



Sustainable Cities: emerging environmental issues of Bathinda, Punjab, India

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Abstract

Urbanisation is functionally related to industrialisation. Essentially, these two form the basis of development by accelerating its pace through infrastructure growth and influx of population from the surrounding regions. All these modify the land use pattern of a city by changing its morphology. Naturally, the quality of local environment deteriorates with increasing pollution in all aspects - land, water, air and noise. The case of the city of Bathinda in Punjab is no exception. It is a fast growing industrial town but is far from being a sustainable one. For the past couple of years, it has been regularly highlighted in the print media for a number of issues relating to pollution, waste management, water supply, drainage and sewerage system, storm water flooding, water deficiency, road accidents, and so on. The present paper makes an effort to investigate in detail and to account for the steadily deteriorating city life of Bathinda.

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Introduction

Cities are the engines of economic development fundamentally based on the level of urbanization due to industrial growth and expansion. The urban functions are essentially related with the employment potential that together affect the quality of city environment and life. Being the growth centers, cities cause both an increased consumption of natural resources and an immense generation of wastes that directly affect the physiographic, geological and hydrological environment of not only the city itself, but also across the region as a whole. Thus, sustainability of cities becomes a major issue at a Global level. An estimated 20 - 50% of solid waste generated remains uncollected in the developing countries and almost 80% of the incidence of diseases is directly related to unsafe water and poor sanitation.

In India, urban population has grown more than eight fold during the last 100 years and according to Census 2011, Punjab is now among the most urbanized states in India having more than 35% of the population living in urban areas. In case of Bathinda, which is one of the major growing cities of Malwa after Ludhiana and Patiala (Fig.1), development began with the commissioning of the thermal power plant in 1974. A fertilizer plant of the public sector which came up here later put the town on the industrial map of India.

Objectives

The major objectives of the present article are to investigate the relation between urbanization and environment, to address the issues that adversely affect the sustainability of the city, and to give recommendations in order to mitigate the risk

factors in the city.

Database and Methodology

The main data base has been taken by the secondary data of Census of India, Primary Census Abstract, City Development Plan and District Census Handbook. Primary data collected through field survey has been used for analysis of the City's profile. Simple indices have been used to analyze the data.

Urban Growth

As a whole, population of urban areas in the state of Punjab is growing rapidly (Table 1). Urban population has almost doubled during 1981 - 2001. Compared to the growth rate of rural population, that of urban population was much higher during the last couple of decades. During 1991 - 2001, growth rate of urban population was more than thrice that of rural population.

Similarly, being one of the industrial towns of Punjab, the city of Bhatinda has been growing quite fast. The magnitude of urban growth was 31,679 during 1981 - 91 and 58,214 during 1991 - 2001 respectively (Table - 2). Naturally, growth rate was much higher during 1991- 2001 than 1981 - 1991.

Urbanization – Environment Linkage

With the advent of science and technology, heavy industrialisation and growth of the service sector resulted in large scale urbanization, that eventually set the pace for acute environmental stress. The greatest attention at international level UNCED (United Nations Conference on Environment and Development, Rio de Janeiro, 1992) has been paid to issues of managing the urban environment linkages which includes aspects like polluted air, filthy water, noise pollution, ecological imbalance and inadequate sanitation. Some national environmental groups have become active in saving endangered species due to ecological imbalance, but give little attention to the acute public health hazards and problems of environmental pollution facing their own citizens (Hardoy and Satterthwaite, 1989).

The burgeoning city of Bathinda in Punjab is also reeling under acute environmental crisis. Large numbers of people have been attracted to the city from all over India because of industrialization

and the availability of jobs in the tertiary and quaternary sector. The sheer magnitude of population growth due to industrialization acts as an important variable affecting urban environmental problems because it directly affects the spatial concentration of people, industry, commerce, vehicles, energy consumption, water use, waste generation, and other environmental stresses (Bartone, Bernstein, and Leitmann, 1992). Normally, the larger the city, the greater is the per capita environmental costs or damages. In the context of Bathinda also, the relationship between city size and environmental damage is well defined (Fig. 2).

