PLANNING FOR SUSTAINABLE DEVELOPMENT OF WALLED CITY AREA OF JAIPUR CITY

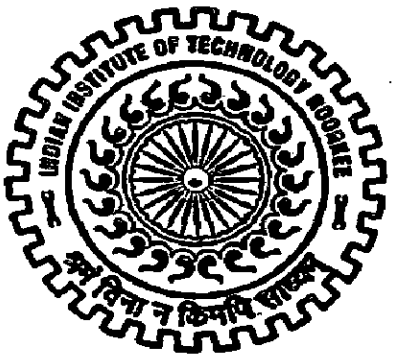
A DISSERTATION

Submitted in partial fulfillment of the requirements for the award of the degree of

MASTER OF URBAN AND RURAL PLANNING

By

NAND KUMAR



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CANDIDATE'S DECLARATION

I hereby certify that the work, which is being presented in the dissertation, entitled **"PLANNING FOR SUSTAINABLE DEVELOPMENT OF WALLED CITY AREA OF JAIPUR CITY"**, in partial fulfillment of the requirement for the award of the Degree of MASTER OF URBAN AND RURAL PLANNING submitted in the Department of Architecture and Planning, Indian Institute of Technology - Roorkee, Roorkee, is an authentic record of my own work carried out during the period from July 2005 to June 2006 under the supervision of **Dr.V. Devadas**, Associate Professor of Planning, Department of Architecture and Planning, Indian Institute of Technology - Roorkee, Roorkee.

The matter embodied in this dissertation has not been submitted by me for the award of any other Degree.

Place: Roorkee
Dated: June 30, 2006

(**Nand Kumar**)

This is to certify that the above statement made by the candidate **Mr. Nand Kumar** is correct to the best of my knowledge.

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CERTIFICATE

Certified that this report entitled **"PLANNING FOR SUSTAINABLE DEVELOPMENT OF WALLED CITY AREA OF JAIPUR CITY"** which has been submitted by **Mr. Nand Kumar,** in partial fulfillment of the requirements for the award of the Post Graduate Degree in **MASTER OF URBAN AND RURAL PLANNING** in the Department of Architecture and Planning, Indian Institute of Technology - Roorkee, Roorkee, is the student's own work carried out by him under my supervision and guidance. The matter embodied in this dissertation has not been submitted for the award of any other degree.

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ABSTRACT

Cities are engines of economic growth. Indian cities are suffering from unplanned economic development due to several factors. In Indian the city plans are prepared by focusing physical development alone. In this process the other important aspects, such as, social, economic, ecology, environment, infrastructure and institutional are omitted without giving proper importance. As a consequence, the city plans concentrated only on physical aspects of the city development, which caused existing alarming situations in almost all the Indian cities.

The sustainable development concept was evolved in the year 1980, and since then the world started to move towards giving importance on resource mobilization, conservation of resources, avoiding over exploitation of scarce resources, etc. in the planning stage itself. Indian city planners also took a note of these events and started to prepare sustainable development plans for the development of the urban system. Sustainable development plan is almost a total development plan, which relies on the key planning tools and techniques, such as, Information, Statistics, Operation Research, System Dynamic, Discounted Cash Flows (DCF) techniques, Decision Support System, etc. which would very much useful for preparing plausible sustainable development plans. In this present investigation, an attempt is made to prepare a plausible sustainable development plan for the wall city area of Jaipur city. At the outset, literature pertaining to sustainable development is collected and reviewed thoroughly, followed by the characteristics of the Jaipur city (Study area) is studied meticulously to understand the existing conditions of the system. Subsequently a household survey was conducted by using a pre-tested schedule and analysed the data thoroughly for understanding urgent conditions of the city.

Theoretical models were developed based on System Dynamics Theory and Theory of Hierarchy of Human Needs and discussed in this investigation. The study conclude with a set of plausible recommendations to achieve sustainable development in the system (Study area).

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1.1 INTRODUCTION

Development, the term has often been associated with economic growth (Ingham 1933). Between 1940s and 1960s, when development as an academic study was taking shape, per capita GNP not only became the major indicator of national economic development, but also the most popular indicator of national development. While some other forms of development – such as 'human development' and 'basic needs' – are also recognized, they are subordinated to the overall goal of economic growth.

The idea of sustainable development has been added to the concept of development. The term 'sustainable development' came into the scene in 1980 when the international union for conservation of nature and natural resources (IUCN) published the World Conservation Strategy, elaborating 'the overall aim of achieving sustainable development through the conservation of living resources' (IUCN, 1980, Lele,1991). Seven years later, the World Commission on Environment and Development (WCED), also known as the Brundtland Commission, offers a definition of sustainable development. According to Brundtland Commission, "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs". (Brundtland WCED , 1987). This commission has given two concepts, and are:

- **Healthy economy**
- **Healthy environment**

The Summit produced, a major action agenda, "Agenda 21" is a blueprint of program for the 21st century. The WCED further notes that 'sustainable development must not endanger the natural systems that support life on Earth: The atmosphere, the waters, the soils, and the living beings. It advocates 'eco-development', which suggests that economic growth should be based on 'a responsible and sustainable use of environmental resources'. (WCED, 1987). Sustainable economic development should not be equated with sustainable development, but only a part of it. Development means a stage of betterment and progress, and its sustainability is an enduring betterment of progress. Sustainable development is, therefore, primarily concerned with long-term development, equity and fairness between generations and potential development in future.

Sustainable development is basically a concern of 'design with nature'. It means development and human interventions in natural system to the extent of carrying capacity of an area. The carrying capacity of land / water area is the population or level of activity that can be sustained for a given length of time without depletion of the resources or breakdown of the biological (natural) systems.
It is well accepted today that there is no universal or standard blueprint for sustainable development. (Rijsberman and Yen, 2000, UNCHS, 2001). What is sustainable today may not be sustainable tomorrow. Therefore, sustainable action will be specific to a place; the same cannot be directly applied at any other.

Cultural development should be one of the key milestones towards achieving sustainability. It is a way to healthy living, contributing to society's well-being and prosperity. The state of society fostering healthy life leads to cultural development.
According to Building and Social Housing Foundation, UK, the following key elements are very much useful for sustainable human settlements.

- Resource budgeting / management
- Energy conservation and efficiency
- Renewable energy technology
- Long-lasting built structures
- Proximity between home and work
- Efficient public transport systems
- Waste reduction and recycling
- Organic waste composting
- A circular city metabolism
- Supply of staple foods from local sources.

The critical concerns for India which require priority action include water, air pollution, land, public health, energy, municipal sanitation and solid waste, and equity and rural development. The UN launched the sustainable city program (SCP) in the early 1990s, as a medium for implementing Agenda 21at the city level. In the early 1980, UNCHS and the United Nations Environment Program (UNEP) jointly prepared the Environmental Guidelines for Settlements, Planning & Management for cities. The sustainable city program is based on a development paradigm that recognizes that cities make an important contribution to social and economic development at national & local levels, they are important engines of economic growth, they absorb a sizeable portion of population growth in

developing countries; they offer significant economic opportunities; they provide housing and services and are important centers of productivity and social progression.

Cities are also the chief causes of un-sustainability (WHO, 1993; Cohen; UNCHS, 2001). They account for most of a nation's resource consumption and waste generation, besides being large-scale pollutes of the living environment. So, sustainable action is a deliberate effort required for every individual; the occupation of the person is immaterial. Restoring and maintaining the health and integrity of the natural environment is fundamental to sustainability of human settlements.

1.2 REVIEW OF LITERATURE

Larger number of distinguished Authors have done good amount of work and published in this field of particular investigation, i.e., sustainable development. The Investigator collected some relevant literature in the field of sustainable urban development since the investigators study lies in this field. The collected literatures are classified into the following headings and are received thoroughly for this investigation. They are:

- **1.2.1** Human settlement and sustainable development.
- **1.2.2** Heritage and sustainable development.
- **1.2.3** Ecology and environment for sustainable development.
- **1.2.4** Infrastructure and sustainable development.
- **1.2.5** Application of Planning Techniques and sustainable development.

The classified literature are further reviewed, and are presented as below:

1.2.1 Human settlement and sustainable development

1.2.1.1 Monto Mani, koshy Varghese, L.S.Ganesh, (2004), argued that settlements, both rural and urban system are exploiting the surroundings natural environment. They are responsible for altering natural processes that are predominately equilibrium – oriented. Restoring and maintaining the health and integrity of the natural environment is fundamental to sustainability of human settlements.[1]

1.2.1.2 According to Hugo Priemus, (2002), sustainable housing is a badly defined concept, both in scientific literature and in policy documents. A narrow definition of sustainability is adopted, whereby the Author concentrates on the ecological dimensions of the concept of 'sustainability. The environmental impact on the greenhouse effect; the quality of air, water, and soil, noise nuisance,

stench, the stock of nonrenewable materials, and biodiversity are discussed. An overview of ways in which the sustainability of housing can be measured is given and the use of a multivariate yardstick advocated. A set of recommendations is presented for politicians and public officials about the way in which sustainable housing can be promoted along with a research agenda on sustainability in housing presented. The Author concludes by pointing out the analogy between the Dutch government's policy to promote sustainable housing and the story of the emperor's new clothes.[2]

1.2.2 Heritage and sustainable Development

1.2.2.1 Chan – Wai – Yin and Ma Shu – Yon, (2002), argues that under the influence of economic growth theories, the idea of sustainable development has been revised to sustainable economic development. As a result, cultural concern has often given way to economic calculation in the course of development. This has been evident in the case of China, where economic construction has destroyed a number of invaluable heritage sites. Development in China, therefore, may not be sustainable, since the major concern of its development policy is focused on sustainable economic development.[3]

1.2.3 Ecology and Environment for sustainable Development.

1.2.3.1 According to Ekhart Hahn and Udoe. Simonies (1991), orientation were formulated out of the necessity of introducing comprehensible guidelines on ecologically compatible urban planning. Explanatory aids as to what is to be understood by ecological urban restructurig are hardly available. Institutions and actors are badly prepared for a topic which, no doubt, will be a central one in the future theoretical assumption and the empirical findings from the research project on central ecological urban restructuring are summarized below:

- Human- Ethological Orientation
- Participation and Democratization
- Orientation to Cycles and Networks
- Orientation of Nature and the senses
- Orientation to Qualified Density
- *Orientation to the "Genius loci"*
- Ecology and Economy
- International Orientation.

In the work, the Author has given more stress for concept of ecological neighborhood and development.[4]

1.2.3.2 A.K. Mukherjee, (1997), argues that environment is the key factor for sustainable development in the urban or rural system. He argues that population, urbanization, poverty, energy consumption, food production, resources trends, land quantity and desertification, pollution, etc are affecting the environment of the higher growth, He stressed that the utilization of resources with environmental conservation is better for sustainable development.[5]

1.2.3.3 C.Y. Jim, (1994), argues that the grave shortage of land suitable for development has always been a major constraint on urbanization in Hong Kong. Rather lax or inappropriate planning controls in the past have resulted in haphazard city growth, leaving extensive areas of densely-packed tenement slums. Recent sluggish attempts at urban renewal have brought little relief, The objectives of environmental planning to rejuvenate the old districts are assigned in relation to this limitations and potential. The problems and opportunities of employing comprehensive redevelopment to upgrade environmental quality with reference to building stocks in the pre-war and post-war private residential, public housing and obsolete industrial sectors are evaluated. The prospects of environmental improvement through new institutional improvement, institutional framework and legislative measures are discussed quite extensively.[6]

1.2.3.4 Xu S and M Madden, (1989), argues that holistic concepts of urban analysis and planning are introduced, based on the principles of ecology and the urban ecosystem. The urban behavior matrix, which contains both behavioural and spatial information, is suggested as the conceptual framework for holistic urban study and various relationships within and between urban ecosystems are discussed. A possible application of the ideas in the urban behavior matrix to an urban ecosystem represented as an activity – commodity framework is discussed.[7]

1.2.3.5 Guangqing Chi and Brran Stone Jr., (2004) argues that a methodology for measuring the ecological footprint of a country-level transportation network in current and future periods. With the aid of vehicle travel behavior and fleet characteristics obtained from a number of state and federal agencies, he estimate the quantity of land required for constructing county highways and remediation annual greenhouse gas emissions through forest carbon sequestration in the years 2001, 2011, and 2011. The results of this study, which focuses on Houghton county, Michigan, indicate that, despite a projected increase in total annual vehicle kilometers of travel along the network. On the basis of these results, Authors argue that the ecological footprint is a viable technique for transportation and land-use planning applications.[8]

1.2.4 Infrastructure & Sustainable Development

1.2.4.1 M. Sohail, M.A SCE, S. Cavill and A.P. Colton, (2004), *tried to explore the constraints to* operation, maintenance and sustainability of urban services. The findings are based in case studies from India, Pakistan, & Sri Lanka. In order to distinguish between the different constraints acting upon urban services, the term "Sustainability" has been separated according to its technical, financial, and institutional aspects. This paper demonstrates how finding from community involvement in service delivery in developing countries can be benefit to engineers or NGOs working with communities to improve the operation & Maintenance of urban services in developed countries. Traditional centralized system of O & M, which are the responsibility of municipalities and utilities, are not delivering. Recently, there has been a search to alternatives such as community-based approaches. Internationally it seems service uses are being encouraged to ensure the infrastructure in their neighborhood is kept in good condition. It is hoped that getting service uses involved will lead to increased efficiency, benchmarking raise awareness debate, contributed to national growth, reduced waste, improved resource allocation, and improved competitiveness. It has been recognized that neither community nor government alone can ensure the sustainability of infrastructure, a partnership approach in needed. [9]

1.2.4.2 Peter Newman, (1995) , to develop the guidelines, the Author had studied some planning principles and their uncertainties which include (1) recognizing human values, environmental matters, social justice, heritage matters, urban economy matters, community matters, maximizing density, housing diversity, transport diversity, fuel diversity, infrastructure diversity, cultural diversity, etc. The Author have discussed at how the uncertainties produced by post modernism can be put to advantage in providing a more sustainable post-modern city. It is suggested that the key principles are recognizing values, maximizing diversity and crossing boundaries. There are developed into some guidelines for urban planning and transport practice.[10]

1.2.4.3 Nina Herala, (2003), integrating land use planning and traffic planning to promote sustainable development how land use planning may be used as one of the means growth in car-borne traffic has increased rapidly and consumes more and more land because of land extensive structure of cities and the traffic demand between human activities.

Planning solutions emphasizing the separation of urban functions, in order to avoid health problems, have, together with the availability of inexpensive land on the outskirts of urban areas, contributed to the current generation of environmental problems, primarily from increased dependency on private cars. The OECD & EU have developed principles of sustainable transport and sustainable traffic to tackle the growth of traffic.

Urban form and location of activities together with economic incentives and well organized public transport has a significant impact on traffic flows. There is not yet a general political agreement on how the reduction of traffic demand should be legally regulated, but some criteria are suggested to measure sustainable mobility in land use planning. [11]

1.2.4.4 Christy Mihyeon Jeon, S.M. ASCE, and Adjo Amekudzi, M. A SCE, (2004), addressed the sustainability of transportation system is an important activity as evidenced by a growing number of initiatives around the world to define and measure sustainability in transportation planning and infrastructure provision. While there is no standard definition for transportation system sustainability, it is largely being defined through impacts of the system on the economy, environment, and general social well-being; and measured by system effectiveness and efficiency, and the impacts of the system on the natural environment. Frameworks based on important causal relationships between restructure and broader environment, infrastructure impacts on the economy, environment, and social well-being; and the relative influence of agencies over causal factors, are largely being used to develop and determine indicator systems for measuring sustainability in transportation systems.

These frameworks can be used collectively to help agencies define their visions as well as develop policies, planning procedures, and measurement and monitoring systems for achieving stainable transportation systems.[12]

1.2.5 Application of Planning Techniques and Sustainable Development Research.

1.2.5.1 Pramod Paliwal (2005), argues that the concept of sustainable cities is based as a development paradigm that recognizes that cities make an important contribution to social and economic development. System thinking, including hard and soft systems, can be used to provide a new perspective and tools to resolve questions. This paper attempts to analyze the issues underlying sustainable development of Udaipur by applying CATWOE in order to comprehend the systemic elements of the city from a soft systems perspective.[13]

1.2.5.2 B. Ramesh & N. Krishnan (1991) argued that the urban fringe development is resultant of natural increase of population of the city and migration of rural population in search of better living. In the process, some increased population is absorbable in the main city and the rest have to settle is the fringe areas of the city. To monitor fringe area dynamics, Remote Sensing is the best available technique and with it timely information generation is possible. In this paper fringe area development trends have been studied with the help of the aerial photographs and satellite imagery.[14]

1.2.5.3 Monto Mani; Koshy Varghese; and L.S. Ganesh (2004), argued that balancing conflicting requirements and rational decision making is necessary to achieve sustainability. Simulation models to asses and forecast sustainability can aid rational decision making. In the context of human settlements, human nature interactions need to be considered in an integrated manner to build appropriate simulation models. The integrated model framework proposed here severs as a base for such simulation models. The model framework is based on the premise that a community's attitude and its living environment determine human settlement sustainability.

A generic model design comprising fundamental components of the proposed sustainability assessment and forecasting model framework is also presented in this paper. Discussion on relevant implementation issues inducing a simulation system and key limitations of the framework are also presented.

This framework can be adopted for development and implementation of a simulation system for sustainability amendment and forecasting studies.[15]

1.2.5.4 Bill Hopwood, Mary Mellor and Geoff O' Brien (2003), presented a classification and mapping of different trends of thought on sustainable development, these political and policy frameworks and their attitudes towards change and means of change. Sustainable development has the potential to address fundamental challenges for humanity, now and into the future. However, to do this, it needs more clarity of meaning, concentrating on sustainable livelihoods and well-being rather than well-having, and long term environmental sustainability, which requires a strong basis in principles that link the social & environmental to human equity.[16]

1.2.5.5 Igor S Mayer and Robin Seijdel (2004), explored how the combined application of two techniques, a decision-support tool and a simulation game, can support decision making for sustainable urban development. The techniques are applied in decision-making for real and in fictional sustainable urban renewal projects benefits and challenges of this combined approach are discussed based on experiences in seven applications. The main finding is that the use of the decision-support tool combined with the simulation-gaming procedure can support agenda setting and help create a shared understanding of problems and potential solutions in the field of sustainable urban renewal.[17]

1.2.5.6 Christopher J. Petti (2004), Studied the planning-support systems offer on effective way of integrating social, economic and environmental datasets, enabling a number of holistic spatial planning scenarios to be generated and evaluated by local planners. With increased acceptance of computer technology as a platform for the development and delivery of professional tools, planning-support system (PSS), may well be embraced by parishioners to improve current practices. The author provides a technical and experimental examination of an application of the what if?. PSS in

assisting in the formulation of a sustainable land use strategy for Harvey Bay, Australia, supplementing previous published results. The focus of the research is to examine the underlying model and discus the collaborative application of the PSS with local planners in scenario building exercise. Furthermore, the perceived strengths and weakness of the PSS are outlined from the perspective of the urban modeler, together with ex-ante feed back from the local planners on the use of the PSS to formulate urban-growth scenarios. In conclusion, the merits of the use of such a PSS are discussed and some future directions for the development of collaborative spatial decision-support tools are offered. [18]

1.3 FINDINGS AND INFERENCES

The following inferences are drawn from the literature survey:

1. To maintain sustainable human settlement the available natural resources shall be exploited with environmental consideration
2. To maintain sustainable human settlements good ecosystem is very much essential. To have a good ecosystem judicious use of natural resources along with maintaining good biodiversity is stressed
3. *In urban planning, in planning stage itself ecology and environmental aspects must be* given priorities with regard to human interaction with biodiversity, orientation towards cycles and networks, orientation towards ecology and economy etc., further it has been stressed developing ecological neighborhood for sustainable development .
4. To have sustainable development , good environment is stressed for, in a urban system population , urbanization , poverty , higher quality of energy consumption , over exploitation of resources, desertification , polluting etc., are affecting the environment
5. Judicious use of resources with environmental consideration is advocated for sustainable development
6. Transportation network plays a very major role in sustainable urban development therefore developing optimum transportation is stressed for sustainable development with the ecological consideration. It has been further argued that ecological footprint is viable technique for transport and land use planning applications
7. Infrastructure services such as physical, social, and economical are more essential for having quality of urban life to maintain the quality of urban life proper administration mechanism is advocated

8. Peoples participation in management of infrastructure is stressed for having good quality of life in the urban system.
9. Systems concept have been employed to understand the causal relationship between infrastructure , environment , economy , social well being and their relative influence of agencies to measure the functions of the system pertaining to transportation planning.
10. To understand the dynamic function of the urban system and its fringe area development population have been considered as a major variable.
11. System dynamic models have been employed in planning. Simulation models, Forecasting models etc., are used in their model tool to evolve optimal sustainable urban development plan. In this human settlement, human and natures interactions are quantified in a integrated manner to develop appropriate simulation model.
12. Decision support system, Game theory are also employed to evolve sustainable urban development projects.
13. The following factors comprising spatial , social, economy and environmental are considered for evolving and integrated plan leads to sustainable development is prepared by using planning support system method In this sustainable land use strategies have been evolved which is useful for optimal physical planning .
14. Over the years, due to development uncertainties raised which hinder development process to measure the uncertainties in development in pertaining to socio economic and environment systems concept have been used which leads to optimal plan preparation for sustainable urban development .

The Investigator has chosen the walled City area of the Jaipur city for conducting the present investigation after conducting the literature survey and thoroughly analyzes them. Since the study area is having the problems of backwardness. To conduct the investigation, a set of objectives are framed.

1.4 OBJECTIVES

The following objectives are framed to conduct the investigations.

- To assess the existing physical, socio-economic and environmental condition of the walled city area.
- To study the present status of development.
- To identify the control parameters, which decide the functions of the systems.
- To forecast the demand and supply of infrastructure services for 2031 A.D.
- To evolve a set of plausible guidelines for sustainable development of the system.

1.5 SCOPE

The present study aims at preparing a set of policy guidelines and evolving a feasible development plan to achieve sustainable development in the study area. The investigator hopes that if the proposed recommendations are implemented constructively in the system, the study area will achieve sustainable development.

1.6 CONCEPT

System concept is employed in the investigation. A system functions as a whole with the interaction of several sub-systems. All the subsystems of the system are interlinked and interdependent on each other, and function as a whole with dynamic characteristics. If one of the sub-systems are functions with advancement or defunct, or partly function, its effect can be observed in the whole system.

The study area under investigation is considered as a system, which has the following sub-systems, such as, physical, social, economic, ecological, environmental, infrastructure and institution and is functioning as a whole. These entire sub-systems are interlinked & interdependent to each other.

This system concept is employed to assess the functions of the system and to evolve a set of policy guidelines for feasible sustainable development of the system.

1.7 RESEARCH DESIGN

Survey research methods have been employed in this investigation. The research methodology of this investigation is presented in Fig. 1.1

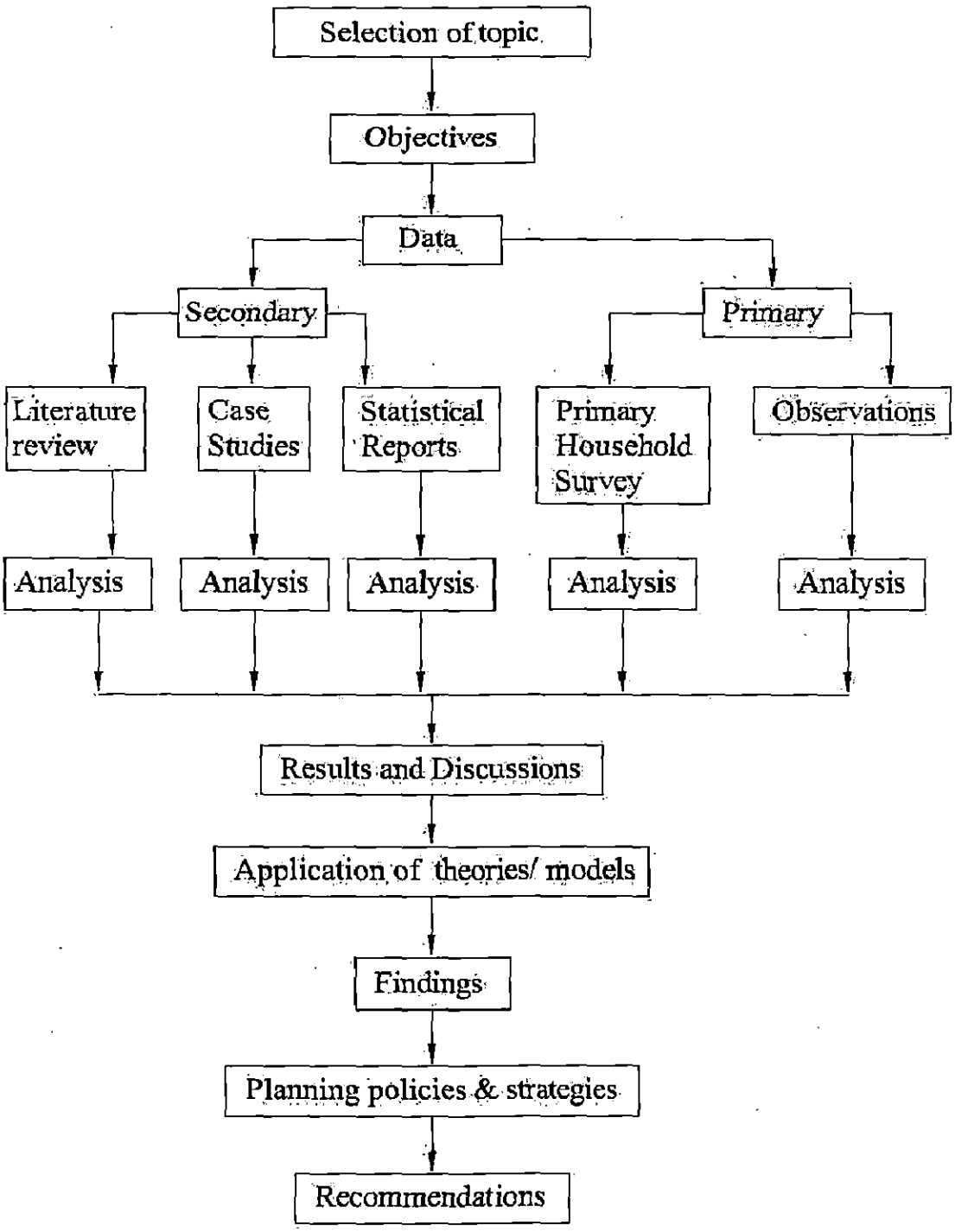


Fig. 1.1 Research Methods

1.7.1 Data

Two sources of data were collected and employed in this investigation. They are:

a) Secondary Sources: Published literature and unpublished literature, documents, etc., pertaining to this investigation.

b) Primary Sources: Conducting survey at various levels for obtaining the requisite data.

1.7.2 Tools and Techniques:-

1.7.2.1 Survey Tools

Relevant Survey tools, such as, schedules, questionnaire were employed.

1.7.2.2 Survey Techniques

A suitable random sampling technique was employed for identifying households, conducting investigation, etc.

1.7.2.3 Analytical Tools

Relevant analytical tools, such as code sheets, computer hardware, software (Microsoft, Mat lab) were used for data processing and analysis.

1.7.2.4 Analytical Techniques

Relevant Analytical techniques, such as, tabulation, correction etc., were attempted based on the requirement.

1.7.3 Analysis

Analysis was done on the basis of literature survey and the survey results

1.7.4 Application of Statistical Techniques

Appropriate Statistical techniques, such as, standard deviation, forecasting techniques, etc., were employed based on the requirements.

1.7.5 Application of Theories / Models

In the present investigation, the Investigator employed theoretical conceptualization of the system dynamic theory to establish the functions of the urban system. Further, Abraham Maslow's Theory of Hierarchy of Human Needs is also employed in this investigation.

1.7.6 Results & Discussions

Results of all types of analysis, such as, literature review, household survey etc., were discussed in detail to draw inferences.

1.7.7 Findings

Plausible findings were drawn for evolving a set of policy guidelines and for developing a feasible sustainable development plan.

1.7.8 Recommendations & Conclusions

Plausible recommendations were made to achieve sustainable development of the system (study area).The study is concluded with the plausible recommendations.

2.1 Introduction:

The Investigator has reviewed two case studies to supplement the literature review for in depth understanding the system. The studies, pertaining to Udaipur and Navi Mumbai, are studies carefully, and are presented -- as below:

2.2 CASE STUDY OF UDAIPUR

2.2.1 A Heritage City

Udaipur is confined in the State of Rajasthan lies in the, latitude: 27.42^{0}N, longitude: 75.33^0 E, covering over 37 km^2 and 577 m above sea level. It is on the banks of the River Ayad, in a valley surrounded by the Aravalli hills, near Lake Pichola. The lakes surround imperial palaces, built in the seventeenth century of marble and sandstone, and lend the status of heritage city to Udaipur – with a legacy of 500 years of architecture, culture and natural beauty. The capital of Mewar State, Udaipur, takes its name from Maharana Udai Singh, who founded the city in 1568 after retreating from the third attack on the city of Chittaur by the armies of the Mughal Emperor Akbar.

The old city within the walls is built on small hills and consists of narrow medieval road and twisting lanes with small temples at turnigs. Interspersed with old dwellings are new and modern shops, houses, markets and down-to earth busstands. Udaipur is home to various arts and cultural centers, as well as promoting and supporting rural and local crafts, including jewellery and fabrics.

2.2.2 The traditions of sustainability

Udaipur has traditionally maintained the spirit of living in a sustainable manner. The traditional festival of Hariyali (green) Amavasya (no moon day) is celebrated at the onset of rainy season. The entire community observes this festival on the banks of lakes and rivers and on the hills surrounding the city-the objective being to spread the message of the significance of lakes and plant life for a sustainable Udaipur.

The women of Udaipur perform an annual ritual to the goddess Dashamata, where trees are worshipped for the long life of their spouses. The trees are holy and sacred and the message of conservation of forests is reflected in the ritual. This is a way of communicating that the trees are vital for the sustenance of human being, and religious symbols are strong way to put that across.

2.2.3 Traditional Water Resource Management

Udaipur is built on the banks of the River Ayad and is famous for its man-made lakes (built around 200 years ago). As a city grows geographically and demographically, pressures on the natural resources, and particularly water resources, increase. The perpetual water flow took care of all aspects of growth, development of the city, irrigation, drinking water, Bawris (reservoirs), maintaining the water level of lakes and ground water, salubrious climatic conditions, and conservation of forests.

There are about 50 Bawris, built between 500 and 100 years ago, in the city which are recharged by lake water. They are unique architecturally, the water contained in an open square or rectangular tank reached by a flight of steps.

2.2.4 Systemic Issues of Sustainable Development

Udaipur's economy has traditionally been agrarian-commercial. The principal areas for economical sustenance today are tourism and mining.Tourism has opened new vistas for employment in this region, and the hotel industry has witnessed a boom as a direct offshoot of the increase in numbers of tourists. However, some construction has been controversial where greenbelt land has been used for hotels. Furthermore, natural areas surrounding the lakes have been encroached upon and the lakes are being used as hotel disposal conduits.

The demand for land increases, which, in turn, sends real estate prices spiraling with the mushrooming of hotels. The construction of hotels in contravention of environmental norms, encroaching into the lakebed and riverbanks and polluting the drinking water (Judev 2003) is a serious threat to sustainability. Exploration of the mineral wealth of the region has contributed to employment and local finances.

The increase in the average atmospheric temperature in the past few years in Udaipur has been attributed to the development of the mining industry. This has also resulted into deterioration of the water resources. Intensive marble mining has emerged as a major problem in the region. This disrupts the natural watershed by leaving behind both gaping holes and piles of rubble. The cutting of marble also creates a fine white powder that settles on and destroys the surrounding vegetation. Marble cutting consumes large quantities of water, usually tapped from deep underground sources. Mineral wealth has generated enormous economic opportunities but indiscriminate mining activities have taken their toll on the environment. Semi-mechanized opencast mining has endangered forest cover. The result is havoc, in the form of climatic changes and drying up of water resources. A chain reaction had been triggered and the ultimate consequences of unsustainable development are dreadful.

2.2.5 Water resources

With the growth in population, further environmental dangers are feared. The water resources are inadequate to sustain the growing number of inhabitants. With forest cover and the green belt in peril, the water resources are also at risk. The recharge basins, responsible for perennial availability of water in the traditional Bawris, have given way to a concrete jungle. The populace perhaps is now reaping the aftermath of developing unsustainably. Thousands of tube wells both for agricultural use and urban domestic consumption, are a primary cause of the falling water table. World Bank, Bakshi, (2001), depicts the facts of increasing consumption of water with population rise and over use of underground water resources and the resulting perils. The ground water level has receded alarmingly with the increase in general demand for water. Indiscriminate underground boring for water is a common phenomenon and has led to a drastic decrease in the water table (Chakravarty 2003). The Bawris have been destroyed and the river is degenerating.

The rapid development of the city is becoming a serious threat to the existence of the river, lakes and hills surrounding Udaipur. The River Ayad has become a convenient channel for the disposal of industrial wastage and sewerage. The river carries enormous quantities of sediment, which is both killing the river and filling up the reservoirs with silt. The people may boast of modern development, they have used the embankments for residential settlements at the expense of recharge basins and they have attained industrial development by using the river as a conduit for waste disposal. They are basking in short-term increases in their quality of life but they are losing long-term sustainable development. All this has led to an ecological disequilibrium. The disturbed ecological balance is turning up its heat – literally – on the city.

The most significant environmental (E) aspect in the system of Udaipur is its ecology. The disastrous consequence of unsustainable development disturbed the ecological balance in the city.

2.2.6 Findings:

The increase in population, which is a result of growing economic opportunities, has put pressure on the land available for cultivation, forests and the beautiful hills surrounding Udaipur. As land holdings have been divided within ever expanding families, most people no longer have enough land for viable agriculture, even in a good rain year. The growth, if not in consonance with the environment, is in direct contrast with the concept of sustainable development (Banerjee 1988). In the past few years, forest cover, especially on the hills, has been seriously damaged and encroached upon by illegal settlements. Increasing population has also caused pressure on both residential and commercial land, resulting in large agricultural farms being sold for construction for residential and commercial use, and existing green belt cover being destroyed.

1. Agriculture as an occupation is also under serious threat due to the non-availability of cultivable land that is now being increasingly used for residential colonies, tourist resorts, marble mining and the construction of hotels.
2. Agriculture has a relatively long gestation period, whereas other businesses pay back relatively quicker.
3. Fertile land was the source for sustainable employment for a large number of families, and also fulfilled the demand and supply equilibrium for food grains and vegetables but is now being used indiscriminately for nonagricultural purposed.

   It is only the spirit of sustainable development amongst the people of Udaipur has kept the city alive. The public action is required to maintain sustainability of the region and there is no alternative any amount of government action is meaning less without the active participation and initiative of the people.

2.3 CASE STUDY: NAVI MUMBAI

Navi Mumbai project was planned to accommodate two million people from Mumbai by virtue of the method of financing its development. Navi Mumbai acts as an effective counter magnet for Mumbai. CIDCO formulated a strategy to develop transport and communication infrastructure in Navi Mumbai, as part of the development program of the Mumbai Metropolitan Region.

2.3.1 Study area:-

Greater Mumbai has limits to its growth due to its peculiars physical shape. The city of Navi Mumbai owes it origin to the realization in the late 1960s. Mumbai is a collection of small islands, which is in the form of a narrow strip, extend into the Arabian Sea. Its central Business District located at the Southern most tips, there by, concentrating activities in a small area and leading to unidirectional traffic movement. The study area (Navi Mumbai) is presented in Fig. 2.2

The wedge shape of city aggravated the problems in the Mumbai they are lack of drinking water, free flow of sewage, slums, sub – standard environment, congestion, increase in vehicular traffic etc.

