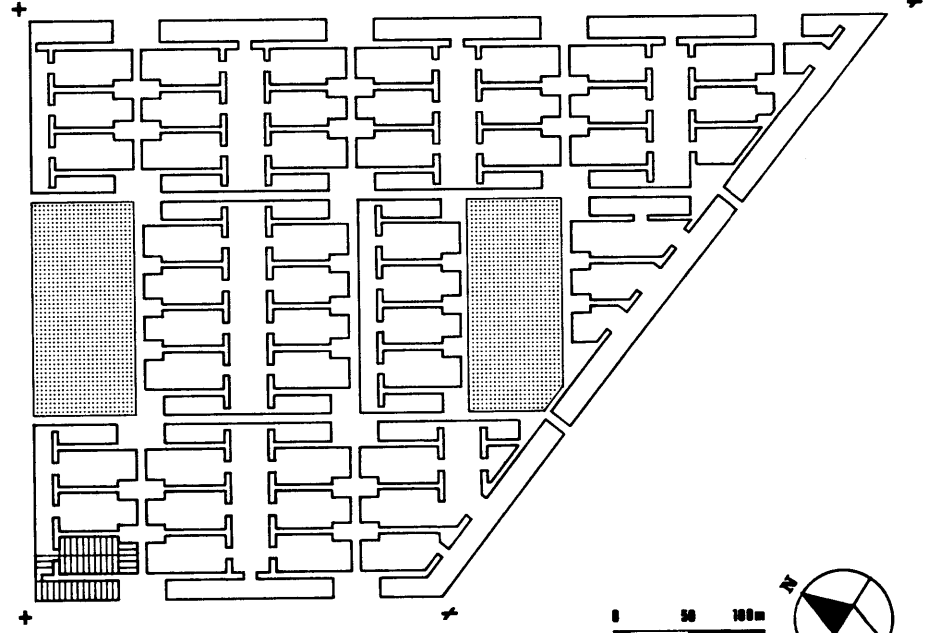
LAYOUT	LOT AREA m ²	LOT No.	DEN SITY GROSS	PUBLIC		SEMI PUBLIC		SEMI PRIVATE		TOTAL	STREET LENGTHS		TOTAL m	
				Ha. %	Ha. %	Ha. %	Ha. %	Ha. %	I-II		III-IV			
EXISTING	26.4	2250	576	9.1	52	0.2	11	-	8.2	47	17.5	1822	990	2812
EQUIVALENT	30.0	2284	857	1.9	16	1.0	9	3.0	25	6.0	50	1740	290	2030
PROPOSED	37/50 58/64	2093	540	2.4	14	1.8	10	2.8	16	10.560	17.5	2520	690	3210



EXISTING LAYOUT



EQUIVALENT LAYOUT

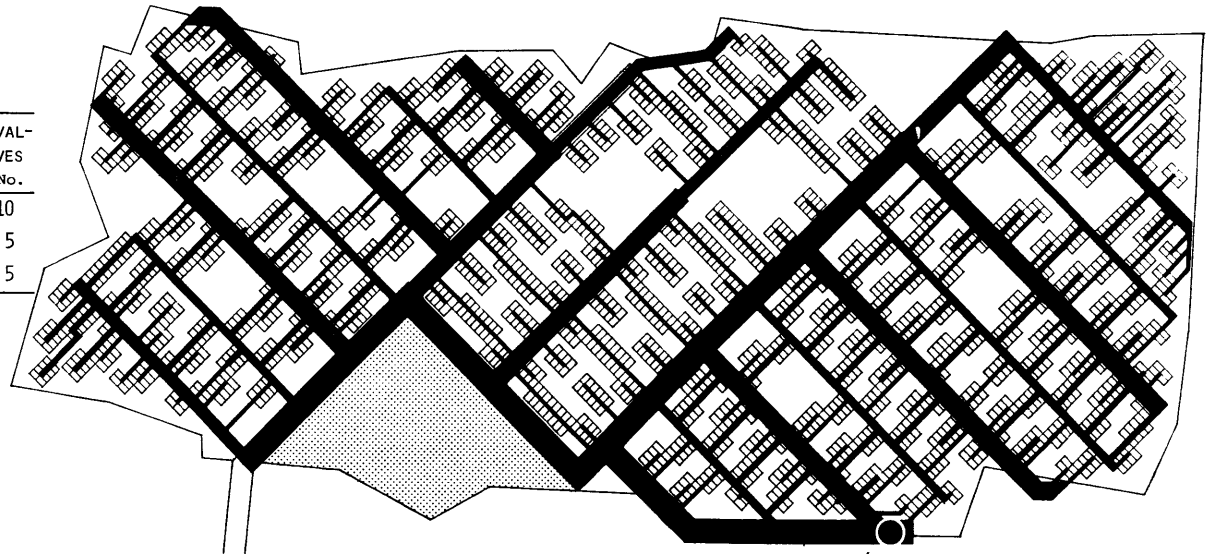


PROPOSED LAYOUT

Water Supply

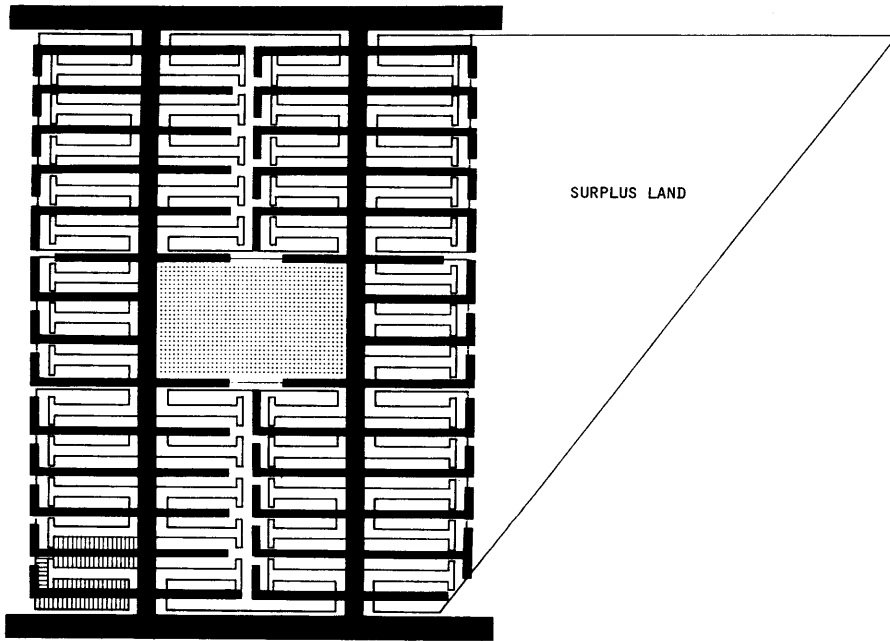
LAYOUT	PIPES						TOTAL LENGTH m	VAL- VES No.	
	3/4"Ø m	1"	1 1/2"	3"	4"	6"			
EXISTING	4780	2385	1207	578	1541	824	-	11315	10
EQUIVALENT	-	-	3242	-	800	-	300	4342	5
PROPOSED	-	3158	2123	-	1203	-	697	7181	5

TABLE OF LAYOUTS, COMPONENTS AND QUANTITIES: The table shows that the Existing layout exceeds the two others in quantities of components. Main line in the Equivalent and the Proposed layouts represent half of the measured lengths; they are shared by the adjoining developments.
NOTE: Service connections are not included in the table.