The extent of pollution in the city is increasing each passing day and monitoring stations are rare or non-existent. The solid waste management system is lacking. The water of the city is highly contaminated by the discharge of untreated industrial wastes, leaching of liquids from industrial or municipal waste; inadequate treatment of municipal sewage and flushing of hazardous and toxic materials into water courses. Some parts of the city also suffer from large open sewers with organic wastes coming down from industries, drains laden with chemicals (nitrogen and phosphorus), pathogens, sediment, and pesticide residues from the sewers and urban runoff which together rapidly deplete the magnitude of dissolved oxygen in the water. Besides, sanitation is a major problem affecting the water quality.

As the city becomes more densely populated, the volume of waste water generated per household exceeds the infiltration capacity of local soils and requires greater drainage capacity and the introduction of sewer systems in all parts of city. Though the Municipal Corporation provides the necessary sanitation system, these are of conventional type and due to their poor coverage, only a small proportion of the civic population is served. Due to the heavy pressure of population, the problem of transportation and traffic congestion also becomes a daily phenomenon with the associated increase of noise and air pollution. The higher economic growth of the city has resulted in a large-scale influx of population and the emergence of a number of squatter settlements and slums. The magnitude of urban poverty has also increased manifold. The urban environment of the city has

now become completely degraded and Bathinda is considered as one of the most polluted cities of Punjab.

Evolution of Bathinda

Bathinda is one of the oldest cities of Punjab with a population of about 2.8 lakhs (2011). It is the fifth largest city of Punjab and currently the administrative headquarters of Bathinda district. It is situated in the northwestern part of India in the Malwa region of Punjab. The nature and pattern of its evolution can be clearly visualized from Fig. 4, 5 and 6. The city has medium and large scale industrial units like Thermal Power Plant, National Fertilizers Limited (N.F.L.), Bathinda Chemicals, Milk Plants and Vardham Polytex along with more than 500 small scale registered industrial units dealing with products like manufacturing of utensils, pharmaceuticals and cotton ginning. The latest trend is towards manufacturing of electrical transformers and production of electric motors, plastic pipes and electric wires. Besides this, there is a huge concentration of agro-based industries in the city. The Thermal plant and N.F.L. are located in the northern part of the city, whereas the other planned industrial areas like the Industrial Estate, Industrial Focal Point and Industrial Growth Centre are situated in the southern part. The small scale or service industries are found scattered all over the city.

Physiography

The city of Bathinda is facing the problem of water logging throughout the rainy season. For the last 15-17 years, the low lying areas in Ward No. 7 and 27 are being used for the disposal of domestic waste, sewage and solid waste which directly leads to land pollution as well as ground water contamination. It results in the seasonal outbreak of the diseases like, malaria, dengue and typhoid. Ward Nos. 15, 17, 18 and 23 occupy the physiographically lowest level, causing backflow of drainage water and resultant health hazards. As per the City Development Plan of Bathinda, 2010 about 18% of the population live in such substandard conditions.

Geology

Bathinda area has experienced earthquakes that have caused slight to moderate damages in the past.

In the seismic map, Bathinda finds its place in the 'moderate zone' (Fig. 3). Soil bearing capacity permits the construction up to (G+2) to (G+3) but due to huge competition, it has now gone up to (G+4) and (G+5). Ward Nos. 15, 17, 18, 19, 23 and 25 are denser in population, and there is no open space or park for safety. Hence, it poses a threat to human life as there is a huge risk of collapse and resultant damage.

Hydrology

Due to the shortage of basic infrastructure, 21% of the total population directly depends on ground water which is often contaminated causing health hazards like bent bone, tooth decay, and diseases related to the upper respiratory tract. Samples collected and analyzed by the State Agricultural Department to check the quality of ground water reveals that 47% of the samples are not suitable for drinking.

Ground water quality of Bathinda city is polluted due to disposal of fly ash along water bodies and untreated water into them. Dumping of solid wastes into open water bodies also contributes towards their contamination and subsequent pollution. The foremost deficiency in the water supply system in Bathinda city results from the non-availability of piped water to some parts of the city - namely the areas across the Canal and in Namdev Nagar, which comprise 11% of the total civic area. The contamination of water is most frequent as the water and sewer lines lie one above the other in narrow lanes. There are areas like Amarpura Basti, Lal Singh Basti, Udham Singh Nagar, and Dhillon Colony which gets piped supply of ground water contaminated with high fluoride level (not recommended for human consumption). It is observed that 15% of the civic area has poor quality ground water while another 53% has ground water of moderate quality. This has resulted in an increase in the number of patients suffering from teeth decay and crippled bones from 9973 in 2001 to 20136 in 2005.