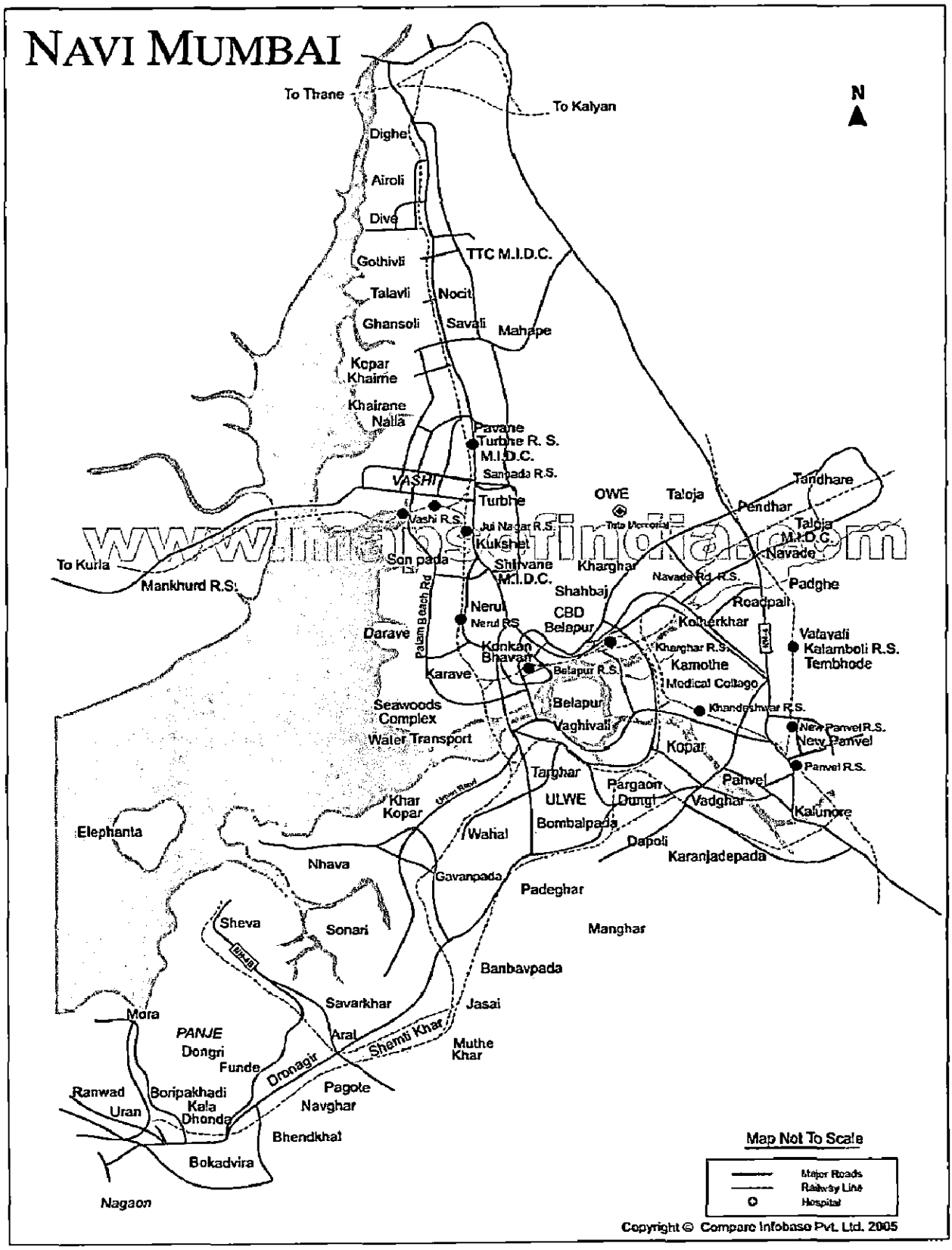


Fig. 2..2 Study Area (Navi Mumbai)

2.3.2 Objectives:

The Navi Mumbai has been developed in order to meet the following objectives:

- To decongest the Mumbai city in terms of population & their activities.
- To provide housing and office space at prices, which were small proportions of the prevailing prices in Mumbai for the same.
- To ease the traffic congestion problem in Mumbai city.
- To provide new markets in Navi Mumbai for 60,000 jobs and accommodate 100,000 visitors daily.
- To release activity space in Mumbai by relocating certain trade & commercial activities.
- To create and maintain of housing stock, infrastructure financing, and maintenance of public health by public private partnership.
- To integrate the original land owner into the new urban setting, thus making the program financially viable through a market driven approach.

2.3.3 Scope:

The city has been planned on the principles of sustainable development. A new city was thus developed, which has been new methodologies being applied, such as, involving people in the development of the city through their participation, using land to generate the resources needed to run the city, offering a better quality of life and amenities, etc.

2.3.4 Variables considered

Some of the most important variables considered in the project are as under:

(A) Housing

CIDCO built the 103,750 houses and total housing stock of Navi Mumbai is 165,000, which are distributed among various categories such as the lower income & economically weaker section categories (47. 39%), the middle income group category (37.33%), and the higher income group category (15.28%). The rest of the houses are built by the private & co-operative sectors. The private sector has catered only to the higher income group.

(B) Water Supply

The Navi Mumbai ground water is saline and hence, not potable, so rivers Barvi, Ransai, Patalganga are the main sources of drinking water supply to Navi Mumbai. These sources supply

65 MLD per day of water. 12 percent of expenditure of physical infrastructure is used for drinking water supply.

(C) Sewerage and drainage

It is planned underground, running on pumping and gravity mechanisms. The treated effluent is used for gardening and afforestation in some cases.

(D) Solid Waste Management

The elaborate road network facilities, efficient collection and transportation system of solid waste are introduced. Two dumping sites, served by 14 compactors are provided. In Navi Mumbai, the total solid waste generated is 325 MT per day.

(E) Transportation

Water transport, by way of Hovercraft services is planned between the Gateway of India and Navi Mumbai. A Mass transit rail commuter system, covering a length of 157 Km. & occupying 900 – Hectare areas, is planned, with 7 corridors and 26 stations. Almost all the plots are approachable by vehicular – asphalt road. A total road length of 550 Km is already developed till the end of 1994.

(F) Social Amenities:

Navi Mumbai confined 38 educational, 28 socio – cultural, 18 welfare and 14 religions institutions till 1992, which has helped the cosmopolitan residents lead fuller and richer lives.

(G) Land Development

The land developed by shifting of wholesale markets, commissioning of commuter railway, provision of infrastructure, etc., have helped in hiking the real estate prices in Navi Mumbai.

(H) Environment

In Navi Mumbai, the pollution levels in the city are greatly reduced except for the high level of hydrocarbons, which is due to heavy traffic on the roads. There are 85 gardens covering an area of 40 hectare and 1.2 million trees planted under the afforestation program.

(I) Social life

Majorities of the families in Navi Mumbai are nuclear, with high education and employment rates. The organized open spaces allow active recreation for children and youngsters.

2.3.5 Findings/Inferences

1. Navi Mumbai was developed on polycentric nodal pattern to avoid a situation like Mumbai.
2. Avoiding the unidirectional flow of traffic during peak hours, the employment centers are sought to be dispersed.
3. Better environmental control by using land use zoning and development regulations as tools.
4. Mass transit transportation system is planned and supplemented by the road transport.
5. Controlling the development from high to low intensities, the differential floor space percentage index for different land uses, is adopted.
6. Achieving equitable distribution of benefits of development, the entire area of Navi Mumbai was notified for acquisition, mainly to use it as a major resource for development.
7. Structure planning was adopted by acquisition of complete land.
8. Public – private partnership was adopted at various levels and aspects, such as, land assembly and development planning designing, infrastructure, maintenance of municipal services etc.
9. Participatory developers scheme has been evolved for providing the housing to lower income groups.
10. Participation of citizens is sought in collection of bills, such as service charges, environmental upgradation measures, etc.

2.3.6 Conclusions

The land is the only major resource of development, due to that the project is unique in nature, which has been effectively utilized to generate finance for the development and maintenance of the city. Sustainability is achieved by establishment of partnerships and involvement of the people.

The Navi Mumbai was developed with the aim of decongesting Mumbai in terms of population, traffic and its activities. The city was developed as a counter magnet of Mumbai.Land as a resource used for achieving physical, economic & environmental sustainability. New concept of town planning, i.e., establishment of various partnerships, infrastructure financing, maintenance of public health & an innovative rehabilitation program have helped in achieving the objectives of the project.

The following strategies adopted for the sustainable development of Navi Mumbai, which are summarized into the following five heads. They are:

a) Planning
b) Land Development
c) Financing
d) Implementation
e) Rehabilitation

The efforts shown in adopting new approaches in the project is commendable, but it is not necessary that the project may be entirely successful, gives the complexity of the problems in the urban areas. Still such efforts are needed to achieve sustainable development of our cities.

3.1 Introduction

Jaipur is the pristine jewel in the desert sands of Rajasthan and confined in the rugged hills of the Aravallis. Jaipur is as remarkable for its marvelous architecture and town planning as it is for the lively spirit of the people who inhabit it. The picturesque capital of Rajasthan, Jaipur is color washed pink-the color associated with hospitality in Rajput culture. Jaipur displays a remarkable harmony and architectural splendor. The ancient heart of the Pink city still beats in its fairy-tale palaces, rugged fortresses perched on barren hills and broad avenues that dominate entire city. The only planned city of its time, Jaipur is encircled by a formidable wall.

This famous city is the capital of Rajasthan and has earned universal renown as "Pink City ", and pink it is, with beautiful constructed palaces, havelis and forts. Jaipur, which means the city of victory was built exactly 273 years back and is 262 km by road from Delhi (Capital of India). A strong wall encircles the old city and even today has a suggestion of formidable strength; its function of protecting all within is obvious. The plains of Rajasthan of which Jaipur is the capital once thundered and echoed with clash of swords and the drums of wars. Built in 1727 by Sawai Jai Singh-II, Jaipur was the first planned city of its time (the earlier planned city in Northern India having been built near Taxila sometime in the 2nd century BC). Jaipur was planned by Vidhyadhar Bhattacharya, a Bengali architect, in a grid system with wide straight avenues, roads, streets and lanes and uniform rows of shops on either side of the main bazaars, all arranged in nine rectangular city sectors (chokris) in accordance with the principles of town planning set down in the 'Shilpa Shastra'- and epochal treatise on the Hindu architecture.

3.1.1 Location

Jaipur city is located at 26 degrees and 54 minutes North latitude and 75 degrees and 49 minutes east longitude. It is bound in the North by Sikar and Alwar, in South by Tonk, Ajmer and Sawai Madhopur., Nagaur, Sikar and Ajmer in the West and in East by Bharatpur and Dausa districts. The study area is presented in Fig. 3.1.

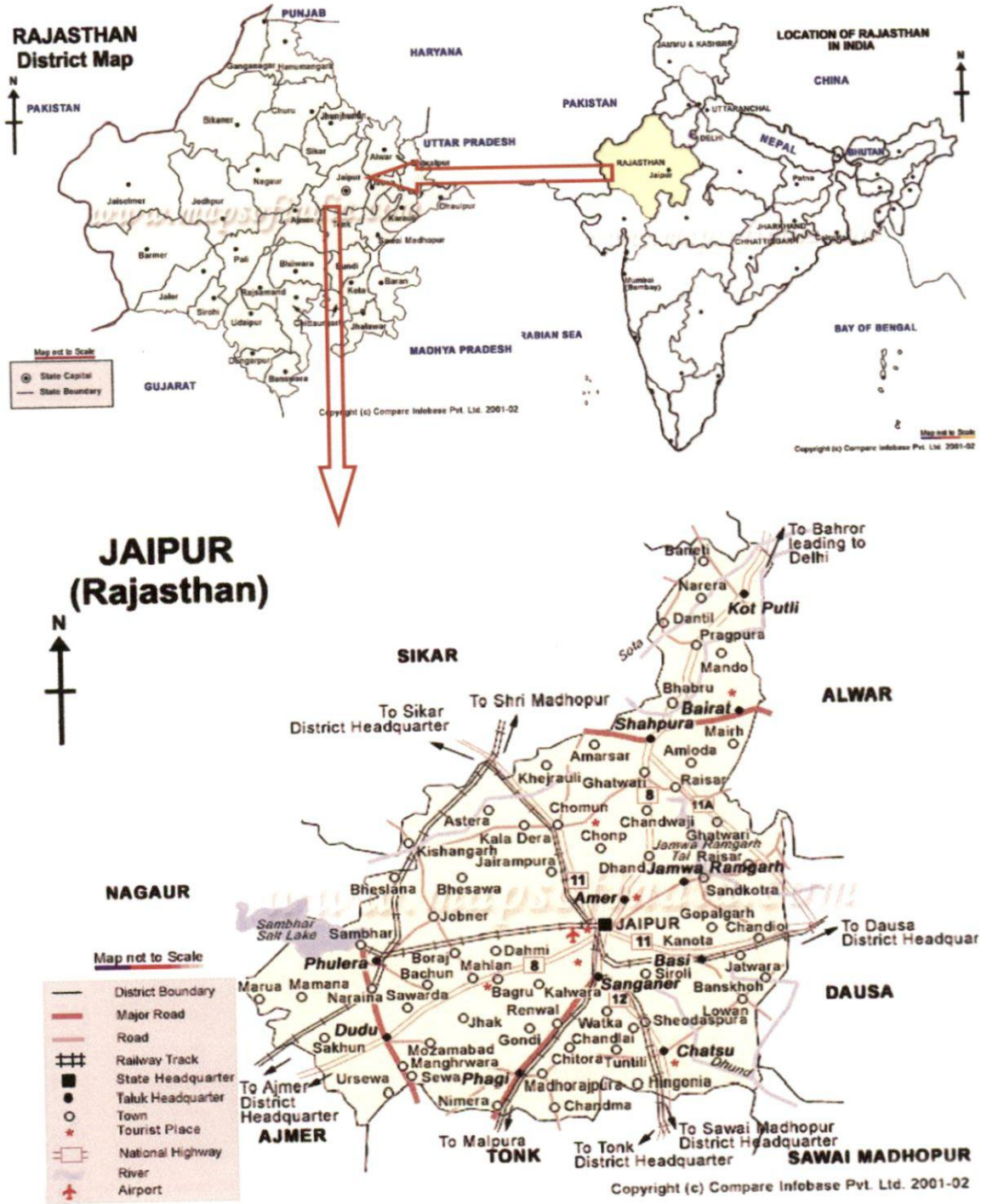


FIGURE 3.1 : Location Map

3.1.2 Region

Jaipur Region comprising of area includes Jaipur city, Amer, Sanganer, and towns and settlements of Bassi, Chandlai, Sheodaspura, Bagru, Chomu, Achrol, Jamwa Ramgarh and Contiguous areas. The area of Jaipur Region may work out to be approximately 1464 Sq. Km & it's 4.11 % of the state which is shown in the Fig. 3.2

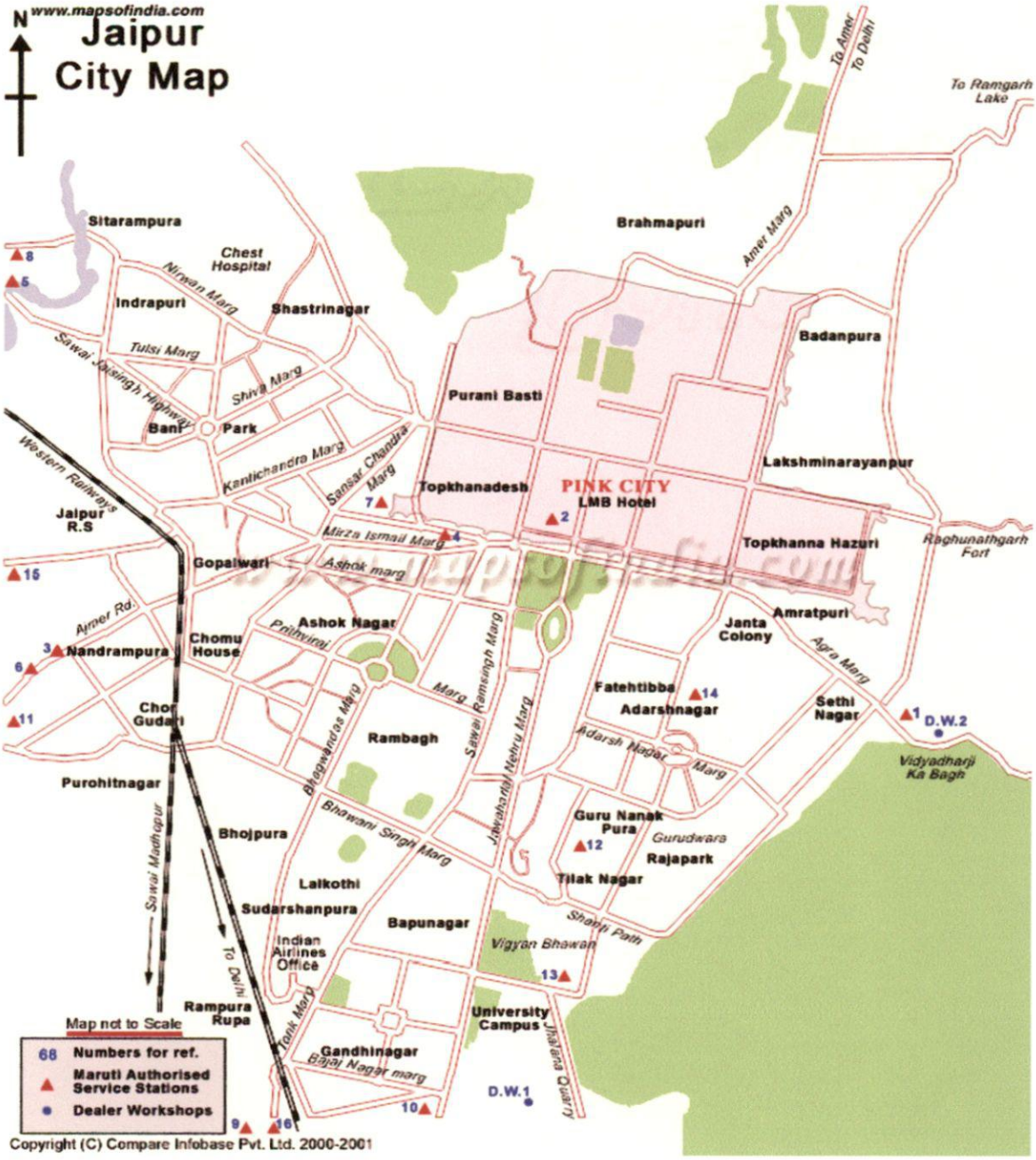


FIGURE 3.2 : The Study Area

3.1.3 Regional Linkages

Jaipur is well linked by roads, railways and airways to the rest of the country. The city lies on Delhi-Ahmedabad rail route of Western Railways. The N.H. 8 and N.H. 11 intersect at Jaipur and NH 12 leading to Jabalpur starts from Jaipur. Jaipur lies at a distance of about 260 Kms from Delhi, 135 Kms from Ajmer, 225 Kms from Agra, 245 Kms from Kota. The city is well connected by Air with its airport at Sanganer located towards South of the city. The regional linkages for Jaipur city is presented in fig.3.3.

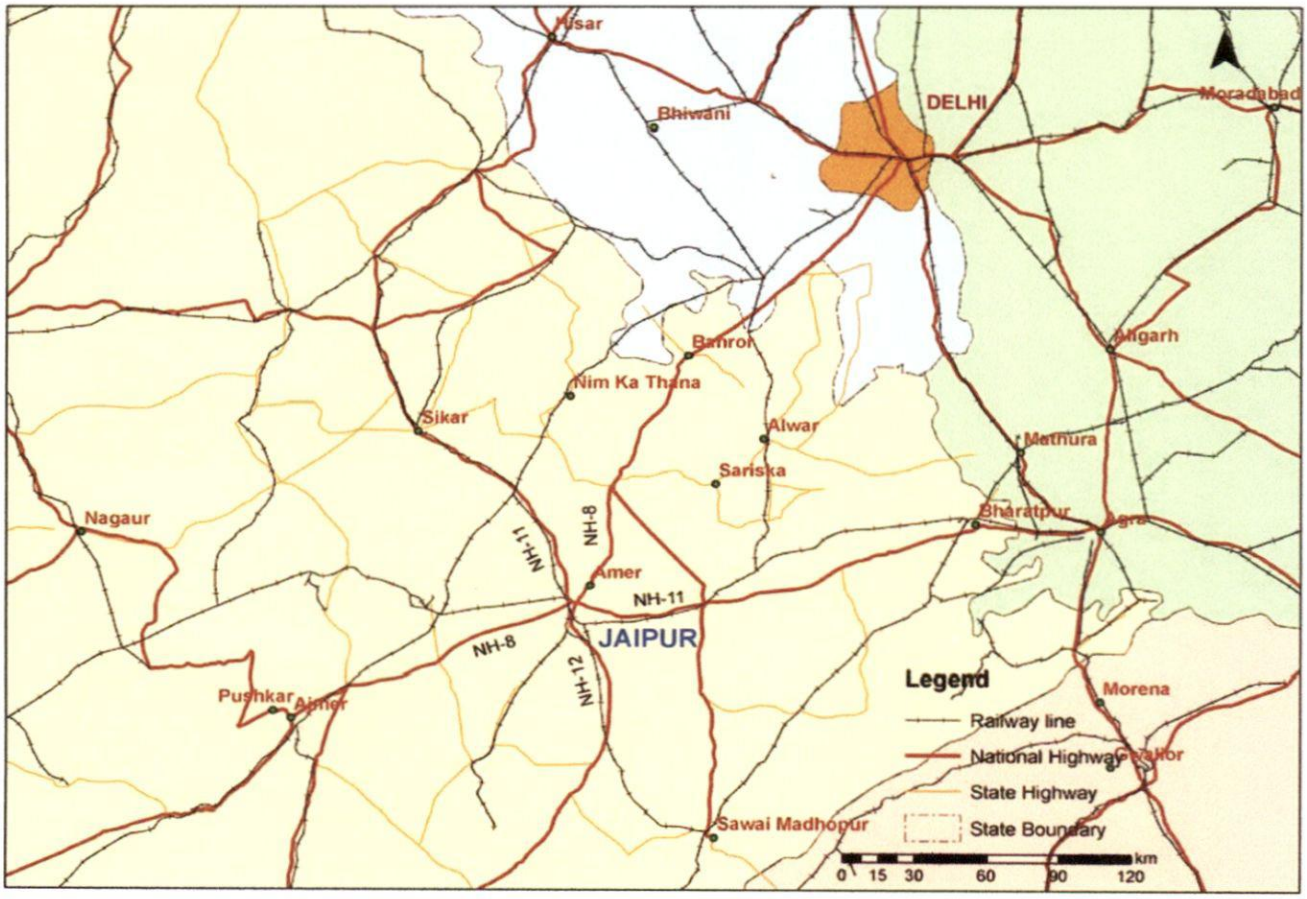


Figure 3.3 : Regional linkages

3.1.4 CONSTITUENTS OF JAIPUR REGION

The Jaipur Region comprises two distinct constituents

- The Jaipur Municipal Corporation (JMC) that includes the walled city and the rest of JMC;
- Rest of JDA area that include the satellite towns and the villages.

The entire JDA area comprises Jaipur city (JMC) and the neighboring satellite towns namely, Chomu, Bagru, Bassi, Sheodaspura, Achrol and Jamwaramgarh. It covers a total area of 1464 sq.km, out of which, the municipal area of Jaipur covers 288 sq.km. The JMC Area is further divided into the walled city and the rest of JMC area. The walled city has a spatial extent of only 6.7 sq. km. but houses nearly 4 lakh people. The 2001 census shows that the population of the walled city has decline from 1991 due to out movement of inhabitants from the area to new residential colonies. The constituent of Jaipur area is presented in table 3.1 and Fig. 3.4

Table 3.1 Constituents of Jaipur

S. No.	Area	Total Area (sq. km.)		Total Population (millions)		% to Total JDA Population	
		1991	2001	1991	2001	1991	2001
1.	JMC	218.3	288.4	1.52	2.32	81.4	86.8
1a.	Walled City	6.7	6.7	0.5	0.4	26.4	15
1b.	Rest of JMC	192.3	281.7	1.02	1.92	54.7	71.8
2.	Rest of JDA	1220	1149.9	0.35	.36	18.6	13.2
3.	Total JDA	1464	1464	1.87	2.68	100	100

Source: Census of India- 1991 and 2001.

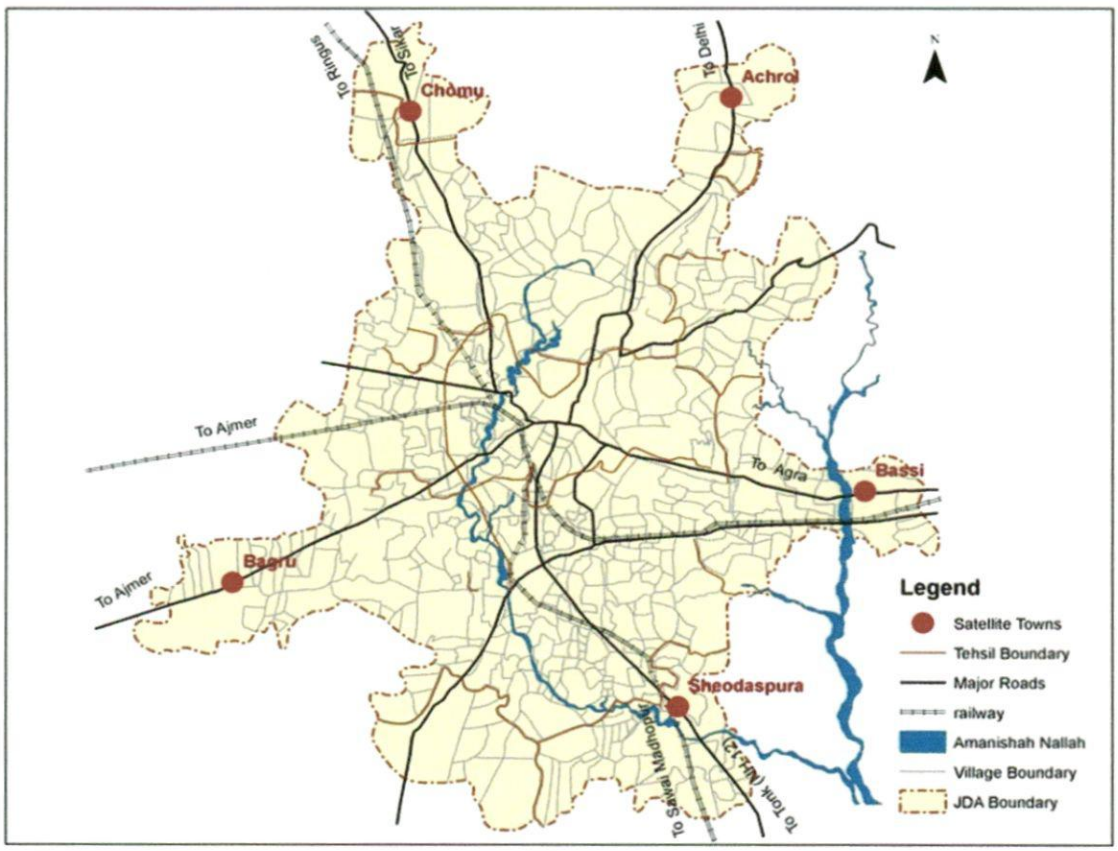


Figure 3.4: Jaipur Development Authority (JDA) Area

3.2 PHYSICAL CHARACTERSTICS

3.2.1. Climate

Jaipur region falls under the semi-arid region of climatic zones and experiences a continental type of climate owing to its proximity to the desert and it being inland. It is characterized by hot summers and cold winters.The month of May experiences the highest maximum temperature of 40.3°C and January the lowest minimum temperature of 7.8°C. The data is based on 30 years observations recorded by the Indian Meteorological Department. Jaipur recorded the maximum temperature of 45.2°C and minimum temperature of 2.5°C in the year 2001. The climatic characteristics of Jaipur region are presented in Table 3.2

Table 3.2 : Climate Characteristics of Jaipur Region

Months	Temp (°C)		Mean Wind Speed (Kmph)	Rainfall (mm)	Relative Humidity (%)	
	Maximum	Minimum			8:30A.M	5:30 P.M
Jan	22.5	7.8	5.6	7.9	63	35
Feb	25.7	10.7	5.5	11.7	54	28
Mar	31.5	15.8	7.9	6.1	42	19
Apr	37	21.4	9.7	4.1	30	16
May	40.3	25.4	12.6	16.2	32	17
Jun	39.3	27.2	12.5	66	52	32
Ju	33.9	25.5	9.5	216.3	75	61
Aug	32	24.3	8.4	231.2	82	70
Sep	33.2	22.9	7.6	80.3	72	55
Oct	33.4	18.6	6	22.6	51	32
Nov	29	13.1	3.9	3.2	50	33
Dec	24.4	9.1	3.9	3.3	61	38

Source: Climatological Tables, 1951-80, IMD

Normal annual rainfall received by Jaipur is 563.8 mm. August receives the highest amount of rainfall of 231.2 mm, while November receives the lowest amount of 3.2 mm. The city gets its maximum share of rainfall from the Southwest monsoons. The maximum rainfall has been recorded in the month of August. The average annual rainfall for the year 2001 was 430.09 mm, that witnessed a drastic decrease in the year 2002 with the average annual rainfall received being 207.4 mm and average annual rainfall is presented in Fig. 3.5.

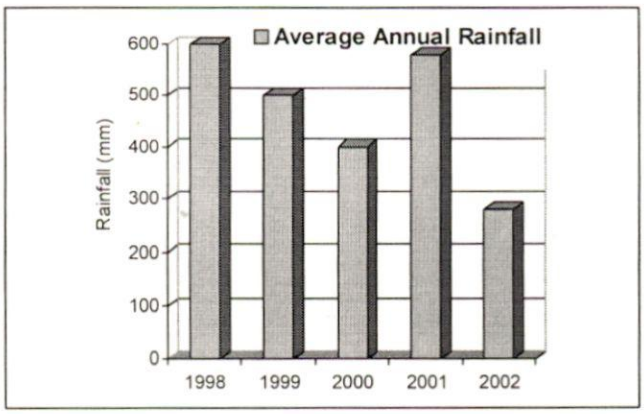


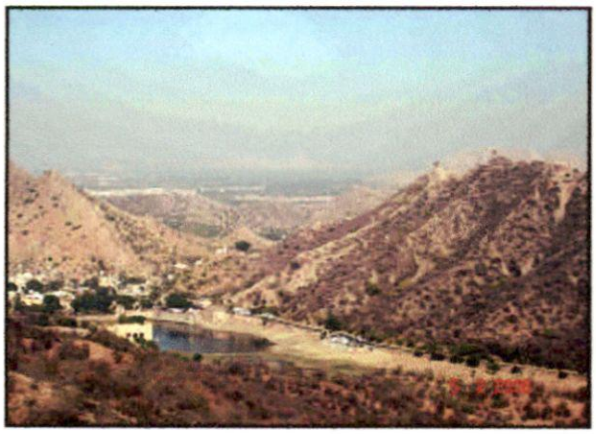
Figure 3.5: Annual Rainfall

Relative Humidity in the city is the highest in the month of August and the lowest in January. Wind speed is the highest in the month of May. The predominant wind is flown from the Northwest direction.

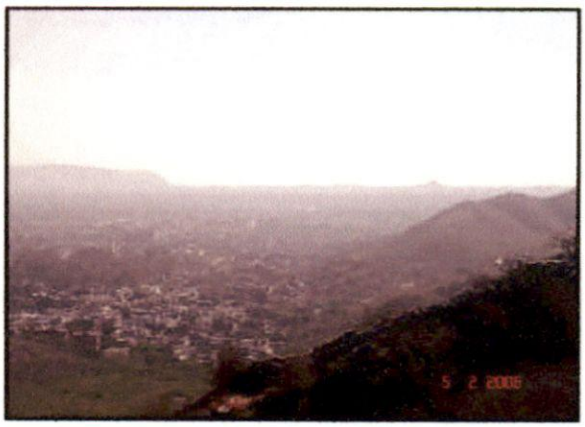
3.2.2. Land Resources

(A) Topography

Jaipur is surrounded by the Aravalli hills to the North and East. The South and West parts of the walled city area is reasonably flat. The elevation varies from 382 m to 462 m above mean sea level between the North and South parts of the city. The region is drained by a number of seasonal rivers of which Bangarana, Dhkundh, and Bandi are prominent. The Bangarana has been impounded near Jamwa Ramgarh by Ramgarh Dam. Amanishah nallah towards the West and the South of the city is a major drainage channel, which meets the Dhundh River towards South -East of the city. The Northwest region is drained by various local nallahs, which ultimately form the Bandi River. The Northern area is drained by local nallahs converging to form Bangarana River. The general slope of the Jaipur city and its surroundings is from North to South and then to South-east. Higher elevations in the North exist in the form of low, flat-topped hills of Nahargarh (587 meters). Jaigarh, Amber and Amargarh, which are deeply dissected and eroded. The overall trend is a decline of level from the areas bordering the hills in the North to plain in the South slopes of the plain areas are in general gentle



View of the Aravali Ranges in Jaipur



View of the city from Nahargarh Fort

(B) Drainage

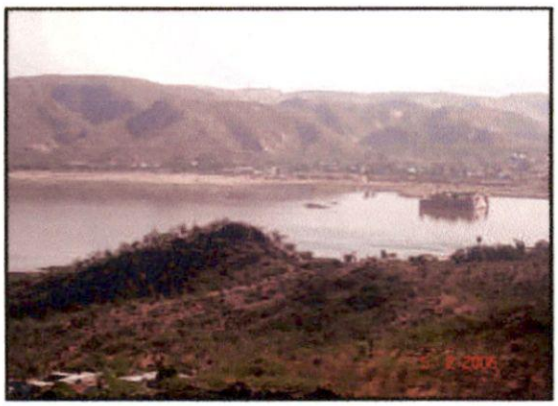
The general slope of the city is from North to South, which is also the direction of drainage. Nearly, all ephemeral streams flow in this direction. The Southern end of the city opens out in the plains and stretches far and wide towards Sanganer and beyond. The walled city was originally located on the rocky side to provide an easy drainage system on either side of the city but the future expansion of the city took place towards the south and west.

3.2.3. Water Resources

(a) Surface Water Resources

There is no perennial surface water source in the city. Amanishah Nallah and Dhund river are two non-perennial streams, which flow from North to South. The former passes through the Jaipur city while the latter flow on the East of the city and is joined by Amanishah Nallah in Southeast of the city.

There is another small drainage system in the North foothills, which fills up the artificially impounded lake called the Jal Mahal (Man Sagar). Among the large surface water bodies is Jal Mahal Lake or Mansagar Lake in the North of the city. It is approximately 130 ha in its full spread and has a catchment area of 23.5 sq.km. Approximately, 40% of the total catchment area falls inside dense urban area. The lake is used for the disposal of sewage. Other historic water bodies the Talkatora Lake in the walled city and the Ramgarh lake have dried up due to urbanization of their catchment areas. The Ramgarh Lake, which used to be the main source of supply for more than 30 years, and produces a negligible quantity today.



One of the natural drainage channels Flowing through the city

The Mansagar Lake

(b) Ground water Resources

Nearly 92% of the population of Jaipur depends on ground water for meeting their needs. The difference in ground water levels in various parts of the city is presented in Table 3.3 and Fig. 3.6. Ground water is available at the deepest level in the walled city and Jhotwara industrial area. This could be attributed to the high population density in the walled city and it being heavily dependent on ground water. . Jhotwara Industrial area also faces the same problem of groundwater being available at great depth. In this case, Amber is positioned very well with the water depth going upto 10-11m.