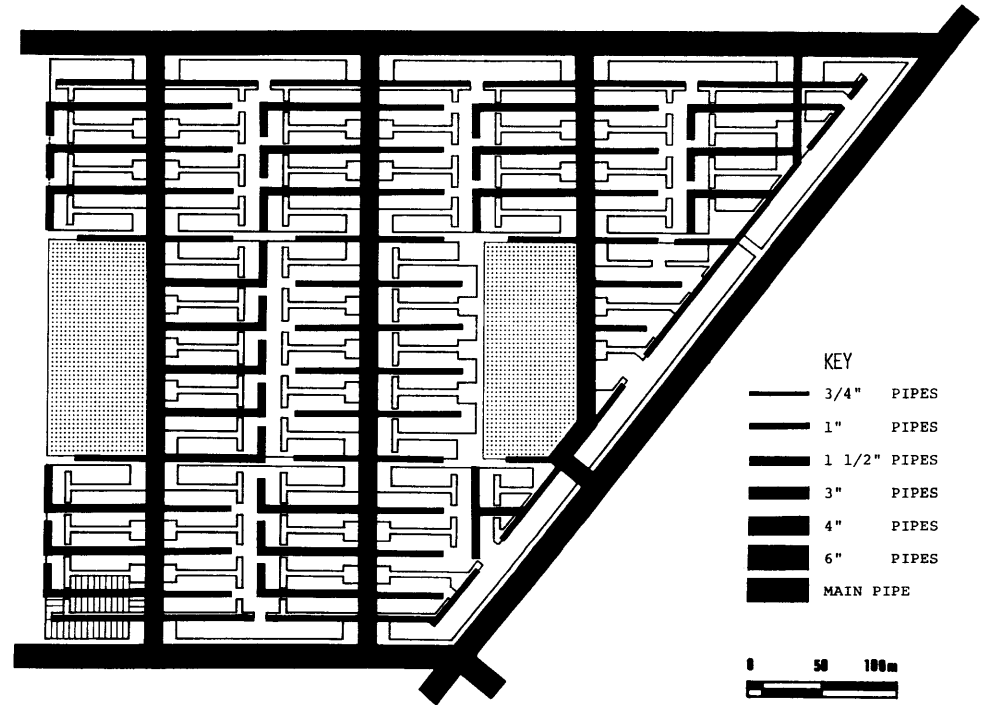


EXISTING LAYOUT

TUBE WELL/OVERHEAD TANK



EQUIVALENT LAYOUT



PROPOSED LAYOUT

- KEY
- 3/4" PIPES
 - 1" PIPES
 - 1 1/2" PIPES
 - 3" PIPES
 - 4" PIPES
 - 6" PIPES
 - MAIN PIPE

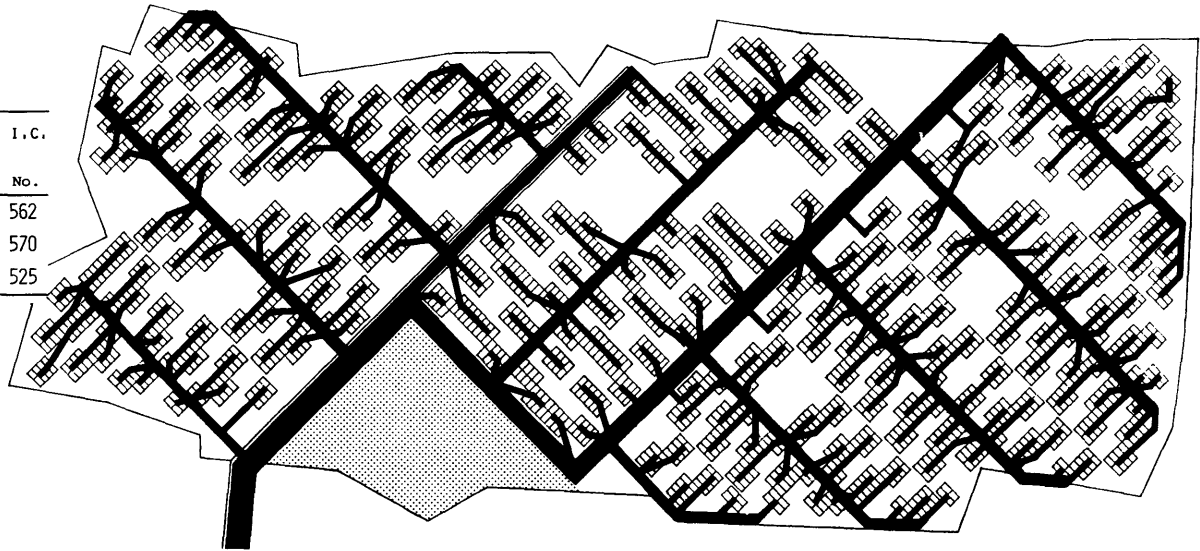


Sewage Disposal

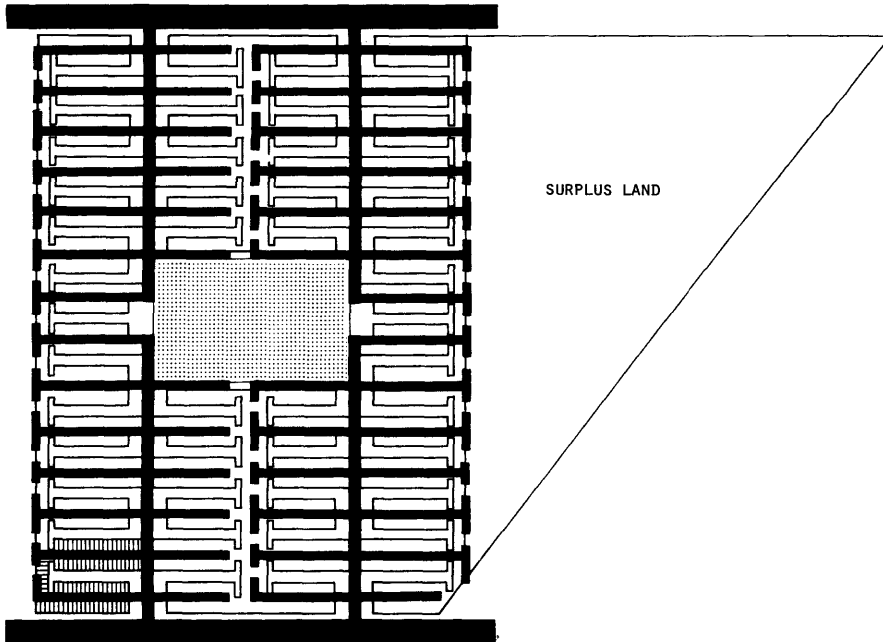
LAYOUT	PIPES						TOTAL LENGTH	M.H. No.	I.C. No.
	4"Ø	6"	9"	12"	18"	24" MAIN			
	m								
EXISTING	7115	147	385	1540	530	144	9863	165	562
EQUIVALENT	2152	5116	740			300	8308	30	570
PROPOSED	3140	5740	600			697	10141	46	525

