

**CHAPTER IV**

**MORPHOLOGY AND LANDUSE PATTERN**

## 1. Introduction :

Impressions of growth of any settlement are portrayed in the pattern of land use, structure and morphology. Thus it makes it necessary to study the evolution of the land use pattern, structure and the layout. Transformation takes place on the land over a period of time.

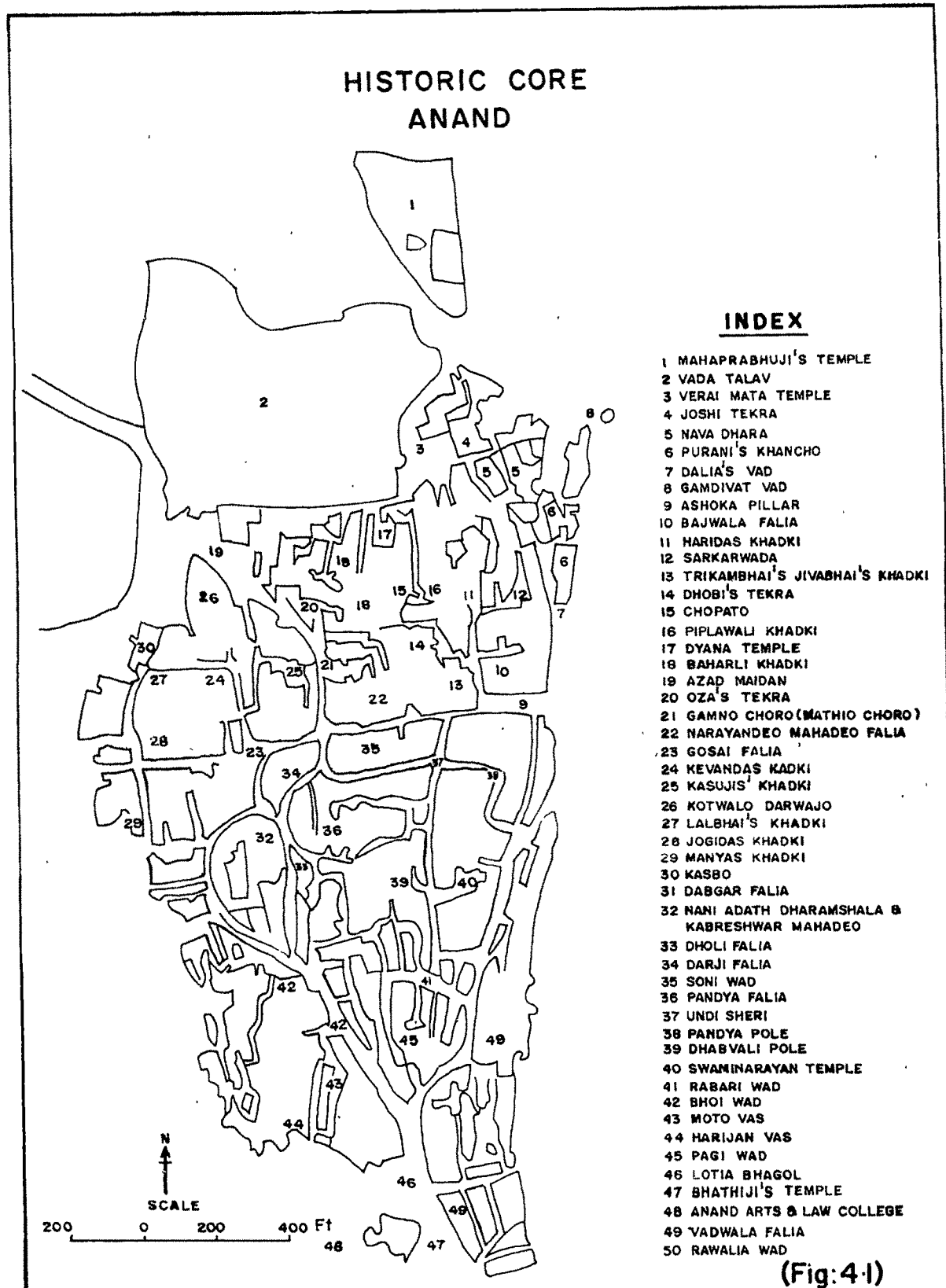
Anand's growth must be dealt in context to the land use pattern, the structure and morphology of the city.

"The land use pattern of any urban area is a reflection not only of the immediate and current space requirements of the community but rather of the cumulative needs over a period of years".\*1

"Any effective planning for future should consider the present pattern of land use and factors responsible for its change".\*2

Anand founded its nucleus in the flat alluvial area of the Charotar region of Kheda district. Which is a featureless plain with no outstanding contours to break the monotonous physiography. The city is situated at a height of about 142 feet above mean sea level and is spread over 21.13 Sq.km.

Minor variations in height occur within the city. The Core or "gamtal" ( Fig :4.1) situated in the Central portion of the municipal limit of the city is at a higher level than Vada talav and Lotia talav area, located in the north and south of it respectively. They provide an outlet for the water of Gamtal area around these tanks. The station area is nearly 7 to 8 feet higher than Gamtal area and the road from the Station to the Gamtal is gently sloping from



East to West direction. The Gamdivat road (Juna rasta ) is nearly 3 feet lower than the Station road area that gets flooded during heavy rains. However, recently due to laying of new drainage lines and widening of the existing lines the problem of drainage of storm water is solved to a considerable extent. The Polson Dairy area is 3 feet higher than Gamdivat road.

The Western and Northern areas of the town, which are still agricultural areas are slightly elevated than Gamtal. The Southern area of the city occupied by the Institution of Agriculture slopes towards Lotia tank. With the advent of Railway communication and the Station to the east of Gamtal, the original nucleus of the city extended towards east for about 1– 6 km. The pockets between Anand – Karamsad – Sojitra road, Anand – Nadiad road, Anand – Samarkha – Bhalej road, as well as Anand – Vidyanagar road and the railway lines, are the most developed areas of the present city. Showing compactness the old construction in the central area are being demolished and replaced by multistoried apartments making it more congested. High rise buildings form ribbon development along the main roads.

## **2. Structural Evolution :**

Anand has witnessed changes in the pattern of growth and spatial organisation i.e. Evolution from a village to a town and finally to a city with a population of 1,31,104 persons to be classed as class I – C. Anandpur was the name of the village in the 14<sup>th</sup> Century settled by a Gosai named Anandgir. The Gosai community resided in Gamtal prior to the settlement of patidars (Patel community who were basically farmers). In course of time, the patidars

bought up the land from the Gosai's and settled in the Gamtal area. The Gosai street, Mathia chora and Bavano math in Nana adath of Gamtal bear proof that the Gosai's once occupied the area.