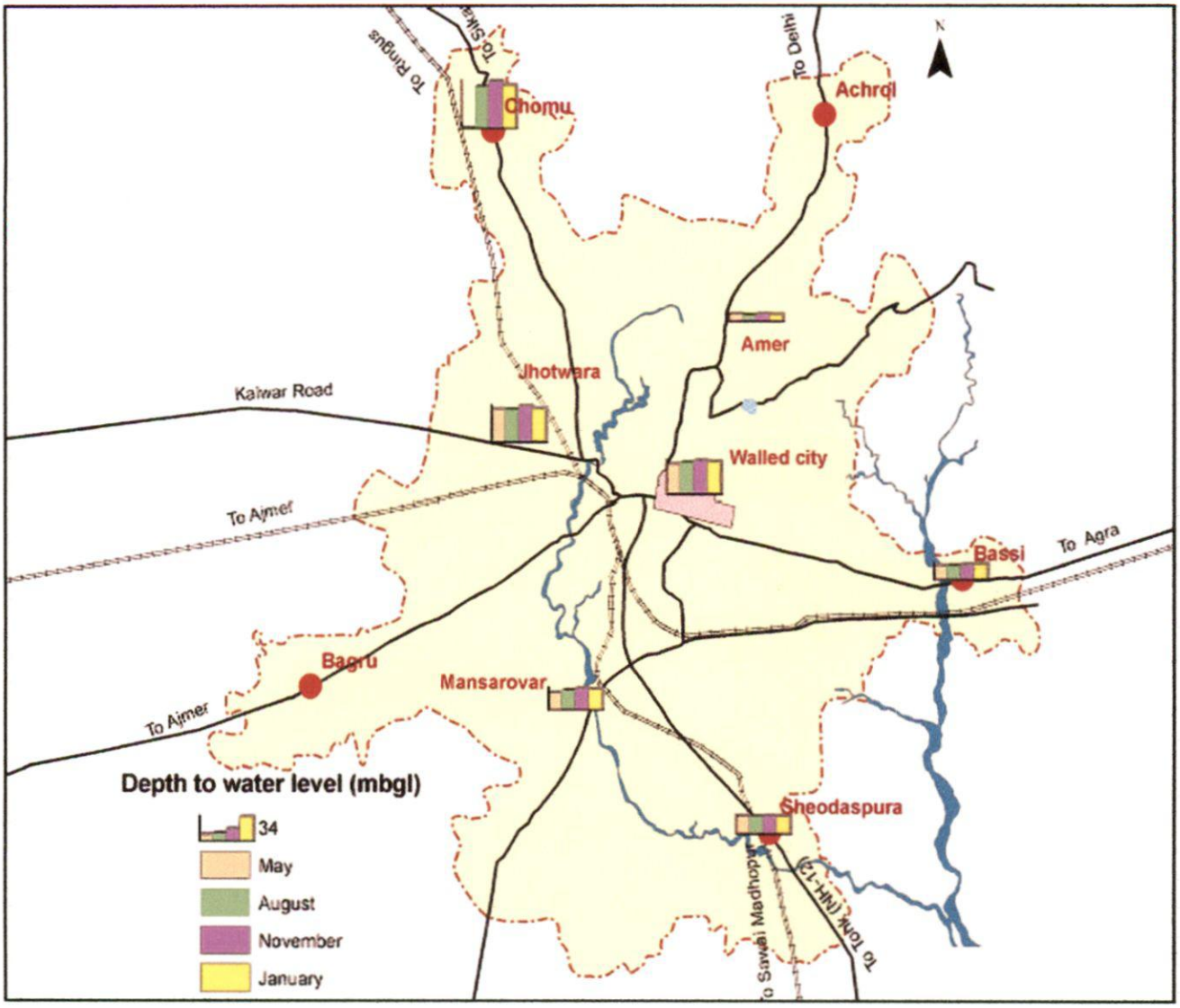


Figure 3.6: Variation in ground water levels across Jaipur city

Table 3.3: Variation in ground water levels across Jaipur city

Location	Depth to water level (mbgl)			
	May 2002	August 2002	November 2002	January 2002
Amber	10.96	10.50	11.27	10.60
Chomu	-	61.23	67.60	67.60
Walled city	42.7	46.16	48	47.25
Jhotwara	47.30	47.0	52.57	47.90
Mansarovar	24.55	28.75	30.15	29.55
Sheodaspura	25.02	25.21	24.96	25.18

Source: Ground water year book 2002-2003,Rajasthan Note: mbgl = Metre Below Ground Level

3.2.4 Forest Resources

Jaipur city is flanked by reserved forests on the North and East. Nahargarh reserve forest is to the North of the city and Amer reserve forest further to its North, Kilangarh reserve forest lies to the East and Jhalana Bani reserve forest is situated on the South-East of the city as presented in Fig. 3.7. The forests are characterized by dry forests of Khair tree. Deforestation is resulting in soil erosion, which is exposing the rocky surface and leading to silting of drainage channels. Drainage channels are a direct sufferer of deforestation. With the water resources already being scarce, silting of drainage channels only adds to the existing problems

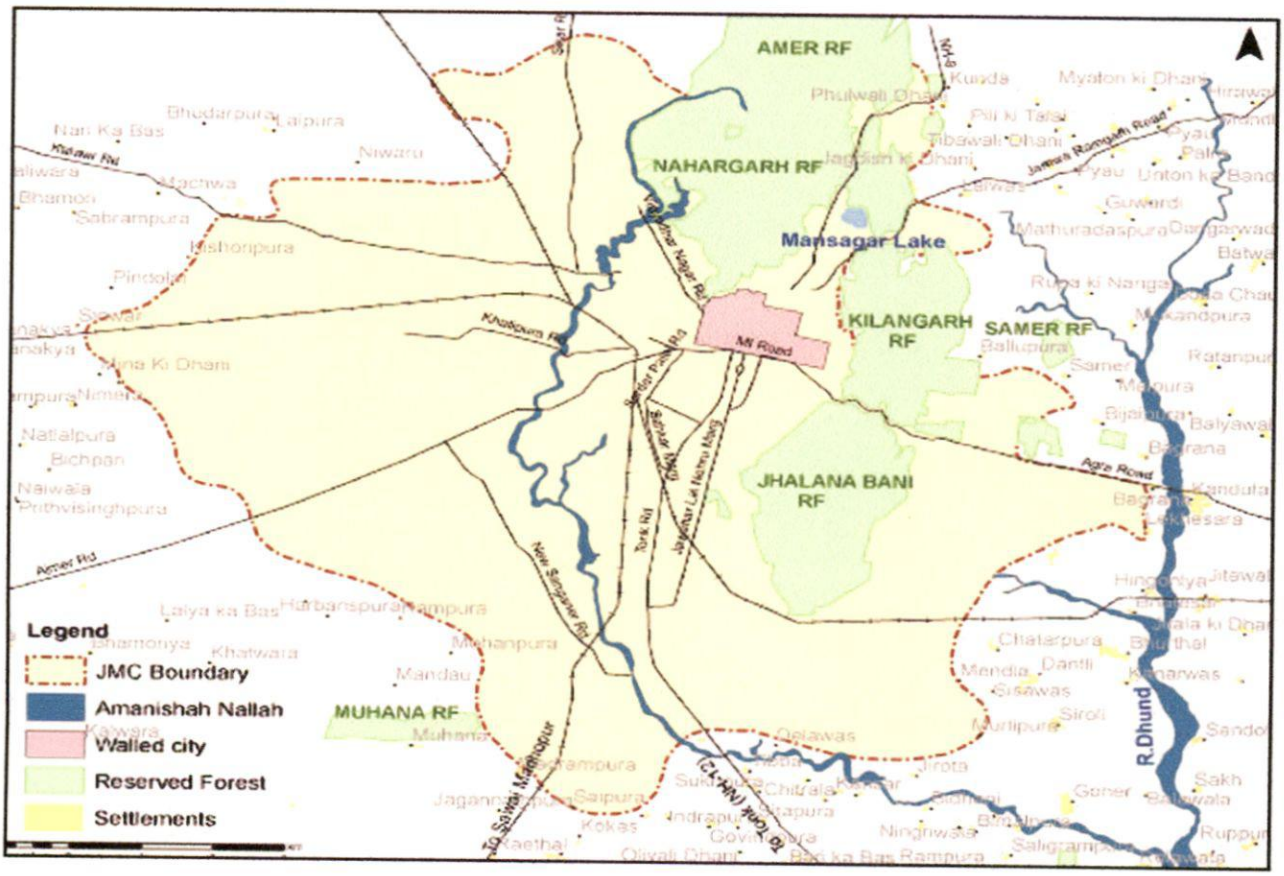


Figure 3.7: Forest areas in and around city

3.3. HISTORICAL BACKGROUND

Jaipur, like all other cities, has passed through different phases of growth, stagnation, decay and rapid development. Before Jaipur was built, Amber town was the capital of a small State by the same name consisting of three parganas-Amber, Dausa & Baswa. Its rulers belonged to the Kachwaha clan of Rajputs. The spatial growth pattern of Jaipur can be divided into four distinct phases. Each phase has made a special contribution to the development of Jaipur. The understanding of these phases would enable us to understand the growth trends better and appreciate the efforts that have gone into making Jaipur city as it today. The spatial growth of Jaipur has been presented in Figure 3.8.

3.3.1. Phase I: 1727-1850 AD

Foundation for this city of Jaipur was laid by Sawai Jai Singh II in November, 1727 as a new capital of the Amber State. Most of physical development of this new capital took place before 1800 A.D. Jai Singh's successors continued to add to the glory of the city by constructing various temples, palaces and other important buildings.

Jaipur is one of the few planned cities of its times based on the principles of ancient town planning doctrine of Shilpa Shastra. The city conformed to the traditional walled city concept with the encircling wall and 9 entry gates. Jaipur walled city evolved as a gridiron plan with the main road running almost East West along the ridge in the center and the palace complex at the core. The buildings were built following a strict Architectural guideline. By 1734, the main markets of the town including Johari Bazaar, Sireh Deorhi Bazaar, Kishanpole Bazaar and Gangauri Bazaar

3.3.2. Phase II: 1850-1930

During this phase, the city grew out of the confines of the walled city. The establishment of railway line in 1868 A.D fueled the growth of the city. During the Rajasthan Famine of 1868-69, Ramniwas Garden was constructed as part of the famine relief work. Modern water Works and Gas Works for lighting the city streets was also established during this phase.

3.3.3. Phase III: 1930-1970

In 1930s, five development schemes, Fateh Tiba, area south of Ramniwas Bagh, Ashok Nagar, New Colony in Jalu pura and Bani Park were conceived to provide residential plots, land for public institutions and other amenities for the increasing population. Civil Lines area was developed primarily to house the Senior Government servants. Mirza Ismail (MI) Road was constructed as a ceremonial highway from Ajmer Road to Moti Doongri Road in the early 1940s.

The beginning of Sawai Mansingh II's reign was the beginning of the modernization of Jaipur city. After Sir Mirza Ismail took over as Dewan of Jaipur in 1942 major land development schemes outside the walled city were taken up.

The Rajasthan University was inaugurated in 1947 thereby opening opportunities for the southward growth of the city. A sudden increase of population after partition was seen that was mainly due to the influx of refugees during this time. Bapu Nagar and Gandhi Nagar residential areas were developed towards south of the city. Development towards the Northwest of the city took place in the early sixties with the establishment of the Jhotwara Industrial Estate.

3.3.4. Phase IV: Post 1970s

During the last 3 decades, the major growth direction has remained largely the same i.e., towards the Southwest and Northwest of the city. This is due to the presence of hills in the

Northern and Eastern side of the city that act as natural barriers. Towards the South, the city has extended beyond Sanganer. On the West, the city now extends uptil the Western bypass road. New areas have developed between the Delhi railway line and the Amanishah Nalah on the West. The residential area in this place has been developed by the cooperative housing societies. Such societies have also come up in areas between Gopalpura bypass and Jhotwara Industrial Area.

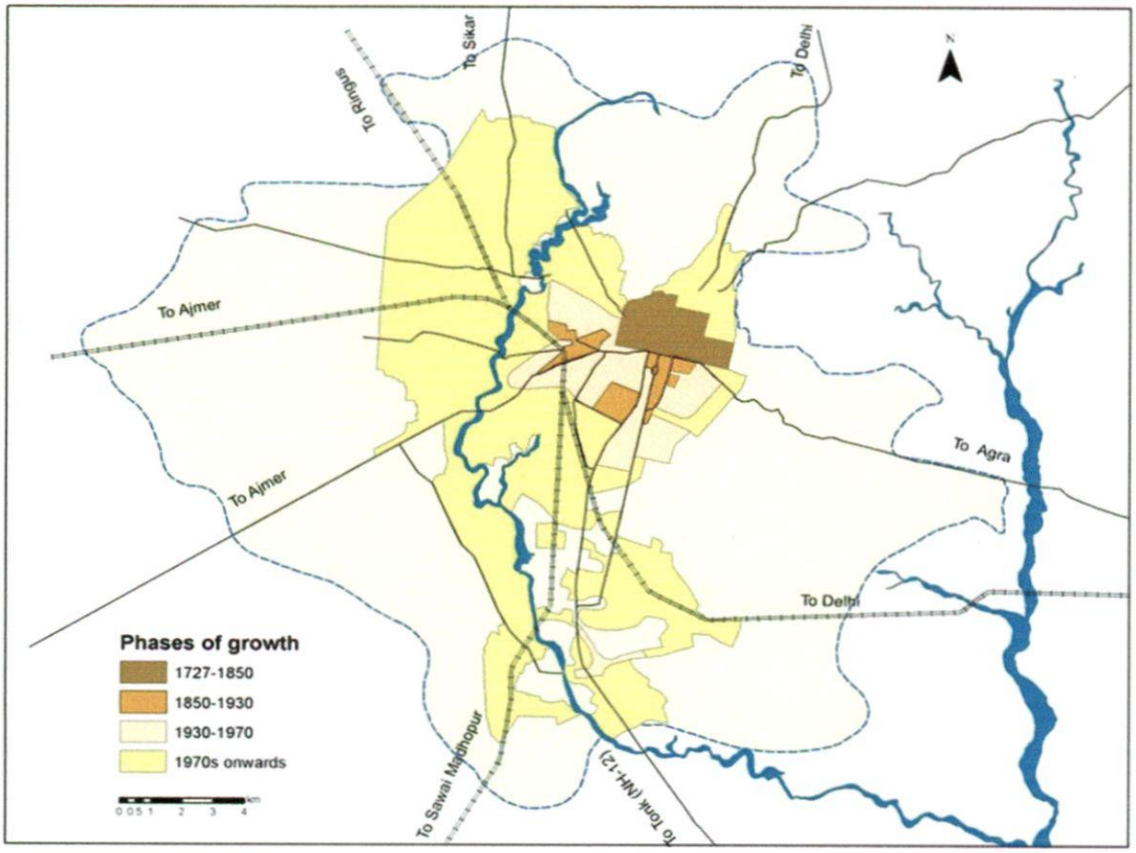


Figure 3.8: Jaipur Growth Pattern, 1727 to 2005

3.4 PLANNING OF THE CITY

The walled city is planned in the valley to the North and East of the city. On the North of the walled city, was the old capital Amer while the southern boundary was determined by the ancient trade route of Delhi-Agra-Ajmer. The city has been planned on the basis of Prastara style, one of the ancient treatises on Hindu town planning with a size of 4 Km x 6 Km. The city has been designed as a nine square grid (residential sectors) in keeping with the Vastu Shastra, six of them as an orthogonal cluster. The main axis of the city followed the local topography along a ridge so that natural drainage could be made use of. The town was divided into four, nine or sixteen major wards with appropriate number of roads running East West and North South. The central Square with the observatory accommodated the palace and its gardens, administrative offices, etc. covers a larger area merged with the square on its North.

Jaipur city is a geometrically square shaped city. The square of the walled city on a side of 1.61 mile is divided into nine equal works by two intersecting lines from each side at right angle, and at equal distances. Its approximate area is 6.77 Sq. km.

The iron-grid patterns of streets of Jaipur were carefully classified according to the width and usage. The main streets are 110 feet wide, while the smaller streets, lanes and by lanes are of proportionate 55 feet, 27.5 feet, 13.75 feet respectively. The crossings of the main market are called Chaupars. Like street width, the shops on both sides are also standardized in widths and design. There are about 160 shops between the Chaupars on each side of the main street and their widths and heights have been collectively worked out.

The roads are built on the highest level in an area to avoid their flooding during the rains, so the first major road running East-West along the Southern wall of the Chandra mahal (city palace) was kept on the crest line of the dunal plane. This ridge road running through the Chaupars. Since the crest line is not exactly East-West but slightly tilted from South-East to North-West at an angle of 11.75 degrees. Hence the square of the city automatically tilted by the same angle and it is not horizontal on the plan.

Thus, from the above description, it is evident that the walled city has not developed at any one time, but expanded from time to time by the rulers of Jaipur State and finally by the Government of Rajasthan. The walled city area is presented in Fig. 3.9.

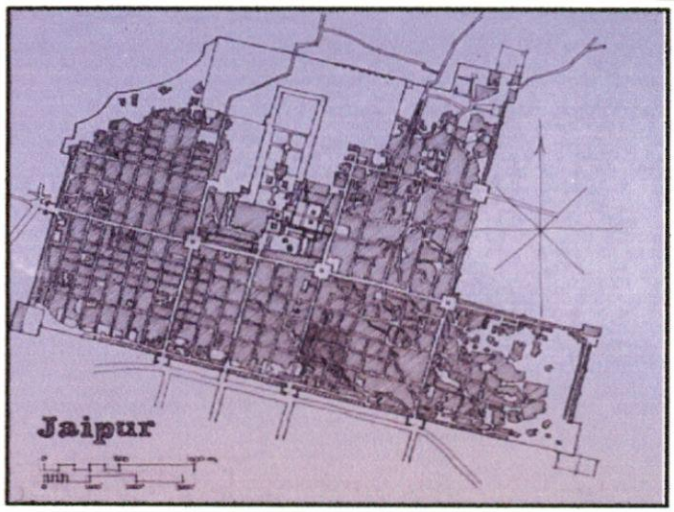


Figure 3.9: Walled city Jaipur

3.5 STATISTICAL ANALYSIS

3.5.1 Demographic profile

Total Population of Jaipur district is 52.52 lac and the total urban population of the Jaipur City is 24.89 lacs. The sex ratio for Jaipur city is 868, i.e., 868 females for every 1000 males. The density of population for Jaipur has been recorded as 6956 persons per sq. km. The population in this city from 1971 to 2001 is presented in Fig. 3.10 and Fig. 3.11 of JDA and JMC area respectively.

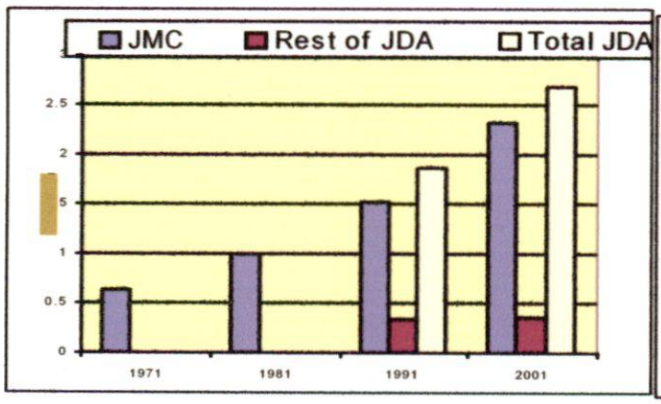


FIGURE 3.10: Population – JDA Area

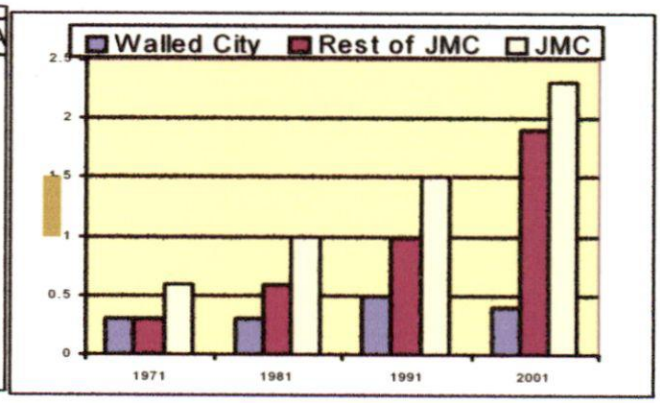


FIGURE 3.11: Population – JMC Area

3.5.2 Density

The density of Jaipur increased steadily in the past decades, indicating rapid urbanization of the city. The ward-wise analysis of density pattern in the city shows that the old city inner wards are densely populated. New residential areas to the South and the Northeast of the city have low densities because there are still large tracts of lands available for infill. The density level in the city is presented in Fig. 3.12.

The population density in the Walled City has also been analyzed that wards 45, 46 and 56 have relatively higher density of population (more than 12 PPH) than others. The population density of walled City and JMC area have been presented in Fig. 3.13 and Fig. 3.14.

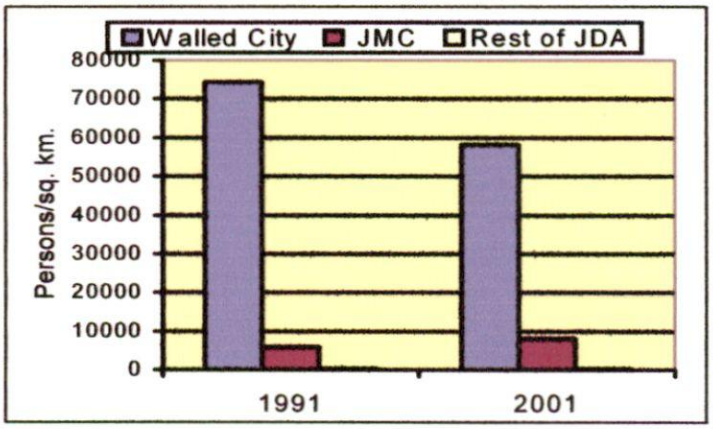


Figure 3.12 Population Density

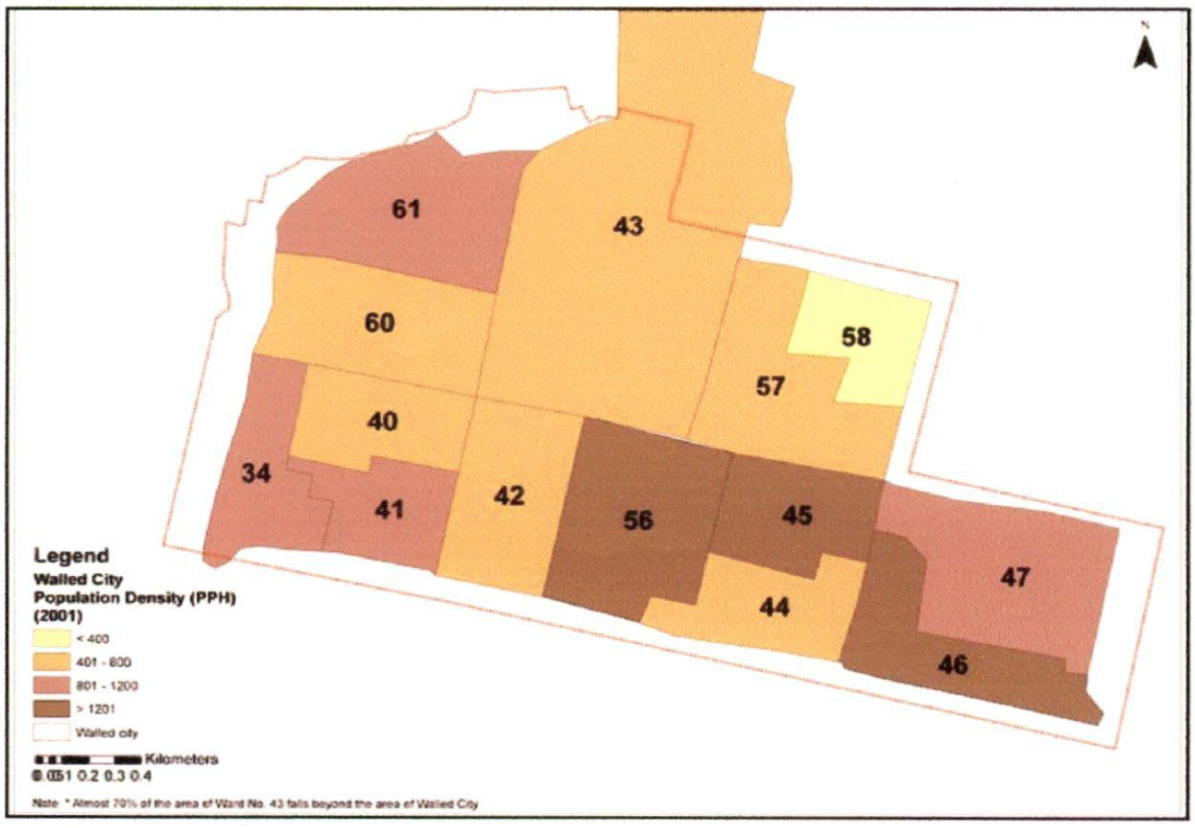


Figure 3.13: Density of Population 2001-Walled City

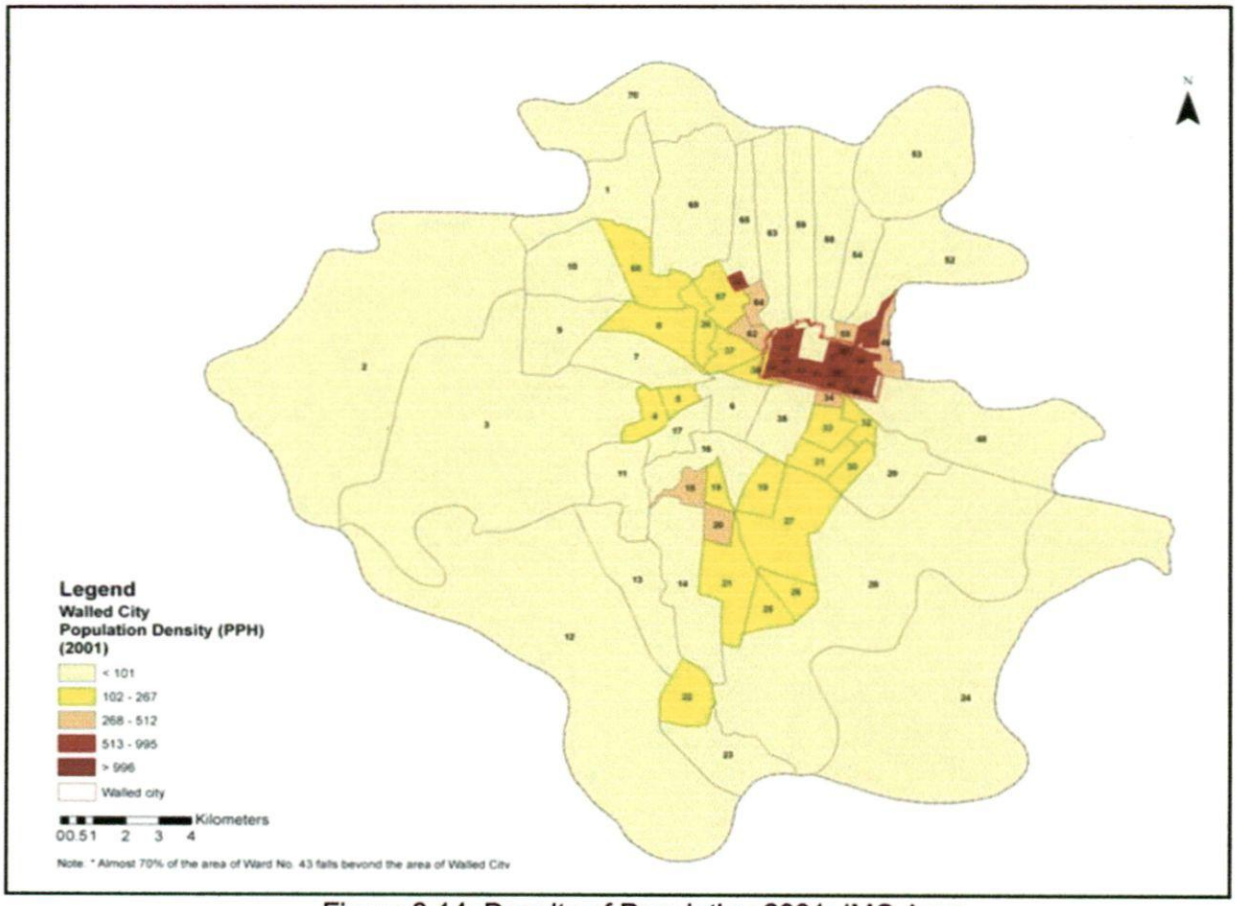


Figure 3.14: Density of Population 2001-JMC Area

3.5.3 Population and Growth Rate

The total population of Jaipur as per the 1991 census was 1,518,000. It included the population of Jaipur City (1,458,000), Sanganer Town (360,000) and Amber Notified Area Committee (230,000). The city population grew by about 500,000 at a decadal growth of 49.56% and at annual compound rate of 4.11 %. Current estimates indicate it to be around 1,900,000. Today, Jaipur is one of the fastest growing cities in India with a decadal growth rate of 49.2% (81-91period).

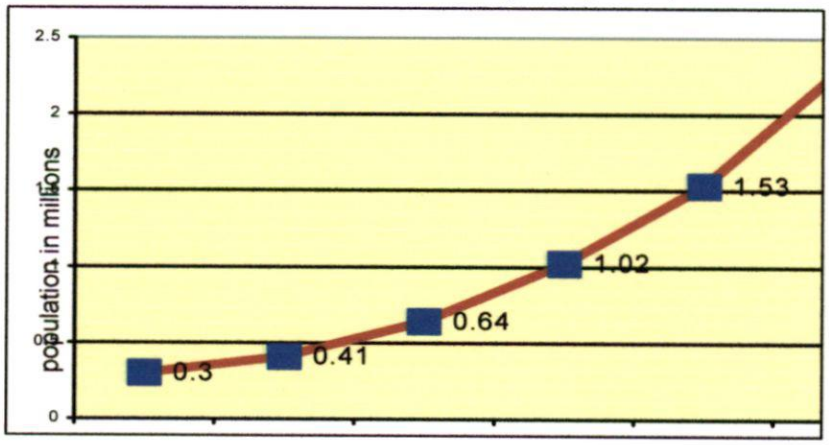


FIGURE 3.15: Population – JMC

The population has shown a steady increase since 1901. Census figures of the pre-independence period show a negative trend up to 1921. The decline in population was a result of a chain of famines experienced throughout Rajasthan. The decade of 1941-51 registered a highly accelerated growth rate

of 66% because of massive influx of refugees from across the border, and population and growth rate in Jaipur is presented in Fig. 3 .15 and Fig. 3.16. The population growth within the walled City was nearly equal to that of rest of the JMC area between 1981 – 91. However, between 1991-2001, the walled City has witnessed a decline in population, and presented in Fig. 3.17

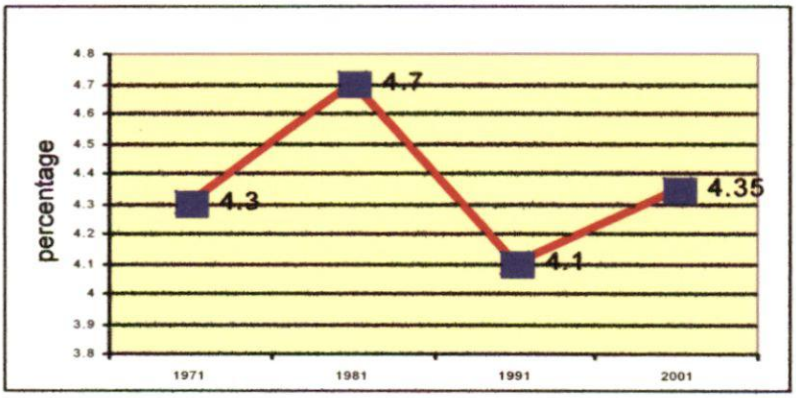


FIGURE 3.16: Population Growth Rate

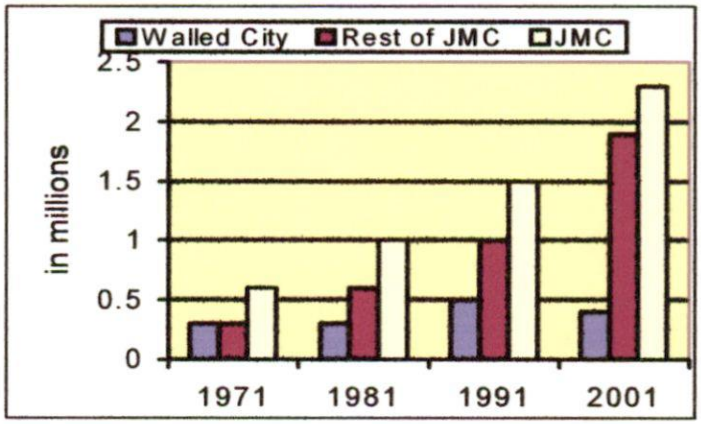


Figure 3.17 Population Growth Rate – JMC Constituents

3.5.4 LITERACY RATE

The literacy rates and sex ratio of Jaipur city and its constituent parts have been presented in Table 3.4. The number of literates in the city has grown from 58.5% in 1991 to 66.2% in 2001, which is above the national average of 65.4%. The city level figures are higher than the corresponding state level data, which in 1991 was only 38.5% and 49% in 2001.

The walled city has a lower rate of literacy than the rest of the JMC area. The literacy rate was only 51.65 in 1991 in the walled city whereas for rest of the city it was 55.3 %. The gap was widened in 2001 when the literacy rate of the walled city dipped to only 40% and in the rest of the city it rose to 75%. Comparison of literacy among males and females show that more percent of male are literate than females and this holds true also for the state and the country as a whole.

3.5.5 SEX RATIO

The sex ratio in Jaipur has been below 900 in the history of the city. The sex ratio in the walled city in 1991 and 2001 has been higher than the rest of the JMC area. In the JMC area the sex ratio shows an improvement from 868 females in 1991 to 876 females per 1000 men in 2001. The sex ratio of the city is lower than both the state and national average. This is lower than the state and national figures, which are 910 and 927, respectively. The lower sex ratio is indicative of migrant male workers in the workforce.

Table 3.4: Literacy Rate and Sex Ratio

S. No.	Area	Literacy Rate (%)						Sex Ratio	
		1991			2001			1991	2001
		Total	Males	Females	Total	Males	Females		
1.	Total JMC	58	66.8	47.4	66.2	73.4	58	877	889
a.	Walled City	51.65*	NA	NA	40.2	43.5	36.5	887*	899
b.	Rest of JMC	55.3*	NA	NA	75.5	84.3	65.7	868*	880
2.	Rajasthan	38.55	54.99	20.44	49	65.2	34.8	910	920
3.	India	52.21	64.13	39.29	65.38	75.85	54.16	927	933

Source: Census of India – 1991 and 2001

3.6 LAND USE DISTRIBUTION

The Master Plan prepared in 1976 envisaged the population of Jaipur to be 12,50,000 by 1991. The population figures of the census indicate that the growth of Jaipur was much faster than projected in the Master plan. The Master Plan suggested a total land envelope of 33,500 ha for the population of 12,50,000. However, the actual extent of the developed area in 1991 was only 25,270 ha and it accommodated a population of 15,18,000. This is a clear indicator of the city's growth accommodating itself in less land than envisaged in the Master Plan. Consequently, the city has a density higher than what was stipulated in the Master Plan. Analysis of land use in 1991 indicates the extent of the implementation of the Master Plan. Table 3.5 and Fig. 3.18 and Fig. 3.19 give the quantitative analysis of different land uses for envisaged and actual area.

TABLE 3.5: LAND USE DISTRIBUTION

S.N	Land Use	As Proposed for 1991		Actual area in 1996	
		(Acres)		(Acres)	
		Acres	%	Acres	%
1	Residential	17,200	51.34	15,880	62.84
2	Commercial	1,688	5.03	950	3.75
3	Industrial	4,460	13.31	2,490	9.85
4	Governmental	440	1.31	390	1.54
5	Recreational	1,000	2.98	530	2.09
6	Public & Semi-public	2,580	7.70	2,120	8.38
7	Tourist facilities	200	.59		
7	Circulation	6,020	17.97	2,910	11.51
		33,500	100	25,270	100.0

Source: Draft Master Plan for Jaipur, 2011

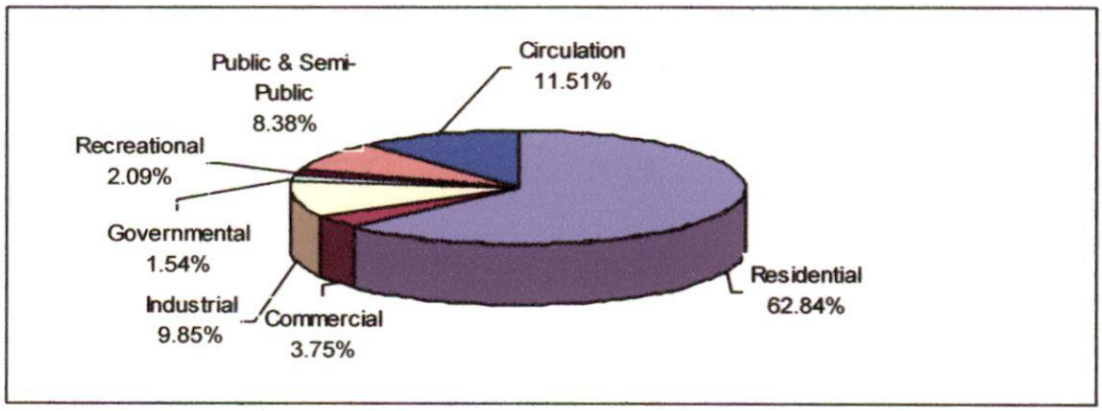


FIGURE 3.18: EXISTING LANDUSE DISTRIBUTION 1996

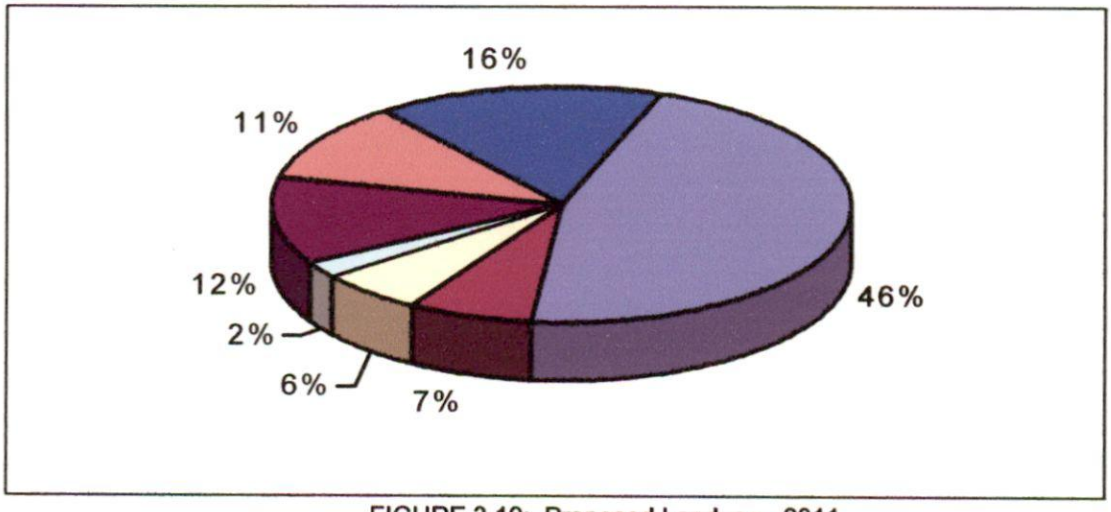


FIGURE 3.19: Proposed Landuse - 2011

3.7. REVIEW OF MASTER PLAN PROPOSALS

The land use in 1971 has been compared to the existing land use in 1991. There is a very sharp change in the proportion of some of the land uses from 1971 to 1991. In 1971, the percentage of land under residential use was 51% that was increased to 62% in 1991. The area under circulation was decreased from 17% in 1971 to 12% in 1991.This is primarily due to an expansion of the city without the corresponding development of road networks. The area under semi public use also decreased from 17% in 1971 to 8% in 1991. The proportion of area under recreational use was already quite low that further decreased by 1% between 1971 and 1991. Only the area under governmental sector was constant. The area under industrial land use witnessed a rise from 7% to 10% in 1991. The area under commercial use also witnessed an increase of 1%. An assessment of the landuse variations of different constituents of the Jaipur city has also been presented in Table 3.6 gives landuse breakup of the walled city, the rest of the JMC area and the rest of JDA area.

Table 3.6: Landuse of JDA Constituents (%)-1996

Landuse Type	Walled City	Rest of JMC	Rest of JDA
Residential	67.3	26.6	10
Commercial – Private services	4.2	2.6	0.3
Institutional	1.5	9.2	0.2
Industry	1	3.1	0.9
Parks & Gardens	1.1	2.7	0.3
Vacant (streets etc.)	25	15.6	6
Not developed (incl. Agri.)	0	40.2	82.3
Total	100	100	100

Source: JDA unpublished Maps as quoted in Population, Urban Development and Water Demand of *Jaipur City, Jaipur Water*
Supply and Sanitation Project, Draft Final Report, Appendix I, Volume 1 of 2, 1998.