M.H.- MAN HOLES
I.C.- INSPECTION CHAMBERS

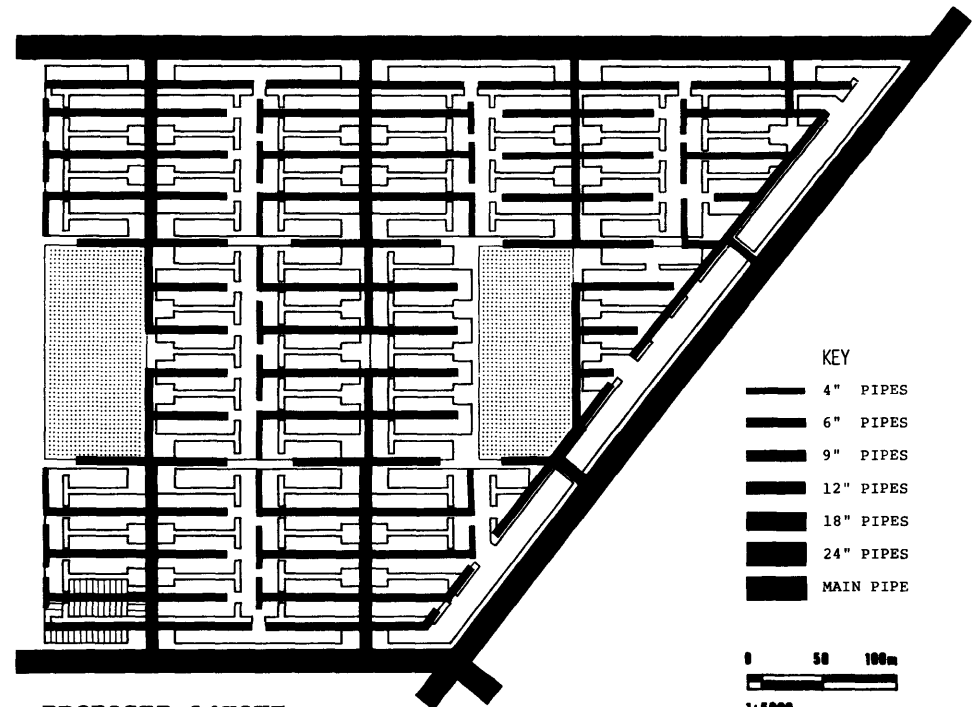
TABLE OF LAYOUTS, COMPONENTS AND QUANTITIES: The table shows that the Existing layout exceeds the Equivalent layout in quantities of components. It represents slightly lower total pipe length and almost 3.5 times more manholes than the Proposed layout. But, the latter is a part of the development of a larger area in wider time scale, therefore, has long range implications. The Equivalent and the Proposed layout have shared main pipes similar as in water supply.