In the north of Gamtal, a garden known as Hnumanji's wadi was the burial ground of the Gosai's. Anandpur slowly changed its name to Anand over a period of time. Nearly, a century ago, it was a village of about 8000 souls entirely depending on agriculture and livestock grazing with their farms surrounding the Gamtal where they resided. The extension of the village towards the eastern side followed the construction of the railway line and the Station in 1941 – 51.\*3

The eastern and western parts of the Gamtal are the two parts, one, which settled by the younger Gosai brother came to be known as Nano adath (Nano – small, adath – half) while that in the west, settled by the elder brother came to be known as Mota – adath (Mota – elder, adath – half). The road which passes through tower to Bethak temple via. Mathia chora, Masjid and Vada talav divides these two Adaths viz – Nano and Mota adath of the Gamtal.

Anand village was confined to the Gamtal area till the middle of the 19<sup>th</sup> Century. It was surrounded by Vada talav on the north, Lotia bhagol to the south, Gamdivat vad and Govind dalia vad on the east and the present Anand – Samarkha – Bhalej road to its west.

It was in the later part of the 19<sup>th</sup> Century that the railway line was opened and Anand station was established just 1 mile in the east of Gamtal. The mamlatdar office, police station and court were established in 1869 near the present railway station. With the establishment of

municipality in 1889, Anand Municipal General hospital was established after 13 years i.e. in 1902.

The Christian missionaries came to settle and established another hospital named Emery hospital in 1903 and the I.P.Mission hospital was also established along with the Emery hospital. These occupied, one by one, large plots near the station and mamlatdar office.

In 1914 the Charotar education society was founded to look after the educational activities of the city and surrounding region by establishing numerous schools and colleges and institutes.

The development of Bank road which was earlier a dirty and dusty road without any development, took place in 1951. This road was densely covered by trees and surrounded by fields. The station road was constructed in 1935 by acquiring some fields, by the municipality.

The Polson model dairy constructed in 1929, started functioning in 1930 to produce butter and other milk products for the British army. It was located west of the railway station near the age-old Burmah Shell Company's storage.

It was only after 1930 that the city developed rapidly. The Sharda high school and Pioneer high school on the station road and Gamdivat road respectively started in 1930 and 1937. Later the Institute of Agriculture was started in the year 1940 in the southeastern portion of the city.

The present development is rapid mostly along the Amul dairy road, Polson dairy road, Juna rasta, Anand – Samarkha – Bhalej road, Anand – Sojitra road, Anand – Vidyanagar road and Anand – Nadiad road via Acme garage, due to the development of many new residential complexes and cooperative housing societies. The overall growth and development of Anand is much more rapid than any other town or city of Kheda district.\*4

### **3. Functional Morphology :**

Anand can be divided into six major distinct units of uses for functions –

- (i) Residential.
- (ii) Trade and Commerce.
- (iii) Industrial.
- (iv) Educational.
- (v) Public service or administrative.
- (vi) Agricultural.

#### **Residential units :**

The oldest residential area “Gamtal” (Core) is the city centre demarcated as ward VIII (Fig : 4.1). The density of population is about 65375 persons per Sq.km. While the southern part of Anand i.e. ward XIV has the minimum population density of 1481 persons per Sq.km. The core is a very congested, lacking in open grounds, parks etc making it extremely gloomy and unhygienic.

The residential new extensions are coming up along Vidyanagar road, Sojitra road and Samarkha – Bhalej roads in the west, southwest and northern parts of Anand respectively. The core continues with its age old traditional houses with some new apartments along some important streets. While comparatively better constructions and bungalows line up on Anand-Nadiad road connected to N.H. 8.

With the development of industries and educational institutions in the city, a large number of cooperative housing societies have come up and new residential areas are growing mainly in wards XII and XIII, thus occupying the Agricultural waste and Scrub lands in the fringe. Presently there are 143 cooperative housing societies and colonies in the city, and many more are under construction and few are unoccupied.

About 83% of these societies have proper drainage, light and water facilities, along with streets connecting them to the important roads of the city and the region. However, with the influx of labourers and unemployed youth of the surrounding regions temporary huts and slums have mushroomed in the city.

The Gamtal area (Fig : 4.1), shows that the high caste people like Patel, Pandya, Joshi etc occupy the central part of the core while people of lower caste like Khumbhar, Chamar, Mochi, Bhoi, Harijans, Ravalia occupy the outskirts of the core. This is a common feature of most of the Indian towns and cities.

The houses in the core are close to each other, with 4 rooms on the ground floor used mainly as Kitchen, Store room, for Cattle (Gaman), Lavatory etc. While the first floor is used



as living room or as storage for agricultural products like tobacco, sundhiyu (Cattle feed) and fuel in the form of wood or cow – dung cakes.

Settlement type and pattern :

The charotar region of Kheda district is a very densely populated region of Gujarat with number of villages and hamlets found within 10 to 15 km of range from Anand municipal limits. The main occupation of these people being agriculture they have settled permanently. Anand therefore is an important urban centre for marketing the produce of these villages due to its better connectivity and adequate transport facilities.

Houses and buildings :

According to 1991 data analysis and compilation, residential and mixed complexes cover an area of 11.1 Sq.km. (52.53%) of the total municipal area (21.13 Sq.km.).

The total population of 1,31,104 people of the city lives in 19956 houses (1991) some of which are also used for other purposes like commercial and administrative. But the houses and buildings of wards VIII, IX, X are used only for residential purposes because they occupy the core and some area adjacent to core in its northern portions.

The core area has poor ventilated, compact, non-uniform, poorly built houses. There are houses built out of bamboos, tin roofs and thatched roofs also in the core area; as well as in

the periphery amidst newly constructed multistoried buildings. The houses along the station road, Sardarganj, Juna rasta and Amul dairy road have adequate sanitary facilities. However with the increasing number of multistoried and increasing use of water has led to drainage problems in some of the areas in the core. The cooperative housing societies are individual bungalows with much better space for kitchen garden and display fine architectural works. They have all the facilities of modern structure – bathroom, kitchen, garage, garden, fencing or wall, porch and backyards etc.