The largest proportion of all the developed land uses are concentrated in the JMC area. It is interesting to note that virtually there are no parks and institutional areas within the walled city. This is despite the fact that the walled city originally had open spaces for recreation. A large proportion of the undeveloped land is in the rest of JDA area.

3.7.1 Master Plan for Jaipur 1971-1991

a) The walled city Area

The walled city was designed for 60,000 persons in an area of 6.4 sq.km while it had a population of 4.97 lakhs in 1991.The residential density of 700 persons per ha in the walled city was

recommended by the Master Plan. Tourist facilities and a five star hotel were proposed to be developed in the Jal Mahal Lake area North West of the walled city. The small industries in the walled city were proposed to be shifted from their location.

The proposed landuse for 1991 in the master plan however, could not be attained.Whilethe residential development far exceeded the proposals others uses such as commercial, industrial, circulation, etc fell below the targets. It is evident that instead of 52% residential land use proposed for 1991, the area under land use was 62%. The area under commercial land use was proposed to be increased to 5.4% but it got limited to 3.8%. Similarly, the area under Industrial land use was proposed to increase to 16% but only 10% of the area was under this land use in 1991

3.7.2. Master Plan 2011

The Master Plan 2011 was prepared by Jaipur Development Authority in 1995 and came into effect from 1998.The entire Jaipur region was demarcated as the planning area. The Jaipur region includes Chomu, Bagru, Bassi, Sheodaspura, Achrol and Jamwaramgarh as satellite towns along with the Jaipur city. The area of the Jaipur region is 1464 sq.km. It was also proposed to develop inner ring towns between Jaipur city and the satellite towns. The population of Jaipur was expected to reach 42.2 lakhs by 2011.The population of Jaipur city is assigned at 35 lakhs for the year 2011.The spill over of 7.2 lakh population was proposed to be diverted to the satellite towns. The satellite towns are proposed to be developed as counter- magnets for the city of Jaipur.

a) Proposed Land utilization -1991-2011

Jaipur region was divided into three broad categories by the Master Plan. They are:

Rural Area: The rural area is proposed to cater to the predominantly agriculture- based rural economy. The various settlements in this area will have scope for expansion for their natural growth and their related economic functions.

Ecological Zone: This zone includes the hill ranges, forest covers, water bodies, settlements etc. Functions and activities that are eco-friendly and occupy minimum built up area for incidental use are proposed for this zone. The area of the ecological zone is 481 sq.km.

Urbanizable Area: The unrealizable area caters to concentrated form of urban activities. These areas have been equally distributed in the region taking into account the potentials of existing settlements, land classifications and areas sustainable to urbanization, directions of growth, available physical infrastructure, contiguity of urban areas, planning concepts, feasibility of development, etc.

The overall urbanizable area is around 391 sq.km. The area under residential land use was proposed to be 46% in 2011 while the area under commercial was proposed to be 7%. The area under industrial landuse was planned to be 6% and that of public-semi public is 11%. Area under recreational landuse was proposed to increase to 12%.The area under Government use and circulation was proposed to be 2% and 16% respectively in 2011. However, this proposal was not in tune with the trends in landuse development between 1971and 1991. The residential area was proposed to go down. This was not practical especially in the light of the fact that the area under residential landuse was continuously going up. Commercial area was also proposed to be increased by only 3% that is quite low considering the demand for commercial spaces in the city.

Spatial Strategies for Walled City Area - Master Plan 2011

- No permission to be given for commercial complexes, shopping areas, etc., inside the walled city area.
- New building bylaws shall be proposed for the walled city to reduce the density.
- Shifting of wholesale activities, traffic generating and intensive activities to areas outside.

3.8 SOCIO-ECONOMIC STRUCTURE

3.8.1 Role of the City and its Economic Base

The occupational structure of the Jaipur region indicates that the Administrative Services and the Trade and Commerce sectors form the basis of economic activities. Other important sectors are Tourism, Transport and Communication, Manufacturing, Construction and Agriculture. Trade and Commerce and Tourism will continue to be the most prominent sectors of the economy. Being the state capital, Jaipur will also continue to house major central and State government departments as well as the offices of public sector organizations.

3.8.2 Occupational Pattern

The work participation ratio increased from 26.87 % in 1971 to 28.17% in 1991. The occupational structures in Jaipur in 1971 and 1991 show an increase of 114.8% in the primary sector, 175.3% in the secondary sector, and 153.1% in the tertiary sector during those two decades.

The ratio of the population in the primary sector to the total population in the city decreased marginally from 0.94% in 1971 to 0.88% in 1991. The share of the primary sector to the total work force also decreased from 3.6% in 1971 to 3.0% in 1991.

The ratio of the workforce in the secondary sector to the total population in the city increased from 8.07% in 1971 to 9.7% in 1991. The share of the secondary sector to the total work force increased from 31.09% in 1971 to 33.09% in 1991. The ratio of the workforce in the tertiary sector to the total population in the city increased form 16.96% in 1971 to 18.74% in 1991. The share of the tertiary sector to the total work force has, however, decreased from 65.3% in 1971 to 63.91% in 1991. These trends indicate the emergence of a growing secondary sector and local entrepreneurship, and are presented in Figure 3.20 and Table 3 7

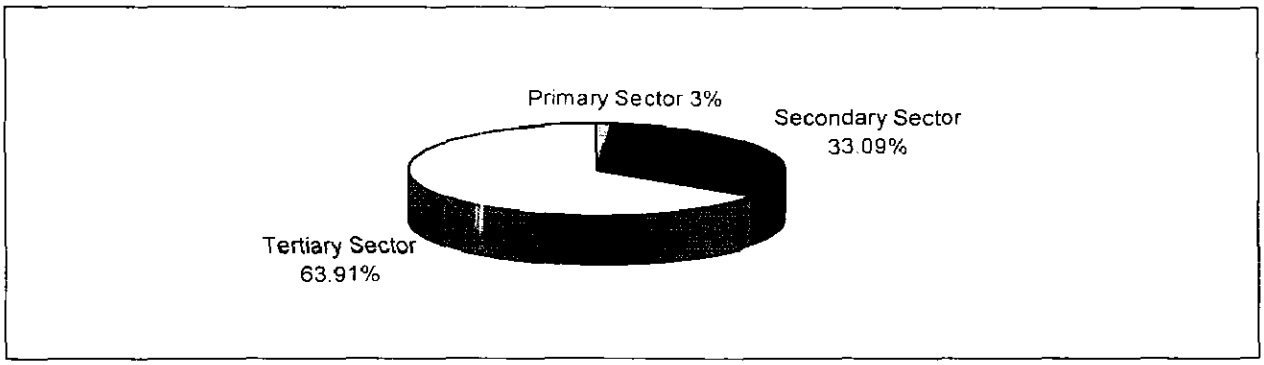


FIGURE 3.20: DISTRIBUTION OF WORKFORCE 1991

Table 3.7: Distribution of Workforce (1991)

Category	% of
Primary Sector	**3**
Cultivators	1.5
Agricultural Labourers	0.5
Animal Husbandry	1
Mining	0.6
Secondary Sector	**32.3**
Household Manufacturing	3.9
Non-Household Manufacturing	22
Construction	6.4
Tertiary Sector	**63.9**
Trade and Commerce	24
Transport, storage and communication	8
Other Services	31.8

Source: Town Directory, Census of India, 1991

The household industry in Jaipur also shows a distinct trend in the spatial distribution of workforce. There are 30% of all employment in this sector is being generated from the walled city .This is despite the fact that walled city has 15% of the population of the city. There are variations in the distribution of workers within the JMC area as well shows the proportion of workers in each of the zones of the city. The maximum percentage of workers (42%) can be seen in HawaMahal East that includes the walled city. Hawa Mahal West also has a large proportion of workers. The walled city has the largest proportion of workers of the city in household

industries. This is despite the fact that the landuse under industries in the walled city is very low 35% of the commercial workers are also located within the walled city. In the rest of JMC area, trading, transportation, construction, heavy industries and agriculture workers are the predominant. In the rest of JDA area, the workers are predominantly agricultural workers. There are eight major employment centers in the city that include Jhalana Doongri Institutional area, J. L. N. Marg, Jhotwara, Durgapura, Sanganer, Loha Mandi, Muralipura, Vegetable and fruit market lal kothi, Hardware market Hassanpura and Brick Mart Sanganeri gate. The distribution of work force is presented in Table 3.8 and Fig. 3.21.

Table 3.8: Spatial Distribution of Workforce (1991)

Occupatio	Walled City	Rest of JMC	Rest of JDA
Agriculture	7.6	56.1	36.3
Livestock and mining	9.9	86.3	3.8
House Hold industries	73.3	21.1	5.7
Other industries	41.7	53.5	4.8
Construction	13.9	79.6	6.5
Trade and Commerce	34.6	63.3	2.1
Transport	23.5	74.4	2.1
Other Services	27.4	70.3	2.3

Source: Household study done by JDA (1991) for Preparation of the master plan 2011

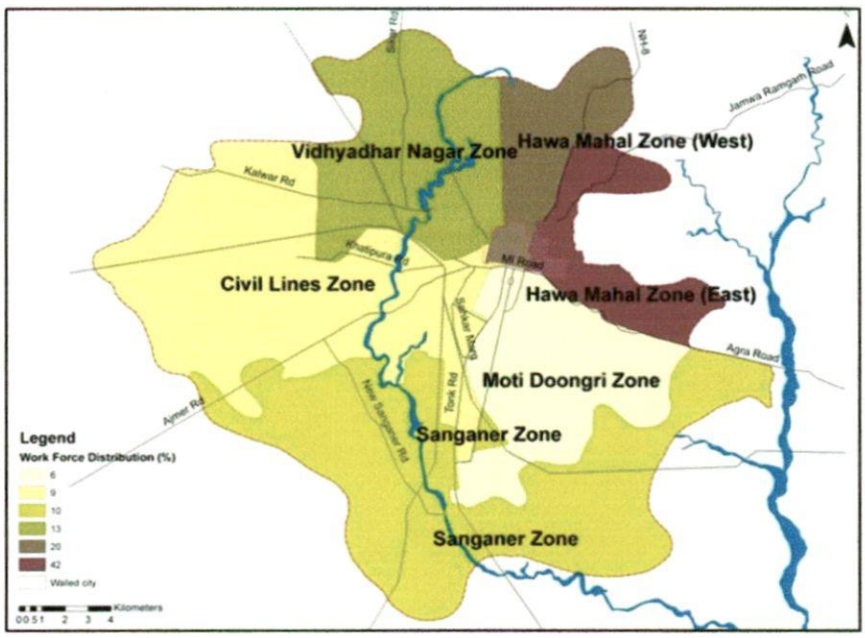


Figure 3.21: Spatial Distribution of Workforce-JMC

3.8.3 TRADE AND COMMERCE

Trade and commerce plays a vital role in the economic growth of Jaipur. The proportion of the workforce in this sector constitutes 24% of the total main workers in the city and exhibits a participation rate of 7.03% (1991 census).The growth in the sector is also gauged by the employment opportunity it generates. The Master Plan in 1971 envisaged a workforce of 70,000 persons, in the trade and commerce sector alone by 1991. The actual number of persons in the occupation identified was 102,521. There are an estimated 75,000 persons employed in 45,000 shops and commercial establishments in the city. An average of 3,500 shops and commercial establishments are set up every year in Jaipur. The surveys also reveal that there are approximately 2,500 wholesale traders in the city. Precious stones, jewellery, marble, cement, cloth, and readymade garments comprise the major commodities treated in Jaipur.

3.8.3.1 **Retail Shops**

The number of retail shops has nearly doubled in the city. Between 1991-2000, the number of shops has grown from 45000 to 80000. A significant proportion of the retail shops are concentrated in the walled city. The retail markets in the city can be seen along all major roads of the city. In one sense, the main roads can be called as the commercial corridors of the city. However, this situation results in traffic congestions (due to lack of parking spaces for both vendors as well as shoppers). Besides this, these markets are not planned properly and are intermixed with residences and household industries and godowns. The number of shops in the city is presented in Fig. 3.22.

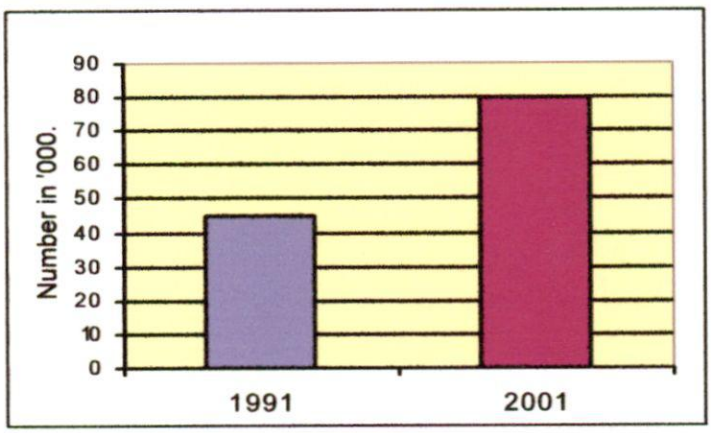
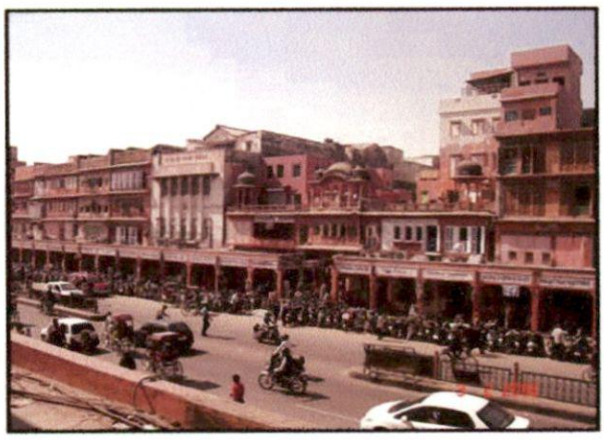


Figure 3.22: Number of Shops



Walled City Photographs on Street Parking

3.8.3.2 Wholesale Trade

The number of wholesale units in 1991 was 25005. There are five types of wholesale markets that include grain market, fruit and vegetable, building material, iron and steel and slaughter house. The grain markets accounts for nearly 58% of the total wholesale trade Iron and steel occupies the second place in the wholesale trade followed by fruits and vegetables and building materials. The major markets under each type of wholesale trade are presented in Table 3.9 and Fig. 3.8. Surajpole is the biggest grain market and handles nearly 35% of total trade in the city. Lal Kothi Centre is the biggest fruit and vegetable wholesale market. The largest volume of trade in building material is carried out in Agra Road area. South of Industrial Area is the only area that has slaughterhouses. The truck terminal (east) is the main iron and steel centre of the city.

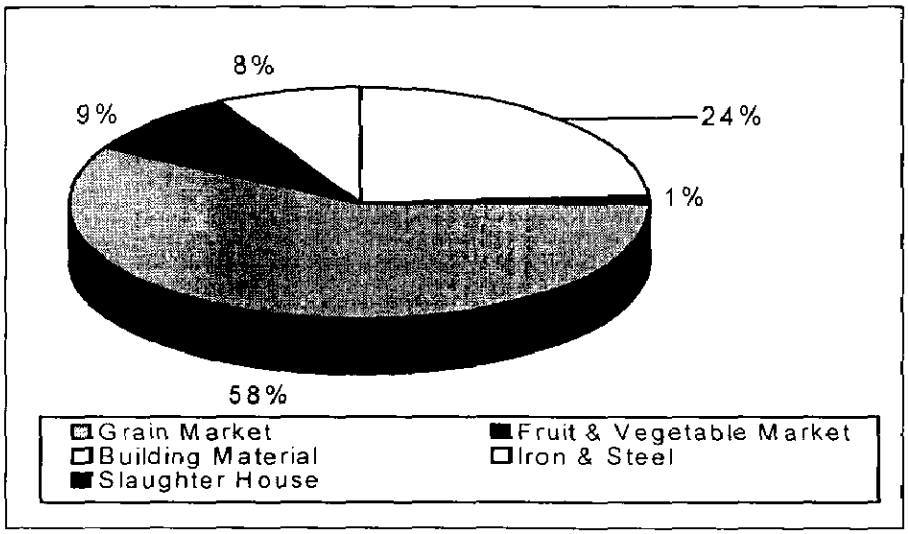


Figure 3.23: Composition of Wholesale Trade

Table 3.9: Wholesale Markets

S.No.	Market	Proportion to Total
A.	**Grain Market**	**58.5**
1.	Chandpole	4.8
2.	Surajpole	34.6
3.	Subcity Centre	5.2
4.	Sikar Road Centre	13.8
B.	**Fruit And Vegetable Markets**	**8.6**
5.	Subcity Centre	1.7
6.	Lal Kothi Centre	5.2
7.	Sikar Road Centre	1.7
C.	**Building Material**	**7.6**
8.	Agra Road	3.5
9.	South of Industry Area	4.2
D.	**Iron and Steel**	
10.	Ghandhinagar Railway Station	10.4
11.	Coal and Timber	
12.	East of Truck Terminal	13.8
E.	Slaughter House	
13.	South of Industrial Area	1.04
	Total	**100**

Source: Civic Surveys for Jaipur, Master Plan-2011.

3.8.3.4 Spatial Distribution of Commercial Activities

The spatial distribution of trading activities shows that the walled city has a significant proportion of activities). On an average, 28-30% of all activities are located in the walled city. The exception is in the case of printing press, wherein the walled city has 56% of the activities. Commercial activities are presented in Fig. 3.24.

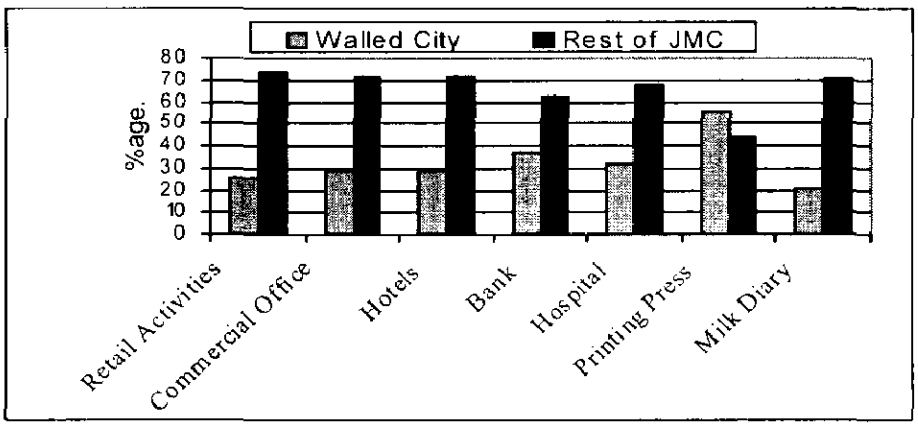


Figure 3.24: Commercial Activities-Spatial Distribution

3.9 TRADITIONAL ART AND CRAFT OF JAIPUR

The traditional bazaars located within the walled city conduct retail and wholesale trading of these handicrafts. In the traditional set up, these were systematically planned and integrated into city design. Rectangular blocks, uniform rows of shops, broad streets ending in Chaupars and chokdis are some of the features of these bazaars. During the time when they were planned each block of the bazaar had a precise of number of shops lining the streets and each rectangular block was designed for a particular craft or trading product. The bazaars of Jaipur are still known by the names given to them 270 years ago. The main ones are Badi Chaupar, Johari Bazaar, Hawa Mahal, Tripolia Bazaar, Chhoti Chaupar, Sanganer, Maniharon Ka Rasta, Chandpole and Kishanpole. These bazaars, today have, outgrown their carrying capacity and over spill on to the pavements creating chaos. The informal sector also mainly locates itself in these areas, and thus, adding to the congestion. The traditional bazaars in the walled city are presented in Table 3.10. and Fig. 3.25.

Table3.10: Traditional Bazaars with their Specializations

S.No.	Name of Bazaars/Lane	Specializatization
1	Badi Chaupar	Turbans
2.	Bhindon Ka Rasta	Marble Statue Carving
3.	Chameli Bazaar	Silver
4.	Chandpole	Pickles and Sharbats
5.	Chora Rasta	Jaipur Book Shop, Maps, Guide books and Snacks
6.	Chhoti Chaupar	Moodas(Straw Chairs)
7.	Ghatgate Bazaar	Iron Work
8.	Gheewalon ka Rasta and Haldiyon ka	Special Sweets, Digestives and Supari
9.	Gopalji ka Rasta	Precious and Semi- Precious Stones
10	Handipura	Kites
11.	Hawa Mahal	Antiques, Textiles, Quilts, Costume Jewellery, Fashion Accessories and
12.	Johari Bazaar	Jewellery, Textiles, Precious and Semi- Precious Stones, Snacks, Contemporary Jewellery, Precious
13	Kalyan ji ka Rasta	Marble Statue Carving
14.	Khazanewalon ka Rasta	Idols and Sculptures, Stone Inlay Work, Stone Carving (Screen etc), Marble Crafts
15	Kishanpole Bazaar	Tent Makers and Silver Jewellery
16	Koli Basti	Carpet
17	Kumharon ki Basti	Pottery
18	Loharon ka Rasta	Iron Work
19	Maniharon Ka Rasta	Lac Work
20	Nahargarh Road	Local Musical Instruments
21	Pannigeron ka Mohalla	Silver and Gold Foils
22	Purani Basti	Wood Blocks
23	Ramganj Bazaar	Shoes/ Mojari
24	Sanganer	Block Printed Textiles and Traditional Block Prints
25	Tateron ka Rasta	Copper, Brass, Metal Work and Brass Inlay Work
26	Teli Pada	Leather Shoes
27	Tripolia Bazaar,	Utensils, Tin Trunks and Metal Work

Source: Jaipur City Guide, 2005.

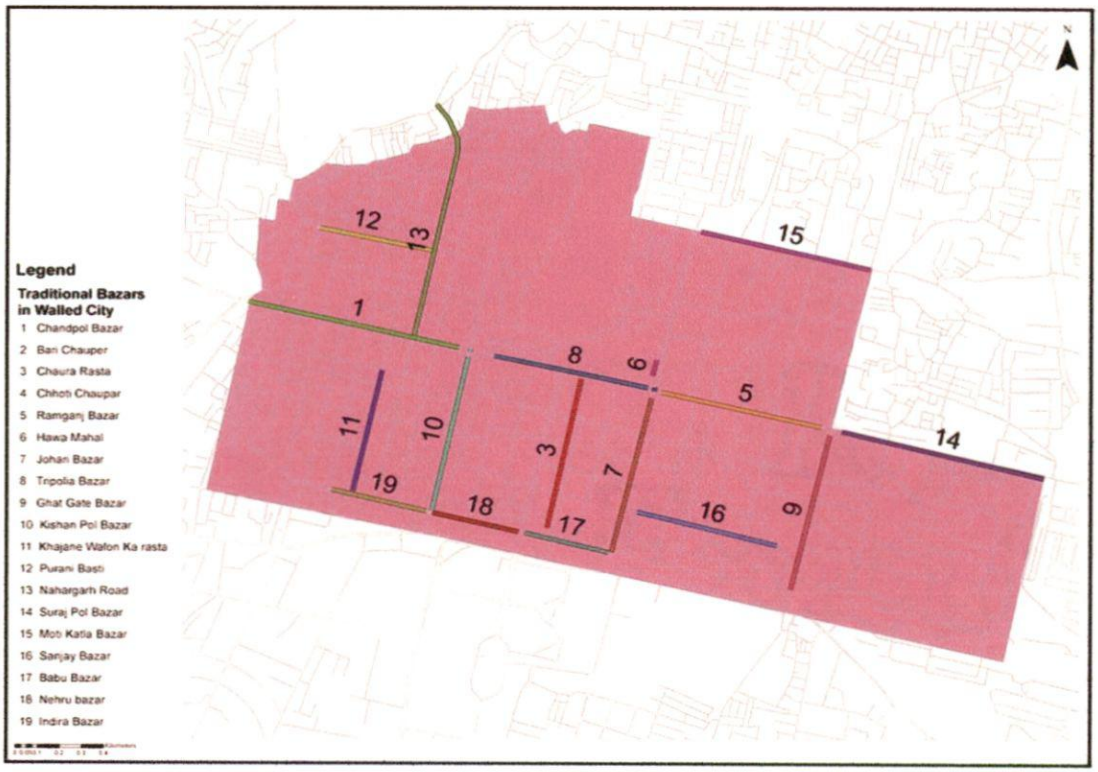


Figure 3.25: Traditional Bazaars- Jaipur

3.10 INDUSTRIAL SECTOR

Industrial growth in Jaipur dates back to 1943 with the establishment of the Jaipur Metal and Electrical Industry, Limited. This firm and the National Engineering Industries, Limited, setup in 1950, are the oldest of the industries established in Jaipur.

The maximum growth in the workforce occurred in the decade from 1981 to 1991 was 60.43%. The growth during the period 1961 to 1991 was at a rate of 258.30%, with the workforce in 1991 amounting to almost three and half times that of 1961. This growth is attributed to the emergence of a large number of small-scale industries.

The city of Jaipur experienced a growth in industry, especially in the decades of 1961-71 and 1971-81. During a span of five years from 1986-91, the number of small-scale industries increased by almost 50%. The growth in the number of registered industries (large, medium and small) has been phenomenal over the past three decades. In 1963 there were about 10,000 workers employed in 178 factories of all three industrial categories. By 1991, the number of small-scale industries alone had risen to 5,000 and there were 43 large and medium scale industries.

3.10.1 Large and Medium

The maximum numbers of industries in Jaipur agro-based, metal and allied products, and chemical based. The machine tools and textile industry category have only one industry registered.

The maximum employment opportunities available are in the machine tools and parts category and the metal and allied product category, are over 3,500 persons employed in each of the industries. On the other hand, the least employment opportunities generated are in the ceramics and glassware category, with just 25 persons registered in the 2 units established. For efficient functioning, the indicators adopted are require to follow a fixed trend, wherein the production to employee and production to investment ratio are high and the investment to employee ratio is low.

The production per employee is the highest in the ceramics and glassware industry with the value per employee amounting to Rs. 3,840,000. The lowest efficiency is exhibited by the textile industry with the production value per employee placed at only Rs.511, 000.

Regarding to investment per employee, in comparison with all industrial establishments, the electrical and allied products industry have been able to restrict the investments to Rs. 960,000 per employee, while the ceramics and glassware industry have invested at Rs. 1,444,000 per employee.
Contrary to the requirements, the per employee investment is high in the ceramics and glassware industry. Efficient production is able to overcome this factor. The electronics and related products industry extracted the highest benefits by attaining a high production to investment ratio of 7.65, while the textile industries achieved a production of only 15% of the total investment.

3.10.2 Small Scale and Cottage Industries

The numbers of small-scale units have grown by 47%. The employment opportunity generated has also grown correspondingly by 46%. The period experienced growth and at no particular time has employment fallen.

3.10.3 *Household Industry*

The household industry sector covers activities such as blue pottery, brass carvings, lac work, silver paper work, sandal work, puppet making, cloth printing, etc. An estimated 16,000 persons were employed in this sector (1991 census) and have grown by 38% since 1991. The participation rate for the household industry amounts to 1.10 % of the total population. The workforce in this sector constitutes 4% of the total workforce of the city. The work force is predominately occupied in the

precious and semi-precious stone cutting and polishing. A majority of these household industries are located in the walled city.

3.11 INFORMAL SECTOR

Their activities support trade to the major dealers and traders, and arise along frequently used traffic corridors and market places. In continuity with the preparation of the Master Plan, the civic surveys conducted by the Jaipur Development Authority indicate the following characteristics of the informal sector.

- About 36% of the migrant population residing in the city is involved in the informal sector as their main occupation.
- The economic profile of the workforce in the sector categorizes them into the economically weaker section with about 75% of the workers living in single room accommodation.
- The growth in this sector has been vibrant only in the last ten years with 63% of the workforce having arisen during the period.
- Nearly 80% of the workforce operates along with traffic corridors.
- An estimated 145,000 persons are involved in informal trade, which constitutes 33.96% of Jaipur's total workforce. This feature indicates the importance of the sector and its role in the economic growth of the region.

3.12 TOURISM

The State of Rajasthan is associated with tourism, art, and culture of the country. Jaipur gains importance as the gateway to Rajasthan and is an integral part of the famous 'Golden Triangle' (Delhi-Agra-Jaipur) for international tourists coming to India. Jaipur, along with the other tourist destinations, treasures a vast source of tourist attraction centres. From the Hawa Mahal to the Fort of Amer, it has maintained the culture and preserved its nostalgic past.

The city attracts nearly 15% of the tourists visiting the state with about 75% of the tourists belonging to the domestic sector. The state itself attracts one third of the foreign tourists annually.

The city is rich in its art, heritage and culture, which are also reflected in its historical monuments. Though the monuments are more than 100-150 years old, they have retained their traditional architectural splendor. This makes the city as one of the most attractive tourist places in of the country. Jaipur is also known as the city of forts and palaces symbolizes the spirit of Rajputana and preserves its rich history and culture.

The important tourist places are presented in Fig. 3.26.

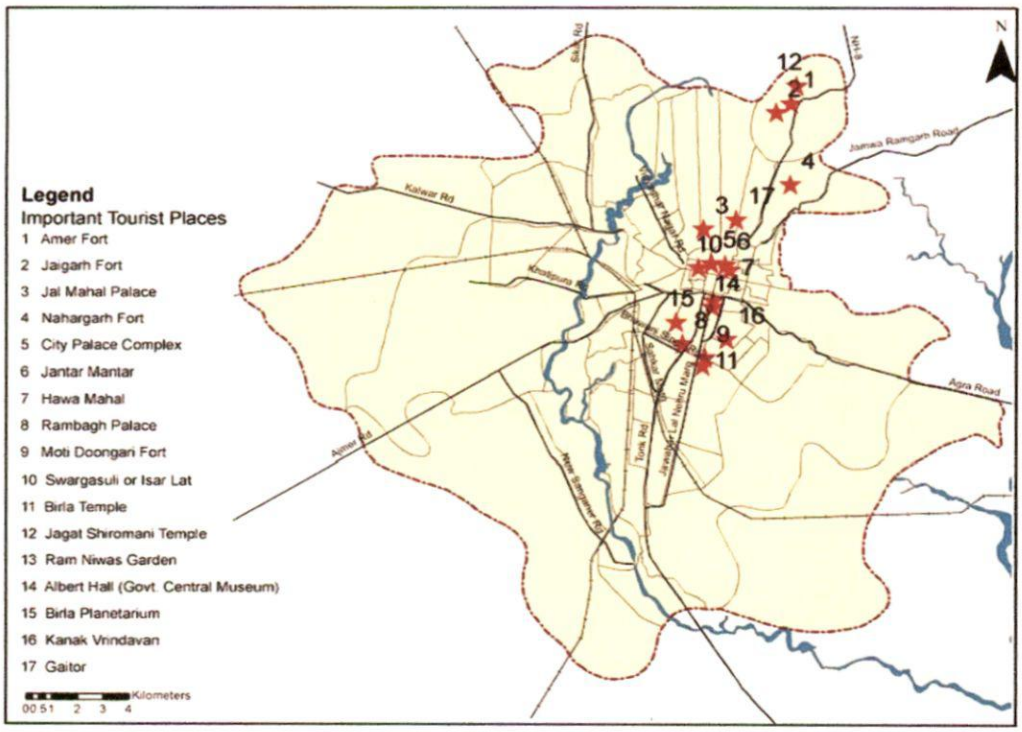


Figure 3.26: Tourist Spots-Jaipur

HAWA MAHAL

CITY PALACE

3.12.1 Tourist Arrivals

The arrival of both domestic as well as foreign tourists has nearly doubled. However, this increase is not consistent in all the years. . The fluctuations are more in the case of foreign tourist arrivals. Foreign tourists comprise about 20% of the total tourist arrivals Rajasthan as a state found a decline trend of foreign customers. It is observed in tourism sector that the influx of tourists to the state have declined by 10%. Amongst the foreign tourists arriving to the state, 30% of the tourists visit Jaipur itself while 8.5% of the domestic tourists come to visit Jaipur. On an average Jaipur receives 3000 tourists every day, who stay in Jaipur for 3-4 days in the city. The number of domestic and foreign tourists is presented in table 3.11 and Fig. 3.27.

Table 3.11: Number of Tourists –Jaipur (in lakhs)

Year	Domestic Tourists	Foreign Tourists	Total	AAGR (%)
1995	6.6	1.5	8.1	
1996	6.6	1.5	8.1	-0.6
1997	7.0	1.8	8.8	9.4
1998	6.2	1.5	7.7	-13.2
1999	6.1	1.3	7.4	-3.1
2000	7.5	1.5	9.0	21.1
2001	6.6	1.7	8.3	-7.9
2002	5.9	0.8	6.7	19
2003	6.4	1.1	7.5	11.1
2004	9.7	2.1	11.7	57.6
2005	11.3	3.8	15.4	28.8

Source: Department of Tourism, Govt. of Rajasthan.

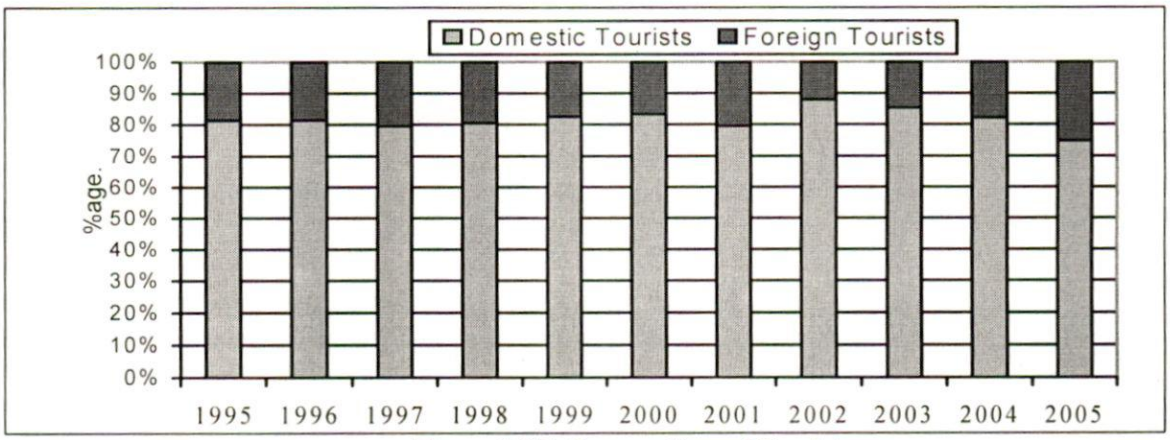


Figure 3.27: Composition of Tourists

3.13 INFERENCES :

- The population for the city of Jaipur has been rising at a steady pace with an average decadal growth rate of 49.56%.
- The population density has increased from 4,832 persons per km^2 in 1981 to 6,956 in 1991within the same municipal area- indicating rapid densification of the city.
- The occupational structures for 1971 and 1991 show that there has been a decline in the share of the tertiary sector by 1.47 % during the two decades. The secondary sector share has increased from 31.05% to 33.02% during the same period. The share of the construction sector has shown the highest growth of 2.8% within the secondary sector.
- The total work force in the Industrial Sector (non-household) grew by almost 187% from 33,063 in 1971 to 94,970 in 1991. In 1991, there were forty-three large and medium scale units and 4953 small-scale units working in the district. Of the large-scale enterprises, the machine tools, metal and allied products, and chemical based industries predominate.

- The percentage of the work force in the trade and commerce sector grew from 19.7% in 1971 to 24% in 1991. The draft master Plan-2011 provides for 289 ha for all wholesale trade activities distributed throughout Jaipur Urban Area.
- Jaipur, being a part of the famous "Golden Triangle", has high tourist potential. There has been steady growth in the inflow of tourists with an average growth of 40,000 per year since 1990.

3.14 PROBLEMS OF THE STUDY AREA

The study area has numerous problems and the more important problems are presented as below:-

1. The increase in population, which is a result of growing economic opportunities, has put pressure on the infrastructure facilities available in the area and has hampered the life of the people, residing in the walled city area, by way of creating congestion, environmental pollution, generation of wastes, acute shortages of water, power, housing, transport, open space and public facilities.
2. The growth in population affected the forests and marshlands due to that environmental degradation is taking place in surrounding area of the city.
3. The urban population has created a pressure an unsystematic growth in the built up area and infrastructure facility, which is spoiling the character of the heritage city.
4. The increased population has deteriorated the air quality by increasing the numbers of motor vehicles. This has led to increased levels of suspended particulate matter, sulphur-dioxide, nitrogen oxides and many other toxic gases in the atmosphere, reducing sunlight and visibility and posing a health hazard to human beings.
5. The growth in population breaking down the municipal services. Electricity is unreliable and water quality is in jeopardy. Public transport is uncertain and overcrowded. Frequent epidemics and diseases like asthma, malaria and tuberculosis are spreading rapidly.
6. Increased population has also caused pressure on both residential and commercial land, resulting in large agriculture farms being sold for construction for residential and commercial use, and existing green belt cover being destroy.
7. The growth in population destroying the architecture character of the walled city area by doing unauthorized construction and that affecting the economy of state, because Jaipur economy is mainly based on tourism, trade & commerce activity.
8. The physical infrastructure is also affected by the growth in population, that is directly related with quality of urban life and health.