EXISTING LAYOUT



EQUIVALENT LAYOUT

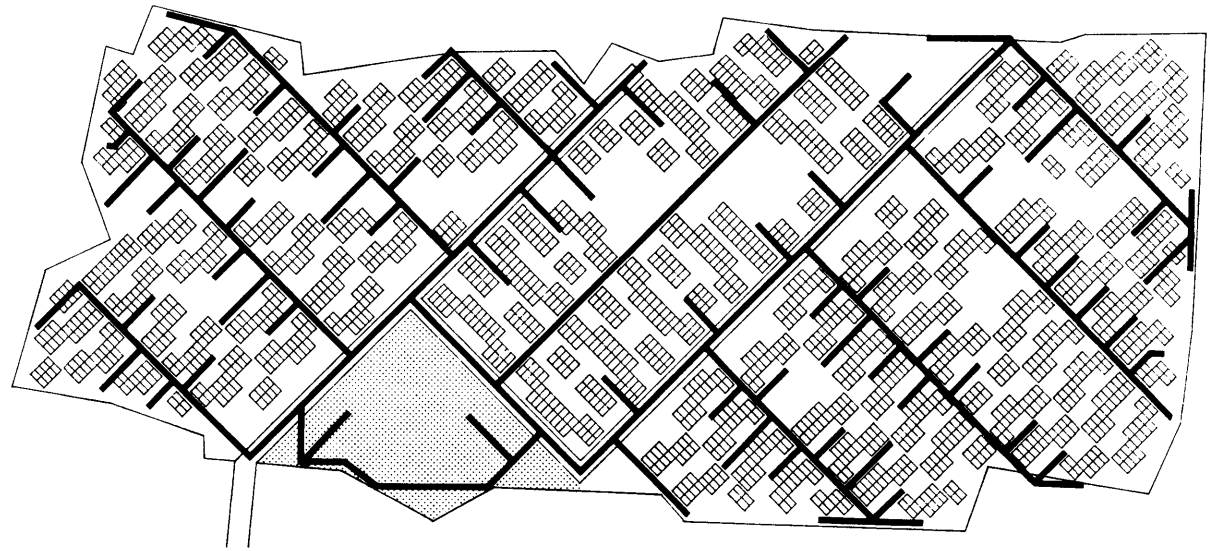


PROPOSED LAYOUT

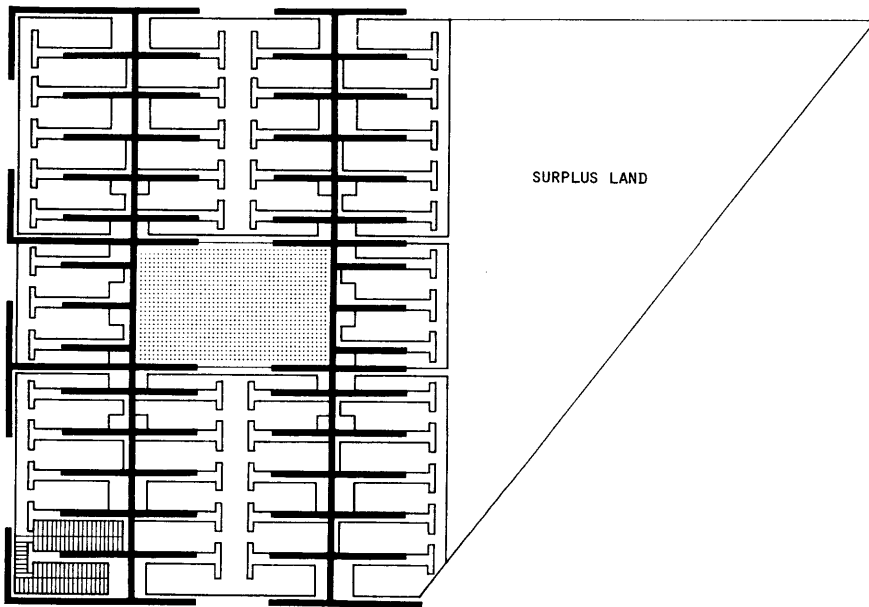
Street Lighting

LAYOUT	NETWORK	POLES	LAMPS
	CABLES m	No.	NO.
EXISTING	5695	207	156
EQUIVALENT	3057	101	101
PROPOSED	5870	164	164

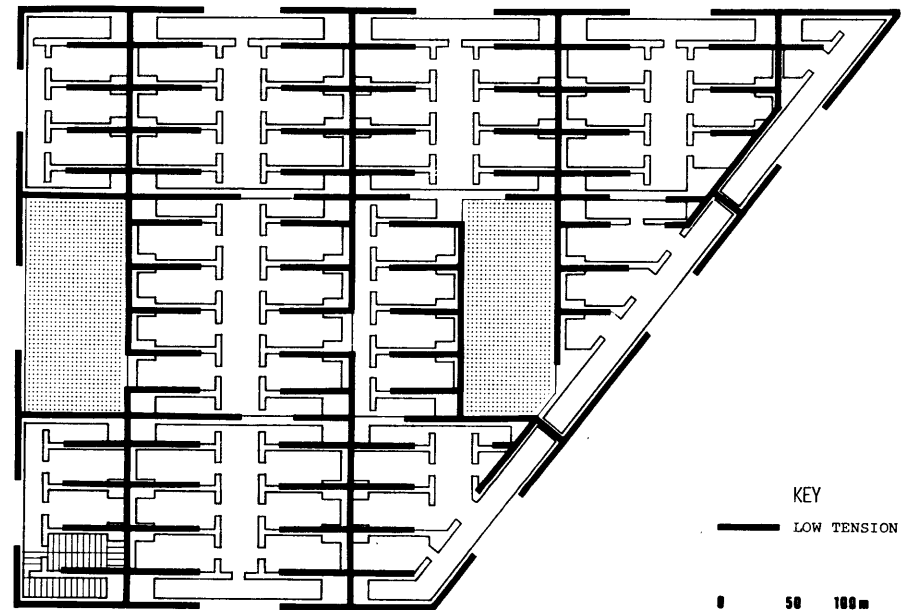
TABLE OF LAYOUTS, COMPONENTS AND QUANTITIES: The table shows that the Existing layout exceeds the Equivalent layout in quantities of components. The Existing layout represents slightly lower figures for lines and lamps than the Proposed but, distribution of lamps is unbalanced in the former case. The Proposed layout should be judged for its long range implications as similar to the sewage disposal layout.



EXISTING LAYOUT



EQUIVALENT LAYOUT



PROPOSED LAYOUT

KEY

— LOW TENSION CABLES

0 50 100 m

1:5000

GLOSSARY

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

-FIRST PREFERENCE: definitions from "Webster's Third New International Dictionary", Merriam-Webster, 1971.

-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/satisfactory.

Words included for specificity and to focus on a particular context are indicated in parenthesis.

Sources of definitions are indicated in parenthesis. (See also: REFERENCES).

ACCESSES. 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.) (U.S.D.P.)

ACTUAL LAND COST. "(The cost of land is)...set solely by the level of demand. The price of land is not a function of any cost conditions; it is set by the users themselves in competition." (Turner, 1971)

AD VALOREM (TAX). A tax based on a property's value; the value taxed by local governments is not always or even usually the market value, but only a valuation for tax purposes. (U.S.D.P.)

AIRPORT DISTURBANCE. The act or process of destroying the rest, tranquility, or settled state of (the site by the annoyance of airport noise, vibration, hazards, etc.) (Merriam-Webster, 1971)

AIRPORT ZONING RESTRICTIONS. The regulation of the height or type of structures in the path of moving aircraft. (Abrams, 1971)

ALTERNATING CURRENT (A.C.) (an electric) current that reverses its direction of flow at regular intervals. (ROTC ST 45-7, 1953)

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)

AMPERES. Amperes (amp) are a measure of the rate of flow of electricity. It is somewhat comparable to the rate of flow of water (quantity/time). A steady current produced by one volt applied across a resistance of one ohm. (ROTC ST 45-7, 1953)

APPRAISAL. An estimate and opinion of value, especially by one fitted to judge. (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.)

ASSESSED VALUE. A valuation placed upon property by a public officer or board as a basis for taxation. (Keyes, 1971)

ASSESSMENT. The valuation of property for the purpose of levying a tax or the amount of the tax levied. (Keyes, 1971)

BACKFILL. Earth or other material used to replace material removed during construction, such as in culvert, sewer, and pipeline trenches and behind bridge abutments and retaining walls or between an old structure and a new lining. (DePina, 1972)

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

BETTERMENT (TAX). A tax on the increment in value accruing to an owner because of development and improvement work carried out by local authorities. (U.S.D.P.)

BINDER COURSE. A transitional layer of bituminous paving between the crushed stone base and the surface course (to increase bond between base and surface course). (DePina, 1972)

BITUMINOUS. A coating of or containing bitumin; as asphalt or tar. (DePina, 1972)

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 a limit or extent (of the site). (Merriam-Webster, 1971)

BUILDING CODE. "A body of legislative regulations or by-laws that provide minimum standards to safeguard life or limb, health, property, and public welfare by regulating and controlling the design, construction, quality of materials, use and occupancy, location and maintenance of all buildings and structures within the city, and certain equipment specifically regulated therein." (BOCA, 1967)

BUILDING DRAIN. Lowest horizontal piping of the building drainage system receiving discharge from soil, waste, and other drainage pipes. It is connected to the building sewer. (ROTC ST 45-7, 1953)

BUILDING MAIN. Water-supply pipe and fittings from the water main or other source of supply to the first branch of the water-distribution system of a building. (ROTC ST 45-7, 1953)

CESS POOL. An underground catch basin that is used where there is no sewer and into which household sewage or other liquid waste is drained to permit leaching of the liquid into the surrounding soil. (Merriam-Webster, 1971)

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

CLAY. A lusterless colloidal substance, plastic when moist (crystalline grains less than 0.002mm in diameter). (U.S.D.P.)

CLEANOUT. A plug or similar fitting to permit access to traps or sewer lines. Cleanouts are usually used at turns and other points of collection. (ROTC ST 45-7, 1953)

CLIMATE. The average condition 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, comprised of house service, collection lines, manholes, laterals, mains. (U.S.D.P.)

COMBINED SEWER. A sewer that carries both storm water and sanitary or industrial wastes. (DePina, 1972)

COMMUNITY. The people living in a particular place or region and usually linked by common interests: the

region itself; any population cluster. (U.S.D.P.)

COMMUNITY FACILITIES/SERVICES. Facilities/services used in common by a number of people. It may 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 owns the unit in much 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/grouped dwelling types; *VERTICAL*: walk-up, high-use dwelling types. (U.S.D.P.)

CONDUCTORS. Materials which allow current to flow such as aluminum, copper, iron. (ROTC ST 45-7, 1953)

CONDUIT. A pipe or other opening, buried or above ground, for conveying hydraulic traffic, pipelines, cables, or other utilities. (DePina, 1972)

CONSERVATION EASEMENT. An easement acquired by the public and designed to open privately owned lands for recreational purposes or to restrict the use of private land in order to preserve open space and protect certain natural resources. (U.S.D.P.)

CONURBATION. Area of large urban communities where towns, etc. have spread and became joined beyond their administrative boundaries. (A.S. Hornby, A.P. Cowie, J. Windsor Lewis, 1975)

CONURBATION. An aggregation or continuous network of urban communities. (Merriam-Webster, 1963)

CORPORATION COCK/CORPORATION STOP. A water or gas cock by means of which utility-company employees connect or disconnect service lines to a consumer. (Merriam-Webster, 1971)

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

CURRENT (See: ALTERNATING CURRENT, DIRECT CURRENT). An electric current is a movement of positive or negative electric particles (as electrons) accompanied by such observable effects as the production of heat, of a magnetic field, or of chemical transformation. (Merriam-Webster, 1971)

CYCLE. One complete performance of a vibration, electric oscillation, current alternation, or other periodic process. (Merriam-Webster, 1971)

DAM. A barrier preventing the flow of water; a barrier built across a water course to confine and keep back flowing water. (Merriam-Webster, 1971)

DEPRECIATION ACCELERATION (TAX). A tax incentive designed to encourage new construction by allowing a faster write-off during the early life of a building. (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 contriving the elements, steps, and procedures for producing what will adequately satisfy some need. (Merriam-Webster, 1971)

DETACHED DWELLING. 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.)

DEVELOPMENT SIZE. There are two general ranges of size: *LARGE*: may be independent communities requiring their own utilities, services, and community facilities; *SMALL*: generally are part of an adjacent urbanization and can use its supporting utilities, services, and community facilities. (U.S.D.P.)