The businessmen, merchants, industrialists, officers, doctors, engineers, advocates, professors and the rich people (mostly NRIs) stay in these posh areas which fall in wards XI, II, XII and some portions of wards I & XIV. The houses and buildings along the station road, Juna rasta, Bank road, Tower Bazaar etc have their ground floors partially or fully used as shops and first, second floors are used for residential and office purpose

#### Trading and commercial units :

Since Anand is a chief marketing and shopping centre for the surrounding areas, commercial activities are mainly carried out between the railway station and the core i.e. along the station road, Sardarganj grain market road, Bank road, Tower Bazaar, Juna rasta and even the Amul dairy road.

Majority of the shops and offices are located on the station road and the Amul dairy road. The vegetable market near the station road, restaurants, teashops and hawkers for fruits and other commodities make the area very busy and over crowded.

The road from Godigate to Municipal hospital is lined with lodges, medical stores, shops of watch repairers, cutlery, tea depots, departmental stores etc. Shops vary from automobiles and spare parts, hardware, electric goods, mattress shop, cloth store, grain shop, saloons and parlours, STD and Xerox, printing press etc can be seen between the municipal hospital and Gamdivat vad place.

The shopping area situated around, the Sardar patel tower is known as Tower Bazaar. Meat shops are situated along the streets of Chamarwada near the Polson dairy. There are about 10 – 15 lemon shops all at one place i.e. Lotia bhagol. Apart from these shops and markets, shops like paan-bidi, grain shops, chavana marts, cutlery, cloth stores, washing companies, book – stalls, etc. are found throughout the city, mainly at the meeting points of the streets.

#### The shopping units of station area :

Due to lack of space, multistoried buildings are constructed for the use of offices, shops and residences along the station road.

The Sardarganj grain market – This is located at the south end of Sardarganj road, fully equipped and newly constructed after 1960. There are 70 shops, which are uniformly wide

and constructed after planning. Majority of these shops is 40 feet in length and there is an open space between every third or fourth shop. The central open space is used for parking and transaction of goods. Trucks, tempo, three wheeler (Chakkda), camel and bullock carts are commonly seen here. There are 37 wholesale merchants in the market with substantial investments in wholesale trade. This market is the biggest one not only at taluka or district level but also for the whole region beyond even Kheda district. Rapid development of this market is the outcome of quick and frequent transport facilities available here.

#### Industrial units :

Industries are scattered on all important roads of Anand. Amul dairy on the Amul dairy road, west of Anand-Khambhat railway line, occupies a large area besides the factory for its offices, a canteen, garden and parking space. The Polson Model Dairy is located near the railway station on Polson road opposite the old Burmah shell company. It has a well-maintained garden, quarters and parking facilities. Both these dairies are easily accessible. The tobacco factories (Khalis) are mainly situated on the outskirts of the city near the tobacco farms. There are soap factories also, located along the Bank road. Other industrial units mainly comprise of engineering works, steel furniture, tile factory, ice factory, Agarbatti (essence stick) works and other are situated on the station road and Juna rasta along with other shops and offices. All these small scale-manufacturing units should be shifted

away from the residential and commercial areas of the city and located at a suitable place where they can flourish and expand.

Educational units :

The educational institutions occupy a large area in the city (2.64 Sq.km) i.e. 12.49% of the total area of the city which is much more than that occupied by commercial (0.24 Sq.km) and industrial (1.71 Sq.km) units. Out of this 2.44 Sq.km area is occupied by Gujarat Agriculture University situated in the southeast.

The Anand Arts College and The Law College are situated at Lotia bhagol. The Science College is behind Dadabhai Navroji High school and Motibhai Amin Adyapak mandir. The Kasturba Kanya Vidyalaya, Sharda high School, Sharda English Teaching high school are situated on station road, just opposite to each other near UCO Bank and the municipal office building, thus having a central location in the city.

Pioneer High School is located on the road where it meets Juna rasta, opposite to Sharda High School. The Anand High School is at Lotia bhagol while Sardar Patel Agriculture school is located at the Institute of Agriculture.

Public service and Administrative units :

The Anand municipal office is along the Station road in the central part of the town opposite to Bank of Baroda and the Mathio chora in the core. The railway station, the state transport bus terminal, P.W.D. Office, pathikashram – Rest house, General post office, T.D.O. Office, educational committee office, Emery hospital, I.P. Mission hospital etc are all situated at the railway station area.

Most of the banks, shroffs and financiers, municipal hospital garden, Gopal talkies, Arya samaj, Ramji Temple etc are located on the station road. Dena bank and Swastik talkies are situated on Bank road while the civil court, Laxmi talkies, Anand telephone exchange office and Kalpana talkies are situated on Juna rasta. The Mahi Canal Office is along the Anand – Karamsad – Sojitra road near Swastik factory in the southwest of the city. Religious institutions like temples, maths, churches, sangh, masjids and madarsas are spread over the city.

Roads of Anand :

A large population in a nucleated settlement usually attracts transport and other services which gradually enables the settlement to grow into a town serving the surrounding regions.

The station road i.e. Gandhi road, Juna rasta, Amul – dairy road, Anand – Samarkha – Bhalej – Vidyanagar and Anand – Karamsad – Sojitra road are the more important roads of the city with an average width of 20 to 40 feet are double track roads.

The National highway No. 8 touches the city to its extreme northeast. However the roads in the city core are very narrow with an average width of 10 to 15 feet (plate.15). They are crooked, irregular in width and sometimes end as blind lanes, making it difficult for the big vehicles and even pedestrians to pass through them. The small paths of the cropped area of the city are again narrow and used only by carts, and is less serving the city traffic.

The total length of the municipal roads in 1971 was only 22.33 km which increased to 115.90 by 1991 (i.e. by 5 times ). More than 80% of the municipal roads are surfaced roads. Out of which 2.0 km. (4.1%) road have cement surface and rest (75.9%) of the surfaced road is black tar, motorable road. The Station road from Godi (railway godown) to Gamdivat place is cemented. While 55.63 km. road is still unmetalled. With the development and growth of the city and as a result of the various town planning schemes by the municipality and urban development authority, the percentage to pucca roads increased from 21.96 in 1981 to 52% in 1991 while there was a decrease in the percentage of unmetalled roads from 78.03% in 1981 to 47.99% in 1991.

Apart from the municipal roads, there are three asphalt roads (with 15 feet width black tar surface ), owned by the Jilla panchayat, Kheda district. The length of these roads is 3.2 km. (Fig : 4.2).