9. The quality of water is posing a serious health hazard, because of throwing the solid waste in the natural drainage and also leaving the sewage opened in the natural drainage systems that causes the pollution of surface as well as groundwater in and around the city.
10. Indiscriminate underground boring for water is a common phenomenon and has led to a drastic decrease in the water table.
11. Unprecedented Urbanization is posing challenges to the buildings, which was built in two hundred seventy five years ago.
12. Per capita consumption of land and built space, including housing, water, power, and generation of wastes are increasing at an alarming rate as compared to population growth and creating the problems of overcrowding, sanitation & pollution and acute shortage of water, power, housing, transport, open space and public faculties.
13. Most of the commercial activities are located within the walled city area, that is imposing the pressure in the existing infrastructure facilities, and traffic is increasing in the city and that creates the parking problem, congestion & pollution in the area.
14. Change in land use is the major cause of increasing the pressure on the infrastructure, residential uses are converting into commercial areas for that more people are coming into the city and the problem of pollution, traffic jams etc., increases.
15. Jaipur economy has traditionally been agrarian and commercial. The economic and occupational patterns of the region have undergone tremendous changes. The principal areas for economical sustenance today are tourism, trade & commerce. Therefore, these activities are also having great threat to the city.
16. The increase in practically all spheres of activities has cause the traffic and transportation problems. Problems in city manifest in many forms and some of these include the following: Inadequate traffic control and management, Inadequate drainage facilities, Problems of stray cattle, Problems of lane discipline, Problem of informal markets, Unauthorized land uses, etc.

3.15 NEED OF THE STUDY

The present investigation is very much essential to understand the functions of the system. Further, it is also very much essential to evolve a set of policy guidelines for sustainable development of the city. Otherwise, the pressure in the city will further aggravate the problem, and finally it would be a tremendous loss.

4.1 INTRODUCTION: The Investigator has studied the problems and prospects of the Jaipur city thoroughly to understand the function prior to conduct the thorough investigation in the walled city area of Jaipur city since the walled city area is a part of the city by using secondary sources of data. Moreover, the walled city area population purely depends on the rest of the city for all kinds of infrastructure facilities. Therefore, the most important control parameters, which decide the functions of the system (city as a whole) is studied thoroughly and presented as below:

4.2 TRAFFIC AND TRANSPORTATION

The walled city of Jaipur is spread over a compact area of 7.68 sq. km. The average population density is of 1000 to 1500 persons per sq. km. Trade and commerce is mainly conducted from inside the densely populated walled city area. The goods are first transported into the walled city, form where they are again distributed to various parts of the city, which aggravates the traffic and transportation problems, in the congested streets of the walled city. The emergence of informal sector activities in the adjoining areas of the wholesale markets along the road corridors has further aggravated transportation problems. The walled city is still acting as a Central Business District of Jaipur and getting more and more commercialized.

4.3 CHARACTERISTICS OF TRAFFIC & TRANSPORTATION

4.3.1 Sindhi Camp Central Bus Terminal

Long distance inter city buses are operated by Rajasthan State Road Transport Corporation (RSRTC) Jaipur from a central bus terminal known as Sindhi Camp on Station Road. To access Sindhi Camp bus terminal long distance buses, have to pass through the congested walled city area, resulting in delays and increased congestion on these roads.

There are very limited off-street facilities presently existing within or in the vicinity of the main bazaars area of walled city. However, there are three off-street parking lots which are presently used by cars and two-wheelers, and are described as below:

1. **Off –street parking at Sanjay Market (Near Sanganeri Gate).**

   The approach to this parking lot is from the Eastern side of Sanganeri gate. It has small parking lot, which caters to the requirements of Johari Bazaar / Sanjay market and accommodates about 50 cars.

2. **Off-street parking lot at Ram Niwas Garden**

This parking lot caters to the requirements of visitors to the Ram Niwas Garden and to some extent for the shoppers of chaura Rasta/Bapu Bazaar, etc. It can accommodate around 40 cars and 50 scooters.

3. **Off-street parking at Atish Market.**

It is located in between the open space of the Atish Market shops. Recently, it is vacanted from shopkeepers of Atish market and it caters the needs of Atish market and Chura Rasta.

The following points are observed in the walled city area pertaining to traffic and transportation. They are:

1. The general practice of persisting with two way traffic operation on narrow streets.
2. There is no parking fee system, so that the available road space is narrowed.
3. Encroachments on roads and footpaths by the Hawkers and shopkeepers restricting flow of vehicles and pedestrians.
4. At some places parking and no parking zones are specified through the sign boards, but most of the places it is not being strictly observed and there is a mix up of different modes of vehicles (i.e., cars, two – wheelers, cycles, carts, etc., in the area specified for particular mode).
5. No restriction on duration of parking.
6. The high rate of personal vehicle accumulation, such as two-wheelers, automobiles, car and auto rickshaws.
7. Heavy percentage of slow moving vehicles likes cycles, bicycle rickshaws and pedestrians.
8. Movements of large size buses, having stops in the congested area.

4.3.2 Vehicle Growth

The travel needs in the city are catered by a variety of modes of transport in the form of buses operated by Rajasthan State Transport Corporation (RSRTC), Mini Buses run by private operators, Auto-Rickshwas, cycle Rikshwas and private vehicles, such as, cars, two-wheelers and cycles. The improving socio-economic status of the residents, increase in population, availability of automobiles and lack of good mass transport services have resulted in steep growth of private vehicle ownership in the city.

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Auto-Rickshawa, Tempos, Cycle Rikshawas and Private vehicles such as Cars, Two –Wheelers and cycles. The mix of fast and slow traffic results in low speeds and hazards. The improving socio-economic status of the residents, increase in population, availability of automobiles and lack of good Mass Transport Services have resulted in steep growth of private vehicle ownership in the city.

4.3.3 Traffic and Transportation Problems

1. Problem of Congestion and Delays

The walled city has observed the highest congestion throughout the day, regardless of peak or off peak hours. The main cause of congestion is due to the inadequate capacity of the roads, mixed traffic of two-wheelers, rickshaws and auto rickshaws, illegal parking, pedestrian movements, loading and unloading and encroachments on the road surface.

This increased congestion results in low operating speeds, delays, reduction in level of service of the road, environmental and noise pollution.

2. Parking Problem

Parking on the roads and streets have created several problems in the whole walled city area. Large scale on street parking is reducing the width and capacity of the road resulting in increased congestion, particularly low speeds and accidents. Mainly rickshaw and auto rickshaws are parking close to the main junctions/intersections or chaupars, which is also creating big hurdles to the traffic.

3. Problem of Encroachment and Enforcement

Poor development and lack of enforcement has resulted in several problems some of which are mentioned as below :

Buses and mini buses stop on the main carriageway for loading and unloading of passengers, obstructing/stopping the following traffic.

Hawkers establish their kiosks on the road/footpath reducing effective carriageway width and capacity of the road and disturbance to the pedestrians.

Encroachments are right up to the road edge and on the pedestrian footpaths creating hazardous for pedestrians and traffic.

4. Encroachment of Pedestrian Facilities

The pedestrian footpaths are provided in all the markets in the form of covered verandah, but some of them are encroached by the shopkeeper's and hawkers, and they are disturbing the pedestrian movements.

The pedestrian crossing facilities, feet over bridges, sub ways are lacking, and therefore pedestrian choose to cross at unsuitable places along the road.

5. Heterogeneity of Traffic

In the walled city area, the traffic is heterogeneous and slow moving vehicles particularly cycles and rickshaws are flowing along with vehicular traffic on the same carriage way creating disorganized and unsafe driving conditions.

6. Problem of Stray Cattle

Stray cattle are very common observation on almost all roads in walled city area. This creates the traffic safety and environment problems.

7. Problem of Informal Markets

The informal markets, weekly bazaar, which tend to spring upon the section of the road are frequent, causing safety problems as traffic increases. These markets encroach upon the main roads.

8. Unauthorized land uses

Building constructed for residential purposes are being converted to multistoried commercial complexes by the owners, creating parking, environmental and congestion problem. In walled city area, the inner streets, of residential area are converting into commercial activities, where hardly any space available for parking.

4.4 EXISTING CONDITION OF THE WATER SUPPLY SYSTEM

4.4.1 City Scenario

The present water supply system of the city comes under the jurisdiction of the Public Health and Engineering Department (PHED), Jaipur. The supply system is presented in Table 4.1:

Table No. 4.1 Salient Feature of the Water Supply System

Gross supply	348.32 ML.D
Population served	23 lakh
Treatment capacity	54.00 MLD
Per capita supply (Gross)	150 lped

Source pre-feasibility report, RUIDO, March-1998

Of the total population of 23 lakhs, only 84% is supplied water. The rest 16% meets its demand form private sources. Further, there is no organized water supply in the outlying district of the city, where the population is growing fast as the city core has reached its saturation.

The water available for the use of the citizens is primarily ground water. The surface water source of the city is insufficient to meet the requisite demands, providing only 10.45 MLD. The city lacks the treatment facilities also, being capable of treating only 54 MLD of water at the treatment plant located at Laxman Doongri. The rest of the 294.32 MLD water is supplied without treatment and in some cases only after chlorination. The details of water treatment is presented in Table 4.2

Table No. 4.2 Source & Treatment Details

Surface source	10.45 MLD
Sub-surface source	337.87
Treatment capacity	54.00 MLD

Source Pre feasibility report, RUIDO, March – 1998

The water available to the city is not utilized to its full capacity. The net water available to the city is only 58% of the total supply. It has been observed that 42% of the water is wasted due to leakage owing to faulty transmission and distribution system, lack of structured leak detection system and lack of authentic information on transmission losses. Thus, the net per capita supply is 88 lpcd as against the gross supply of 150 lpcd. The current pattern of water usage is presented in Table 4.3

Table No. 4.3 Current Pattern of Water Usage

Gross supply	348.32 MLD
Losses	146.29 MLD
Net supply	202.03 MLD

Source Pre feasibility report, RUIDO, March – 1998

4.4.2 *Zone-wise scenario*

The city is broadly divided into subdivisions like North & South. The sub divisions primarily being demarcated as those lying North and South of the Agra Road. Each of the sub-divisions is further sub-divided into five zones, and each of the zones being divided into chowkries, which are 37 in all for administrative purposes, and are presented in figure 4.1

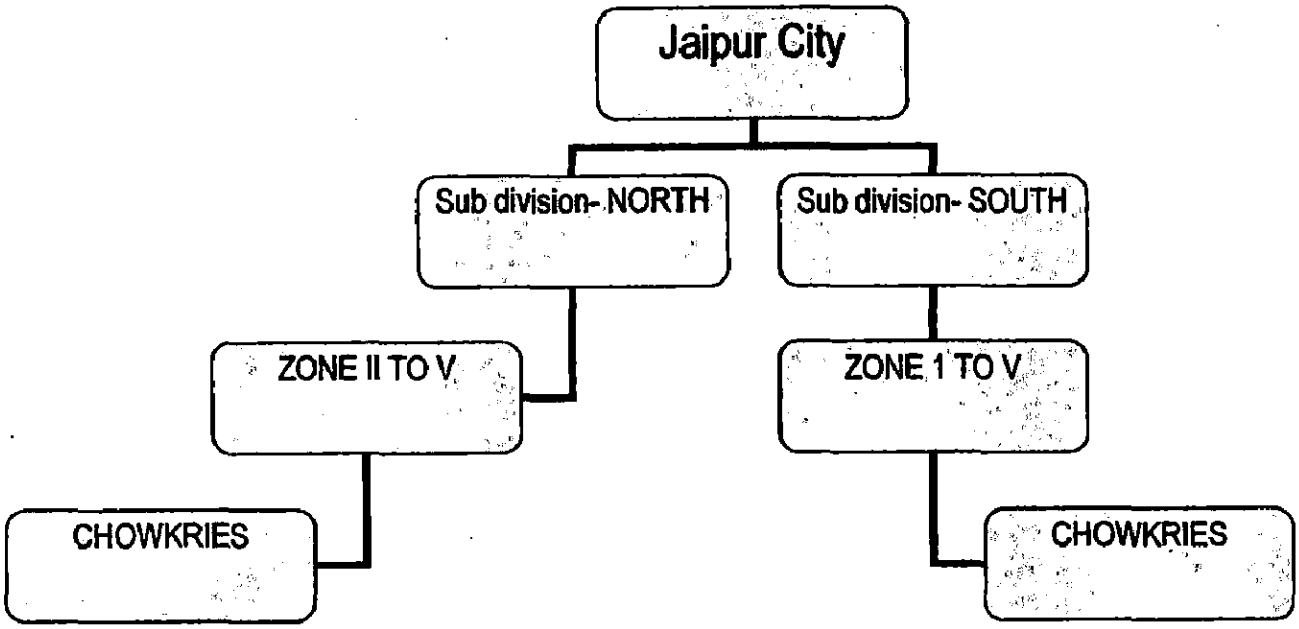


Fig No. 4.1 Administrative functions - Jaipur City

4.4.2.1 North Sub-Division

The subdivision has 5 zones under it. Of these, Zone 1 does not support any population. In this zone, where the treatment plant of Laxman Doongri is located.

Zone II of the North sub-division has the maximum demand of 98 MLD. It comprises of the walled city area and has the highest residential density. The zone is the most deficient zone falling short of 62 MLD and is grossly under supplied having a net supply of 55 Lpcd as against the required 150 Lpcd. On the other hand, Zone IV generates surplus water as against the required amount and the water from here is supplied to the deficient areas in Zone II to meet the daily requirements. The zone IV has industrial landuse as per the Master Plan but there is a large residential settlement which has sprung up as an unauthorized settlement. The settlement has been recognized in the 1991 plan but apart from the legal notification, no facilities have been provided. The settlement does not have piped water supply and is dependent on tankers, own bore wells or private suppliers for fulfilling its demands. The water that has been shown as surplus will not remain so once the demands of the population of this settlement is considered.

Despite providing inter-zone transfers, the sub-division falls short of nearly 15 MLD of water as against its daily demand. The zone wise (North and South) water demand and supply are presented in Table 4.4 & 4.5

The Zone 1 of the sub division falls short of its expected supply by 16.73 MLD reducing the net supply to 97 LPCD as against the required 150 LPCD. Zone IV falls short by 11.88 MLD, reducing

the net supply to 140 LPCD. However, the Zone V has a surplus of 14.39 MLD, which is transferred to zone IV & I, and still the sub-division falls short of 10.75 MLD.

Table No. 4.4 North Zone Demand & Supply

Zone	Population	Demand (MLD)	Supply (MLD)	Per capita supply (lpcd)	Gap (MLD)
I	0	0	14.08		+14.08
II	653323	98.00	36.00	@55	-62.00
III	270940	40.64	31.92	@117.8	-8.72
IV	189088	28.37	72.64	@150	+44.27
V	67340	10.10	7.50	@112	-2.60
Total	1180691	177.11	162.14		-14.97

Source: PHED, Jaipur, 2004 Demand calculated @ 150 LPCD

4.4.2.2 South sub-division

Table No. 4.5 South Zone Demand & Supply

Zone	Population	Demand (MLD)	Supply (MLD)	Per capita supply (lpcd)	Gap (MLD)
I	2634.56	42.16	25.43	@9.5	-16.73
II	130612	26.47	27.52	@150	+1.05
III	259481	47.73	50.15	@150	+2.42
IV	240630	47.50	35.62	@140.02	-11.88
V	206670	33.07	47.46	@150	+14.39
Total	1139685	196.93	186.18		-10.75

Source: PHED, Jaipur, 2004 Demand calculated @ 150 LPCD

4.5 QUALITY OF SUPPLY

Often the quantity, duration and rate determine the quality of the supply system. The supply of the city is almost functioning on a bare minimum level of @ 150 LPCD. Nearly 15% of the population is without the water supply connection. This section of the population falls under the areas, which are non-planned development and were regularized water owing to large-scale development. As a

result the there is a total dependence on private water suppliers or own bore wells or the water tankers.

Of the rest 85% which has piped connected, 35% is receiving less than 100 LPCD, once in every 2 days and at a rate of 1-2 ltrs./min, which is insufficient to meet the requirements of the population. Apart from this the average duration of the supply is 1-2 hrs/day with some areas receiving water for up to 4 hrs. The average rate of inflow is also between 2-5 liters/min. It can be seen that the supply for the citizens is unequally distributed, with a large section of population receiving less than the sufficient quantity.

4.6 WATER AVAILABILITY OF JAIPUR REGION

Because of inherent variable character of rainfall, there are often occasions when the actual rainfall in the region falls appreciably below the expected on a long-term basis. In the case of Jaipur this irregular pattern of rainfall plays a very crucial role. The rainfall even if it is normal in the city but not in the catchment of area Ramgarh Dam, then it fails to fulfill the requirement of the surface source. A scanty rainfall is also not sufficient to replenish the ground water source. The overall effect is manifest in unreplenished ground and surface water resource, lowered levels/drying of lakes, reservoirs and other water bodies. It is therefore very necessary to understand the nature of rainfall in the area, if one has to plan for the optimum use of water so derived from precipitation.

4.6.1 Rainfall pattern

The average annual rainfall experienced in the region is 512 mm (average of 35 yrs.), and the number of monsoon rain day is 27.It is calculated the rainfall for the last few years,and presented in Table 4.6

Table No. 4.6 Rainfall Data

Year	Rainfall in mm.	% Deviation from normal
1901-70	526.8	
2000-01	423.3	-19.6
2001-02	387.8	-26.4
2002-03	214.3	-59.3

Source: Ground water year book 2002-03, Rajasthan

It can be seen from the above tables, the region has been subjected to decreasing rainfall quantity over the past 3 years. The rainfall is not sufficient to replenish the surface source, which is almost dry with situation up to 16' as against 10'. The rainfall thus obtained is confined to 27 days out of

which the maximum amount received is in 6 to 12 days. Therefore, there is an evident need to save water and harvest rainfall.

4.6.2 Groundwater

Ground water is the major source of water in the city as the sufficing the needs of the population. The ground water conditions vary widely within the city and the region. The groundwater depth varies from 12 m to 28m with seasonal fluctuations of 3m. For monitoring the water level behavior, the ground water department has developed a network of key wells, fairly well distributed comprising of dug wells and pedometers in the district of Jaipur. The ground water levels for different dug wells of the city is presented in Table 4.7

Table No. 4.7 Ground water levels in city

	1995	2003
Jhotwara	38.83 m	47.90 m
Durgapura	18.5 m	26.7 m
Khatipura	36.02 m	40.3 m
Gandhi nagar	34.45 m	47.25 m

Source : Rajasthan patrika survey, June' 04

4.6.2.1 Ground Water Quality

Water quality has always been a source of major concern of the PHED department. Major quantity of water supply is met from the ground water. So the quality of water supplied is same as that of the ground water of the city. Water quality of different areas touching the various parameters is mentioned in Table 4.8

Table No. 4.8 Water Quality

Area	Nitrate (mg/ltr)	TDS(mg/ltr)	Fluoride (mg/ltr)
Acceptable	100	500	1.5
Walled city	1060	3973	0.7
Bani Park	810	2218	0.4
C-Scheme	360	1525	0.7
Adarsh Nagar	445	1247	0.65
Sodala	193	785	0.9
Civil lines	295	1063	0.37
Vaishali nagar	45	416	0.4
Khatipura	88	416	0.58
Shyamnagar	280	1155	0.37
Shantinagar	333	1063	0.68
Tonk phatak	113	601	0.4
Gandhi nagar	125	508	0.3
Bapunagar	105	601	0.4
Durgapura	113	878	0.75
Malaviya nagar	95	554	0.54
Vidhyadhar nagar	180	601	0.3
Jhotwara	265	1016	1.0

Source : Rajasthan patrika survey, June' 04

The older development of Walled city, Banipark, C-Scheme & Adarsh Nagar show alarmingly high levels of contaminants. The level of these contaminants is high in the fringe areas too but few of the samples show considerably low levels of contamination. This indicates that the city's sub-surface water usage to be phased out in accordance with the water quality, the less contaminated water being used for potable purposes and the more contaminated being used for non-potable ones.

4.7 FUTURE DEMANDS

The city is facing a very critical situation as regards the water supply is concerned. The present master plan, i.e., Master Plan-2011 has envisaged the future demand is presented in Table 4.9

Table No. 4.9 Future Water Demand

Year	Population in lakhs	Demand in MLD	Local supply in MLD	Net Demand for Jaipur MLD	Demand for villages MLD	Total net demand MLD
2011	32.09	642.7	205.0	437.7	4.8	442.5
2021	46.82	981.0	197.0	784.0	6.2	790.2
2031	68.33	1460.0	180.0	1280.0	60.0	1340.0

Source: Jaipur Master Plan – 2011

The water demand has been adopted at the rate of 180 LPCD in the beginning, which will increase to 215 LPCD in the years 2021 and 2031. This water requirement shall be met through the Bisalpur Dam project, which will have a net supply of 861.32 MLD. But this will also suffice the demands only till the year 2021.

4.7 ANALYSIS

4.7.1 Present status

As the city grew further, the basic ideas of development with respect to topography was not given much consideration. This was mainly due to the fact that most of the development was unplanned and unregularized. Due to this, there was no proper site planning and the areas came up without proper road networks, infrastructure facilities. As a result the natural recharge system of the city was grossly altered but water continued to be drawn without any consideration to the need for replenishment.

1. **Nahargarh Hills & Adjoining Areas**
2. **Jhalana Hills and the Adjoining Areas**

1. The Nahargarh Water Shed

The water shed primarily comprises of the settlement between Amer and walled city, the regions of nahari – ka naka and shastri nagar. The land adjoining the nallah and the hills was put to variety of

land uses irrespective of it being a potential recharge zone. The development was planned-high-density type, and did not consider the topography of the area. The built-up obstructed the natural path of the rivulets/streamlets downhill leading dual problems of-flooding of the areas during peak rainfall & reducing the natural recharge considerably thereby lowering the water table further. The settlement came into existence as a result of encroachment of the shallow areas. These areas play a very vital role in the ground water recharge and thus should have been left as green areas. Since the development was unplanned in the beginning and regularized later on, it does not have a sewerage system due to which the waste generated is being discharged into the Amanishah Nallah converting it into a sewerage channel.

One more after effect of such a development is that, the water continued to collect in the natural depression/low lying areas, thereby leading to various health problems and unhygienic living conditions. During the times of heavy rain, the streets are water logged and this rain water is channeled into the drains carrying waste, thus leading to contamination of rain water which could have been otherwise used for various purposes.

This region served as the main recharge zone and water collection area for the Mansagar Lake. Since the early times, it was the walled city outskirts housing the under -privileged population of the city. As a result not much emphasis was given to the planning and the development was more or less organic.

The area acquired strategic importance due to its location of National Highway – 8. It saw the starting of commercial and institutional development along the main road due to the availability of large amount of land. Further inside of the road, residential activity continued at an un-organized pace, without considering the topography. As a result tremendous deforestation along with fast construction activity started taking place which obstructed the natural path of the rainwater streams & rivulets downhill. Due to this the water inflow into Mansagar Lake was stopped and it started stagnating and water quality deteriorated. This altered the ecology of the region to a great extent, resulting in deterioration of ground water levels and worsening its quality due to inadequate content.

Owing to the importance of the area in maintaining the ecological balance of the region, it should have been declared protected greens and kept free of development. The green cover would have assisted in maintaining the water balance by allowing water seepage into the lower strata of the water table.

2. Jhallana Water Shed

The water shed includes.

a. Jhalana Institutional Area developed in the natural drainage channel of the tributary of Amanishah Nallah.

b. Jawahar Nagar Residential area at the foot of the Jhalana Hills.

c. University Area

As was observed in the previous cases, here too the development is obstructing the natural drainage network. In the institutional area, construction has encroached in the existing channel of Amanishah nallah. The water in the nallah is very less as compared to what it should be. The land adjoining the trickling stream is encroached for construction irrespective of the Nallah Boundary. The residential area of Jawahar Nagar is planned in the watershed region and experiences flooding and water logging during heavy rains due to improper drainage design. Another aspect observed is the quarrying of the hills. The extensive quarrying has resulted not only in the depletion of green cover but also of the hills themselves, altering the natural drainage due to the hill topography and affecting the recharging system. To assist in this quarrying activity the workers involved have illegally set-up their own establishments in the cleared area further affecting the water flow.

4.8 WATER RELATED ISSUES

1. The city is totally dependent on sub-surface water with negligible dependence on surface water.
2. The city lacks treatment facility and has capacity to treat only 54 MLD of the total demand of 350 MLD.
3. The supply losses are high reducing the net supply to 58%. The losses should not exceed 20%.
4. Presently 26% of the city does not have piped water connection leaving –15% population unserved. The unregularised settlements depend upon the private suppliers, tankers and own bore wells.
5. Out of the rest of the 85% of the population, 35% receives less than 100 lpcd of water.
6. There are no checks on ground water extraction leading to uncontrolled tapping of water. The ground water level is falling at the rate of 2 mts./year. The annual ground water extraction is much more than its replenishment.

7. The green spaces within the area are lessening, which adversely affect the water recharge capacity of the city.
8. There is an evident lack of interagency coordination.

4.9 PLANNING RELATED ISSUES

1. Many areas are developed in water shed regions, obstructing the flow of run-off.
2. Most of the fringe areas already existed before their notification in master plan & thus lack proper drainage facilities, leading to collection of run-off on the streets.
3. *The Amanishah nallah has become the sewerage channel for the non-connected* areas, rather than a rainwater channel.
4. There is no provision to collect the surface run-off from the streets, leading to wastage of rain water.
5. The green cover is very sparse, even less than what has been prescribed in the master plan-1991. There is non-recognition of shallow areas as protected areas, which have lead to their being encroached.
6. The rainwater harvesting measures are not being practiced even after specifications of the master plan.

4.10 EXISTING CONDITION OF SOLID WASTE

In Jaipur transportation of solid waste is carried out partially by Jaipur Nagar Nigam and partially by private contractors. Of the 70 wards, Jaipur Nagar Nigam is responsible for 23 wards and private contractors for the balance 47 wards. However, Jaipur Nagar Nigam holds the overall responsibility for transportation of solid waste. It is estimated that Jaipur Nagar Nigam transports only 35% of solid waste generated and private contractor's balance 65% of the waste. There are mostly open depots (3635) for collecting the solid waste.

4.10.1 Street Sweeping and Solid Waste Collection

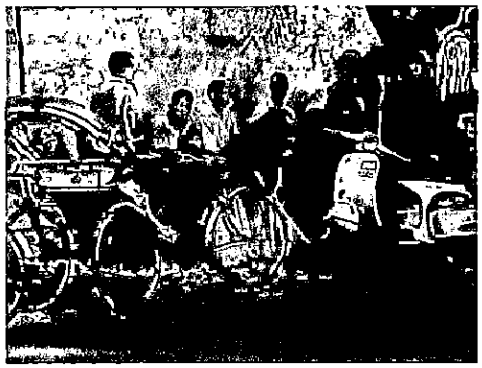
The primary collection of solid waste is done through street and road sweeping because household waste is thrown from house windows/doors or placed in open places. The sweeping and cleaning of city is done on the basis of a three-tire system. Mainly the female sweeper sweeps the street and roads and heaps it on the road/street side. The second sweeper cleans the drains (Nali) and removes the wet silt and recyclable garbage and again heaps those on the drain side. The third

sweeper lifts these heaps of solid waste in handcarts and carries it to the near by collection points and unloads it on land.

- The sweeper (most of the female) sweeps the street and road and heaps it on the road / street side. (Photo a, b &c)

a

b



c

- The second sweeper cleans the roadside drains (Nali) and removes the silt, recyclable and garbage etc. and heaps those on drain (Nali) side (Photo d, e)

d

e

- The third sweeper, with handcart, lifts these heaps of solid waste in handcart and carries either to the nearby dust bin or to open collection point and unloads is on land (Photo f, g & h)



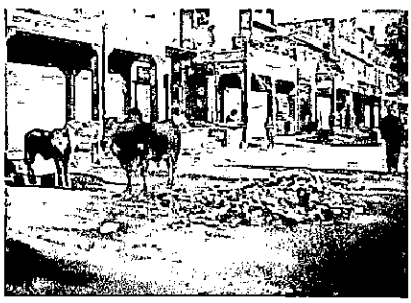
f g h

Details of zone wise collection points in the city are tabulated in Table 4.10.

Table No. 4.10 Details of Collection Points

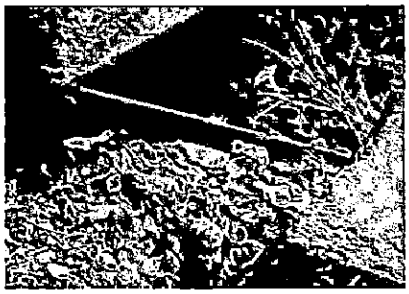
Sr. No.	Name of Zone	No. of Wards	Existing Depots			
			Open		Closed	Total
			On Land	RC (1 m^3)	(4.5 m^3)	
1	Civil Line	14	580	115	6	701
2	Vidhyadhar Nagar	15	715	110	5	830
3	Hawa Mahal (E)	12	367	0	0	367
4	Hawa Mahal (W)	11	545	0	0	545
5	Motidoongri	11	850	0	0	850
6	Sanganer	7	353	0	0	353
			3410	225	11	3646





Stray animals at open depot

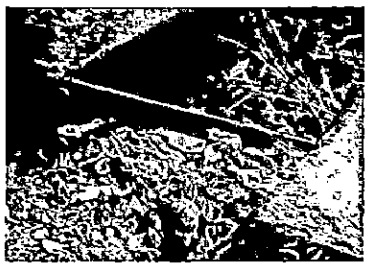




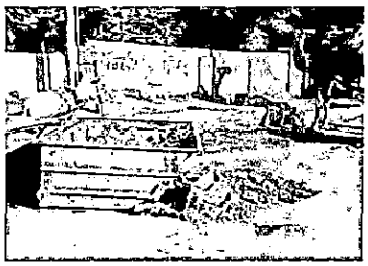
The various sources contributing solid waste are listed below:

A)	Residential & Commercial Area	E)	Medical Establishment
B)	Slum Area	F)	Hotels & Restaurants
C)	Vegetable & Fruit Market	G)	Construction & Demolition Activities
D)	Slaughter House	H)	Industry

The present scenario of SWM in Jaipur is described in a picture gallery below :-



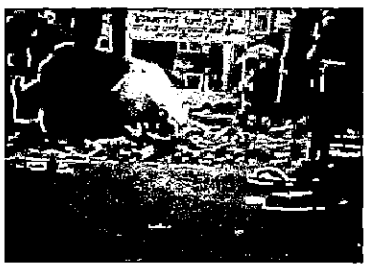
(1). Solid Waste in open drains



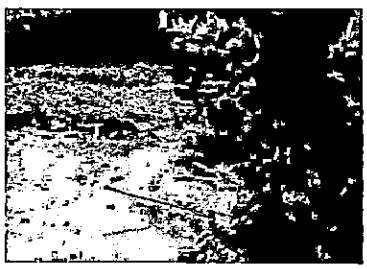
(2). Waste spread out side RC

(3). Water logging due to chocking of drains by waste

(4). Open Depot



(5). *Stray animals at open depot*



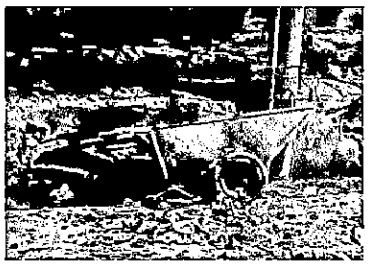
(6). Solid Waste in Nallahs

(7). Solid Waste in Nallahs

(8). Dust bin at MI Road

(9). Safai Karmchari

(10). Waste is collected before opening of shops at Johari Bazar



(11). Situation after Waste is lifted

(12). Crude dumping at disposal site

The city administration has been decentralized in six zones. There are a total of 70 wards in the city. Each zone comprises of 8 to 15 wards as shown in Table 4.11

Table No. 4.11 Ward and Zone Details

Sr. No.	Zone name	No. of Wards	Ward No.
1	Civil Line	14	2,3,4,5,6,7,11,15,16,17,19,20,21,38
2	Vidhyadhar Nagar	15	1,8,9,10,36,37,62,63,64,65,66,67,68,69,70
3	Hawa Mahal (East)	12	44,45,46,47,48,49,50,51,52,55,56,57
4	Hawa Mahal (West)	11	39,40,41,42,43,53,54, 58,59,60,61
5	Motidoongri	11	18,26,27,28,29,30,31,32,33,34,35
6	Sanganer	7	12,13,14,22,23,24,25

The cleaning work of each zone is looked after by the Zonal Administration through the staff deployed at the ward level. Overall in-charge is the Zonal Municipal Commissioner & under him are the Health Officer, Chief Sanitary Inspector, Sanitary Inspector, Jamadar, Supervisor and Sweepers. Chief Health Officer is the overall in-charge of the Solid Waste Management activity of the city.

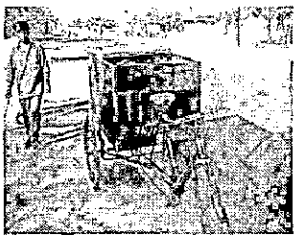
4.10.2 Solid Waste Collection from Commercial/ Institutional Area

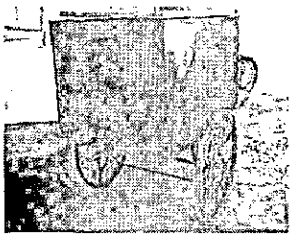
The shops / markets and other establishments normally starts business after 9:30 – 10:00 AM. These timing do not synchronize with the work schedule of the sweepers, as by this time most of the collection procedure is over after collection of solid waste from main streets and roads. Waste from these business communities again accumulates on streets and road. The city does not appear clean. The same is true in the case of hotels, restaurants therefore and vegetable market waste.

According to Master Development Plan, presently there are more than 6,000 registered small – scale industries in Jaipur. There is a high degree of concentration of small scale and household industries in the walled city area. There are about 61 number of large and medium scale type of industries. These are mainly Vanaspati oil refinery, bearings, electricity and water meters etc. There are also leather tanning, carpentry work, pottery and engineering industries including electroplating industries.

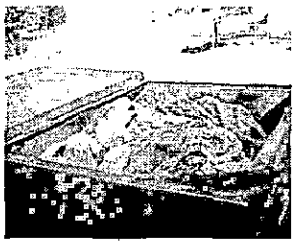
4.10.3 Solid Waste Collection by Private Contractor

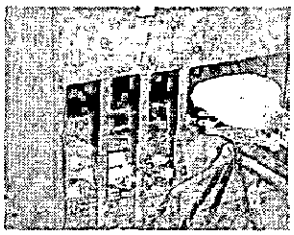
One Private contractor under the name of 'SWACHH JAIPUR ABHIYAN' has been collecting waste house to house in a closed containerized tricycle. The amount charged varies from Rs. 20 to 40 per house per month. Waste is collected from 45000 houses from 13 wards. The collected waste is emptied at open depots. Thus, double handling of waste is not avoided. Part of the solid waste collected is recycled by the agency at source.





Typical Tricycle





Recycled Material

4.10.4 Disposal System

4.10.4.1 Land Fill Sites

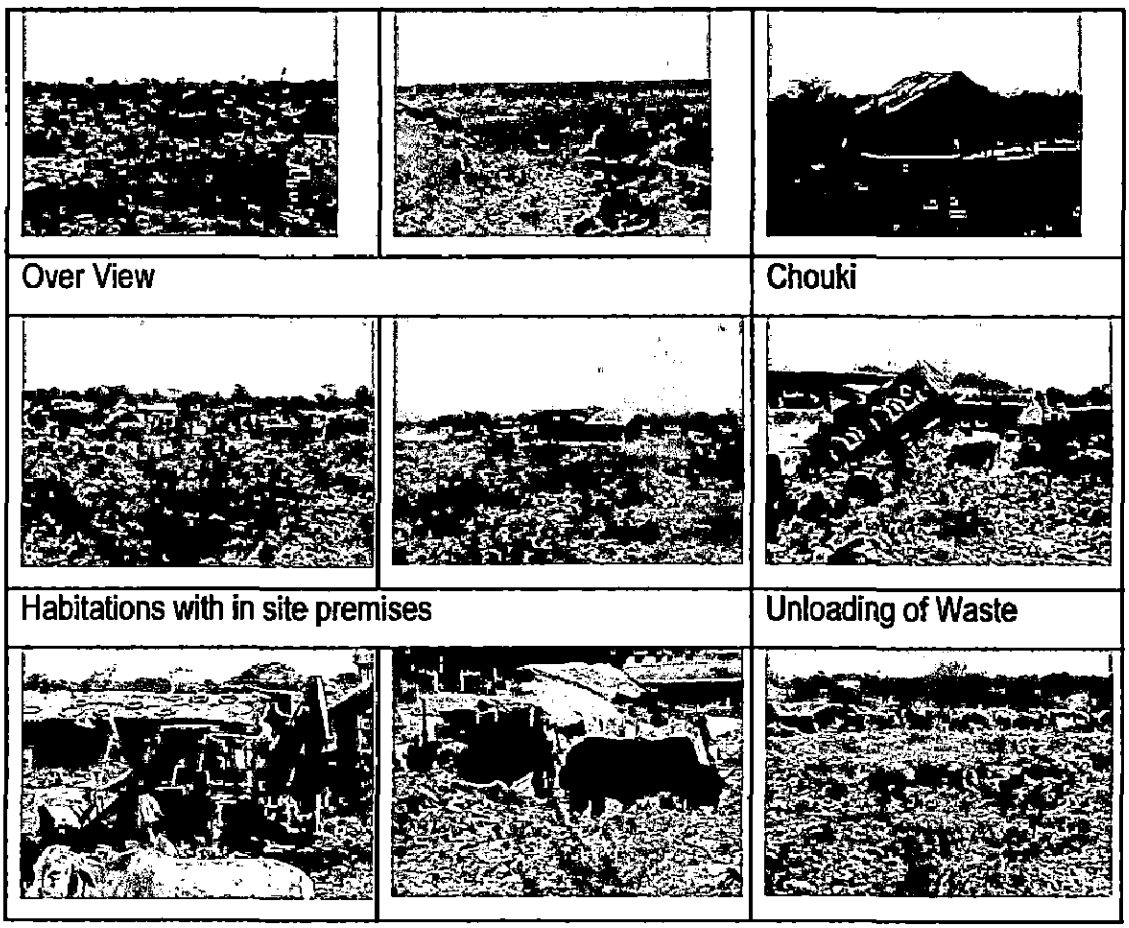
Jaipur Nagar Nigam authorities have reported that they are disposing solid waste at four disposal sites namely;

- Vishwakarma Industrial Area Road No. 6 and Bagrana - In Use
- Naradpura and Maharani Farm - Abandoned

The sites in use will be continued for disposal for one to one and half years, though all the sites are unauthorized and do not have any consent from Pollution Control Board. Maharani Farm and Naradpura landfill sites have been abandoned now. Presently, the Jaipur Nagar Nigam authorities do not have any processing and treatment system. The existing system can not be called as sanitary land filling, but at the best as crude dumping because neither the waste is placed properly nor covered & compacted. There are hardly any controls at the existing sites on the entry of the rag pickers, who during their work remove recyclable material and spread the waste all around spoiling the ambience of the site. Presently, there is no control at the disposal sites for proper disposal. Unauthorized disposal of industrial waste and sludge, including hazardous waste at the disposal site without permission of municipal authority is going on. Hot ashes and cinder deposited at the disposal site result in fire and smoke causing nuisance to the nearby residents. Some times the rag pickers during their search for metals also set the waste on fire.