DIRECT CURRENT (D.C.) (An electric current that) flows continuously in one direction. (ROTC ST 45-7, 1953)

DISCHARGE (Q). Flow from a culvert, sewer, channel, etc. (DePina, 1972)

DISTANCE. The degree or amount of separation between two points (the site and each other element of the urban context) measured along the shortest path adjoining them (paths of travel). (Merriam-Webster, 1971)

DISTRIBUTION (STATION). The part of an electric supply system between bulk power sources (as generating stations or transformation station tapped from transmission lines) and the consumers' service switches. (Merriam-Webster, 1971)

DISTURBED SOIL. Soils that have been disturbed by artificial process, such as excavation, transportation, and compaction in fill. (U.S.D.P.)

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

DUST/DIRT. 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 BUILDER. Four groups are considered: *SELF-HELP BUILT*: where the dwelling unit is directly built by the user or occupant; *ARTISAN BUILT*: where the dwelling unit is totally or partially built by a skilled craftsman hired by the user or occupant; payments can be monetary or an exchange of services; *SMALL CONTRACTOR BUILT*: where the dwelling unit is totally built by a small organization hired by the user, occupant, or developer; 'small' contractor is defined by the scale of operations, financially and materially; the scale being limited to the construction of single dwelling units or single complexes; *LARGE CONTRACTOR BUILT*: where the dwelling unit is totally built by a large organization hired by a developer; 'large' contractor is defined by the scale of operations, financially and materially; the scale reflects a more comprehensive and larger size of operations encompassing the building of large quantities of similar units, or a singularly large complex. (U.S.D.P.)

DWELLING DENSITY. The number of dwellings, dwelling units, people or families per unit hectare. Gross density is the density of an overall area (ex. including lots, streets). Net density is the density of selected, discrete portions of an area (ex. including only lots). (U.S.D.P.)

DWELLING DEVELOPER. Three sectors are considered in the supply of dwellings: *POPULAR SECTOR*: the marginal sector with limited or no access to the formal financial, administrative, legal, technical institutions involved in the provision of dwellings. The housing process (promotion, financing, construction, operation) is carried out by the Popular Sector generally for 'self use' and sometimes for profit. *PUBLIC SEC-*

TOR: the government or non-profit organizations involved in the provision of dwellings. The housing process (promotion, financing, construction, operation) is carried out by the Public Sector for service (non-profit or subsidized housing). **PRIVATE SECTOR:** the individuals, groups or societies, who have access to the formal financial, administrative, legal, technical institutions in the provision of dwellings. The housing process (promotion, financing, construction, operation) is carried out by the Private Sector for profit. (U.S.D.P.)

DWELLING DEVELOPMENT MODE. Two modes are considered: **PROGRESSIVE:** the construction of the dwelling and the development of the local infrastructure to modern standards by stages, often starting with provisional structures and underdeveloped land. This essentially traditional procedure is generally practiced by squatters with de facto security of tenure and an adequate building site. **INSTANT:** the formal development procedure in which all structures and services are completed before occupation. (U.S.D.P.)

DWELLING FLOORS. The following numbers are considered: **ONE:** single story; generally associated with detached, semi-detached and row/group dwelling types. **TWO:** double story; generally associated with detached, semi-detached and row/group dwelling types. **THREE OR MORE:** generally associated with walk-up and high-rise dwelling types. (U.S.D.P.)

DWELLING GROUP. The context of the dwelling in its immediate surroundings. (U.S.D.P.)

DWELLING/LAND SYSTEM. A distinct dwelling environment/housing situation characterized by its users as well as by its physical environment. (U.S.D.P.)

DWELLING LOCATION. Three sectors are considered in single or multi-center urban areas. Sectors are identified by position as well as by the density of buildings as follows: **CENTER:** the area recognized as the business center of the city, generally the most densely built-up sector; **INNER RING:** the area located between the city center and the urban periphery, generally a densely built-up sector; **PERIPHERY:** the area located between the inner ring and the rural areas, generally a scatteredly built-up sector. (U.S.D.P.)

DWELLING PHYSICAL STATE. A qualitative evaluation of the physical condition of the dwelling types: room, apartment, house; the shanty unit is not evaluated. **BAD:** generally poor state of structural stability, weather protection, and maintenance. **FAIR:** generally acceptable state of structural stability, weather protection, and maintenance with some deviation. **GOOD:** generally acceptable state of structural stability, weather protection, and maintenance without deviation. (U.S.D.P.)

DWELLING TYPE. The physical arrangement of the dwelling unit: **DETACHED:** individual dwelling unit, separated from others. **SEMI-DETACHED:** two dwelling units sharing a common wall (duplex). **ROW/GROUPED:** dwelling units grouped together linearly or in clusters. **WALK-UP:** dwelling units grouped in two to five stories with stairs for vertical circulation. **HIGH-RISE:** dwelling units grouped in five or more stories with stairs and lifts for vertical circulation. (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.)

DWELLING UNIT COST. The initial amount of money paid for the dwelling unit or the present monetary equivalent for replacing the dwelling unit. (U.S.D.P.)

DWELLING UNIT TYPE. Four types of dwelling units are considered: **ROOM:** A SINGLE SPACE usually bounded by

partitions and specifically used for living; for example, a living room, a dining room, a bedroom, but not a bath/toilet, kitchen, laundry, or storage room. **SEVERAL ROOM UNITS** are contained in a building/shelter and share the use of the parcel of land on which they are built (open spaces) as well as common facilities (circulation, toilets, kitchens). **APARTMENT:** A MULTIPLE SPACE (room/set of rooms with bath, kitchen, etc.) **SEVERAL APARTMENT UNITS** are contained in a building and share the use of the parcel of land on which they are built (open spaces) as well as some common facilities (circulation). **HOUSE:** A MULTIPLE SPACE (room/set of rooms with or without bath, kitchen, etc.) **ONE HOUSE UNIT** is contained in a building/shelter and has the private use of the parcel of land on which it is built (open spaces) as well as the facilities available. **SHANTY:** A SINGLE OR MULTIPLE SPACE (small, crudely built). **ONE SHANTY UNIT** is contained in a shelter and shares with other shanties the use of the parcel of land on which they are built (open spaces). (U.S.D.P.)

DWELLING UTILIZATION. The utilization indicates the type of use with respect to the number of inhabitants/families. **SINGLE:** an individual or family inhabiting a dwelling. **MULTIPLE:** a group of individuals or families inhabiting a dwelling. (U.S.D.P.)

EASEMENT. Servitude: a right in respect of an object (as land owned by one person) in virtue of which the object (land) is subject to a specified use or enjoyment by another person or for the benefit of another thing. (Merriam-Webster, 1971)

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

EFFLUENT. Outflow or discharge from a sewer or sewage treatment equipment. (DePina, 1972)

ELECTRIC FEEDER. That part of the electric distribution system between the transformer and the service drop or drops. (HUD, Mobile Court Guide, 1970)

ELECTRIC SERVICE DROP. That part of the electric distribution system from a feeder to the user's service equipment serving one or more lots. (HUD, Mobile Court Guide, 1970)

ELECTRIC TRANSFORMER. A device which changes the magnitude of alternating voltages and currents; generally from distribution voltages to user voltages; a distribution component that converts power to usable voltage. (TM 5 765 US Army, 1970; U.S.D.P.)