Landuse

Industrial areas account for more than 20% of the city's total area (Fig. 6). The rubber industry in the Ward Nos. 27 and 28 affects the population living in the surrounding areas. The poultry farm and grave

yard of Ward No. 25 similarly pollutes the local environment. The fodder market along the road is responsible for increasing incidence of accidents. The bus stand, truck terminal and Mini Secretariat are the centres of traffic congestion giving rise to traffic jam, air pollution and noise pollution. The land use pattern of the city is unequally distributed. The western part of the city has fallen short of utilities as haphazard development occurred therein. Poor intra-city link is responsible for a number of areas not being able to achieve their potentials

Air Pollution

The major sources of air pollution in city are the thermal plant, N.F.L., motor vehicles and other industries which emit smoke and gas into the atmosphere exceeding the prescribed limits. The Thermal Plant emits huge amount of gas due to poor quality of coal and thereby generates about 600 tons of ash per day having no proper location for its dumping and disposal. It is dumped along the Kotkapura road and contaminates the waterbodies situated therein posing a serious health hazard. Vehicular pollution accounts for about 80% of total air pollution. There is a pollution monitoring station near the railway station that records the level of various pollutants (SPM, SO_x , and NO_x). The major findings are that the air contains a large volume of suspended particles throughout the year far above the permissible limit of $120\mu\text{g}/\text{m}^3$. This may be attributed to mixing of dust from open land, pollutants from industrial areas and smoke from vehicular traffic. SO_x , NO_2 have been found to be within the permissible limits.

Land Pollution

It refers to the changes in the properties of soil through addition of materials like industrial effluents, chemicals and other types of waste. The Municipal Corporation of Bathinda dumps the wastes in the land fill sites without any treatment. The waste includes both wet and liquid materials that is leached through the soil; as a result, land is polluted deteriorating the quality of ground water. The ash produced by the thermal plant is dumped on the Kotkapura road, which pollutes the land and affects 11,075 people of the locality. Unauthorized dumping of solid waste in Ward Nos. 7 and 27 causes

pollution of underground water and foul smell. Open sewage system in Ward Nos. 21 and 22 directly affects 2200 people of the surrounding areas.

Water Pollution

The Bathinda Branch of the Sirhind Canal is the only supply line for surface water, but it is currently under the threat of pollution. Originating from the Ropar head works, it traverses through vast areas containing several towns and villages that dispose their waste water directly into the canal. Industrial units located nearby also dispose their wastes into the canal. The dirty water including sewage is normally put into ponds that become the breeding grounds of mosquitoes. These ponds further pollute the subsoil of the localities. As a result, nearly 37,410 people are directly affected as 21% of them are not served by the Municipal's water supply.

Solid Waste Management

Solid waste consists of highly heterogeneous mass of discharged materials from the urban community. In Bathinda city, the average solid waste generated by person is 0.5 kg/day; hence, the total production comes to about 110 tons per day (Table 3). However, the collection of solid waste by the Municipal Corporation is only 90 tons per day. As a result, collection of 20 tons of solid wastes is delayed and lie in the vats close to the residential area and become a source of foul smell and unhygienic conditions to their surroundings. A shortage of manpower is responsible for this delayed collection and the residual waste becomes the breeding ground for flies and mosquitoes, which eventually leads to an increase in the incidence of diseases like malaria, typhoid and diarrhea.

Sewerage

Proper sewerage is very important for the disposal of the huge wastes generated from domestic, industrial, commercial and institutional units. The work of laying underground sewerage in the city was first taken up in 1963- 64. In the past 43 years, only 65% of the population could be provided with proper sewerage facilities. The unplanned colonies of the fringe areas like Kothe Amarpura, Kothe Sucha Singh, Kothe Joga Nand, Guru Nanak Nagar, Hardev Nagar, Partap Nagar, Amarpura Basti, Sanguana Basati, Jogi Nagar, Balla Ram Nagar,

Katcha colony, Kheta Singh Nagar, Alam Basti, Matti Das Nagar, Beant Nagar, Nachhattar Nagar, Dhillon Colony, Wisheshar Nagar, and Subash Basti do not still have the facility of sewerage. Waste water is disposed through open drains. Unfortunately, sewerage treatment facility does not exist in Bathinda. The raw sewage is discharged into a manmade drain, known as Lassara Drain. Present disposal practice is completely undesirable from the environmental point of view as it poses a great threat to the health of the people residing in nearby localities, because it contaminates the ground water, makes the surroundings unhygienic and ugly, and often brings about other health hazards.