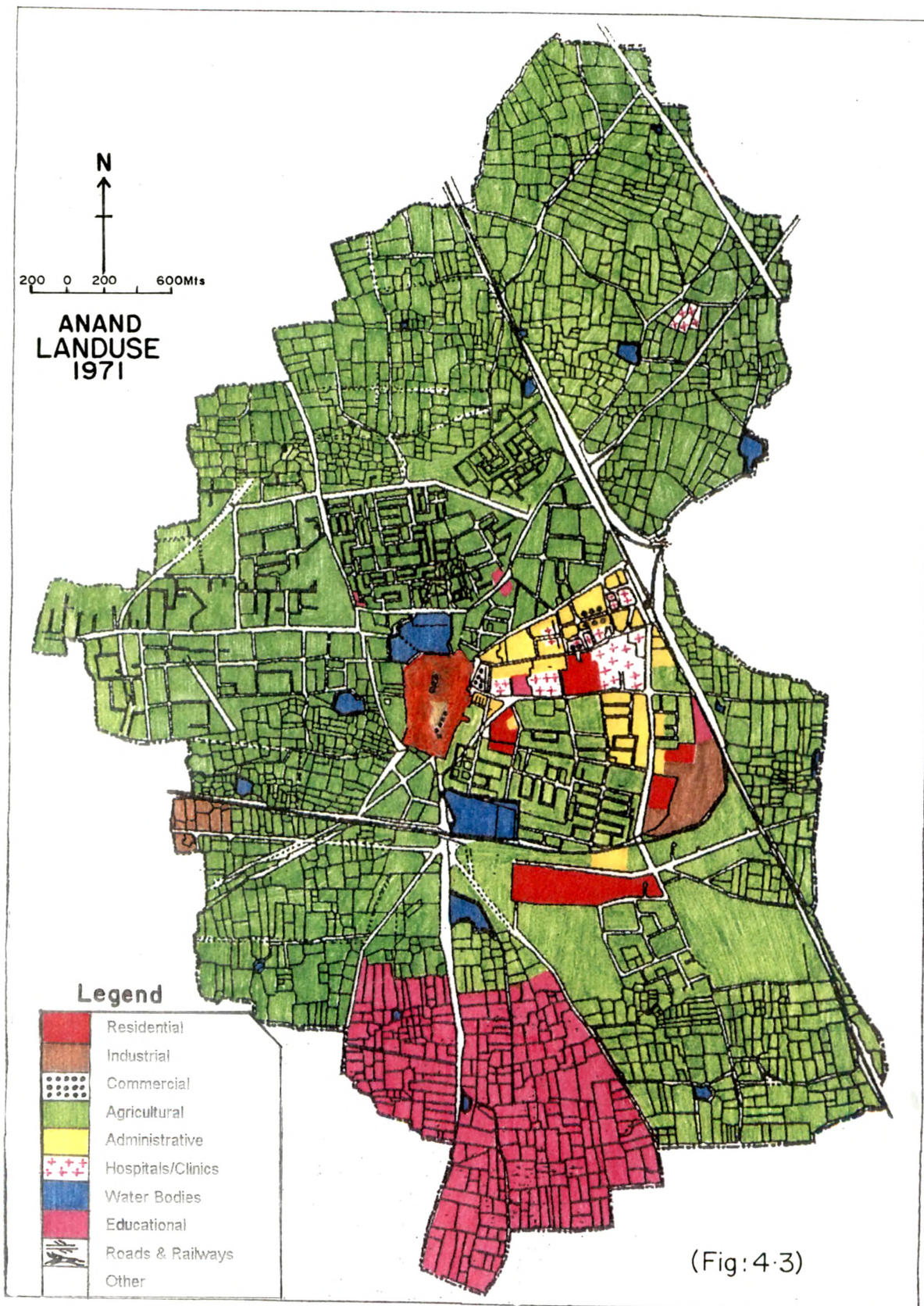
#### Agricultural areas :

It was until 1971 that the agricultural area dominated in the land use categories of Anand with 13.42 Sq.km. area (63.51%). However during the decade 1971-81 more and more people came and settled at Anand, due to industrial development. There was a drastic change in the land use with area occupied by agriculture declining to 6.501 Sq.km. (30.7%) in 1981 giving away land for industrial, commercial and residential purposes. However even today the northwestern, eastern and southern parts of the city are cultivated (Fig : 4.5) which accounts to a total area of 2.080 Sq.km. (9.84%) in 1991. The Goradu, sandy loam soil is rich in productivity, produces bajri, rice, kodra, jowar, lemon, tobacco, pulses and vegetables etc. These are the main crops grown here and in some parts double cropping is done where there is adequate supply of water.