ELECTRICAL CIRCUIT. A closed, complete electrical path with various connected loads. Circuits may either be 'parallel' (voltage constant for all connected loads) or 'series' (voltage divided among connected loads). Parallel circuits are fixtures wired independent of each other, which are used in nearly all building wiring. (U.S.D.P.; ROTC ST 45-7, 1953)

ELECTRICAL FREQUENCY. The number of times an alternating electric current changes direction in a given period of time. Measured in cycles per second: hertz. (ROTC ST 45-7, 1953)

ELECTRIC GROUND. The electrical connection with the earth or other ground. (Merriam-Webster, 1971)

ELECTRICAL NETWORK COMPONENTS. It is composed of the following: **GENERATION:** produces electricity; **TRANSMISSION:** transports energy to user groups; **DISTRIBUTION STATION:** divides power among main user groups; **SUBSTATION:** manipulates power into useful energy levels for consumption; **DISTRIBUTION NETWORKS:** provides electric service to user. (U.S.D.P.)

ELECTRIC PHASE. May be either a single-phase circuit (for small electrical devices) or a three-phase circuit (for heavy equipment, large electrical devices). In single-phase only one current is flowing through

the circuit with the voltage dropping to zero twice in each cycle. In three-phase currents flow through the circuit with the power never dropping to zero. (U.S.D.P.)

ELECTRICAL POWER. The source or means of supplying energy for use; measured in watts. (U.S.D.P.)

ELECTRICAL WIRING SYSTEMS. May either be single-phase or three-phase. **SINGLE-PHASE:** 2 hot wires with 1 neutral wire; **THREE-PHASE:** 3 hot wires with 1 neutral wire. (ROTC ST 45-7, 1953)

ELECTRICITY. Electrification: the process (network) for supplying (the site) with electric power. (Merriam-Webster, 1971)

EMBANKMENT (or FILL). A bank of earth, rock, or other material constructed above the natural ground surface. (DePina, 1972)

EROSION. The general process whereby materials of the earth's crust are worn away and removed by natural agencies including weathering, solution, corrosion, and transportation; (specific) land destruction and simultaneous removal of particles (as of soil) by running water, waves and currents, moving ice, or wind. (Merriam-Webster, 1971)

EXCRETA. Waste matter eliminated from the body. (U.S.D.P.)

EXISTING STRUCTURE. Something constructed or built (on the site). (U.S.D.P.)

EXPLORATORY BORING. Initial subsurface investigations (borings) are done on a grid superimposed on the areas of interest and on areas indicated as limited/restricted/hazard in the initial survey. (U.S.D.P.)

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

FAUCET (also TAP). A fixture for drawing liquid from a pipe, cask, or other vessel. (Merriam-Webster, 1971)

FINANCING. The process of raising or providing funds. **SELF FINANCED:** provided by own funds; **PRIVATE/PUBLIC FINANCED:** provided by loan; **PUBLIC SUBSIDIZED:** provided by grant or aid. (U.S.D.P.)

FIRE/EXPLOSION HAZARDS. Danger: the state of being exposed to harm; liable to injury, pain, or loss from fire/explosion (at or near the site). (Merriam-Webster, 1971)

FIRE FLOW. The quantity (in time) of water available for fire-protection purposes in excess of that required for other purposes. (Merriam-Webster, 1971)

FIRE HYDRANT. A water tap to which fire hoses are connected in order to smother fires. (U.S.D.P.)

FIRE PROTECTION. Measures and practices for preventing or reducing injury and loss of life or property by fire. (Merriam-Webster, 1971)

FLEXIBLE PAVEMENT. A pavement structure which maintains intimate contact with and distributes loads to the subgrade and depends upon aggregate interlock, particle friction, and cohesion for stability. (DePina, 1972)

FLOODING. A rising and overflowing of a body of water that covers land not usually under water. (U.S.D.P.)

FLOODWAY FRINGE. The floodplain area landward of the natural floodway which would be inundated by low velocity flood waters. (U.S.D.P.)

FLOW METER. A device to measure flow of water. (U.S.D.P.)

FLUSH TANK TOILET. Toilet with storage tank of water used for flushing bowl. (U.S.D.P.)

FLUSH VALVE TOILET. Toilet with self-closing valve which supplies water directly from pipe. It requires adequate pressure for proper functioning. (U.S.D.P.)

FOOT CANDLE. A unit of illumination on a surface that is everywhere one foot from a uniform point source of light of one candle and equal to one lumen per square foot. (Merriam-Webster, 1971)

FUMES. Gaseous emissions that are usually odorous and sometimes noxious. (Merriam-Webster, 1971)

GAS. A system for supplying natural gas, manufactured gas, or liquefied petroleum gas to the site and individual users. (U.S.D.P.)

GRADE. Profile of the center of a roadway, or the invert of a culvert or sewer. (DePina, 1972)

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

GRIDIRON BLOCKS. The blocks determined by the dimensions of the lots. In gridiron 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.)

GRIDIRON LAYOUTS. The urban layouts with gridiron blocks. (U.S.D.P.)

GOVERNMENT/MUNICIPAL REGULATIONS. In urban areas, the development of the physical environment is a process usually controlled by a government/municipality through all or some of the following regulations: Master Plan, Zoning Ordinance, Subdivision Regulations, Building Code. (U.S.D.P.)

HEAD. (Static). The height of water above any plane or point of reference. Head in feet = (lb/sq. in. x 144)/(Density in lb/cu. ft.) For water at 68°F. (DePina, 1972)

HIGH-RISE. Dwelling units grouped in five or more stories with stairs and lifts for vertical circulation. (U.S.D.P.)

HOT WIRE. Wire carrying voltage between itself and a ground. (ROTC ST 45-7, 1953)

HYDRAULICS. That branch of science or engineering that deals with water or other fluid in motion. (DePina, 1972)

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

INCOME. The amount (measured in money) of gains from capital or labor. The amount of such gain 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.)

INCREMENT (TAX). A special tax on the increased value of land, which is due to no labor/expenditure by the owner, but rather to natural causes such as the increase of population, general progress of society, etc. (U.S.D.P.)

INFRASTRUCTURE. The underlying foundation or basic framework for utilities and services: streets; sewage, water network; storm drainage, electrical network;

gas network; telephone network; public transportation; police and fire protection; refuse collection, health, schools, playgrounds, parks, open spaces. (U.S.D.P.)

INSULATOR. A material or body that is a poor conductor of electricity, heat, or sound. (Merriam-Webster, 1971)

INTERIOR CIRCULATION NETWORK (SITE PLANNING). The pedestrian/vehicular circulation system inside the site. It should be designed based upon the exterior circulation/accesses and land development requirements. (U.S.D.P.)

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

KILOWATT (kw). (1000 watts) A convenient manner of expressing large wattages. Kilowatt hours (kwh) measure the total quantity of energy consumed in a given time. One kwh represents the use of an average of 1 kilowatt of electrical energy for a period of 1 hour. (ROTC ST 45-7, 1953)

LAMPHOLE. A vertical pipe or shaft leading from the surface of the ground to a sewer, for admitting light for purposes of inspection. (U.S.D.P.)

LAND COST. Price: the amount of money given or set as the amount to be given as a consideration for the sale of a specific 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 LEASE. The renting of land for a term of years for an agreed sum; leases of land may run as long as 99 years. (U.S.D.P.)

LAND-MARKET VALUE. Refers to: 1) the present monetary equivalent to replace the land; 2) the present tax based value of the land; or 3) the present commercial market value of the land. (U.S.D.P.)

LAND OWNERSHIP. The exclusive right of control and possession of a parcel of land. (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 temporary holding or mode of holding a parcel of land of another. (U.S.D.P.)