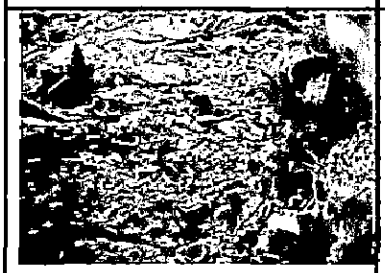
a. Bagarana Landfill Site- In Use

The site is currently under use. It is approximately 20 kms away from the city along Jaipur-Agra National Highway no. 11 There is a hut like structure (chouki) where record of incoming vehicles are maintained.



Over View | Chouki

Habitations with in site premises | Unloading of Waste

Leveling by Excavator	Cattles	Stray Animals
		
Flies	Rag Pickers waiting for unloading of waste	

b. Vishwakarma Industrial Area Road No. 06 Landfill Site - In Use

The site is located near industrial area. Solid waste is disposed in the depression formed during high floods in 1981. Most of the Vidhyadhar Nagar Zone is disposed off here. No permanent structure is existing for maintenance of records.

		
Over View		

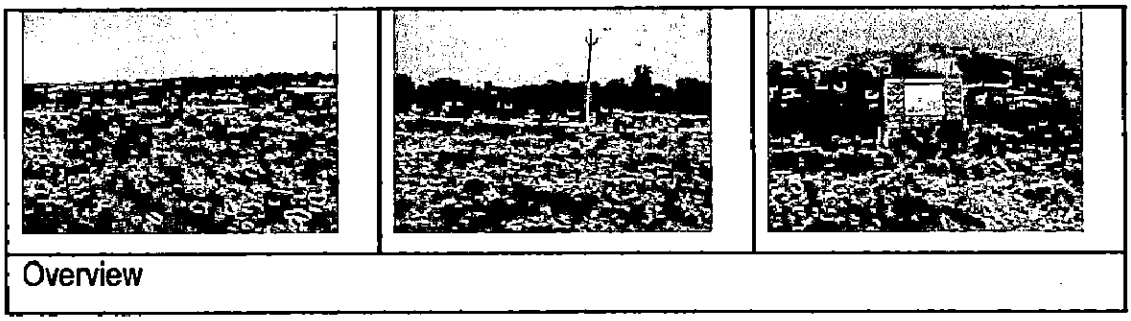
c. Maharani Farm Landfill Site - Abandoned

This site is located within the city. This site has been abandoned due to local resistance. The area is surrounded by residential areas. During the visit to the site, local residents complained about unhygienic conditions and health problems, especially to children, due to disposal of waste.

		
Nallah flowing through site		

d. Naradpura Disposal Site - Abandoned

This site is about 15 kms away from the city along the Delhi Bypass road. The site is now abandoned. There exists a foundation stone indicating that the land was to be used for housing colonies.



Overview

4.10.5 Medical Establishments - Biomedical Waste

It has been reported in NHDS & SEARCH 2000 that there are a total of 480 Medical Establishments in Jaipur city. It is also reported that total bed facilities for Jaipur city is more than 8000 beds. *Table*shows details of various medical establishments with bed capacity. Details of medical institutions is presented in Table 4.12.

Table No. 4.12 Details of Medical Institution and Beds Facilities at Jaipur

Sr. No.	Type of Institution	Gover-nment	Private	Trust	Total	Bed	Quantity of waste (Kg)
1.	Hospitals with beds 200 and above	7	-	2	9	3932	7995
2.	Hospitals with beds 50 to 199	7	6	3	16	1254	2550
3.	Hospital with beds less than 50	5	88	14	107	1917	3898
4.	Nursing homes (bed less than 50)	-	38	-	38	506	1029
5.	Clinics and Dispensaries	47	245	-	292	303	616
6.	Laboratories & Diagnostic Centers	-	18	-	18		27
	Total Institutions	66	395	19	480	7912	16115

Source: Report on survey of Bio-Medical waster in Jaipur by NHDS and SEARCH year 2000-01

The Sawai Man Singh hospital has the biggest capacity of 1692 beds, details of which are given in Table 4.13 . This hospital normally reports 100 % occupancy.

Table No. 4.13 Details of Bed Capacity at SMS Hospital

S.No	Name of Specialty	Total	S.No	Name of Specialty	Total
1.	General Medicine	221	11.	Plastic Surgery	65
2.	Gastroenterology	34	12.	Neurosurgery	85
3.	Neurology	36	13.	Cardio – Thoracic	86
4.	Cardiology	50	14.	Urology	63
5.	Nephrology	49	15.	Radiotheraphy	32
6.	Skin & VD	26	16.	Family Welfare	7
7.	General Surgery	209	17	Dental Wing	5
8.	Orthopaedics	211	18.	Paying Beds	79
9.	ENT	45	19.	Common Beds	160
10.	Opthalmology	96	20.	CT ICU Beds	107
				1 Total	1692

4.10.5.1 Bio Medical Treatment Plant

Jaipur Nagar Nigam has entered into a contract with a private firm for Bio-medical waste treatment. This will be operated by a private party. 5.0 ha. land has been allotted adjacent to the proposed disposal site under this project The contract includes collection, transportation and processing of biomedical waste from various medical establishments in the city. The waste collected by the concerned company will be subjected to micro wave, autoclave, shredder, incinerators treatment etc. The refuse and ashes, from the plant will be disposed of at the plant site.

4.10.5.2 Composting plant / Bio-energy Plant

Presently a small quantity of solid waste (10-20 TPD) is processed for composting / vermin culture. Small communities are practicing vermin composting along with cow dung and vegetable market waste. However, the quantity thus processed is very small.

A compost or Bio-energy plant is proposed near the landfill site proposed under this project for 500 T/d solid waste. There was about 10.0 ha. land is kept reserved at Khori Rupara for this purpose. This contract will be on DBOO basis. The inert and reject from this plant will be disposed of at this site.

4.10.6 General Observations and Deficiencies

i. Transportation system does not synchronize with the system of community waste storage facility.

ii. Waste is not transported on a day to day basis leaving a backlog of waste to be transported.

iii. As far as the transportation of the market waste is concerned it is observed that the timings of transportation do not synchronize with the timings of primary collection of waste.

iv. Presently, transportation in walled city is carried out during morning hours and early afternoon.

v. Transportation vehicles are not covered, which is against the guidelines of Supreme Court.

vi. Manual loading is still followed by the private contractors.

vii. Disposal site are far away and no transfer stations exists.

viii. In the walled city, day time lifting of solid waste has always been problematic for the transporters. The width of main lanes of walled city not fit for two way traffic. Moreover encroachments across the lanes also pose a problem. Transportation from the inner lanes of the city was found very difficult.

ix. The system of transfer stations in the SWM transportation of Jaipur does not exist.

x. Primary collection of solid waste in Jaipur city is primitive and inefficient.

xi. The solid waste is neither stored at source nor segregated. It is thrown on streets, footpaths, open spaces, open drains or water bodies, back yard lanes etc.

xii. Maximum primary collection and storage points are on open land, which develops unhygienic condition, smell, odor, proliferation of flies and mosquitoes and other diseased vectors.

xiii. Only few important roads and markets are swept on daily basis, while the other roads and markets are not being swept on daily basis.

xiv. All type of solid waste generated is mixed with municipal solid waste including biomedical infectious waste, hazardous industrial waste, demolition waste, highly putriciable waste and inert waste.

xv. Only two sites for disposal of solid waste and both are unauthorized.

xvi. Hospital waste is currently being disposed along with other waste although an attempt is underway for separate treatment of bio medical waste.

xvii. Very little attempts are being made for processing and treatment of waste before disposal or disposal sites.

xviii. The other attempt at processing at disposal sites are by rag pickers who create more problems at the site by spreading the waste.

xix. Illegal dumping by private contractors in other low lying areas other than the landfills is also being carried out.

xx. No systematic records are kept at landfill sites as to the quantity of waste dumped. No weigh bridges exist at landfill sites.

xxi. No compaction of waste is done to increase life of landfill sites. Equipments like bulldozer and loaders are not available.

xxii. There is no control over the dumping of inert and organic waste at the site. As such the waste at the landfill site has very little use for composting. More over hazardous industrial waste and construction debris was also dumped at the same site.

xxiii. No attempts at leachate control or recovery of biogas is being made at the site.

4.11 EXISTING CONDITION OF DRAINAGE

The walled city was initially developed with a well-laid out drainage system. For the areas outside the walled city neither the drainage has been properly planned nor has it has been provided in all the areas. The natural slope of Jaipur City is from Northwest to Southeast and the major drains in Jaipur are the Amanishah and Ganda Nalla.

4.12 EXISTING CONDITION OF SEWERAGE AND SANITATION

The topography of Jaipur divides the town into two drainage zones (north and south) along a ridge line through Chandpole, Tripolia, and Ramganj Bazar. The north zone consists of 70% of walled city area. The northern portion slopes towards Jalmahal Lake but contains certain depressed areas like Raja Mal Ka Talab, Govind Nagar and the adjoining area near Jalmahal. The southern zone has a general slope from north to south. At present, the North zone is served by a sewerage system which is connected to a sewage treatment plant (STP) 27 MLD capacity which was commissioned in 1979 near Jalmahal Lake. The treatment plant consists of pretreatment units, aeration tanks, sludge thickeners and sludge drying beds. The condition of the STP is poor. About 60% of aerators are non-functioning and this affects the quality of treated effluent. The treated effluent from the STP is discharged into Jalmahal Lake. Major portion of the sewage in the northern drainage zone of the city finds its way into the Jalmahal Lake. The Lake is connected to an escape

channel, which carries the excess sewage from the lake and leads to open land near Jaisinghpura where sewage farming is being in practice. Parts of the north zone and most of the south zone are unsewered. The portions of south zone are discharging sewage to open channels without any treatment. About 33% of the population is connected to the sewer system. On site sewage disposal through septic tanks or soakage pits are prevalent. About 40% of the households outside the walled city limit are connected to these facilities. Jaipur Development Authority and Rajasthan Housing Board have also developed new colonies having sewer lines, but the raw sewage is being discharged to nallas. The private housing colony households are, in general, provided with septic tanks and soak pits.

4.12.1 Problem Identification

The present sewage treatment plant is located in a dense residential area. The treatment plant does not often function due to inadequate maintenance.

4.12.1.1 North Zone

In this zone even though the sewerage system exists, only the toilets have bee connected to the sewerage and the sullage is let out in to the road side open drains. Because of this constraint, the quantity of sewage actually reaching the STP is less than the expected quantity and also the BOD concentration of Sewage is very high.

4.12.1.2 South Zone

The Southern portion of the city has a slope towards Sanganer. The south zone has a partial sewerage system and the sewage from sewer lines is being used for cultivation and balance quantity goes into the Amanishah Nallah.

Some sewer lines and the main trunk sewers up to proposed STP site at Delawas have been laid by PHED in the south zone.

Most of the areas resort to direct disposal to pits (Kul) manly of which are even taken up to subsoil water level. Limited use of septic tanks and soak pits is also in use. The system of disposal of an alarming magnitude in terms of pollution threat to ground water and increasing incidence of water bore diseases. Waste water drainage is by way of open and covered drains left untreated. A very large percentage of population is still using open fields for defection especially Kachchi Basti dwellers.

The small portion of the Northern area of the town is covered under full fledge sewerage scheme with collection system and treatment plant. In the remaining part of the town, the area which is sewered is discharging the untreated sewage in to Amanisha Nala, which finally drains to the river. In Northern zone, the sullage flow of unsewerd areas is connected to near by open drains which finally discharges to Jal Mahal Lake, Tal Katora Lake pollution the lakes to a large extent. In unsewered areas, waste from toilet is either connected to the septic tank, or soak pits resulting into the contamination of the ground water, which is an important source of water for the city at least for next decade.

Under present scenario, the area where sewerage system is existing (viz) walled city, 90% of the houses do not have their sullage from kitchens and baths connected to the sewers, only the W.C. connection have been provided for the houses. This has two major impacts on the sanitation.

1. The quantity of sewage reaching the treatment plant is less and it is very concentrated.
2. The sullage is discharged into the open storm water drains which become extremely insanitary. These drains also get choked due to garbage, causing fly and odour nuisance.

Hence inspite of having a full fledge sewerage system, total hygienic conditions are not be achieved. It is immensely important, first to discharge the sullage water to the sewers so that the existing sewerage system functions efficiently and the sewers as well as STP receive the design flow. This will help to keep the sewers clean by achieving proper cleansing velocities. Secondly, the sullage water should not be allowed in to the open drains by adhering to strict rules and regulations.

The proposed water supply scheme and sewerage scheme should be implemented simultaneously failing which problems will be faced by the environment, affecting the public health and commercial activities.

To sustain the higher rate of growth in the town infrastructure in general is to keep up and sewerage is an important component of the infrastructure, which needs to be developed.

4.13 HERITAGE & CONSERVATION

4.13.1Introduction

Heritage is a terminology that most truly expresses the character of the city. The city is known as the "Pink City" and has a vast and rich heritage. The city was built by Sawai Jai Singh in 1727. The city was planned as per the ancient Hindu treatise of Shilpa Shastra. The city continued to amalgamate new changes into it while preserving its old character.

4.13.2 Heritage areas

The heritage buildings in Jaipur can be broadly classified into three heads viz., royal palaces and forts, temples and museums. The largest concentration of the heritage buildings is within the walled city and the JMC area. It has been observed that there are eight major heritage buildings available within the walled city area, while ten are confined in the municipal area. The heritage areas in the city have been constructed at various points of time in history. Each has its own unique characteristics and is an architectural marvel in its own right.

i). City Place Complex

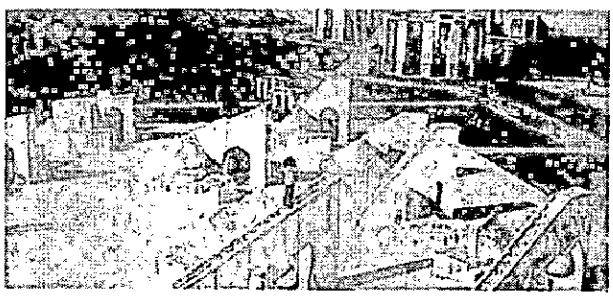
- 1729-1732, located in the heart of the city.
- The place occupies about one-seventh of the old city area.
- It is popularly known as City Place to differentiate from ancient Amber Place.

ii). Hawa Mahal

- 1799, located at Sireh Deori Bazaar, in the walled city
- The palace is otherwise known as 'Palace of Winds' built by poet king Sawai Pratap Singh.
- At present, it has been converted into a museum exhibiting a fine collection of ancient paintings, sculptures, handicrafts, coins and armoury.

iii). Jantar Mantar

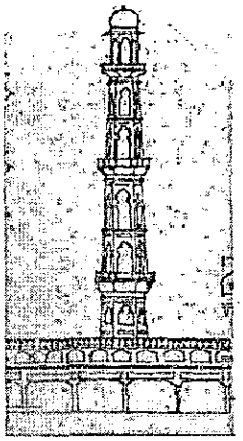
- Built by king Sawai Jai Singh II as astronomy was a life – obsession for him and to know time in that era.
- It comprises five open air astronomical observatories being one of the largest and oldest observatories in India.



iv). Nawab Sahib ki Haveli

- 18th century, located in Tripolia Bazaar. Haveli is rich in intricate carving.
- A panoramic view of the city can be enjoyed from the rooftop of the Haveli.

v). Swargasuli or Isar Lat



- 1749, located on western side of Tripola Bazaar.
- Also known as the 'heaven-piercing minaret' built by Sawai Ishwari Singh to commemorate a grand victory.

vi). Maharani ki Chhatri

- The funeral place for the royal ladies is located just before the Ramgarh road crossing, marked by some wonderfully carved cenotaphs.

vii). Ram Niwas Garden

- 1868, located few meters away from Ajmeri gate.
- Built by Maharaja Sawai Ram Singh
- It sprawls across an area of 4 acres and was designed by surgeon Major De – Faback.

viii). Albert Hall

- It is oldest museum of the State and houses a large collection archaeological and handicraft pieces.
- Architectural features are the arched verandahs and domed pavilions inspitred by British models and Mugal style respectively.

The Jaipur Development Authority has identified heritage buildings in the walled city. A total of 300 buildings have been identified in various chowkhris of the walled city. These have been categorized into large, medium and small on the basis of area. The location of all the buildings in the various chowkris of the walled city has been presented in **Table 4.14.** & **Figure 4.2**

Table No. 4. 14: Heritage Buildings-Walled City

Chowki	Large	Medium	Small	Total
Purani Basti	6	14	26	46
Top khana Desh	6	11	31	48
Modi Khana	9	21	22	52
Vishveshvarji	5	17	41	63
Ghat Gate	7	11	12	30
Top khana Hazuri	3	3	11	17
Ramchandraji	9	9	5	23
Gangaploe	1	7	13	21
Total	**46**	**93**	**161**	**300**

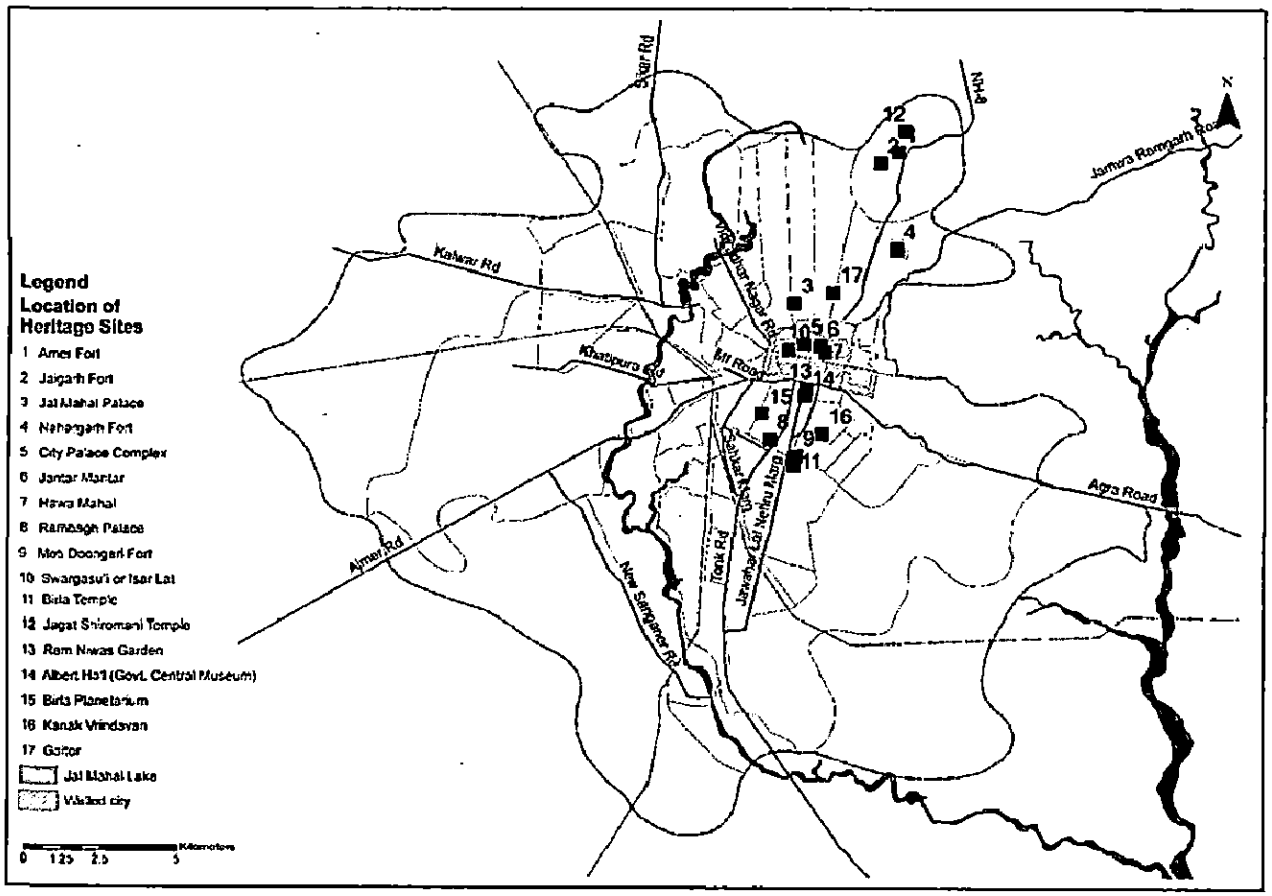


Figure 4-2: Location of Heritage Sites in Jaipur

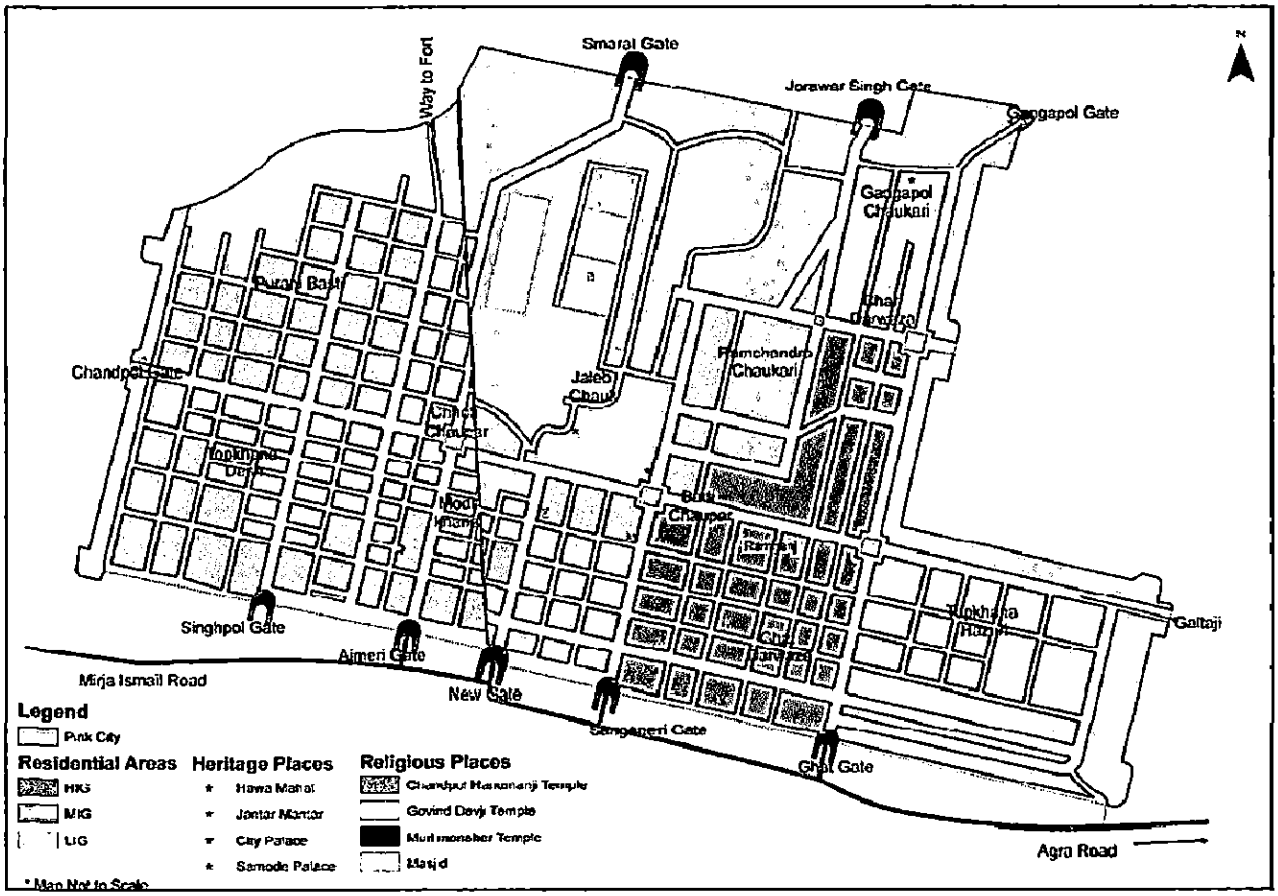


Figure 4-3: Heritage Characteristics of Walled City

4.13.3 Problems

The major issues with respect to heritage and conservation include excessive commercialization, insufficient infrastructure facilities, encroachment on streets by hawkers and vehicles, misuses of proposed walkways in the walled city, inadequate parking facility, legislative and legal framework and lack of awareness.

- Excessive, uncontrolled and unchecked commercialization of the inner streets in the walled city has led to problems, such as, traffic congestion during the peak hours.
- Haphazard construction of shops has spoiled the cultural fabric of the city.
- Due to lack of infrastructure facilities people from walled city are moving out to the outskirts. The vacant houses are in turn converted into commercial areas.
- No rules and regulations proposed for maintenance of heritage walkways.

5.1 INTRODUCTION

An assessment of the present status of development of the walled city, Jaipur, is very much essential in order to understand the present status of development, which required in formulating workable recommendations to solve the existing problems. To assess the present status of development, all the important parameters of the systems are identified, and assessed in detail. The assessment is done in such a way that all the physical, socio-economic, ecological and environmental parameters are considered. The assessment of the present status of development also includes the land use, housing, traffic and transportation, recreation, water supply, sewerage, etc. Different infrastructure facilities considered in this investigation are transportation, health, sanitation facilities, power, education, water supply, etc. The functions of these various parameters have been studied carefully by conducting primary household survey at household levels in the study area. The following are the control parameters, which are identified and studied.

- Physical,
- Social,
- Economic,
- Ecology,
- Environment
- Infrastructure, and
- Institution

5.2 Household Survey

The walled city of Jaipur is divided into nine squares, and the squares are further divided into wards for development administration. The investigators had conducted an observation study in the entire walled city area covering all nine squares and understand the functions of the system thoroughly. Further, he decided to conduct household survey in the study area (walled city) for understanding the system at the micro level by employing pretested schedules. The Investigator has chosen all nine squares to conduct household survey to give equal importance to all the squares. The Investigator has chosen 11 to 12 households randomly covering all the squares, to the conduct the household survey and conducted the survey at the household level by him-self.

A survey of a total of 100 household is conducted from amongst the nine squares. The survey includes the study of the physical, social, economic, ecological as well as environmental aspects of the study area. The first and foremost step involved in selection of the wards. Followed by identification of households for conducting investigation. In the present investigation households are selected by using random sampling method. . The schedule and the list of variables used for this present investigation are presented in Annexure-I. To analyze the present status of development, income is considered as the dependent variable. To analyze the socio-economic condition, the surveyed households are grouped into different income groups, such as, monthly income less than Rs. 5,000, Rs 5,000-Rs 10,000, Rs. 10,000 – Rs.15,000, Rs. 15,000-Rs. 20,000, Rs.20,000-Rs. 25,000, greater than Rs. 25,000. Detailed analysis has been done by considering dependent variables versus several independent variables.

The detailed socio-economic and physical analysis of the present assessment of the study area is presented as below:

5.2.1 Households:

In this Investigation, income is considered as y variable and the other variables are considered as x variables. ($x_1+x_2+x_3.....x_n$) In the study area, income is not evenly distributed among the households and income is deciding almost all functions of the households. For example, income decides the social status of the households; Income decides the expenditure on various activities, such as house construction, education, recreation, possessing household appliances, possessing vehicles, etc. Having this knowledge in mind, the Investigator considers income as the y variable and the analysis is done corresponding to the other variables ($x_1+x_2+x_3.....x_n$). At the outset, to process the data, the lowest income household and the biggest income household are identified, and the households are grouped into six segments, such as households having monthly income of below Rs.5000, Rs.5000 – Rs.10000, Rs.10000 – Rs.15000, Rs.15000 – Rs.20000, Rs.20000 – Rs.25000, and above Rs.25000. The number of households confined within each income group put together and presented in Table 5.1. for analysis. The table 5.1 illustrates that almost one – fifth (18%) of the households are having less income, and the number of households confined into various income groups are decreasing along with increase in income groups from monthly income of Rs.5000. It is interesting to state that more than half (57%) of the households are confined in the moderate income group. It shows that, thus, this city's standard of living is not bad and the purchasing power of the people of the city is moderately good.

Table No. 5.1 Households

S.No.	Income of households	No. of households	%
1	<5000	18	18
2	5000-10000	39	39
3	10000-15000 .	18	18
4	15000-20000	12	12
5	20000-25000	7	7
6	>25000	6	6
	Total	100	100

5.2.2 Religion

In India, religion is almost the opium of the human being especially among the downtrodden communities, and religion plays a major role in the functions of the system. In the study area, the following major religions are popular, such as Hindu and Muslim; and occupation is more or less confined on religion. For example, Muslim Community personals are more or less engaged in business activities. The social life is also more or less decided on the basis of religion. Having this knowledge in mind, the Investigator, consider religion as one of the most important parameters and analyzed properly. For doing in depth analysis, the households are grouped based on the religion, and corresponding to their income groups and presented in Table. 5.2. The table illustrates that about four – fifth (79%) of the households confined in Hindu religion, Followed by, about one – fifth (19%) in Muslim, and the rest 2% are confined in others. It shows that the majority of the households are belonging to the Hindu, and the society is Hindu religion dominated. It is interesting to note that in both religions, availability of households are decreasing along with increasing monthly income from Rs.5000 onwards.

Table No. 5.2 Religion

S.No.	Income (in thousands)	Religion			
		Hindu	Muslim	Others	Total
1	<5000	16	2	0	18
2	5000-10000	33	6	0	39
3	10000-15000	14	4	0	18
4	15000-20000	7	4	1	12
5	20000-25000	5	1	1	7
6	>25000	4	2	0	6
	Total	79	19	2	100

5.2.3 Caste

Caste plays an important role in the social structure of a region .The caste divisions are studied and are incorporated under different income groups, and presented in Table. 5.3

The above table shows the fact that the major castes (Hindu Brahmins, jains, guptas) dominated in this region, consisting of more than three fourth (79%) of the households. While others constituting of the other castes (like the jats, rajputs, sc, muslims), constituted the rest 21% of the households.

Table No. 5.3 Caste

S. No.	Income(in thousands)	Caste			
		General	%	Others	%
1	<5000	16	20.2	2	9.5
2	5000-10000	33	41.8	6	28.6
3	10000-15000	14	17.7	4	19.0
4	15000-20000	7	8.9	5	23.8
5	20000-25000	5	6.3	2	9.5
6	>25000	4	5.0	2	9.5
	Total	79	100	21	100

5.2.4 Gender

An attempt has been made to study the number of male and female members in a family as grouped with six groups ranging from 1 to 6, incorporated under different income class categories, and presented in Table.5.4. An attempt has also been made to study the Sex ratio in various categories of income as sorted out.

The above table shows that the number of females as compared with the number of males increases as we move from the lower income group to the higher one. It may hence, be concluded that the sex ratio gets strengthened as we move from group no.1 (621.6) to group no.6 (761.9). It may also be concluded from the table that in overall survey of the total number of households the system has 719 females per thousand males which is about 71.9 percent.

Table No. 5.4 Gender

S. No.	Income Of Households	Total Population	Gender		Sex Ratio
			Males	Females	
1.	<5000	60	37	23	621.6
2.	5000-10000	177	101	76	752.5
3.	10000-15000	88	49	39	795.9
4.	15000-20000	67	41	26	634.1
5	20000-25000	42	25	17	680.0
6	>25000	37	21	16	761.9
	Total	471	274	197	719.0

5.2.5 Marital Status

An attempt has been made to study the number of married and unmarried members in a family as grouped with six income groups ranging from 1 to 6 incorporated under different income class categories, and presented in Table 5.5.

The proportion of married to unmarried is less in income group < 5000 and income group 15001-20000. The reason of less proportion of married to unmarried in <5000 income group is due to their big family size, more number of children, whereas the reason among 15001-20000 income group is due to their more inclination towards education, they are getting married at later age. The more proportion of married to unmarried with 5001-15000 income group is due to their small family size and more awareness of small family size due to high education standards.

Table No. 5.5 Marital Status

S.No.	Income(in thousands)	Married	%	Unmarried	%	Total	%
1	<5000	38	13.72	22	11.34	60	12.74
2	5000-10000	107	38.63	70	36.08	177	37.58
3	10000-15000	48	17.33	40	20.62	88	18.68
4	15000-20000	38	13.72	29	14.95	67	14.23
5	20000-25000	24	8.66	18	9.28	42	8.92
6	>25000	22	7.94	15	7.73	37	7.86
	Total	277	100.00	194	100.00	471	100.00

5.2.6 Education

The educational status of an area is an important indicator to understand the status of development of the region. Keeping this in mind, an attempt has been made to study the educational structure of the study area.

Most of educated persons (Graduates) are confined in Rs. 5001-20000 income groups where as it is least in lower income group. It may also be observed that the income group from 5001-15001 has the highest number of educated people thus indicating that the middle class is spending quite a large amount of money education.

Table No. 5.6 Education

S. No.	Income (in thousands)	Primary	%	Secondary	%	Technical Graduate	%	Non - Technical Graduate	%	Total	%
1	<5000	10	8.2	17	11.9	2	8.0	9	9.7	38	9.9
2	5000-10000	56	45.9	45	31.5	7	28.0	24	25.8	132	34.4
3	10000-15000	23	18.9	25	17.5	8	32.0	21	22.6	77	20.1
4	15000-20000	9	7.4	23	16.1	1	4.0	20	21.5	51	13.3
5	20000-25000	16	13.1	20	14.0	0	0.0	7	7.5	43	11.2
6	>25000	8	6.6	13	9.1	7	28.0	12	12.9	40	10.4
	Total	122	100.0	143	100.0	25	100.0	93	100.0	383	100

5.2.7 Occupation

The occupational structure of an area is an important indicator to understand the status of development of the region. Keeping this in mind, an attempt has been made to study the occupational structure of the study area.

Occupation is one of the major factors which more or less influences households income, standard of living, etc. Having the importance of occupation in mind the occupation pattern of the households are studied properly and presented in Table 5.7. The table illustrates that above nine–tenth (90.7%) and above one-tenth (9.3%) of the people are confined in the tertiary sector and the primary sector respectively. It may also be observed that as one moves upwards the income group, the number of people involved in primary occupation decreases and the other is in increasing trend.

Table. 5.7 Occupation

S. No.	Income Of Households	Total Population	Occupation			
			Primary	Tertiary	Total	%
1.	<5000	60	2	19	21	15.00
2.	5000-10000	177	2	49	51	36.42
3.	10000-15000	88	7	23	30	21.42
4.	15000-20000	67	2	13	15	10.71
5	20000-25000	42	0	9	9	6.42
6	>25000	37	0	14	14	10.00
	Total	471	13(9.3)	127(90.7)	140	100

5.2.8 Type of houses

An attempt has been made to analyze the type of house that the people residing in the area and is presented in various income categories in table 5.8.

It may be observed from the table that a very large segment (70%) of the population falls in the semi-detached type of houses. The people with comparatively low income are engaged in more of semi-detached type of housing. As the income goes on increasing the proportion of engagement in semi detached and apartment type of housing decreases while the portion of detached houses increases. The percentage of people living in detached type of houses is also about one-third, i.e. 29 percent.

Table No. 5.8 Type of houses

S. No.	Income (in thousands)	Detached	%	Semi - Detached	%	Apartment	%	Row	%
1	<5000	5	17.24	13	18.57	0	0.00	0	0.00
2	5000-10000	10	34.48	29	41.43	0	0.00	0	0.00
3	10000-15000	3	10.34	15	21.43	0	0.00	0	0.00
4	15000-20000	5	17.24	7	10.00	0	0.00	0	0.00
5	20000-25000	3	10.34	3	4.29	1	100.00	0	0.00
6	>25000	3	10.34	3	4.29	0	0.00	0	0.00
	Total	29	100.00	70	100.00	1	100.00	0	0.00

5.2.9 Ownership of houses

An attempt has been made to analyze the ownership of house that the people residing in the study area and possess and is presented in various income categories in Table 5.9.

It may be observed from the table that a very large segment of the population falls in the owned type of houses (87%). The people with comparatively low income are also owners of landholdings in larger numbers. As the income goes on increasing, no rented houses but only owned houses are observed. The percentage of people living in rented houses is just 13 percent only, which is considerably very less.

Table No. 5.9 Ownership of houses

S.No.	Income(in thousands)	Rented	%	Owned	%
1	<5000	4	30.77	14	16.09
2	5000-10000	6	46.15	33	37.93
3	10000-15000	2	15.38	16	18.39
4	15000-20000	0	0.00	12	13.79
5	20000-25000	1	7.69	6	6.90
6	>25000	0	0.00	6	6.90
Total		13	100	87	100

5.2.10 Finance

An attempt has been made to analyze the type or source of ownership of house that the people residing in the study area possess and is presented in various income categories in Table 5.10.