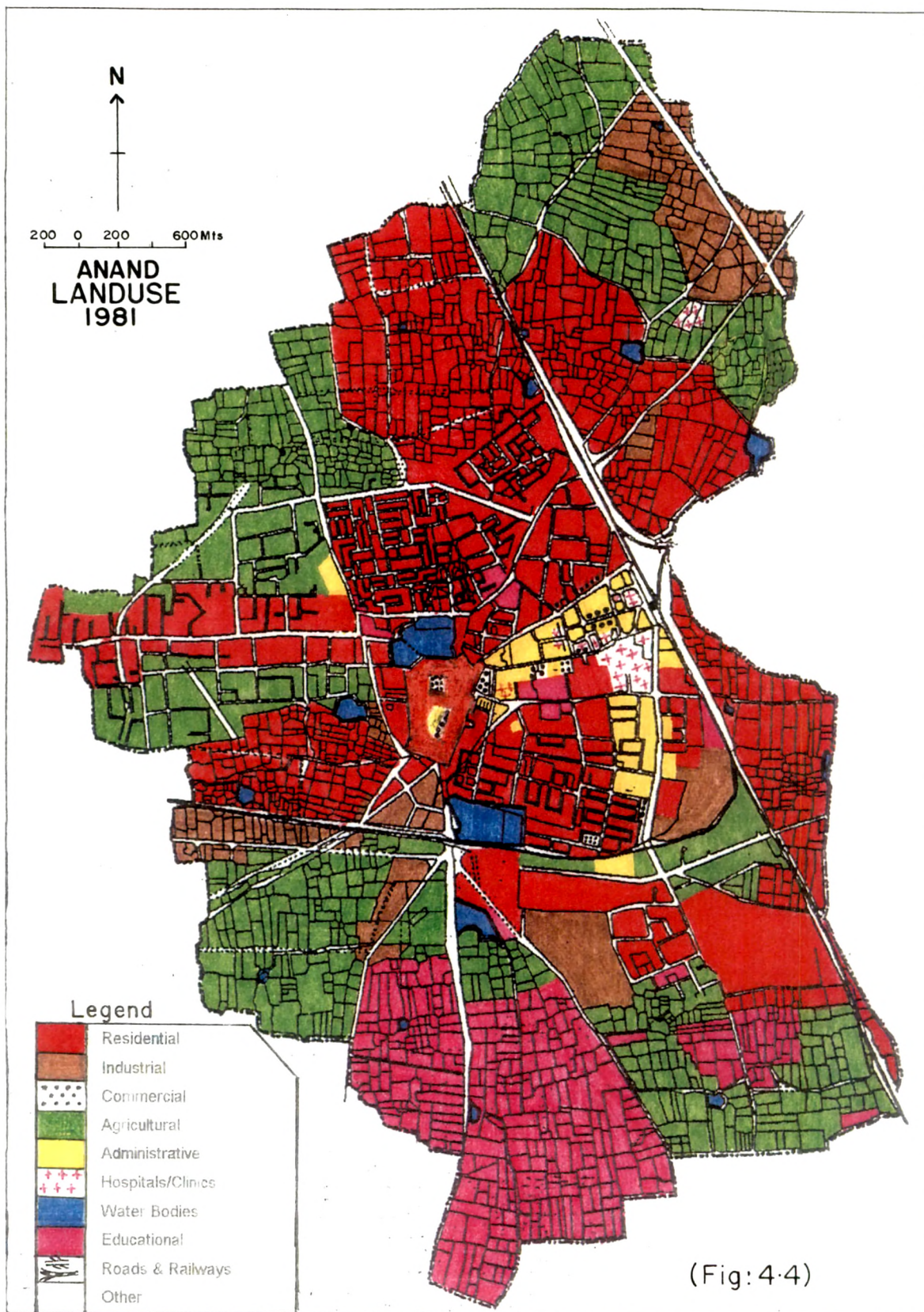
#### **4. Urban Land use :**

According to the municipal authorities, Anand covers an area of 21.13 Sq.km. which is under different uses (Table: 2.1) (Fig: 4.3,4.4,4.5).

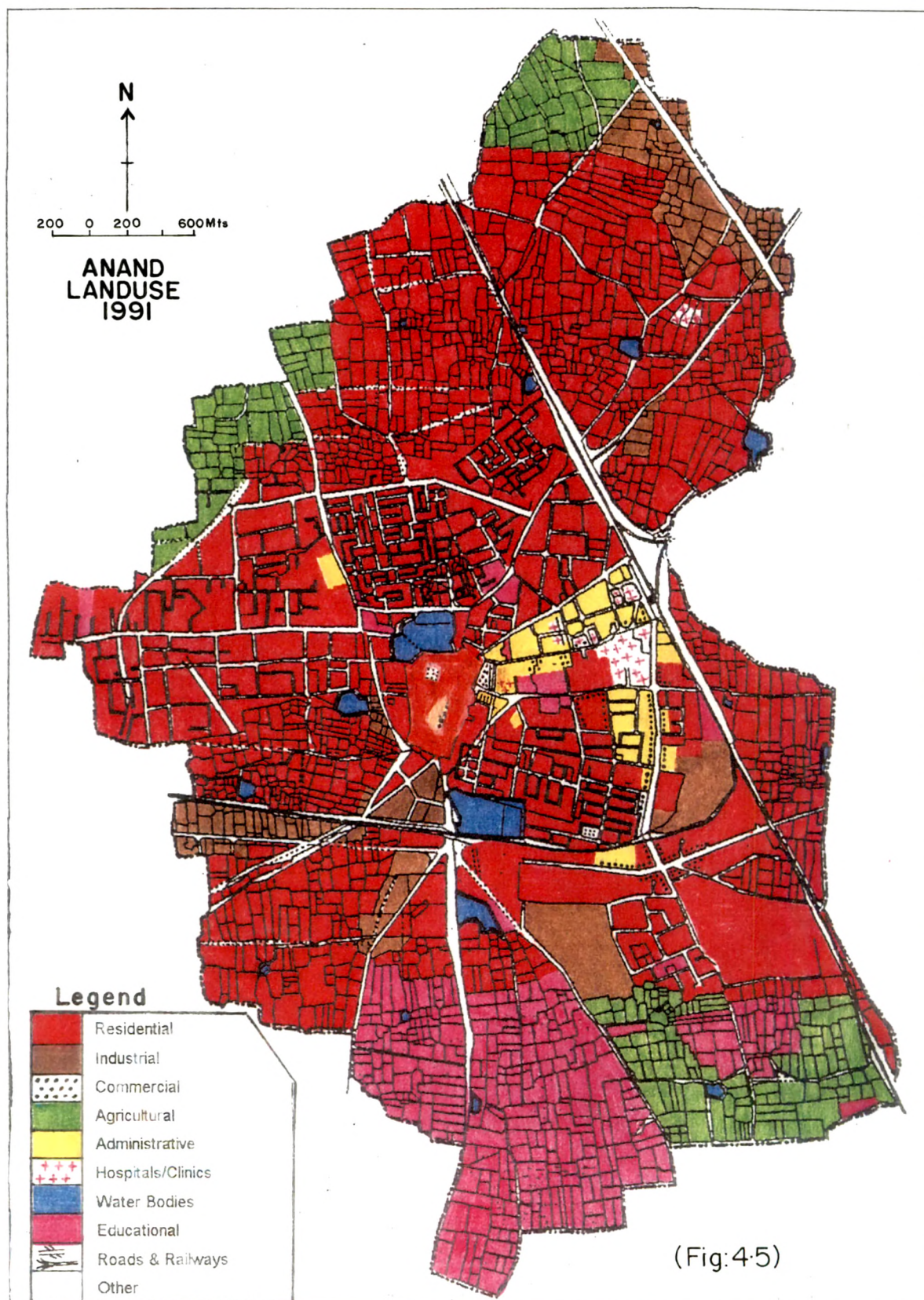
The 1991 report of the municipality shows that the maximum area presently is under residential use as is normal with all settlements (11.1 Sq.km) followed by educational establishments (2.64 Sq.km). While a 2.0 Sq.km area is devoted to agricultural purposes. It is











worth mentioning here that in 1961, about 13.64 Sq.km of land was under agricultural purposes and only 0.4535 Sq.km. area was residential.