LAND UTILIZATION. A qualification of the land around a dwelling in relation to user, physical controls and responsibility. *PUBLIC* (streets, walkways, open spaces): user -anyone/unlimited; physical controls -minimum; responsibility -public sector. *SEMI-PUBLIC* (open spaces, playgrounds, schools): user -limited group of people; physical controls -partial or complete; responsibility -public sector and user. *PRIVATE* (dwellings, lots): user -owner or tenant or squatter; physical controls -complete; responsibility -user. *SEMI-PRIVATE* (cluster courts): user -group of owners and/or tenants; physical controls -partial or 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.)

LATERAL SEWER. A collector pipe receiving sewage from building connection only. (U.S.D.P.)

LATRINE. A receptacle (as a pit in the earth or a water closet) for use in defecation and urination, or

a room (as in a barracks or hospital) or enclosure (as in a camp) containing such a receptacle. (Merriam-Webster, 1971)

LAYOUT. The plan or design or arrangement of something that is laid out. (Merriam-Webster, 1971)

LEVELS OF SERVICES. Two levels are considered: *MINIMUM*, are admissible or possible levels below the standard; *STANDARD*, are levels set up and established by authority, custom of general consent, as a model, example or rule for the measure of quantity, weight extent, value or quality. (U.S.D.P.)

LIFT PUMP. A collection system component that forces sewage to a higher elevation to avoid deep pipe networks. (U.S.D.P.)

LOCALITY. A relatively self-contained residential area/community/neighborhood/settlement within an urban area which may contain one or more dwelling/land systems. (U.S.D.P.)

LOCALITY SEGMENT. A 400m x 400m area taken from and representing the residential character and layout of a locality. (U.S.D.P.)

LOCATION. Situation: the way in 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 semipublic common court (owned in condominium). (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.)

LUMINAIRE. In highway lighting, a complete lighting device consisting of a light source, plus a globe, reflector, refractor, housing and such support as is integral with the housing. (DePina, 1972)

MANHOLE. An access hole sized for a man to enter, particularly in sewer and storm drainage pipe systems for cleaning, maintenance and inspection. (U.S.D.P.)

MATRIX (OF BASIC REFERENCE MODELS). A set of models of urban layouts arranged in rows and columns. (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, 1972)

MEDIAN BARRIER. A double-faced guard rail in the median or island dividing two adjacent roadways. (DePina, 1972)

MESHING BOUNDARIES. Characterized by continuing, homogeneous land uses or topography, expressed as: *LINES*: property lines, political or municipal divisions, main streets, etc.; *AREAS*: similar residential uses, compatible uses (as parks with residential). (U.S.D.P.)

MICROCLIMATE. The local climate of a given site or habitat varying in size from a tiny crevice to a large land area, but being usually characterized by considerable uniformity of climate. (Merriam-Webster, 1971)

MODE OF TRAVEL. Manner of moving from one place (the

site) to another (other parts of the urban context). (U.S.D.P.)

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.)

MUTUAL OWNERSHIP. Private land ownership shared by two or more persons and their heir under mutual agreement. (U.S.D.P.)

NATURAL FEATURES. Prominent objects in or produced by nature. (U.S.D.P.)

NATURAL UNDISTURBED SOIL. Soils that have not been disturbed by artificial process. Although natural, they depend greatly on local conditions, environment, and past geological history of the formations. (U.S.D.P.)

NEIGHBORHOOD. A section lived in by neighbors and having distinguishing characteristics. (U.S.D.P.)

NETWORK EFFICIENCY (LAYOUT EFFICIENCY). The ratio of the length of the network to the area(s) contained within; or tangent to it. (U.S.D.P.)

NEUTRAL WIRE. Wire carrying no voltage between itself and a ground. (ROTC ST 45-7, 1953)

NOISE. Any sound (affecting the site) that is undesired (such as that produced by: traffic, airports, industry, etc.) (Merriam-Webster, 1971)

ODOR. A quality of something that affects the sense of smell. (Merriam-Webster, 1971)

OHMS (electrical). The unit of resistance to the flow electricity. The higher the number of ohms, the greater the resistance. When resistance is constant, amperage (and wattage) are in direct proportion to voltage. Resistance varies inversely with the cross-sectional area of the wire. Ohms = volts/amperes. $R = E/I$. The practical mks unit of electrical resistance that is equal to the resistance of a circuit in which a potential difference of one volt produces a current of one ampere or to the resistance in which one watt of power is dissipated when one ampere flows through it and that is taken as standard in the U.S. (U.S.D.P.; ROTC ST 45-7, 1953; Merriam-Webster, 1971)

OPTIMIZE/OPTIMIZE. To bring to a peak of economic efficiency, specially by the use of precise analytical methods. (Merriam-Webster, 1971)

ORGANIC SOILS. Soils composed mostly of plant material. (U.S.D.P.)

OXIDATION POND (LAGOON). A method of sewage treatment using action of bacteria and algae to digest/decompose wastes. (U.S.D.P.)

PERCENT RENT/MORTGAGE. The fraction of income allocated for dwelling rental or dwelling mortgage payments; expressed as a percentage of total family income. (U.S.D.P.)

PIT PRIVY/LATRINE. A simple hole in the ground, usually hand dug, covered with slab and protective superstructure; for disposal of human excreta. (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.)

POLICE PROTECTION. Police force: a body of trained men and women entrusted by a government with the maintenance of public peace and order, enforcement of laws, prevention and detection of crime. (Merriam-

Webster, 1971)

POPULATION DENSITY. It is the ratio between the population of a given area and the area. It is expressed in people per hectare. It can be: *GROSS DENSITY*: includes any 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.)

PRIVY. A small, often detached building having a bench with one or more round or oval holes through which the user may defecate or urinate (as into a pit or tub) and ordinarily lacking any means of automatic discharge of the matter deposited. (Merriam-Webster, 1971)

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.)

PUMP. A device or machine that raises, transfers, or compresses fluids or that attenuates gases especially by suction or pressure or both. (Merriam-Webster, 1971)

REFUSE COLLECTION. The service for collection and disposal of all the solid wastes from a community. (U.S.D.P.)

RESERVOIR. Large-scale storage of water; also functions to control fluctuations in supply and pressure. (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.)

RESISTANCE. The opposition to electrical flow. (Resistance increases as the length of wires is increased and decreases as the cross-sectional area of wires is increased). (ROTC ST 45-7, 1953)

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 thorough-fare which one may lawfully use, the strip of land devoted to or over which is built a public road, the land

occupied by a railroad, the land used by a public utility. Rights-of-way may be shared (as streets; pedestrians and automobiles) or exclusive (as rapid transit routes; subways, railroads, etc.) (Merriam-Webster, 1971; U.S.D.P.)

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. (DePina, 1972)

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

RUNOFF. That part of precipitation carried off from the area upon which it falls. (DePina, 1972)

RUNOFF-RAINFALL RATIO. The percentage (ratio) of stormwater runoff that is not reduced by evaporation, depression storage, surface wetting, and percolation; with increased rainfall duration, runoff-rainfall ratios rise increasing runoff flow. (U.S.D.P.)

SAND. Loose, distinguishable grains of quartz/feldspar, mica (ranging from 2mm to 0.02mm in diameter). (U.S.D.P.)

SANITARY SEWERAGE. The system of artificial usually subterranean conduits to carry off sewage composed of: *excreta*: waste matter eliminated from the human body; *domestic wastes*: used water from a home/community containing 0.14 total solids; and some *industrial wastes*, but not water from ground, surface, or storm. (U.S.D.P.)