Slums

The industrialization of Bathinda city has resulted in the emergence of several slums in the city. This is largely due to migration of poor people from rural areas and other smaller towns and villages of Punjab, Haryana and Rajasthan for employment purpose and to avail higher level of services in city. As per Bathinda Master Plan 2009-31, currently the slum dwellers account for about 18% of the total population. As there is no formal housing for the industrial workers, slums have come up in the town near the industrial areas, thereby giving rise to some of the basic problems related to everyday life.

Road Accidents

Road accidents in the city are increasing rapidly because of increase in population and due to inadequate infrastructure. As per the figures made available by the Police Department, the total number of accidents increased from 97 in 2007 to 110 in 2009. There is a need for strict traffic rules and regulations and its execution and a proper enforcement and execution mechanism to decrease the number of accidents in the city

Major Findings

Although Bathinda is located in the 'moderate' earthquake prone zone, no building plans are yet prepared or constructed maintaining the required safety measures. Currently, about 21% people are forced to drink ground water in the absence of piped municipal water supply which is certainly inadequate to meet the demand. Against the recommendations in the 'master plan' of the city, no

industry has yet been shifted from the city to the focal points / industrial growth centers till now. Only less than 2% 'green areas' are available in the city at present. Industrial areas are yet to be segregated by green covers to reduce the pollution. Currently, man power and infrastructure are too inadequate to collect 100% of the solid wastes generated. Dumping of fly ash on open lands along roads causes air pollution / ground water pollution much above the permissible limit of $120\mu\text{g}/\text{m}^3$. New ecologically feasible sites for 'land fill' must be explored immediately.

Recommendations

The foregoing analysis shows that the issues of urbanization and environmental sustainability are very intricate. They have to be sorted out at local and state level, if meaningful results are desired. The following measures are suggested to avoid environmental risk and for the attainment of sustainability in the city of Bathinda:

1. The poultry farms, rubber and other polluting industries should be immediately shifted or relocated from the present locations.
2. Low lying city areas should be developed for parks or for recreation purpose.
3. Municipal Corporation and other developing agencies must ensure cent percent piped water supply to the city.
4. Location of the collection bins should be efficiently organized to collect cent percent solid waste.
5. New technology based biogas plants can be used to supplement the demand of electricity and gas.
6. Thermal plant authorities must ensure curbing of air pollution by using necessary pollution control devices and advanced technology.
7. Buffer zones should be provided around industries to segregate the industrial areas from residential areas thereby reducing the magnitude of pollution.
8. Proper legal provisions should be there regarding construction of buildings to cope with natural hazards like earthquakes.
9. There should be adequate provisions for

required management devices to control vehicle population and road accidents.

Conclusion

It is true that cities are the engine of economic growth based on urbanization and industrialization. However, high intensity infrastructures bring in many challenges and environmental deterioration of the urban areas. The government should ensure development with sustainability of cities. Policy makers and planners should take special care of the urban environment in the current pattern of development.

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Table – 1: Growth of Urban Population in Punjab

| | Population ('000,000) | | | Growth Rate (%) | |
|-------|-----------------------|-------|-------|-----------------|-----------|
| | 1981 | 1991 | 2001 | 1981-1991 | 1991-2001 |
| Total | 16.79 | 20.28 | 24.36 | 20.79 | 20.12 |
| Urban | 4.65 | 5.99 | 8.25 | 28.82 | 37.73 |
| Rural | 12.14 | 14.29 | 16.11 | 17.71 | 12.74 |

Source: Commission on Urbanization of Punjab, 2005

Table – 2: Growth of Bhatinda (1981 – 2001)

| Year | Population | Growth (%) |
|------|------------|------------|
| 1981 | 127,363 | - |
| 1991 | 159,042 | 24.87 |
| 2001 | 217,256 | 36.60 |

Source: DC Handbook, Bhatinda (1981 – 2001)