This land transformation over a period of three decades 1961 – 1991 from agriculture to residential and to some extent also to industrial and commercial suggesting the process of urbanization and urban character (Fig : 4.7 ).

The land under agriculture is mainly used for crops like bajra, rice, kodra, tobacco, lemon and vegetable. This falls to the north, northwest and southeast portion of Anand.

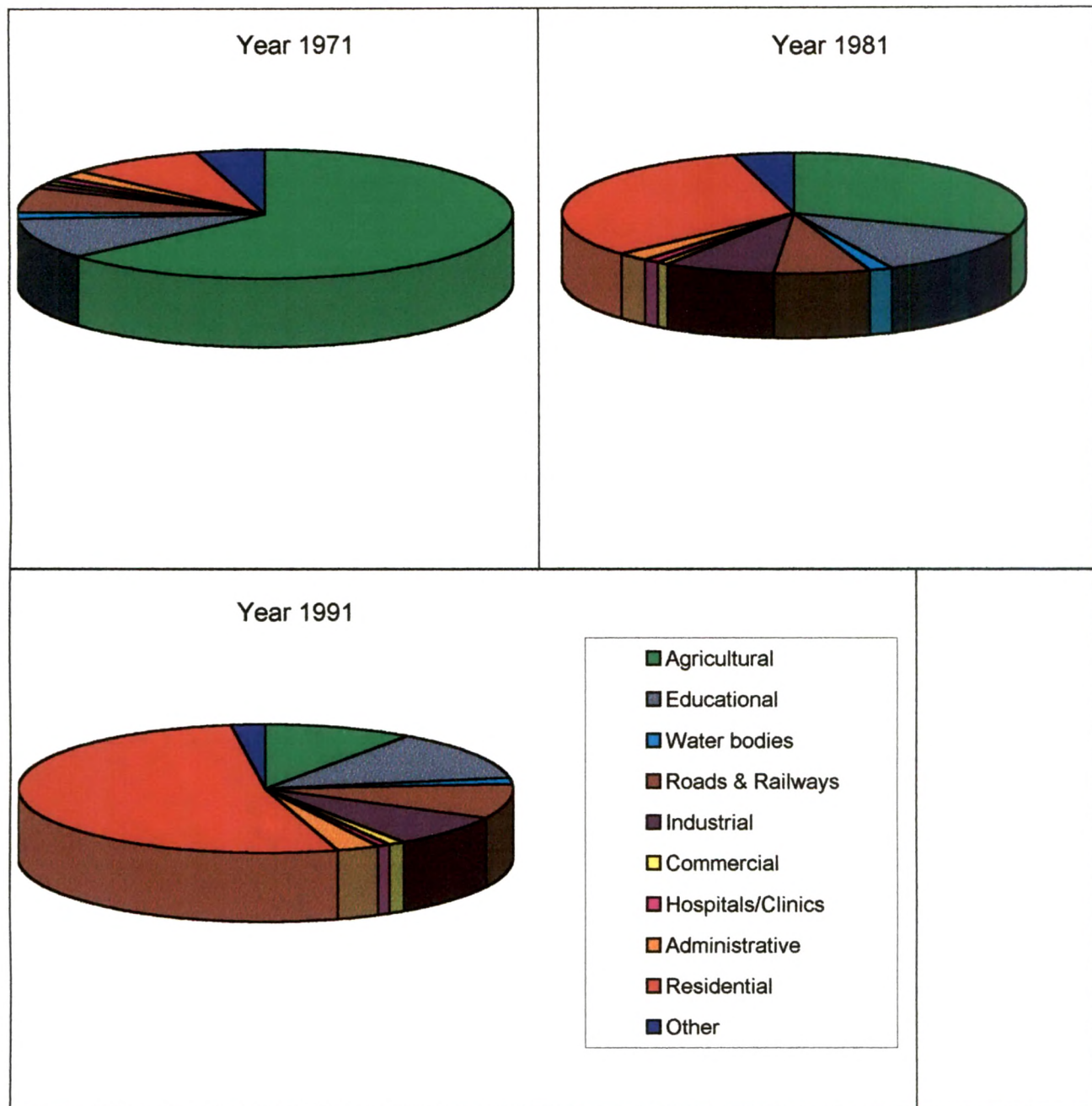
The institutional uses cover a large area. The Institute of Agriculture and horticulture occupies about 2.44 Sq.km. of the area in the southeastern part of the city while other educational units which comprises schools and colleges occupy about 0.13 Sq.km (3.73%) of the total area used for educational purpose.

The undeveloped area excluding that of Institute of agriculture occupies 0.48 Sq.km. of the total municipal area. While roads and railways together occupy 1.7680 Sq.km. i.e. 8.36% of the total area of Anand.

The commercial activities which occupied only 0.1538 Sq.km.( 0.72 %) in 1961 has grown to occupy 0.2476 Sq.km. (1.71%) in 1991. Public buildings and other administrative units occupy 0.550 Sq.km of the total area of Anand. Industrially occupied area has grown from 0.1741 Sq.km. in 1961 to 1.71 Sq.km in 1991.(Fig : 4.6)