SEMI-DETACHED DWELLING. Two dwelling units sharing a common wall (duplex). (U.S.D.P.)

SEPTIC TANK. A tank in which the organic solid matter of continuously flowing sewage is deposited and retained until it has been disintegrated by anaerobic bacteria. (Merriam-Webster, 1971)

SERIES CIRCUIT. Fixtures connected in a circuit by a single wire. When one fixture is out, the circuit is broken. Fixtures with different amperages cannot be used efficiently in the same circuit. (ROTC ST 45-7, 1953)

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

SEWAGE. The effluent in a sewer network. (U.S.D.P.)

SEWER. The conduit in a subterranean network used to carry off water and waste matter. (U.S.D.P.)

SEWER BUILDING CONNECTION. The pipe connecting the dwelling with the sewer network. (U.S.D.P.)

SEWERAGE. Sewerage system: the system of sewers in a city, town or locality. (Merriam-Webster, 1971)

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.)

SILT. Loose, unconsolidated sedimentary rock particles (ranging from 0.02mm to 0.002mm in diameter). (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: *GROSS AREA*: includes the whole site or the bounded piece of ground. *USABLE 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.)

SITE AND SERVICES. The subdivision of urban land and the provision of services for residential use and complementary commercial use. Site and services projects are aimed to improve the housing conditions for the low income groups of the population by providing: a) *SITE*: the access to a piece of land where people can build their own dwellings; b) *SERVICES*: the opportunity of access to employment, utilities, services and community facilities, financing and communications. (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)

SMOKE. The gaseous products of burning carbonaceous materials made visible by the presence of carbon particles. (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)

SOIL INVESTIGATION. It is the process to find the soil structure and other characteristics. It may include the following stages: initial soil survey, exploratory boring, construction boring. (U.S.D.P.)

SOIL PIPE. The pipe in a dwelling which carries the pipe discharge from water closets. (U.S.D.P.)

SOIL SURVEY (INITIAL). An on-site examination of surface soil conditions and reference to a GENERAL SOIL MAP. It is used to reveal obvious limitations/restrictions/hazards for early planning consideration. (U.S.D.P.)

STACK. The vertical pipe in a dwelling of the soil-, waste-, or vent-pipe systems. (ROTC ST 45-7, 1953)

STANDARD. 1) Something that is established by authority, custom or general consent as a model or example to be followed. 2) Something that is set up and established by authority as a rule for the measure of quantity, weight, extent, value or quality. (Merriam-Webster, 1971)

STANDPIPE. A pipe riser with tap used as a source of water for domestic purposes. (HUD/AID, Minimum Standards, 1966)

STORM DRAINAGE. Storm sewer: a sewer (system) designed to carry water wastes except sewage (exclusively storm water, surface runoff, or street wash). (Merriam-Webster, 1971)

STREET LIGHTING. Illumination to improve vision at night for security and for the extension of activities. (U.S.D.P.)

SUBDIVISION REGULATIONS. Regulations governing the development of raw land for residential or other purposes. (Abrams, 1972)

SUBGRADE. The layer of natural soil or fill (compacted soil) upon which the pavement structure including curbs is constructed. (DePina, 1972)

SUBMAIN or BRANCH SEWER. A collector pipe receiving sewage from lateral sewer only. (U.S.D.P.)

SUBSISTENCE INCOME. The minimum amount of money required for the purchase of food and fuel for an average family to survive. (U.S.D.P.)

SULLAGE. Drainage or refuse especially from a house, farmyard, or street. (Merriam-Webster, 1971)

TAP (also FAUCET). A fixture for drawing a liquid from a pipe, cask, or other vessel. (Merriam-Webster, 1971)

TAX EXEMPTION. A grant by a government of immunity from taxes; (a ten-year tax exemption on new housing in New York stimulated new construction in the 1920's; to ease its housing shortage, Turkey granted a ten-year tax exemption on new buildings). (Abrams, 1966)

TAX INCENTIVE. Favorable tax treatment to induce the beneficiary to do something he would not otherwise be likely to do. (U.S.D.P.)

TAX STRUCTURE - TAXATION. The method by which a nation (state, municipality) implements decisions to transfer resources from the private sector to the public sector. (U.S.D.P.)

TELEPHONE. An electrical voice communication network interconnecting all subscribing individuals and transmitting over wires. (U.S.D.P.)

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.)

TITLE. The instrument (as a deed) that constitutes a legally just cause of exclusive possession (of land, dwellings, or both). (Merriam-Webster, 1971)

TOILET. A fixture for defecation and urination, esp. water closet. (7th Collegiate Webster, 1963)

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)

TRAP. A fitting that provides a water seal to prevent sewer gases and odors being discharged through fixtures. (ROTC ST 45-7, 1953)

TREATMENT WORKS. Filtration plant, reservoirs, and all other construction required for the treatment of a water supply. (ROTC ST 45-7, 1953)

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

URBAN TRANSPORTATION. Means of conveyance of passengers or goods from one place to another along ways, routes of circulation in a metropolitan context. (U.S.D.P.)

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: *VERY LOW (below subsistence level)*: the income group with no household income available for housing, services, or transportation; *LOW (1 x subsistence level)*: the income group that can afford no or very limited subsidized housing; *MODERATE (3 x subsistence level)*: the income group that can afford limited housing and rent only with government assistance; *HIGH (5 x subsistence level)*: the income

group that can afford housing without subsidy, by cash purchase, through mortgage payments, or by rent; *VERY HIGH (10 x subsistence level)*: the income group that represents the most economically mobile sector of the population. (U.S.D.P.)

USUFRUCT. The right to profit from a parcel of land or control of a parcel of land without becoming the owner or formal leasee; legal possession by decree without charge. (U.S.D.P.)

UTILITIES. Include: water supply, sanitary sewerage, storm drainage, electricity, street lighting, gas, telephone. (U.S.D.P.)

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

VALVE. A water supply distribution component which interrupts the supply for maintenance purposes. (U.S.D.P.)

VENT. A pipe opening to the atmosphere, which provides ventilation for a drainage system and prevents trap siphonage or back pressure. (ROTC ST 45-7, 1953)

VIBRATION. A quivering or trembling motion (such as that produced by: heavy traffic, industry, aircraft, etc. (Merriam-Webster, 1971)

VIEWS. 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 water from wash basins, sinks, and similar fixtures. (ROTC ST 45-7, 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)

WATERSHED. The catchment area or drainage basin from which the waters of a stream or stream system are drawn. (Merriam-Webster, 1971)

WATERWORKS. The whole system of reservoirs, channels, mains, and pumping and purifying equipment by which a water supply is obtained and distributed to consumers. (Merriam-Webster, 1971)

WATT. Watts (w) measure the power of the flow of energy through a circuit. Wattage is the product of volts times amperes. Both watts and horsepower denote the rate of work being done. 746w = 1hp. (ROTC ST 45-7, 1953)

ZONING ORDINANCE. The demarcation of a city by ordinance into zones (areas/districts) and the establishment of regulations to govern the use of land and the location, bulk, height, shape, use, population density, and coverage of structures within each zone. (U.S.D.P.)

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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 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
(= 100 centimeters)	3.28 feet
1 kilometer	= 3,280.83 feet or
(= 1,000 meters)	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

All incomes, cost and rent/mortgage data have been expressed in terms of the U.S. equivalent;

1 U.S. Dollar = 8.90 Indian Rupees. (1976)