Table – 3: Share of Solid Waste Generation in Different Sectors of Bhatinda City

| Sources | Share (%) |
|--|-----------|
| Residential | 60 |
| Commercial | 15 |
| Market | 6 |
| Sweeping & Cleaning – streets & drains | 5 |
| Hospital | 2 |
| Institutional | 2 |
| Others | 10 |
| Total | 100 |

Source: Municipal Corporation, Bathinda (2008)

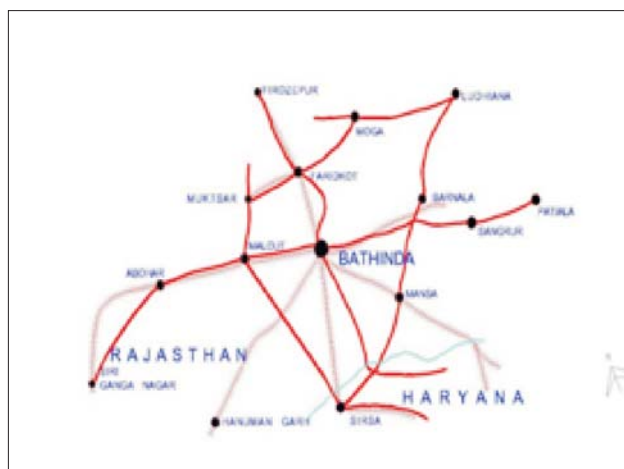


Fig. 1 : Regional Location of Bhatindas (not to scale)