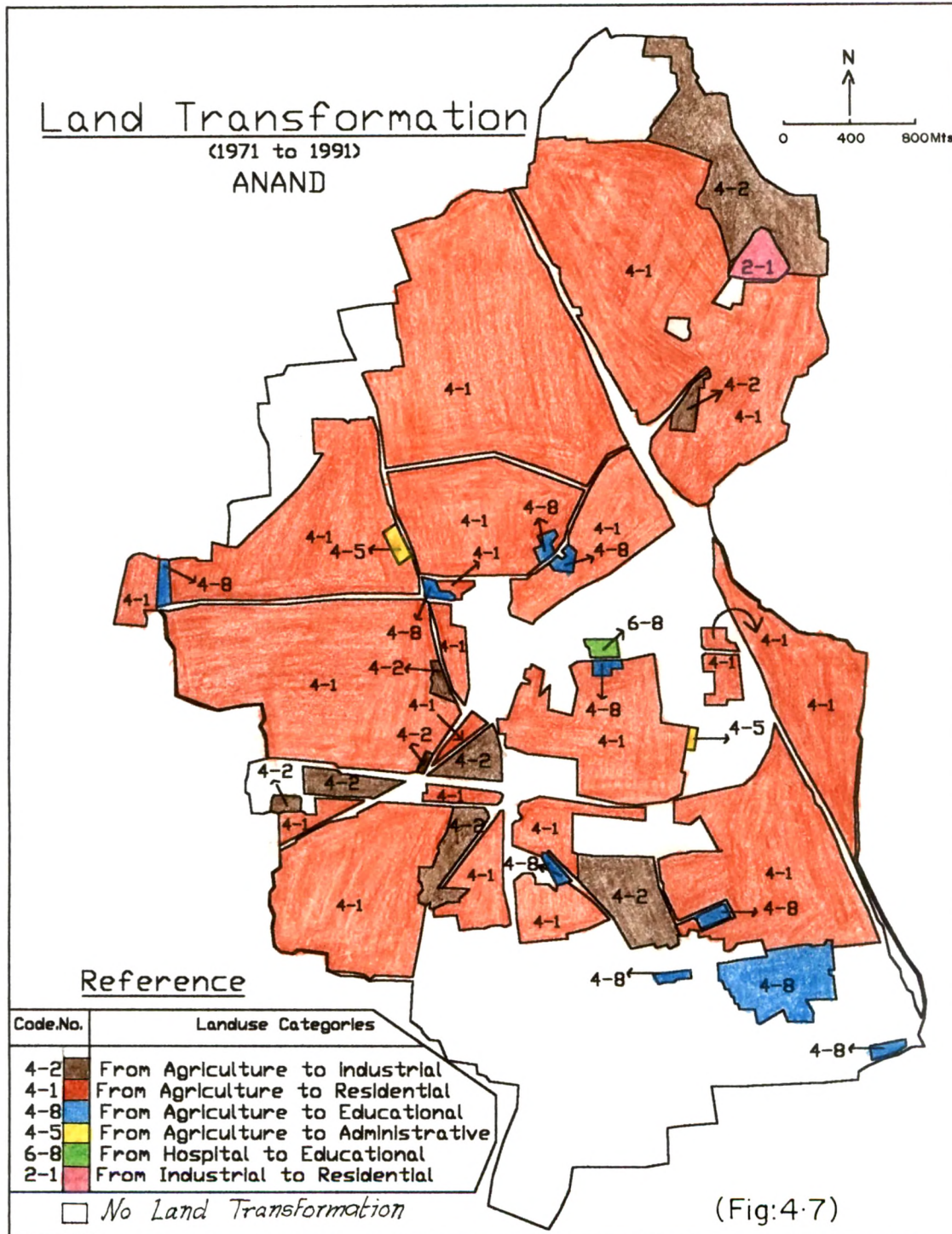
Thus, a major change in land use has taken place by transforming rich agricultural land to residential, industrial and commercial uses from 1971 to 1991 (Fig : 4.7) The invasion of

### Changes in Landuse - Anand



(Fig:4-6)





agricultural land by buildings or concrete structure, is a proof to the rapidly growing population and the expansion of the settlement.

**Table : 2.1**

| Land use           | Area in Sq.km. |         |        |        |
|--------------------|----------------|---------|--------|--------|
|                    | 1961           | 1971    | 1981   | 1991   |
| Residential        | 0.4535         | 1.8710  | 6.8775 | 11.100 |
| Industrial         | 0.1741         | 0.2200  | 1.6520 | 1.7100 |
| Commercial         | 0.1538         | 0.1538  | 0.1834 | 0.2476 |
| Agricultural       | 13.6466        | 13.4228 | 6.5010 | 2.0800 |
| Administrative     | 0.3077         | 0.4150  | 0.4880 | 0.5500 |
| Hospitals/Clinics  | 0.2040         | 0.2440  | 0.2030 | 0.2000 |
| Water Bodies       | 0.3500         | 0.3500  | 0.3500 | 0.3500 |
| Educational        | 3.5756         | 2.1890  | 2.6200 | 2.6400 |
| Roads and Railways | 1.3201         | 1.3201  | 1.4010 | 1.7680 |
| Other              | 0.9443         | 0.9443  | 0.8634 | 0.4844 |
| Total              |                |         |        | 21.13  |

### **5. Urban Sprawl :**

Urban and regional planning is possible only with continuous acquisition of data to formulate governmental policies and programmes. Remote sensing and GIS techniques are commonly used for compilation of urban land use maps and to monitor the new extension in the form of urban sprawl.

Though remote sensing techniques and the use of aerial photography is recently adopted in the developing countries, it has been an indispensable tool for urban planning for more than 35 years. Today with the availability of high-resolution data from more advanced remote sensing satellites, aerial photographs and other maps, new areas of applications have opened up gradually replacing the use of toposheets and aerial photographs.



Urban sprawl is the total spread of an urban area. It is defined as a continuous growth of built-up of a well-defined urban area. The urban sprawl area delimited does not necessarily coincide with the jurisdictional limits (like municipal limit) but may fall beyond or may fall short of it following the criteria of contiguous built-up area.

However, in some cases while framing the limit of urban sprawl the non-built up areas falling in between are also included within the urban sprawl.

The present study of urban sprawl was undertaken with the objective of preparing urban sprawl map showing growth of urban area for different time periods (1952-1998) through satellite imageries and the images obtained by scanning toposheets, maps and Aerial photographs.

#### The study area as viewed by the satellite :

The study area includes Anand municipality limits (1991). Anand, the taluka headquarters of Anand taluka of the Kheda district and the milk capital of India is a fast growing million plus city with a population of 1,31,104 persons as per 1991 census. The city has recorded 56.19% increase in its population during the last decade resulting in rapid expansion in its urban sprawl and changes in land use.

The geographical extent of Anand ranges between the latitudes 22°31'25" N and 22°35'27" N and the longitudes 72°56'55" E and 72°59'16" E, covering the municipal area of 21.13 Sq.km. About one third of the municipal area is under urban use and the remaining

three-fourth is under other uses. The built up area has an average density of 5218 persons per Sq.km.

The study area falls under the west coastal region with a flat topography, with fertile alluvial deposits of the west flowing rivers viz, Mahi and Shedhi. On account of meandering, the changes of its course along the eastern border of kheda district are clearly visible on the False Colour Composite and imageries. The area is well connected to different parts of the country by railway and roads.

#### Methodology :

The source material used for the urban sprawl map generation comprises of two types :

( i ) Remote sensing data and ( ii ) collateral information data.