It may be observed that in terms of the type or source of ownership of house, above table depicts that more than half of the households, i.e., 53 of them are self - financed houses. There are only a few households having their houses financed from bank (2%). While another large section of the households have ancestral possession of the houses which they have inherited from their forefathers (42%). It may also be seen that (3%) of the houses have some other source of possession.

Table No. 5.10 Finance

S.No.	Income (in thousands)	Bank	%	Self	%	Ancestral	%	Other	%
1	<5000	0	0.0	7	13.2	9	21.4	2	66.7
2	5000-10000	0	0.0	20	37.7	18	42.9	1	33.3
3	10000-15000	0	0.0	11	20.8	7	16.7	0	0.0
4	15000-20000	0	0.0	7	13.2	5	11.9	0	0.0
5	20000-25000	0	0.0	5	9.4	2	4.8	0	0.0
6	>25000	2	100.0	3	5.7	1	2.4	0	0.0
	Total	2	100.0	53	100.0	42	100.0	3	100.0

5.2.11 Physical condition of the houses

An attempt has been made to analyze the physical condition of houses that the people residing in the area of study possess and is presented in various income categories in Table 5.11. The condition of the households may tell us about the standard of living that the people residing in that house possess and the way they are maintaining their houses or ancestral property.

In terms of physical conditions of houses, above table depicts that there are very few houses in the study area which may be categorized as dilapidated (4%) and half of the surveyed houses that are in good state (49%) and another about a set of half (47%) in categorized as livable. It may also be observed that the houses having a dilapidated condition are possessed by the lowest income group of < Rs.5000, which may depict their poor financial state. It is also worth mentioning that the people belonging to the income groups Rs.20000 and above generally are residing in houses that are sound and are in a good state, thus depicting the good financial state of that household.

Table No. 5.11 Physical condition of the houses

S. No.	Income (in thousand)	Physical Condition					
		Good	%	Livable	%	Dilapidated	%
1	<5000	8	16.3	6	12.8	4	100.0
2	5000-10000	17	34.7	22	46.8	0	0.0
3	10000-15000	9	18.4	9	19.1	0	0.0
4	15000-20000	6	12.2	6	12.8	0	0.0
5	20000-25000	4	8.2	3	6.4	0	0.0
6	>25000	5	10.2	1	2.1	0	0.0
	Total	49	100.0	47	100.0	4	100.0

5.2.12 Number of Rooms in the Household

An attempt has been made to analyze the number of rooms in the households that the people residing in the area of study possess and is presented in various income categories in Table 5.12. The number of rooms in the household may reveal about the standard and the quality of living that the people residing in that house possess.

It may be observed from the table that the number of rooms in the households in the locality has a wide range from 3 rooms to more than 9 rooms depicting a large variation in the living conditions of the members of the household. It may be seen that as the income increases, one may observe an increase in the number of rooms. It may also be seen that the largest number of households possess 1 to 3 rooms (35%). The number of households having 3 to 6 rooms is (32%). It may also be observed from the table that while the richer sections have larger houses, the lower income groups possess lesser number of rooms.

5.2.14 Availability of Soak Pit/Sewer/Septic Tank

An attempt has been made to analyze the availability of sewage lines, or soak pit or septic tank in the area and is presented in various income categories in Table 5.14.

The table shows that more than half (59%) of the households utilizing the sewerage drains and about two – fifth of the households (39%) have constructed their own manure pits for disposing the solid waste. It is also distressing to mention that 2% of the households do not have any facility for the disposal of the solid waste and are hence utilizing the common drains to dispose them. It can be concluded that the public drainage system in the study area is found satisfactory.

Table No. 5.14 Availability of Soak Pit/Sewer/Septic Tank

S.No.	Income (in thousands)	Septic Tank	%	Soak Pit	%	Sewer	%	No Facility	%	Total	%
	<5000	1	33.33	9	25.00	8	13.56	0	0.00	18	18.00
2	5000-10000	2	66.67	12	33.33	25	42.37	1	50.00	40	40.00
3	10000-15000	0	0.00	4	11.11	13	22.03	0	0.00	17	17.00
4	15000-20000	0	0.00	5	13.89	6	10.17	1	50.00	12	12.00
5	20000-25000	0	0.00	3	8.33	4	6.78	0	0.00	7	7.00
6	>25000	0	0.00	3	8.33	3	5.08	0	0.00	6	6.00
	Total	3	100.00	36	100.00	59	100.00	2	100.00	100	100

5.2.15 Drains

An attempt has been made to analyze the availability of drains in the area of study and is presented in various income categories in Table 5.15. It has also been tried to observe whether the drains are covered or open. This study helps in determining the cleanliness and the hygiene of the study area.

It may be observed from the above table that however drains are available in most of the localities but they are generally open. Of the total surveyed, household about one-third (62%) of the having open drainage, and followed by just above one-third (36%) are having covered drainage, and the rest are not having drainage facilities. The above table reveals that the hygiene and the cleanliness at most of the places are improper as the drains are not covered.

Table No. 5.15 Drains

S.No.	Income (in thousands)	Open	%	Covered	%	No Drains	%
1	<5000	11	17.74	7	19.44	0	0.0
2	5000-10000	27	43.55	11	30.56	1	50.0
3	10000-15000	10	16.13	8	22.22	0	0.0
4	15000-20000	7	11.29	5	13.89	0	0.0
5	20000-25000	5	8.06	1	2.78	1	50.0
6	>25000	2	3.23	4	11.11	0	0.0
	Total	62	100.0	36	100.0	2	100.0

5.2.16 Problems of Drainage

An attempt has been made to analyze the condition of drains in the study area and is presented in various income categories in Table 5.16. It has also been tried to observe whether the drains in the area face problems like overflow or clogging. This study helps in determining the cleanliness and the hygiene of the study area.

It may be observed from the above table that, however, drains are available in most of the localities but they are generally open and hence they overflow. It has been observed from the table that about three-fourth (70%) of the drains of the households are overflowing, and about half (46%) of the drains of the household are clogging. The above table reveals that the hygiene and the cleanliness at most of the places are improper as the drainage is also improper.

Table No. 5.16 Problems of Drainage

S.No.	Income (in thousands)	Overflow	%	Clogging	%	No Problem	%
1	<5000	13	18.57	8	17.39	0	0.00
2	5000-10000	28	40.00	19	41.30	5	38.46
3	10000-15000	12	17.14	7	15.22	0	0.00
4	15000-20000	10	14.29	6	13.04	2	15.38
5	20000-25000	4	5.71	3	6.52	4	30.77
6	>25000	3	4.29	3	6.52	2	15.38
	Total	70	100.0	46	100.0	13	100.0

5.2.17 Overflow of Drains

An attempt has been made to analyze the condition of drains in the area of study and is presented in various income categories in Table 5.17. It has also been tried to observe whether the drains in the area face problems like overflow or clogging. This study helps in determining the cleanliness and the hygiene of the study area.

It may be observed from the above table that almost all the drains (91%) face the problem of overflow during rainy season indicating that there is no proper drainage system in the study area and frequent clogging. The maximum of complaints were from the sections of the income group between Rs.5000 and Rs.10000.

Table No. 5.17 Overflow of Drains

S.No.	Income (in thousands)	Overflow Of Drains During Rainy Season			
		Yes	%	*No*	%
1	<5000	18	19.78	0	0.00
2	5000-10000	35	38.46	6	66.67
3	10000-15000	17	18.68	1	11.11
4	15000-20000	11	12.09	0	0.00
5	20000-25000	4	4.40	2	22.22
6	>25000	6	6.59	0	0.00
	Total	91	100.0	9	100.0

5.2.18 Duration of water supply (hrs. per day)

Water supply is one of the most important parameters, which aspects linked with man's day to day life. An attempt has been made to analyze the availability and the hours of water supply and is presented in various income categories in Table 5.18, and the table illustrates. That about half (46%) of the households receive water supply for about 1 hr, while about another half (48%) of the receive water supply for 1.0 to 2.0 hours. There are only 6% of the houses which receive 3 or more than 3 hours of water supply. It may be deduced that maximum households receive water supply from up to 1 to 2 hours per day.

Table No. 5.18 Duration of water supply (hrs. per day)

S. No.	Income (in thousand)	No. of household with duration (hrs. per day)							
		0 to 1	%	1 to 2	%	2 to 3	%	> 3	%
1	<5000	11	23.9	5	10.4	0	0.0	2	50.0
2	5000-10000	20	43.5	17	35.4	0	0.0	2	50.0
3	10000-15000	4	8.7	14	29.2	0	0.0	0	0.0
4	15000-20000	8	17.4	4	8.3	0	0.0	0	0.0
5	20000-25000	1	2.2	6	12.5	0	0.0	0	0.0
6	>25000	2	4.3	2	4.2	2	100.0	0	0.0
	Total	46	100.0	48	100.0	2	100.0	4	100.0

5.2.19 Vehicles Owned

An attempt has been made to analyze the availability and type of vehicles among the households in the area and is presented in various income categories in Table. 5.19.

The table shows that more than three – fourth (77%) of the vehicles in the study area are 2 – wheelers, followed by four wheelers (14%) and bicycles (13%). It also shows that the four wheelers are availed by the higher income groups.

It can be concluded that bicycles and two wheelers are the major type of private vehicles in the study area.

Table No. 5.19 Vehicles Owned

S.No.	Income (in thousands)	Cycle	%	2 - Wheeler	%	4 - Wheeler	%	Others	%
1	<5000	4	30.8	9	11.7	0	0.0	0	0.0
2	5000-10000	4	30.8	31	40.3	1	7.1	0	0.0
3	10000-15000	3	23.1	13	16.9	5	35.7	0	0.0
4	15000-20000	0	0.0	12	15.6	1	7.1	0	0.0
5	20000-25000	1	7.7	6	7.8	3	21.4	0	0.0
6	>25000	1	7.7	6	7.8	4	28.6	1	100.0
	Total	13	100.0	77	100.0	14	100.0	1	100.0

5.2.20 Recreation

An attempt has been made to analyze the availability and type of recreation available in the localities of the households in the area and is presented in various income categories in Table 5.20.

It may be observed from the above table that more than three – fourth (76%) of the households have recreational facilities in nearby places depicting that there is no scarcity of recreational facilities in the study area.

Table No. 5.20 Recreation

		Distance of the recreational facility from the household in km.							
S.No.	Income (in thousands)	0.0 - 2.0	%	2.0 - 4.0	%	4.0 - 6.0	%	> 6.0	%
1	<5000	13	17.11	5	22.73	0	0.00	0	0.00
2	5000-10000	32	42.11	7	31.82	0	0.00	0	0.00
3	10000-15000	12	15.79	5	22.73	1	50.00	0	0.00
4	15000-20000	8	10.53	3	13.64	1	50.00	0	0.00
5	20000-25000	6	7.89	1	4.55	0	0.00	0	0.00
6	>25000	5	6.58	1	4.55	0	0.00	0	0.00
	Total	76	100.00	22	100.00	2	100.00	0	0.00

5.2.21 Water Quality

An attempt has been made to analyze the quality of water available in the localities of the households in the area of study and is presented in various income categories in Table 5.21. This table is important as it is helpful in assessing the water quality in the study area.

It may be observed from the above table that a good percentage of people (70%) believe that the quality of water supplied in the locality is potable. However, about one – fifth (16%) of the households opinioned that the quality of water supplied to their households is poor and is not even fit for drinking and the opinion is also scattered over irrespectives of all income groups.

Table No. 5.21 Water Quality

S.No.	Income Of Households	Water quality								Total
		Very Good	%	Good	%	Moderate	%	Poor	%	
1	<5000	0	0.0	7	21.2	7	18.9	4	25.0	18.0
2	5000-10000	7	50.0	9	27.2	15	40.5	8	50.0	39.0
3	10000-15000	4	28.6	6	18.2	7	18.9	1	6.2	18.0
4	15000-20000	1	7.1	3	9.1	6	16.2	2	12.5	12.0
5	20000-25000	2	14.3	3	9.1	2	5.4	0	0.0	7.0
6	>25000	0	0.0	5	15.1	0	0.0	1	6.3	6.0
	Total	14	100.0	33	100.0	37	100.0	16	100.0	100

5.2.22 Air quality

An attempt has been made to analyze the quality of air available in the localities of the households in the area of study and is presented in various income categories in Table 5.22. This table is important as it is helpful in assessing the air quality in the area under study.

It may be observed from the above table that about nine-tenth (89%) of the people believe that the quality of air available in the locality is good. However, there are people (11%) who opinioned that the quality of air available to their households is poor. This may help us to deduce the level of pollution in the locality is not so much, and the study area has better quality of environment.

Table No. 5.22 Air quality

S.No.	Income Of Households	Air quality								Total
		Very Good	%	Good	%	Moderate	%	Poor	%	
1	<5000	0	0.0	7	18.9	8	16.7	3	27.2	18.0
2	5000-10000	2	50.0	11	29.7	21	43.7	5	45.4	39.0
3	10000-15000	1	25.0	7	18.9	9	18.7	1	9.1	18.0
4	15000-20000	1	25.0	4	10.8	6	12.5	1	9.1	12.0
5	20000-25000	0	0.0	4	10.8	3	6.2	0	0.0	7.0
6	>25000	0	0.0	4	10.8	1	2.1	1	9.1	6.0
	Total	4	100.0	37	100.0	48	100.0	11	100.0	100

5.2.23 Land quality

An attempt has been made to analyze the quality of land available in the localities of the households in the area of study and is presented in various income categories in Table 5.23. This table is important as it is helpful in assessing the land quality in the study area.

It may be observed from the above table that more than nine-tenth (92%) of people believe that the quality of land in the locality is good. However, slight percentages (8%) of persons are not satisfied about the land.

Table No. 5.23 Land quality

S.No.	Income Of Households	Land quality								Tota
		Very Good	%	Good	%	Moderate	%	Poor	%	
1	<5000	0	0.0	8	17.8	8	25.8	2	25.0	18.(
2	5000-10000	4	25.0	19	42.2	12	38.7	4	50.0	39.(
3	10000-15000	5	31.2	9	20.0	4	12.9	0	0.0	18.(
4	15000-20000	3	18.8	3	6.7	6	19.3	0	0.0	12.(
5	20000-25000	1	6.2	5	11.1	0	0.0	1	12.5	7.0
6	>25000	3	18.7	1	2.2	1	3.2	1	12.5	6.0
	Total	16	100.0	45	100.0	31	100.0	8	100.0	100

5.2.24 Noise Pollution

An attempt has been made to analyze the level of noise pollution in the localities of the households in the study area and is presented in various income categories in Table 5.24. This table is important as it is helpful in assessing the quality of living of the people in the study area. It may be observed from the above table that the level of noise pollution has been termed as high and very high by (60%) and (14%) of the household respectively. There are one-fifth (20%) of the persons opinioned that the pollution level is moderate, and just few (6%) observed that it is low. This shows that the area is suffering from acute noise pollution.

5.2.26 Waste Management

An attempt has been made to analyze the availability and frequency of waste disposal in the study area and is presented in various income categories in Table 5.26. This table helps in determining the hygiene of the locality the households which are situated in the study area.

It shows that all of the households of the area have a system for waste disposal, either as an agency collecting from the household or having a common dustbin in the locality. The collection is effective, can be observed from the fact that about two –third (62%) of the households, the waste is collected everyday and from about one-sixth (15%) collected in alternate days. The condition gets bad at places where the locality dustbin is not emptied for more than 4 days.

It shows that the waste disposal system in the study area is more or less satisfactory.

Table No. 5.26 Waste Management

		Collection of waste from household level							
S.No.	Income (in thousands)	Everyday	%	Alternate Days	%	3 Days	%	> 4 Days	%
1	<5000	11	17.74	2	13.33	2	12.50	3	42.86
2	5000-10000	28	45.16	5	33.33	4	25.00	2	28.57
3	10000-15000	8	12.90	2	13.33	7	43.75	1	14.29
4	15000-20000	7	11.29	3	20.00	2	12.50	1	14.29
5	20000-25000	4	6.45	2	13.33	0	0.00	0	0.00
6	>25000	4	6.45	1	6.67	1	6.25	0	0.00
	Total	62	100.00	15	100.00	16	100.00	7	100.00

5.2.27 Household Appliances

An attempt has been made to analyze the appliances owned by the households in the area of study and is presented in various income categories in Table 5.27. This table is important as it is helpful in assessing the appliances owned in the household and in turn helps in determining the economic condition and the living standard of the household.

It may be observed from the above table that nearly all the households (94%) own television, and about two-third (63%) of the households possess a stove and a mixer/grinder. It is also evident from the table that air – conditioners are no longer a monopoly of the richer sections; they have been possessed by the lower income groups as well that shows that the households are more or less having good standard of living.

Table No. 5.27 Household Appliances

S.No.	Income (in thousands)	TV	%	AC	%	Stove	%	Mixer/ Grinder	%
1	<5000	11	11.70	0	0.00	10	15.87	6	9.52
2	5000-10000	40	42.55	1	33.33	13	20.63	25	39.68
3	10000-15000	18	19.15	1	33.33	26	41.27	14	22.22
4	15000-20000	12	12.77	0	0.00	8	12.70	9	14.29
5	20000-25000	7	7.45	1	33.33	2	3.17	5	7.94
6	>25000	6	6.38	0	0.00	4	6.35	4	6.35
	Total	94	100.00	3	100.00	63	100.00	63	100.00

5.2.28 Household Appliances 2

It may be observed from the above table that almost all the households (97%) own a pressure cooker, and more than three –fourth (77%) of the households possess a cooler. This makes it clear that the people have a good living standard. It is also evident from Table 5.28 that computers and washing machines are no longer a monopoly of the richer sections; they have been possessed by the lower income groups as well.

Table No. 5.28 Household Appliances 2

.No.	Income (in thousands)	Computer	%	Washing Machine	%	Pressure Cooker	%	Cooler	%
1	<5000	1	4.76	3	6.82	18	18.56	14	18.
2	5000-10000	2	9.52	13	29.55	38	39.18	28	36.
3	10000-15000	7	33.33	10	22.73	17	17.53	16	20.
4	15000-20000	3	14.29	7	15.91	12	12.37	10	12.
5	20000-25000	3	14.29	5	11.36	6	6.19	5	6.4
6	>25000	5	23.81	6	13.64	6	6.19	4	5.
	Total	21	100.00	44	100.00	97	100.00	77	100

5.2.29 Household Appliances 3

It may be observed from the above table that about half the households (47%) own tape recorder and only (2%) of the households possess a solar cooker. This makes it clear that the people have

no knowledge or interest in using renewable energy resources. It is also evident from Table 5.29 that microwaves are still a monopoly of the richer sections. Geysers are accounted for about one – third (28%) but it has been scattered over in almost all income groups , however belong to the greater proportion of the owners is still the higher income groups.

Table No. 5.29 Household Appliances 3

.No	Income (in thousands)	Geyser	%	Microwave	%	Solar Cooker	%	Tape Recorder	
1	<5000	0	0.00	0	0.00	0	0.00	8	1
2	5000-10000	7	25.00	1	20.00	1	50.00	17	3
3	10000-15000	9	32.14	0	0.00	1	50.00	8	1
4	15000-20000	4	14.29	0	0.00	0	0.00	5	1
5	20000-25000	5	17.86	2	40.00	0	0.00	5	1
6	>25000	3	10.71	2	40.00	0	0.00	4	8
	Total	28	100.00	5	100.00	2	100.00	47	10

5.2.30 Expenditure 1

Income is one of the most important factors which control the function of the system. Income decides each and every activity of the household. The expenditure is directly proportional to the amount of income generated in the households. The expenditure depends upon the life style of the people also. The expenditure incurred by the households is divided into four categories such as, food, education, recreation, and drinking and is presented in Table 5.30.

It may be observed from the table that almost all income groups, all the families spend a lowest amount of Rs.1500 on their food, which is increasing along with increase in income group. It may also be seen that out of all income groups, people with lower income groups spend the least on education implying that their children go to govt. schools or do not study, same is the case with recreation, while people with higher income spend a lot on recreation; the poor don't have enough left to do the same.

However, it may be seen that drinking has an opposite variation, drinking is more common among the lower and middle income groups of the society while no drinking is observed in higher income groups.

Table No. 5.30 Expenditure 1

S. No.	Income Of Households	No. of households	Activities			
			Food	Education	Recreation	Drinking
1.	<5000	18	1439	278	78	94
2.	5000-10000	39	2923	851	141	21
3.	10000-15000	18	4389	1511	233	122
4.	15000-20000	12	3667	1400	338	96
5	20000-25000	7	4786	1143	786	0
6	>25000	6	7083	2117	1683	0
	Total	100	24287	7300	3259	333

5.2.31 Expenditure 2

An attempt has been made to understand the expenditure per family per month on transport, loans, clothing and health and is incorporated in six different income groups and is presented in Table 5.31.

It may be observed here that almost all income groups, an spending good amount of money for transport, clothes, health, etc., the amount is increasing along with increasing income groups. It may be seen that loan repayment also has more or less the same variation, while lower and middle income groups of the society spend less on loan repayment, it is observed more in higher income groups because lower income group take less amount of money if at all they avail loan, and availability of loan itself is a difficult task to them so that repayment of loan amount is also very less.

Table No. 5.31 Expenditure 2

S. No.	Income Of Households	No. of households	Activities			
			Transport	Loan Repayment	Clothes	Heal
1.	<5000	18	89	28	206	56
2.	5000-10000	39	478	51	392	158
3.	10000-15000	18	1375	167	756	256
4.	15000-20000	12	1233	0	1196	542
5	20000-25000	7	800	643	814	629
6	>25000	6	3176	1167	2667	259
	Total	100	7142	2055	6030	423

5.2.32 Expenditure 3

An attempt has been made to understand the expenditure per family per month on telephone, LPG, Petrol and Electricity and is incorporated in six different income groups and is presented in Table 5.32.

It may be observed from the table that almost in all income groups, all the families spend a lowest amount of Rs.300 on LPG consumption and it increase along with income increases in income group. It may also be seen that out of all income groups, 18% of the people spend an amount less than Rs.400 on the Electricity consumption. It may be seen that telephone and petrol have more or less the same variation, while lower and middle income groups of the society spend less on them, it increases along with increase income groups.

Table No. 5.32 Expenditure 3

S. No.	Income Of Households	No. of households	Activities			
			Telephone	LPG	Petrol	Electricity
1.	<5000	18	106	275	219	392
2.	5000-10000	39	468	304	499	717
3.	10000-15000	18	800	300	1189	881
4.	15000-20000	12	688	388	1067	838
5	20000-25000	7	1500	300	1286	1414
6	>25000	6	2667	450	3083	1250
	Total	100	6228	2016	7343	5491

5.2.33 Ventilation

An attempt has been made to analyze the availability of light and ventilation at the dwelling place in the households in the study area and is presented in various income categories in Table 5.33. The amount of light and ventilation at the dwelling place may help us in determining the quality of living of the people of the households in the area of study.

It may be observed from the above table that most of the people (89%) claimed that the light and ventilation at their dwelling place was sufficient, thus they enjoyed a good quality of living as well at the household level.

Table No. 5.33 Ventilation

S. No.	Income (in thousand)	Light and Ventilation at Dwelling level			
		Sufficient	%	Insufficient	%
1	<5000	15	16.9	3	27.3
2	5000-10000	36	40.4	3	27.3
3	10000-15000	15	16.9	3	27.3
4	15000-20000	11	12.4	1	9.1
5	20000-25000	6	6.7	1	9.1
6	>25000	6	6.7	0	0.0
	Total	89	100.0	11	100.0

5.2.34 Change of Land use

An attempt has been made to analyze the idea of change in land – use (residential to commercial) from the people residing the households in the study area and is presented in various income categories in Table 5.34. The views of the people will help the investigator to determine their outlook towards the issue.

It may be observed from the above table that in general there is confusion among the people. While about half of them (42%) opinioned that it is good, while in majority of them (58%) feel that it is bad. This result is very evident from the fact that the commercialization of the city itself has led to many problems of congestion in the streets and garbage that the people living in the locality face. Another way to look at it is that the conversion is good as it generates job opportunities within the walled city and people don't have to move out in search of work. And hence, the confused opinion has arisen.

Table No. 5.34Change of Land use

S. No.	Income (in thousand)	Change Of Land use - Residential To Commercial			
		Good	%	Bad	%
1	<5000	8	19.0	10	17.2
2	5000-10000	16	38.1	23	39.7
3	10000-15000	7	16.7	11	19.0
4	15000-20000	5	11.9	7	12.1
5	20000-25000	3	7.1	4	6.9
6	>25000	3	7.1	3	5.2
	Total	42	100.0	58	100.0

5.2.35 Informal Activities

An attempt has been made to analyze the idea of Informal activities allowed on road or not from the people residing the households in the area of study and is presented in various income categories in Table 5 .35. The views of the people will help us to determine their outlook towards the issue.

A major portion of the households (59%) opinioned that the informal activities shall not be allowed on roads and they must occur at the places assigned to them. While 41% of the households are of the view that informal activities occur all over the place and hence make their lives messy. The informal activities, function on the streets, occupy more space on the streets and hence making things difficult to function.

Table No. 5.35 Informal Activities

S. No.	Income (in thousand)	Informal Activities Allowed On Road			
		Yes	%	No	%
1	<5000	10	24.4	8	13.6
2	5000-10000	20	48.8	19	32.2
3	10000-15000	4	9.8	14	23.7
4	15000-20000	4	9.8	8	13.6
5	20000-25000	3	7.3	4	6.8
6	>25000	0	0.0	6	10.2
	Total	41	100.0	59	100.0

5.2.36 Tourist Infrastructure

An attempt has been made to analyze the view on the tourist infrastructure from the people residing the households in the study area and is presented in various income categories in Table 5.36. The views of the people will help to determine their outlook towards the issue.

It may be clearly observed from the above table that the opinion is almost equally divided i.e. 51% of the households were of the view that the tourist infrastructure is sufficient, while the rest (49%) believed that it is insufficient.

Table No. 5.36 Tourist Infrastructure

S. No.	Income (in thousand)	Tourist Infrastructure			
		Sufficient	%	Insufficient	%
1	<5000	14	28.6	4	7.8
2	5000-10000	19	38.8	20	39.2
3	10000-15000	6	12.2	12	23.5
4	15000-20000	5	10.2	7	13.7
5	20000-25000	1	2.0	6	11.8
6	>25000	4	8.2	2	3.9
	Total	49	100.0	51	100.0

5.2.37 Pedestrian Facilities

An attempt has been made to analyze the view on the availability of Pedestrian facilities from the people residing the households in the study area and is presented in various income categories in Table 5.37. The views of the people will help to determine their outlook towards the issue.

It may be clearly observed from the above table that a larger section of the households (71%) believe that the pedestrian space is insufficient in their localities indicating that their localities are full of congestion may be due to the conversion from residential to commercial or due to a reason that informal activities are allowed on their roads. While the rest 29% who have claimed the pedestrian facilities to be sufficient seem to have been living in good places; free from congestion.

Table No. 5.37 Pedestrian Facilities

S. No.	Income (in thousand)	Pedestrian Facilities			
		Sufficient	%	Insufficient	%
1	<5000	7	24.1	11	15.5
2	5000-10000	13	44.8	26	36.6
3	10000-15000	5	17.2	13	18.3
4	15000-20000	3	10.3	9	12.7
5	20000-25000	0	0.0	7	9.9
6	>25000	1	3.4%	5	7.0%
	Total	29	100.0%	71	100.0%

5.2.38 Conservation

An attempt has been made to analyze the view on the issue of conservation from the people residing the households in the area of study and is presented in various income categories in Table 5.38. The views of the people will help us determine their outlook towards the issue.

It may be clearly observed from the above table that almost all people (97%) living in the city, believe that conservation is good for a society. This indicates that the people in the city are aware the significance of conservation.

Table No. 5.38 Conservation

S. No.	Income (in thousand)	Conservation			
		Good	%	Bad	%
1	<5000	16	16.5	2	66.7
2	5000-10000	38	39.2	1	33.3
3	10000-15000	18	18.6	0	0.0
4	15000-20000	12	12.4	0	0.0
5	20000-25000	7	7.2	0	0.0
6	>25000	6	6.2	0	0.0
	Total	97	100.0	3	100.0

5.3 INFERENCES

The following inferences have been drawn from the analysis. They are:

1. City's people have moderate income and their standard of living is not bad and the purchasing power of the people of the city is also moderately good.
2. Majority of the people follow the Hindu religion in the study area, while a very meager part follows other religion.
3. Majority of the people mainly belong to the middle income group category, while the lower and higher income groups form only a small percentage,
4. Most of the people, in the study area, belong to the general category. Of which, majority of them belong to the middle income group.
5. The study area is male dominated society, and is also dominated by business activities.

6. The proportion of married to unmarried person is less in low-income group and higher income group which shows big family size and inclination towards education in lower income and higher income group respectively.
7. Higher education is more prevalent in the lower income and middle income group.
8. Most of the people in the study area engaged only in tertiary sector except few of them are engaged in primary sector.
9. Trade and commerce is the major occupation in the study area, with most of the people working in many small and big business located in the walled city area, which is also one of the major reasons for the people belonging to the middle income group category.
10. Most of the people in the study are living in semi detached type of houses and rest of them are living in detached type of houses and apartment, and row type of houses are negligible.
11. People are living in owned houses and the percentage of rented houses are considerably very less.
12. Mainly people are living in self-financed houses and ancestral property. And there are only a few households having their houses financed from bank and other sources.
13. The physical condition of houses, are good and livable in the study area. There are very few houses which may be categorized as dilapidated are possessed by the lower income group. The people belonging to the higher income are residing in sound and good state.
14. The number of rooms in the households in the locality increases as the income increases.
15. Most of the houses have one floor and two floors and few houses have three floor and four floors. This shows that development in the study area is low rise.
16. The public drainage system in the study area is found satisfactory.
17. Most of the drains in the study area is open that reveals that the hygiene and the cleanliness at the most of the places are improper.
18. The problem of overflow and clogging is observed in study area due to open drains.
19. The water supply is mainly 2 hrs. per day in the study area.
20. The bicycles and two wheelers are the major type of private vehicles in the study area. The four wheelers belong to higher income groups.
21. The most of the households have recreational facilities in near by places depicting that there is no scarcity of recreational facilities in the area
22. The quality of water supplied in the locality is potable.

23. The quality of air available in the locality is good; it means the study area has better quality of environment.
24. The quality of land in the locality is good.
25. The study area has high noise pollution which shows that the area is suffering from acute noise pollution.
26. The living standards are good in their households and are leading a quality life, but few households termed that their quality of living is very poor that belong to the lower income groups.
27. The waste disposal system in the study area is more or less satisfactory.
28. The people have a good living standard. All income group people is enjoying the all type of household appliances such as TV, AC, Stove, Mixer/Grider, Computer, Washing, Pressure cooker, Cooler, Tape Recoder, etc.
29. The people in the study area have no knowledge or interest in using renewable energy resources.
30. The people with lower income groups spend the least on education, recreation while people with higher income spend a lot on it. This shows that children belong to household lower income either go to Govt. schools or do not study.
31. The lower income people spend less on transport, clothes, health and loan repayment as compare to higher income group.
32. All the households have LPG, Telephone and electricity facility and their expenditure increases along with increase income group.
33. Most of the people claimed that the light and ventilation at their dwelling place is sufficient, thus they enjoyed a good quality of living in side the house.
34. The confused opinion is observed regarding the change of land use from residential to commercial use.
35. A major portion of the households opinioned that the informal activities shall not be allowed on roads and they must occur at the places assigned to them.
36. The opinioned regarding tourist infrastructure is half –half.
37. The pedestrian space is insufficient in their localities.
38. All people favor the conservation of the wall city area.

6.1 INTRODUCTION

It deals with forecasting the infrasrtucture facilities required, for the year 2031A.D. At the outset, population is projected for the year 2031 by using suitable statistical methods. Depending on increase in population, extra facilities, which requirements are calculated by using suitable planning standards.

Understanding the past behaviour, it is possible to have good projection or forecasting for the future. One can understand about the trend, cyclical and seasonal components of the time series by using the knowledge and can develop forecasts that will provide helpful planning and decision-making information.

The forecasts may need to be modified, if the major technological breakthroughs or competitor actions significantly differ from past conditions. However, if no major changes occur, projections of past trend patterns can prove extremely helpful in forecasting future values of the time series.

The important control parameters, which decides functions of the system, considered for projections in this present investigation are:

1. Population
2. Housing
3. Water supply
4. Sewerage
5. Electricity
6. Solid Waste Disposal
7. Education
8. Health care facilities
9. Commercial facilities
10. Parks and playgrounds

6.2 FORECASTING THE FACILITIES FOR THE YEAR 2031

There are few methods available for forecasting such as, geometric increment method, regression method, arithmetic increment method, incremental increase method, logistic curve method, etc. in

this investigation population is considered as the focal point. Considering the population, other requirements are calculated by employing relevant standards, which have been set for different variables by different concerned organizations. To have plausible projections, the planning standards which are given in the UDPFI (Urban Development Plan Formulation & Implementation) guidelines have been followed.

To project the population availability for the year 2031, geometric increment method was employed by considering the population increment from 1991 census to 2001 census. The method, which is followed, for population's calculation for the study is as follows:

6.2.1 Population

Total population in the year 1991 = 336240

Total population in the year 2001 = 386905

According to Geometric Increment Method:

$P_n = P_o (1+r)^n$

Where P_n = forecasted population of n years

P_o = Population at present

n = Number of years

r = rate of growth

To find r,

$P_{2001} = P_{1991} (1+r)^{10}$

$386905 = 336240 (1+r)^{10}$

$1+r = 1.0141$

$r = 0.0141$

Therefore population in the year 2031

$P_{2031} = P_{2001} (1+0.0141)^{30}$

$= 386905 (1.0141)^{30}$

$= 5,8947.59$

$= 5,89,479$

Increase in population $= P_{2031} - P_{2001}$

= 589479-386905

= 202574

Thus the population of the walled city in the year 2031 would be 589479 and gross density would be 1259.57 person/ ha.

As per the National Commission on Urbanization (NCU) only 500 person/ha. as a gross density for urban area, according to this, the walled city can take 2,34,000 population and remaining population 3,55,479 has to be shifted outside the walled city area.

It means that the walled city is already densely populated and due to that the problem of congestion, traffic and transportation is acute. To solve these problems, the extra population has to be shifted outside the walled city area for sustainable development of the area.

6.2.2 Housing

Requirement of housing for the year 2031 in the study area is calculated as follows:

Population to be considered for construction of houses = 202574

Considering a general family size of 5,

Number of houses required = 202574/5

= 40514.80

= 40515 Units.

If the extra population would be shifted outside the walled city area then no need of further construction of houses inside the walled city area, otherwise we have to provide provision for it.

6.2.3 Physical Infrastructure

6.2.3.1 Water supply

The supply of water will also have to be increased to meet the needs of the growing population, besides, water is also required for recreational purposes, fire fighting, in hotels, hospitals, public buildings. Satisfying the requirements of all these, quantity of water required would be

Water Supply requirement for Domestic purpose = 135 Lpcd absolute min.

Taking 135 Lpcd for Domestic purpose,

Total Domestic requirement = 135x202574

= 27347490 litre/day

= 27.34ML/day

According to 2004 data, the per capita shortage of water supply was 11.08 Litre/day.

So the shortage for water supply for walled city area in 2001 = 4.28 ML/day.

So the total quantity of water supply will be required in 2031 = 27.34 + 4.28

= 31.62 Ml/day

6.2.3.2 Sewerage System:

The quantity of sewerage generation is forecasted against a population of 202574

Sewerage is assumed to be assumed 80% of water supply in the areas as per the UDPFI guidelines.

= 80x36/100

= 28.40ML/day (2031 population)

For present population (2001) = 80x 106.10/100

= 84.88 ML/day

Total sewerage generated = 2001+2031

= 28.40+84.88

=117.28 Ml/day

Already one plant having capacity of 27 MLD is functioning.

Total sewage to be treated = 117-27

= 90ML/day

Assuming the capacity of the treatment plant to be 50 ML/day

No. of treatment units required = 90/50 = 2 Nos.

6.2.3.3 Electricity

There are 2 KW of power required per household (including domestic, commercial & of the requirements) Total no. of households (assuming 5 persons per household)

Total no. of households (assuming 5 persons per household)

= 202574/5

= 40515 households.

Therefore, No. of service connections required = no. of households = 40515

Total quantity of power required = 2 x 40515= 81030kw.

1 electric sub – station of 11 kw for a population of 15,000

Hence, number of electric sub – stations required = 14

6.2.3.4 Solid Waste Management

There is no separate data of solid waste generated in walled city area.

Assuming 500gms. Per capita per day of solid waste generated, solid waste generated by a population of 202574

= 202574x0.5kg

= 101287kg/day = 101.287 t/day

Per person waste generated in 2001 = 0.44 kg

Quantity of solid waste generated (2001) = 170.238 t/day

Thus, total quantity of solid waste to be treated in 2031 = 101.2 +170.238 = 271.43 t/day

Assuming a compost plant with a capacity to handle 200tones.

No. of composting plants required = 271.34/200 = 1.35=1 nos.

6.2.4 Social Infrastructure

For social and recreational infrastructure area has sufficient number of provision of facilities in the nearby vicinity. So there is no need to provide extra infrastructure.

6.2.5 Commercial Infrastrúcture

This area already acting as a Central Business District of the city. So there is no need of further provision of it

7.1 INTRODUCTION:

The Investigator has made an attempt to develop a theoretical conceptualization of an urban system concept by employing system dynamic theory in the present investigation since sustainable development is aimed at the city as a whole rather a fragment/segment manner. System theory looks at the entire system (study area) as a whole for the development of the system. Further, the Investigator has employed theory of hierarchy of human needs, in this present investigation to evolve strategies for the development of the study area by providing basic needs like water.