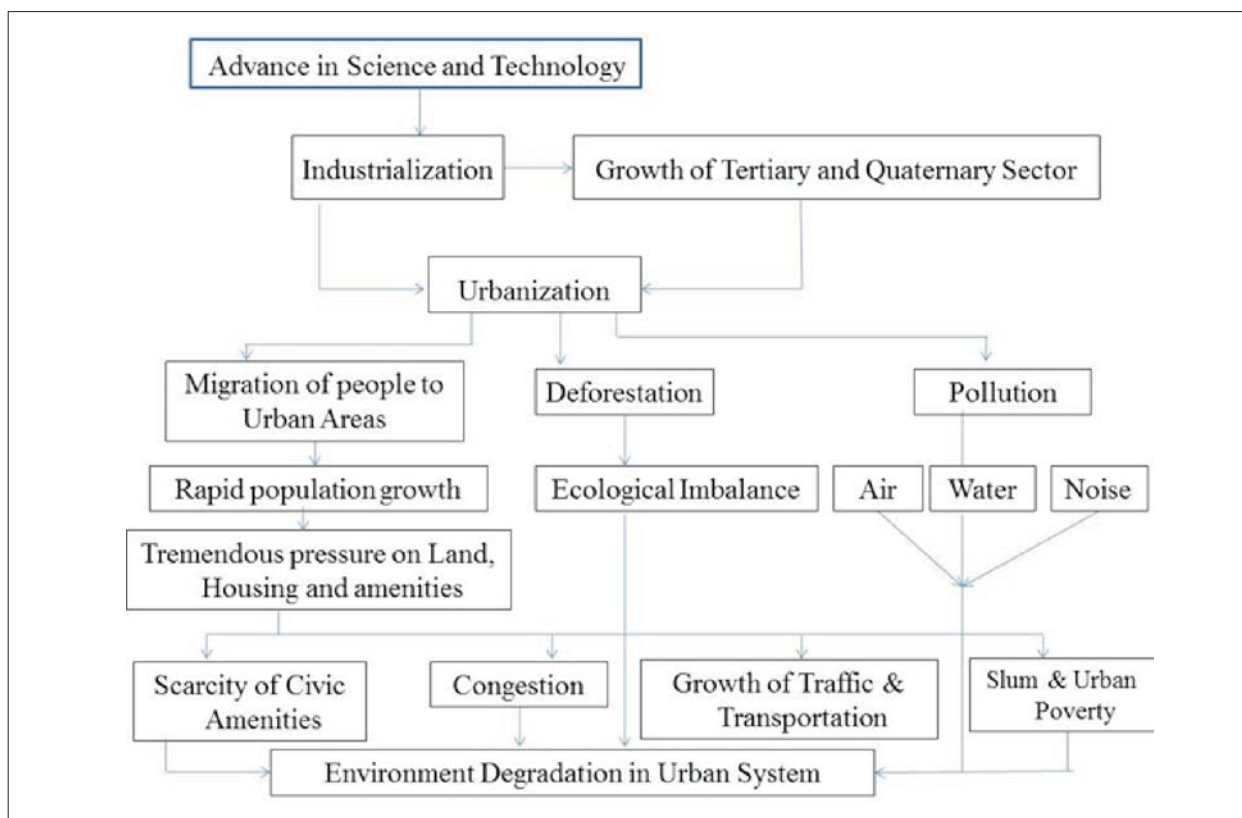


Fig. 2. Urbanisation - Environment Linkage (after Ganeshwar, 1989)

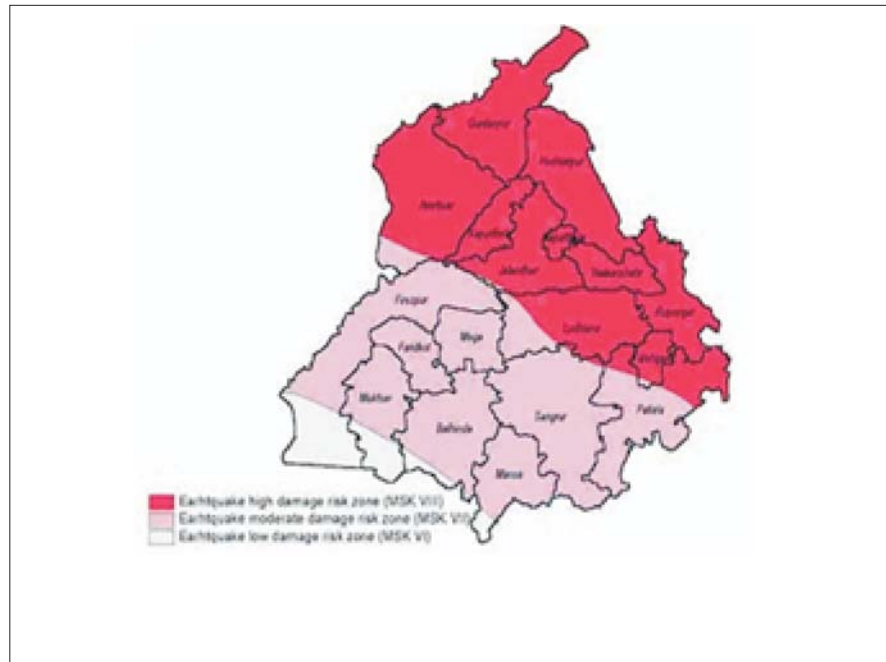


Fig. 3. Earthquake-prone Regions of Punjab (*not to scale*)