#### Data products used :

- Survey of India Topo map, Scale 1 : 63,360 – 1952, 46 B/4.
- Census atlas, government of India Scale, 1 : 50,000 – 1971.
- Survey of India Topo map, Scale 1 : 50,000 – 1974, 46 B/4.
- Census atlas, government of India Scale, 1 : 50,000 – 1981.
- Geocoded IRS – 1 B imagery on 1 : 50,000 Scale, 1992.

### Image processing and GIS technique :

Visual image interpretation techniques have been used for this study. Various maps of different time period were brought to the same scale and layers were created using GIS Software and image analyst. The super imposition of these layers gave the final zones of urban sprawl from time to time which were delineated and hatched with shades in order to finally get a complete urban sprawl map during the period from 1952 to 1998.

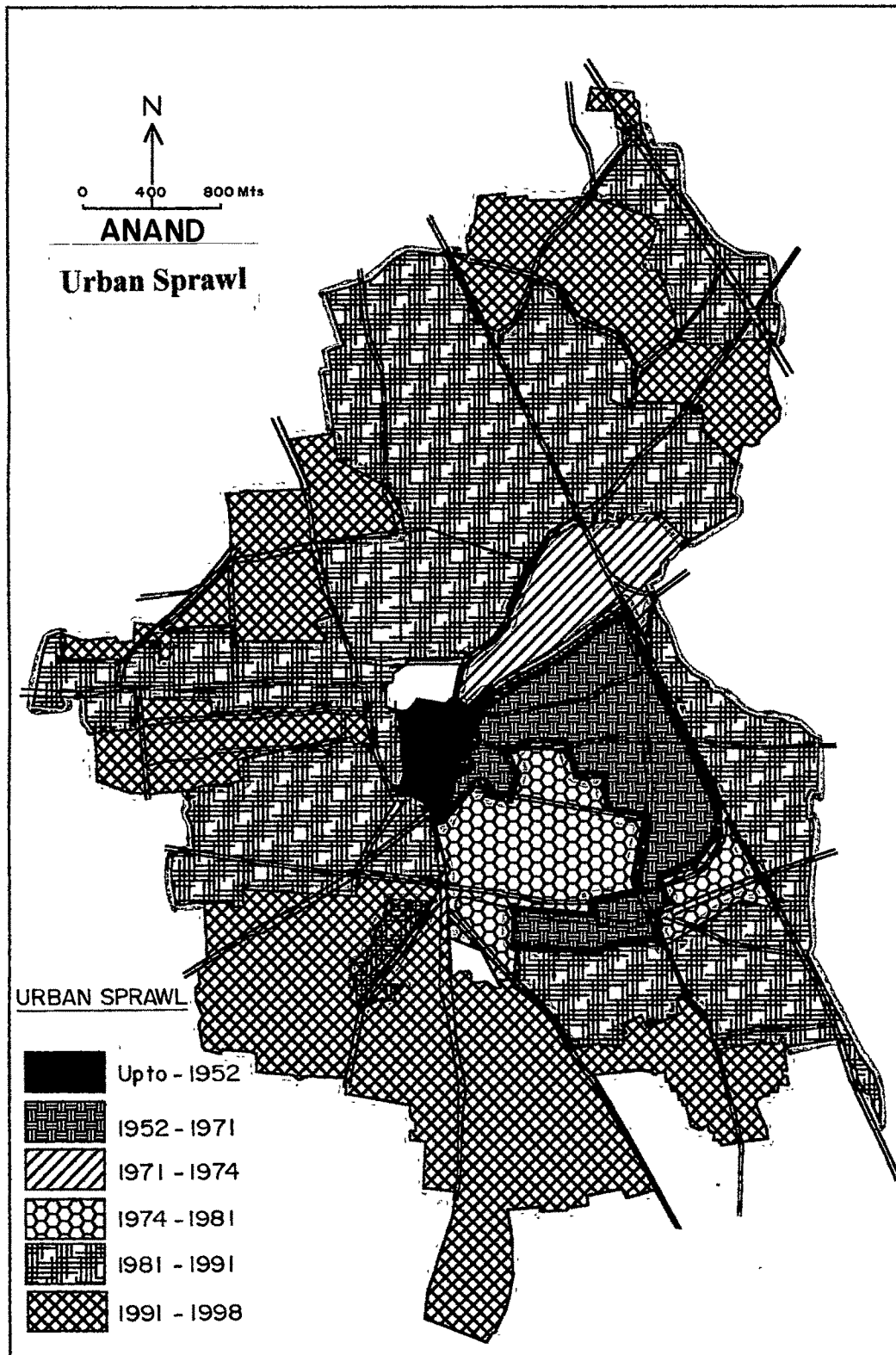
### Urban Sprawl from 1952 to 1998 :

The urban sprawl map (Fig : 4.8) shows the spread of built-up area of Anand as delineated from satellite data of different time period along with images obtained after scanning toposheets, aerial photographs and other maps obtained from census atlas.

The built-up area has increased 11 times during the past 46 years (Table:2.2).

**Table 2.2. Urban Sprawl.**

| Sr.No. | Year | Area in Sq.km. | Percentage increase | Average annual percentage growth in area. |
|--------|------|----------------|---------------------|---|
| 1      | 1952 | 0.1304         | -                   | -   |
| 2      | 1971 | 1.1457         | 778.6               | 4097                                      |
| 3      | 1974 | 1.5597         | 36.13               | 9.03                                      |
| 4      | 1981 | 2.3141         | 48.36               | 6.90                                      |
| 5      | 1991 | 8.0691         | 248.69              | 24.86                                     |
| 6      | 1998 | 12.5611        | 55.66               | 6.95                                      |



(Fig:4.8)

The city as demarcated, from the maps of 1952 was spread over an area of 0.1304 Sq.km. The built-up area increased by 778.6 % during 1952-71 and by 248.69 % during 1981-91. Thus, the city has experienced rapid growth especially during the last two decades. While immigration of people from outside to the city has perhaps been the strong reason, the activities of development authorities and urban housing boards in providing housing facility has also contributed significantly in the increase of urban sprawl.

However, the influence of increasing congestion and prices in the city core leading to the demand of housing in the fringe areas, are also responsible for the increase of urban sprawl. The railway line has been an obstacle to the growth or spread of the settlement towards the southeast and east.

#### Conclusion :

The satellite data and GIS technique helped significantly in demarcating the urban spread. The use of different imageries and maps for different time periods made it possible to monitor the urban growth and changes in land use.

The analysis has revealed that the city has been growing at a faster rate especially during the last couple of decades. Most of the growth has been along the major transport routes towards Northeast, West and Southwest directions.

**6. Reference:**

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