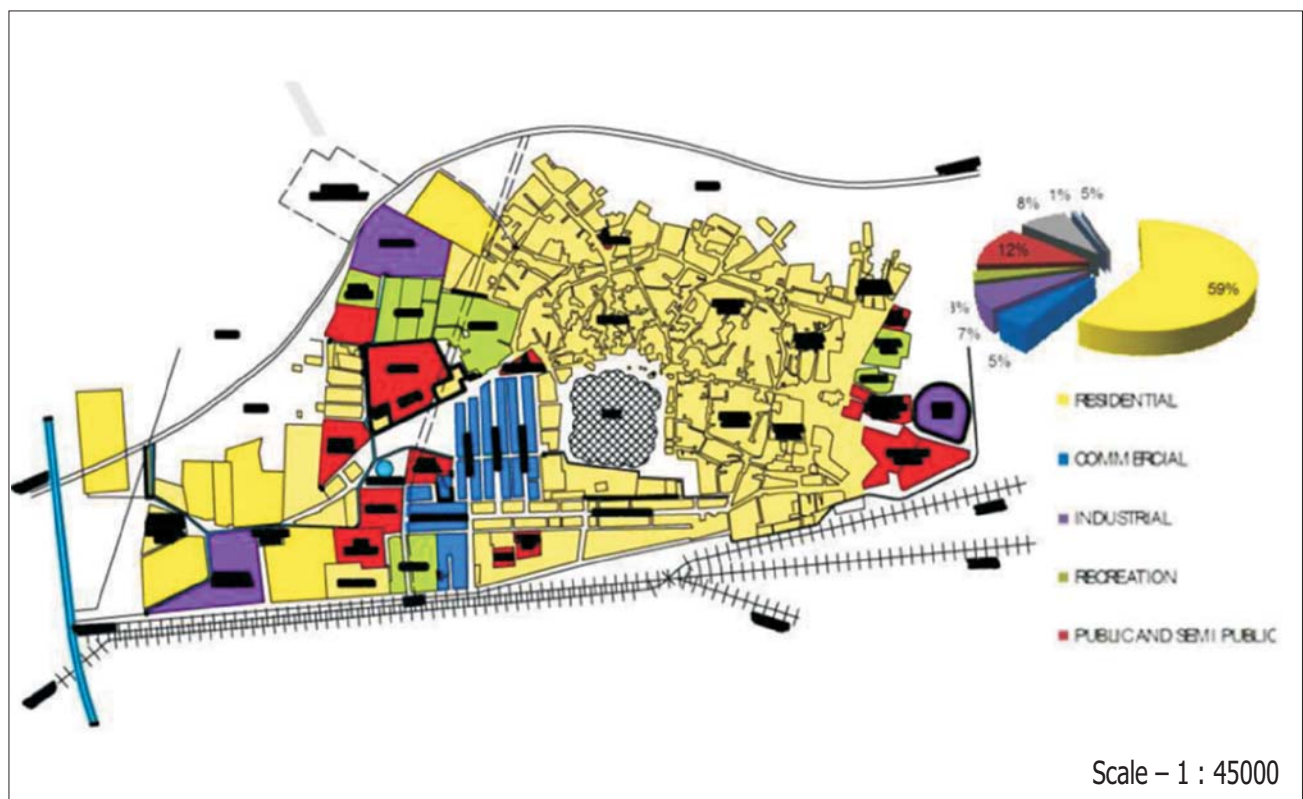


Fig. 4. Bhatinda City, 1950

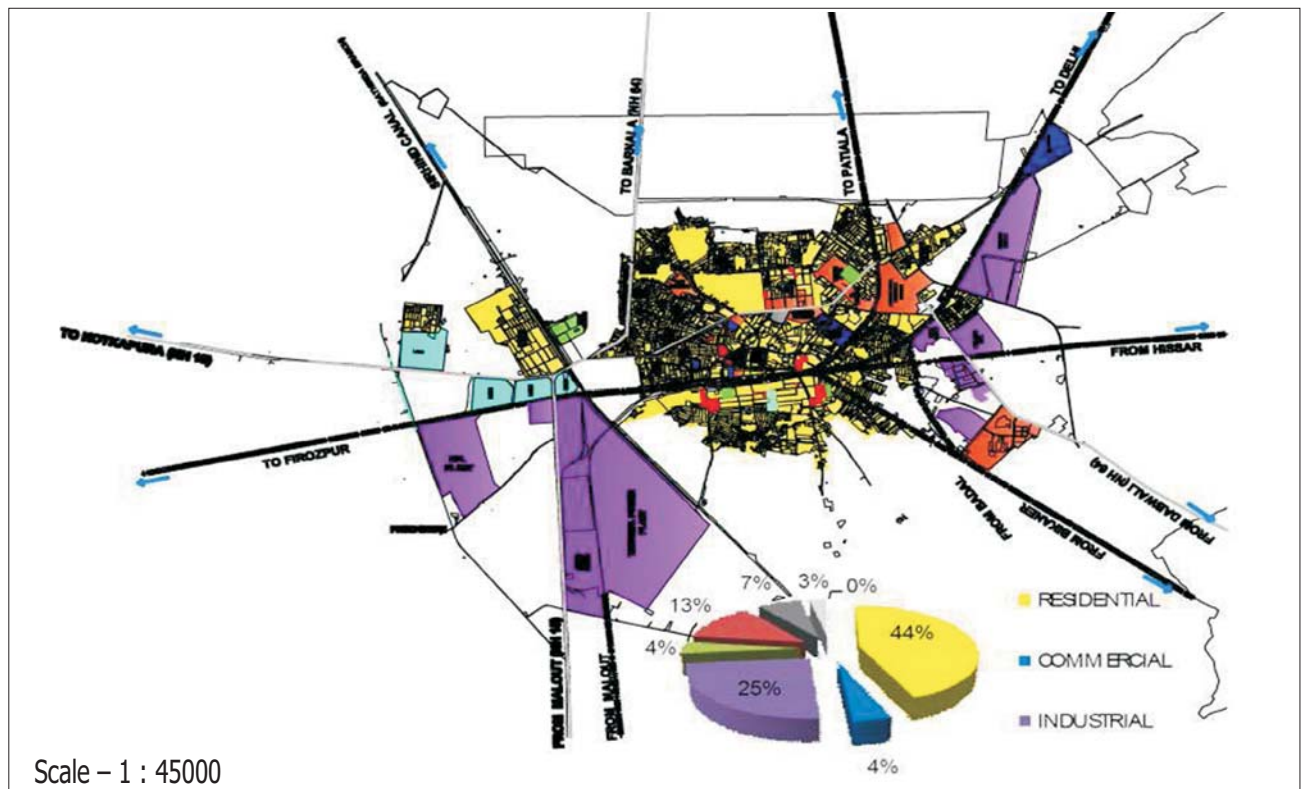


Fig. 5. Bhatinda City, 1996

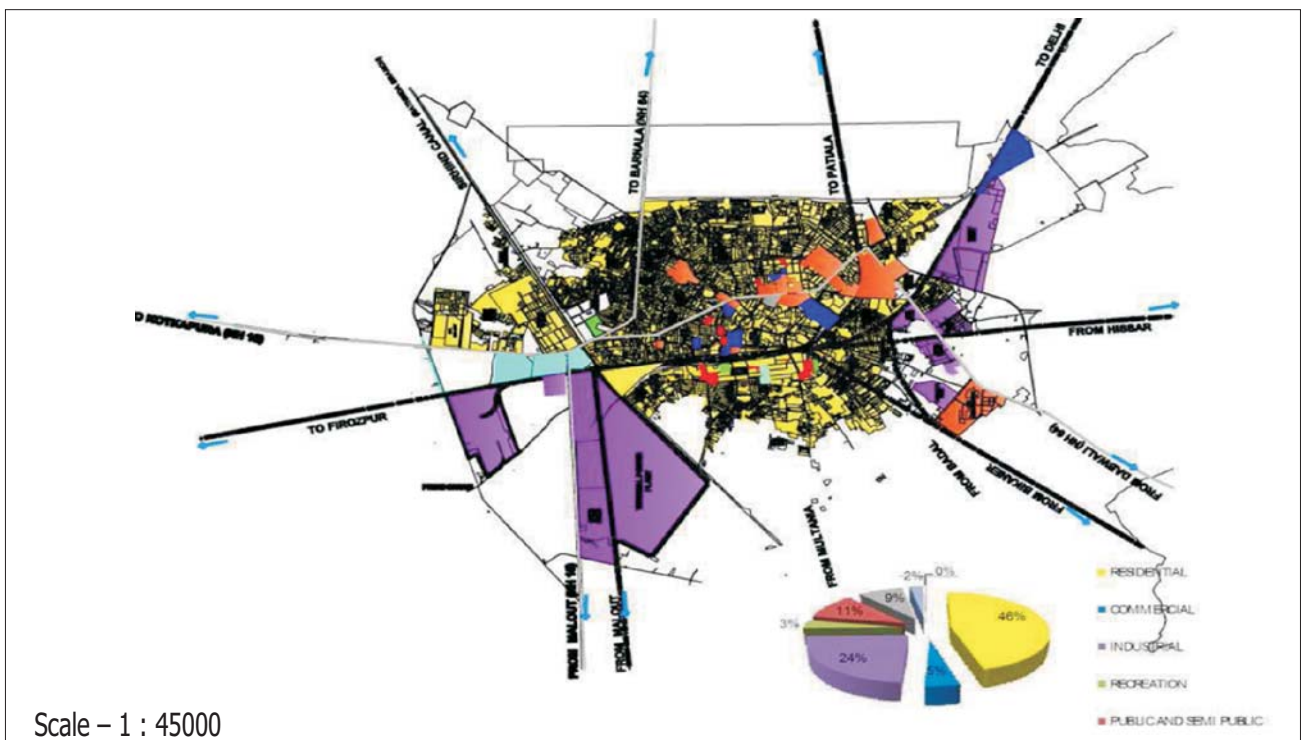


Fig. 6. Bhatinda City, 2002



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