Therefore, system concepts and theory of hierarchy of needs has been analyzed in this investigation.

7.2 System Concept – a system functions as a whole with the interaction of several sub-systems, and all the sub-systems of the system are interlinked and interdependent to each other and forming a system. If one of the sub-systems of the system, partially function or totally defunct or functions with higher degree (taking a lead role) during its functions, its effects can be visualized in the entire system over a period of time. In some cases, the system may function with lot of disturbance or the smooth function of the system may be paralyzed, while in some cases, the system may function with advancement. In this case the walled city area, (the study area) has been considered as a system.

In an urban system, the following sub-systems are together form a system. They are: (1) Physical (2) Social (3) Economics (4) Ecology (5) Environment (6) Infrastructure, and (7) Institutions.

These all the sub-systems are interlinked and interdependent to each other and form a system. The functions of the system is presented in Figure.7.1

The urban system is complex sub system and it has the following features.

(1) It is not a mechanism system but rather an adaptive system.

(2) It is an open system, and thus it can't be studied partially or regulator apart from its contextual environment, which are defined by the nature of external interaction.

(3) It is characterized by extreme interrelatedness of its parts.

(4) It is also characterized by substitutability of parts and functions implying that the detection of new and independent trends as they are often masked by the apparent stability of the parts.

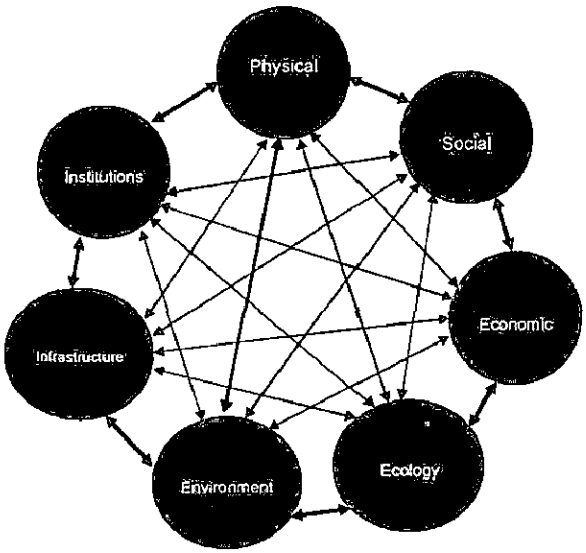


Fig No. 7.1 URBAN SYSTEM

The linkages among the subsystems of the urban system are briefly presented as below by subsystem wise. They are:

Physical: Total area, spatial interaction, such as migration flows, floating population, congestion, density, spatial distribution of economic activities and infrastructure services, topography, etc., are considered. Man needs three things for survival, and are shelter, food and clothes. He makes

shelter on land. Therefore, the basic requirement of land, and it comes under physical component of the system. So, land occupies prime significance.

Social: Demographic structure, urbanization, consumption pattern, social structure, social behavior, occupation, etc., are considered. Man is a social animal; he has to live in the society, for that purpose he has to develop social relationship with others. He builds schools, hospitals, etc., on land. Therefore physical & social sub- systems are interlinked and interdependent.

Economics: Investment, Production, production function, distribution, trade and commerce, employment, capital formation, reinvestment, etc., are considered. Man has to earn money through trade & commercial activity, for that he needs offices of the commercial activity and that he constructs on land. Therefore, economics is interrelated with physical activity. If one subsystem fails or defunct, then the smooth functions of the system is affected, over a period of time.

Ecology: Land use pattern, vegetation, domestic bovine population, flora and fauna, water-bodies, etc., are considered. When development take place, then ecology of the place disturb/affected without that there is no development. For example to construct shelter, the nature of that space is disturbed, People may even cut trees, and alter the available vegetation's character. Even in some places, the water bodies are shielded, which affect the eco system. To construct shelter, money and other resources are essential. Therefore, one can find that physical, social, economical & ecology sub systems are interrelated and interdependent.

Environment: Pollution (land, water, air, noise, etc.), climate, rainfall, atmosphere, conflicts, interest groups, etc., are considered. All these activity take place, and then their effect can be seen on environment. The environment may be affected if it is not protected. If all the sub systems of the urban system are functioning well, the resources are exhausted much, with environment consideration, the good environment is protected. If the physical condition changes, then its effects can be seen in the environment.

Infrastructure: All physical, social and economic infrastructure, their provision, availability, distribution, accessibility, demand and supply, maintenance, etc., are considered. Urban system functions with the development of all kind of infrastructure, such as physical, social and economic. If one of the sub systems like physical infrastructure is developed by improving road, rail & airways, then its effects are clearly visible in the entire system.

Institutions: Government institutions, Private institutions, N.G.O.'s, C.B.O.'s, Local Bodies, etc., are considered. Institutions play a major role in developing any system. In an urban system, urban local bodies, district administration, NGO's, etc., are controlling or directing the functions of the urban system. They evolve policies, plans, programs, implement programs, etc., for the development of the entire system. Thus, all the subsystems of the system are interlinked and interdependent and function as a whole in the system.

7.3 Theory of Hierarchy of Needs

In this present investigation, Abraham Maslow's Theory of Hierarchy of Human Needs (1954) is employed to understand the socio, economic, and physiological conditions of the people of the study area. In this theory, Abraham Maslow has clearly explained the human needs. The human needs are divided into five stages, such as physical needs, security, love and belongingness, esteem, and self-actualization. These five stages are organized in a pyramid starting from the basic stage, (physical need) to the highest reaching stage (self-actualization) and is shown in Fig. 7.2 ,and are discussed as below:

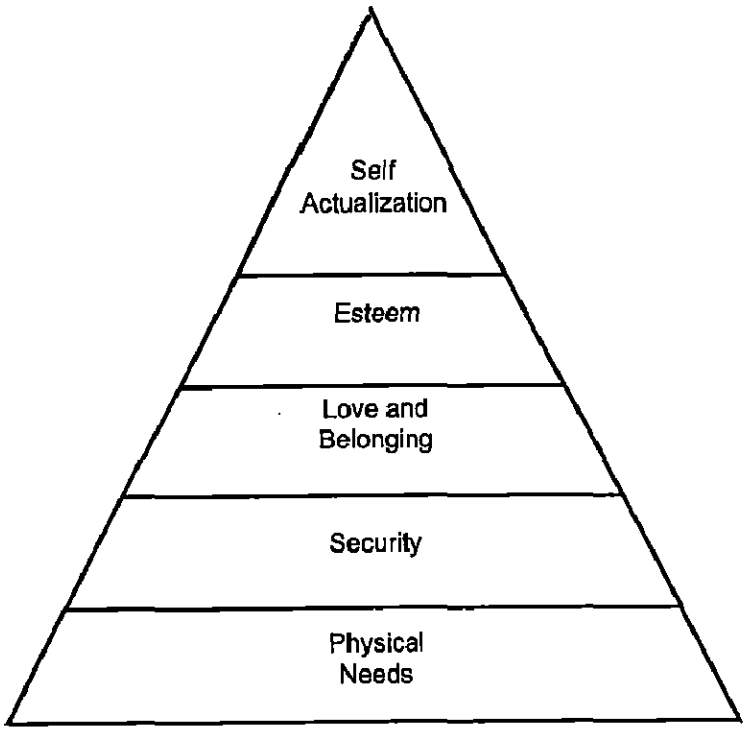


Fig. No. 7.2 Hierarchy of Human Needs **Human Needs**

1. **Physical needs:** In physical needs, the following physical needs, such as food, water, shelter and clothing, must be at least partially satisfied before one can think about anything else.
2. **Security:** Next, one needs to feel safe in his/her surroundings and to know what to expect. One needs protection from physical harm and economic disaster.
3. **Love and acceptance:** At this point, one will do many things to gain affection. One needs to be praised and accepted by the others. People need people. They need contact and association with other human beings to become fully human. Therefore, they form social groups, establish families of many types, and invent complex social institutions. They need opportunities to give and receive friendship and love. A small failure can also make one feel rejected from the society. One needs much support, assurance and personal warmth.
4. **Esteem:** In this stage, not only one wants to be liked by others but also want to be respected. Each human being needs to feel positively about himself. This comes from a feeling of belonging, of participating effectively in the group to which one belongs, and from which as derives feelings of security. It includes feelings of self-confidence, achievement, competence, and independence.
5. **Self – actualization:** To reach this level, all other needs must be fulfilled to the same degree. Each person has unique abilities and talents. Unless lower-level needs have been reasonably well met, there may never be the opportunity to become a self- actualizing person-that is a person who has become what he or she is uniquely capable of becoming a person who is self-fulfilled. If one wants to become a "fuller" person, he has to learn to develop full potential. He has to show his individuality despite social pressures.

As per this theory, the basic stage is physical needs. At the outset, each and every citizen tries to achieve the basic stage. Once the basic stage is achieved; one may try to achieve the second stage, i.e. security, then the third stage, then the fourth stage, and then the fifth stage.

7.4 Significance of Maslow's Theory

According to Abraham Maslow's theory (the pyramid), the bottom most step is the physical needs. Unless and until people achieve the basic step, i.e., physical needs, one may not reach the second stage, but meeting the physical needs itself is a dream to more than a quarter of the total population in India.In this present investigation it has been observed that the people do not meet the basic requirement, i.e., physical needs. They are very much lacking behind, water requirement. It has been observed that the physical need, i.e., water is beyond their dreams in their lives since several factors are functioning adversely. In this grave situation, it in very much inevitable to evolve a set of plausible policy guideline to fulfill the physical needs of the people.

7.5 Application of Maslow's Theory

Doyal and Gough (1991); specify the basic needs of nutritious foods and clear water; protective housing; a non-hazardous work environment and physical environment; appropriate health care and education; security in child hood; significant primary relationship; physical and economic security; safe birth control and child bearing . Maslow, A., (1954) argued that food cloth and shelter are the basic needs .

In the study area, the basic need such as water (see Maslow, A., 1954, and Doyal & Gough 1991) is not met to the larger size of population. It has been observed that water availability is very minimal, i.e., 1-2 hrs/day. It has been also observed that the people of the study area is facing acute water supply crisis and are meeting about 40% of the standard requirement.

The quality of the water supply is very poor. It has been observed that the sub-way water supply system is often become worse since the water supply pipes are damaged and the sewage water is intermingling with the portable water, and it creates adverse effects in the system.

Outflow of drains are also observed in the system, which led to adverse environment. Doyal and Gough (1991) argue that non- hazardous work environment and physical environment is also a basic need. In this case, overflow of drains creates adverse effect in the system, which disturbs the basic needs.

In the study area, few per cent of population are not having at least moderate housing conditions and their housing conditions and are so dilapidated. Doyal and Gough (1991) argue that protective housing is one of the basic needs. Maslow, A., (1954) argues that shelter is one of the basic needs. In this case, few per cent of households do not meet the basic needs in term of housing.

The study area is facing tremendous amount of problems pertain to transportation and parking, which hamper the smooth function of the system. Requirement of conducive environment for living is also considered as basic need. In this case, transportation and parking problems very badly affecting the smooth functioning of the system. Thus, it has been concluded that the study area is suffering from basic needs, and the basic needs must be met before thinking of further development of the system. Therefore, it is an inevitable requirement for making a plausible development plan to achieve sustainable development in the system.

8.1 INTRODUCTION:

The Investigator has developed a set of policy guidelines for the development of the walled city area of Jaipur city based on the thorough investigation done. These policy guidelines are presented in this chapter in the form of recommendations and are presented as below:

8.2 RECOMMENDATIONS FOR TRAFFIC AND TRANSPORTATION

To solve the traffic and transportation problems and congestion in the walled city area, following guidelines are drawn. They are:

8.2.1 Off Street Parking Sites

To meet the present and future parking demands following off-street parking sites are proposed, but some of them are already in existence, shall be upgraded into multistory parking.

1. Ramniwas Bagh
2. Sanjay market
3. Old pension office
4. Near Rajasthan chamber of commerce
5. Khandas of choupar outside walled city gate
6. Jayanti market
7. Jalebi chowk
8. Outside chandpole (old pagalkhana)
9. Old kotwali (Present kanji house)
10. Atish market
11. Central Jail building site.

Some of the above off street parking sites are in the vicinity of the walled city area, which will reduce the parking problems of the system. The location of these proposed parking sites are presented in Fig. 8.1. The detail description of these sites are presented below:

1. Ramniwas Bagh Site

This off-street parking site is located near the New Gate and shall be able to cater to the parking demands of Choura Rasta, Nehru Bazaar, Bapu Bazaar and protion of M I Road. This site is situated near the New Gate. This off-street parking site shall be able to cater for parking demands of Choura Rasta, Link Road, Bapu Bazaar and Nehru Bazaar. In this multistoried parking facility proposed.

2. Sanjay Market Site

It is located near Sanganeri gate. This parking site will cater the demands of Sanjay market and Johri bazaar area. In this, multistoried parking facility are proposed.

3. Old Pension Office

It is located near Tripolia bazaar North of Atish market. This site shall be developed into multistoried parking. It has access through gateways of city palace road.

4. Near Rajasthan Chamber of Commerce and Industry Office

It is located between Ajmeri Gate and Choura Rasta. It can cater the parking demand of Nehru Bazaar. In this area, surface as well as basement parking facilities can be developed.

5. Khandas of Choupar Outside Wall City Gate

It is located at the entry to walled city at Sanganeri Gate, Ajmeri Gate and Chandpole Gate. These spaces can be developed for off-street parking of Auto Rickshaws and Taxis.

6. Jayanti Market Site

It is located behind the Jayanti Market, opposite to the old passport office building. This site is suitable for only off-street parking.

7. Jalebi Chowk Site

In this area, off-street space can be developed by removing the encroachment done by the unauthorized dwellers. This parking can cater the demand for the Govind Deoji Temple.

8. Outside Chanpole Gate (Old pagalkhana)

In this area, parking can be provided by demolishing this building that will provide adequate space for multistoried parking. It can cater the needs of Chandpole Bazaar

9. Old Kotwali (Present Kanjihouse)

This site is located behind the telephone exchange between Sanganeri Gate and Ghate Gate. At present, this place is used for stray cattle's (Kanji house). In this area, the multi-storied parking can be provided after demolisting of this building. This site can cater the demands of Ramganj Bazaar.

10. Atish Market

This site is located among the Atish market. It is recently vacated from the Atish market shopkeepers for parking purpose. In this area, multi-storied parking can be developed, and it can cater the demand of Atish market and Tripollia Bazaar, Chaura Rasta, etc.

11. Central Jail Building

This site is located in between Sanganeri Gate and Ghat Gate. At present, this site is used for central Jail building, but this can be shifted outside of the congested area and this area can be used for developing very good multistoried parking to cater the needs of Ramganj bazar and M.I. Road.

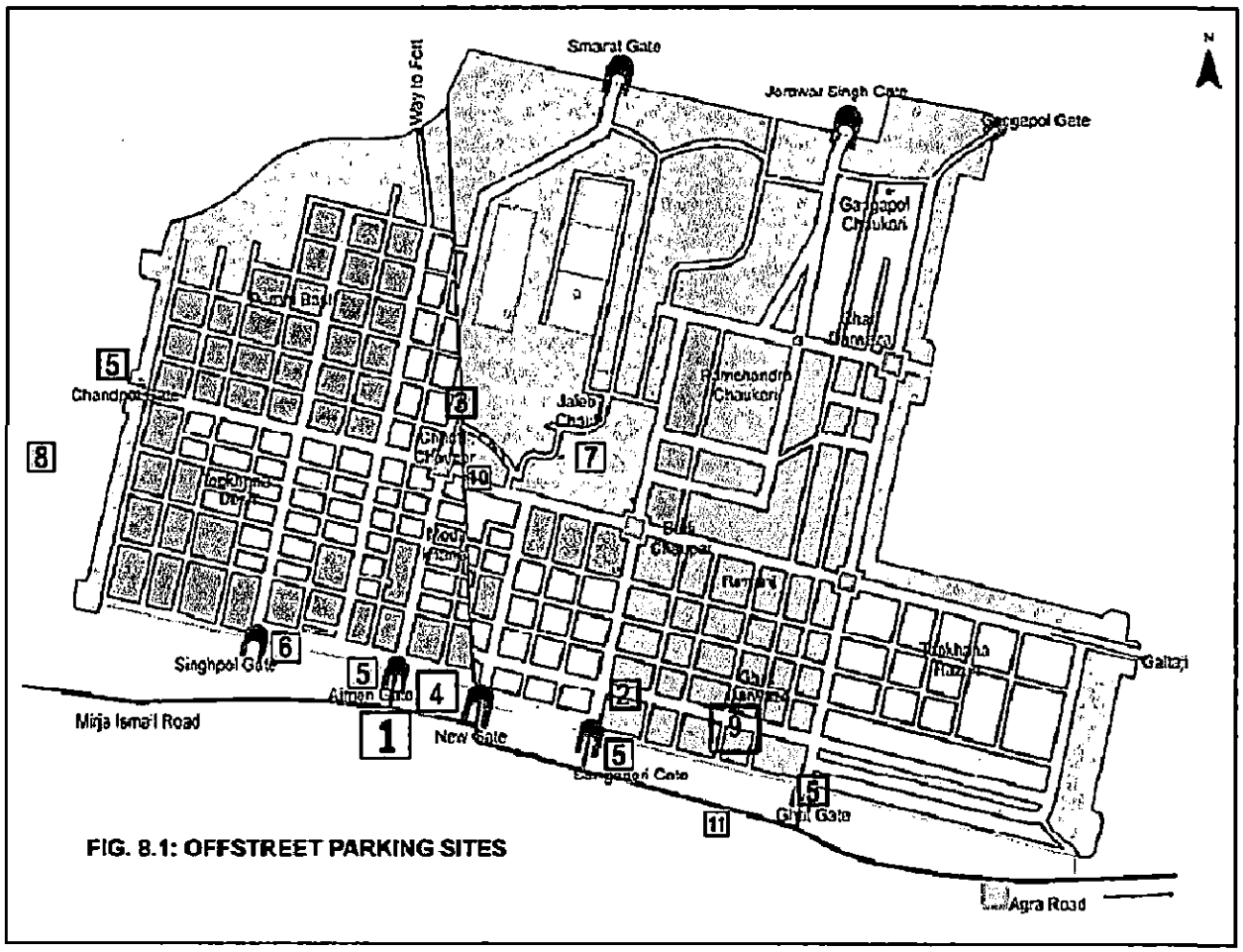


FIG. 8.1: OFFSTREET PARKING SITES

8.2.2 Shifting of Trades

The following wholesale trade and commercial traffic generating and intensive activities should be shifted outside and relocated elsewhere in order to decongest the streets of the walled city. The shifting of trades are also proposed in Master Plan 2011. At present, only hardware and sanitary market are partly shifted outside the walled city area. The following markets have to be shifted from the core area to the outside of the walled city area, and are :

(i) Loha Mandi

(ii) Timber market

(iii) Hardware and Sanitary market

(iv) Transport company offices

(v) Cloth and congested Katla Markets

The existing locations of the above markets are shown in Fig. 8.2

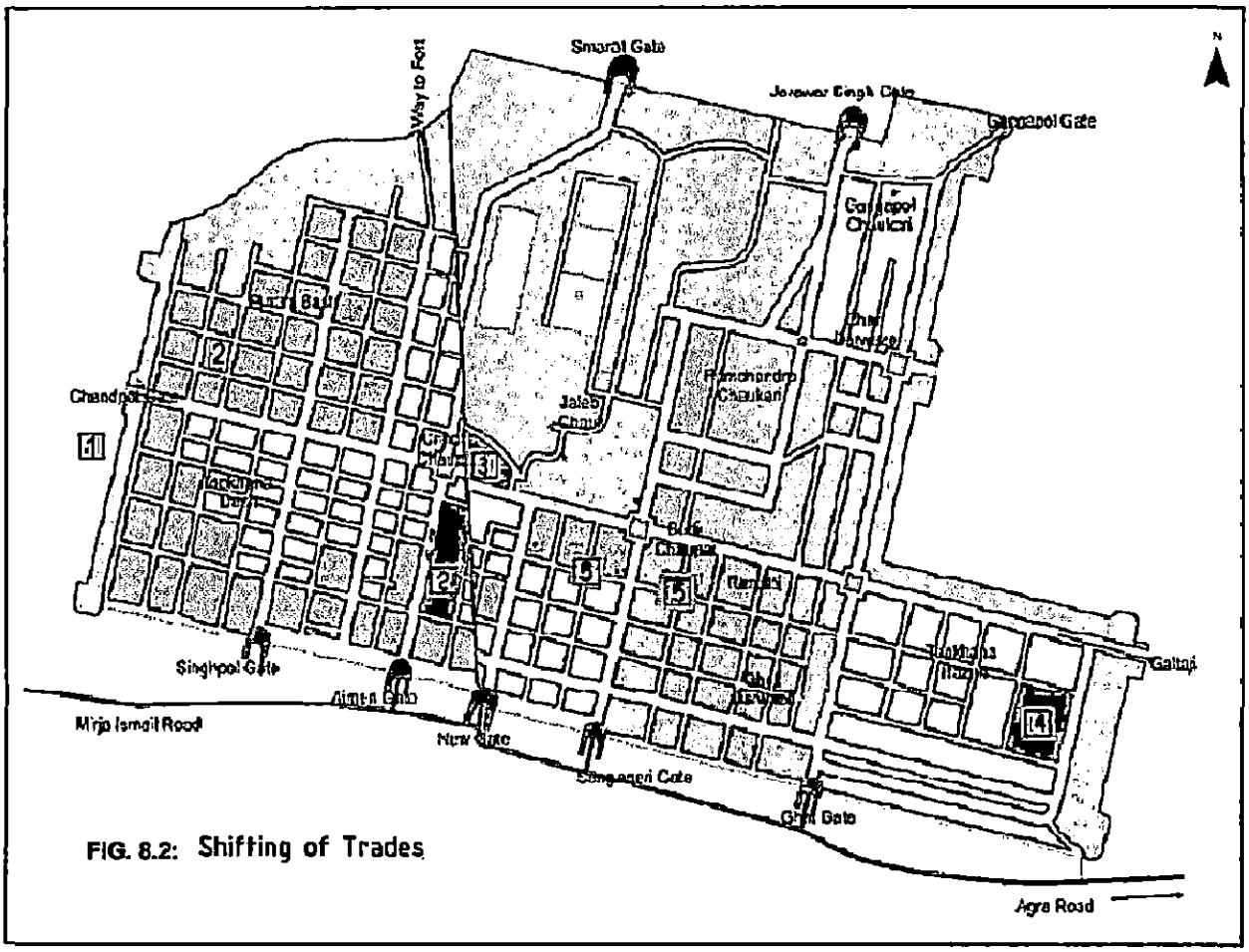


FIG. 8.2: Shifting of Trades

8.2.3 Restrictions on Parking

Parking should be restricted on the following major streets from 9.00 A.M. to 9.00 P.M for four wheeler vehicles. They are:

- Johri Bazaar
- Chaura Rasta
- Kishanpole Bazaar
- Tripolia Bazaar
- Ramganj Bazaar
- Chhoti Chaupar
- Badi Chaupar

In the lanes and byelanes of the walled city area, two wheelers parking and entry of four wheelers should be restricted where road width is less than 3.0 m, and if more than this, it can be allowed. Parking should be provided to accommodate the requirements of residents, institutions, emergency vehicles, etc. For that parking fees can be charged and allowed on curb side parking at following selected locations. These major streets are shown in Fig. 8.3

Chaura Rasta : Amer Jain Hospital, SBBJ Building, Public Library, Jaipur College and girls school and children's hospital, etc.

Kishanpole Bazar: Dental Hospital, Ayurved hospital, Maharaja Government school and Rajasthan school of Arts. Parking of buses, auto rickshaws, tongas, rickshaws, etc., should not be allowed on chaupars.

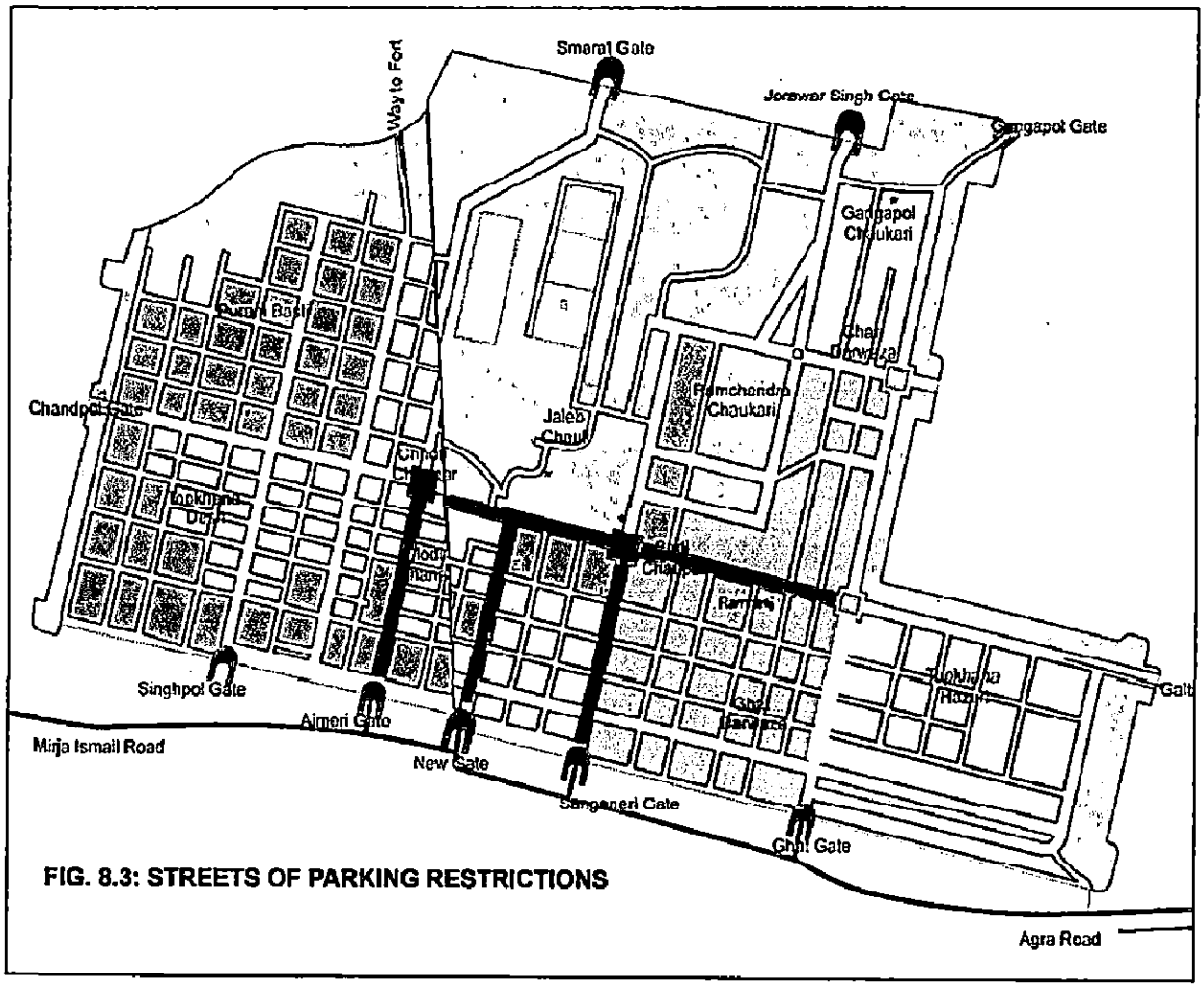


FIG. 8.3: STREETS OF PARKING RESTRICTIONS

8.2.4 Pedestriarisation of streets

Pedestrian activities and flows are high in the walled city area. For segregation of pedetrian, considerations should be given to pedestriasation of certain streets for full or part of the day, such as Bapu Bazaar, Nehru Bazaar, Indira Bazaar, Ramganj Bazaar, etc. No permission for commercial complexes, shopping areas and basements should be given in the walled city area to avoid further congestion. The public transport modes should be encouraged in the walled city area to reduce air and noise problem. Signs and markings should be also done on besides the roads to provide road safety to drivers and pedestrians.

8.2.5 Underground Parking

The following open spaces are identified for underground parking, which will cause least intrusion to the aesthetics of a place. They are :

- **Badi Chaupar**
- **Choti Chaupar**

These parking places are shown in Fig. 8.4

Badi Chaupar: This parking facility is to be developed below the chaupar intersection. The area available for underground parking is around 8000 sq.mts. This would be highly suitable for catering to the demand of Johri Bazaar.

Choti Chaupar: This underground parking facility is proposed to be developed below the choti chaupar intersection. It can cater to the parking demand of Kishanpol Bazaar and portions of Tripolia Bazaar.

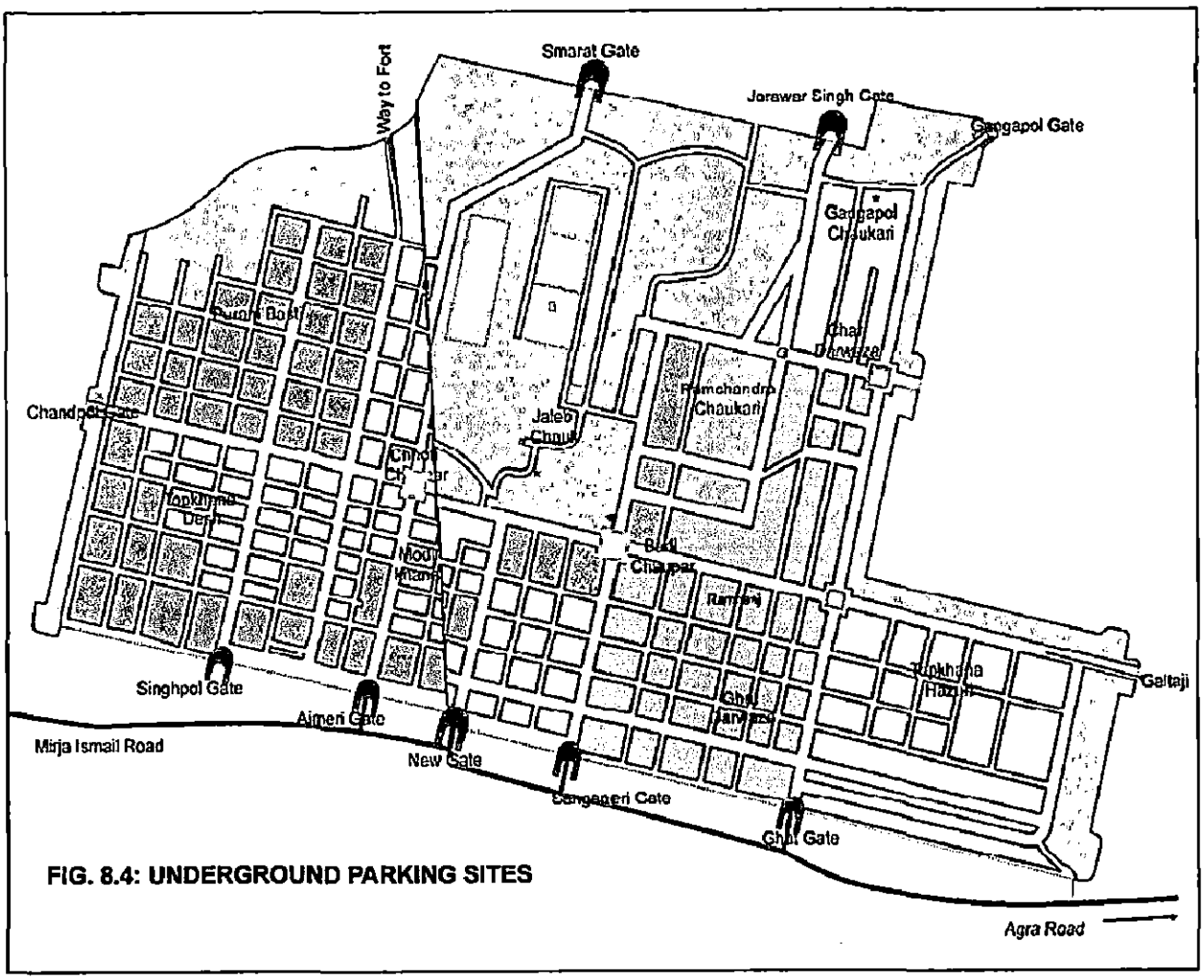


FIG. 8.4: UNDERGROUND PARKING SITES

8.2.6 Shifting of Activity

(i) The central bus stand (Sindhi Camp), which is shown in Fig. 8.5, should be shifted near the Jawahar Circle, by which inter-state traffic and problem of congestion will be reduced.

(ii) The truck terminal should be shifted outside the city area and this will reduce the traffic and degradation of environment.

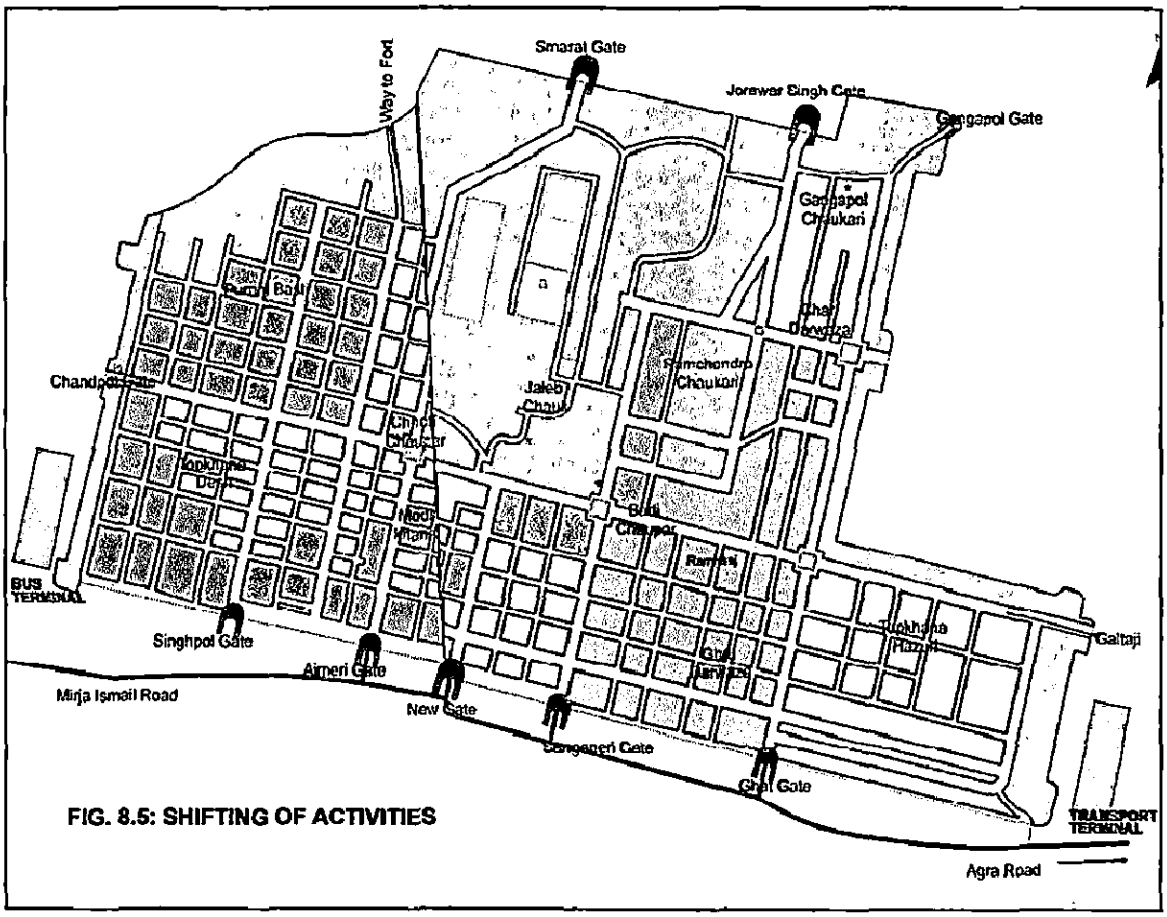


FIG. 8.5: SHIFTING OF ACTIVITIES

General Guidelines

- To decongest the old walled city area, all the State and Central Government offices have to be relocated to other parts of the city.
- Pollution free transport mode such as CNG run buses should be introduced.
- Storing / Godown activities should be banned in the walled city area.
- Satellite towns should be developed to reduce the traffic in the walled city area.
- To achieve a transport facility system that is adequate, safe, comfortable, equitable and is efficient and sustainable by involving the private sectors.
- Pedestrian movement should be safe by providing separately pedestrian walkways and cycle users.
- Efficient public transport system should be provided.

- Sufficient no. of parking spaces should be provided in the walled city area.
- No 'U turn' shall be permitted except at the end points.
- All the intersections of the streets in the walled city should proposed geometrics, for vehicles and pedestrians. This includes provision of medians, channelisations, pedestrian crossing facilities and signalizations.
- Bullock Carts and other animal drawn vehicles should be allowed during the night time only. Entry of goods vehicle should be during off peak hours only, i.e. 10.00 P.M. in the night to 8.00 A.M. in the morning. There should be a separate lane discipline for slow and fast moving vehicles, i.e., rickshaws, bicycles, cars, etc. Encroachments should be removed from the footpaths and roads and proper space should be provided for thelas, Hawkers, and Hat Bazars, etc.
- The traffice & transportation department should prepare comprehensive Traffic Management plans based on the recommendations.

8.3 RECOMMENDATIONS FOR WATER SUPPLY

To make water available in adequate quantities, it is very necessary to make intervention at the planning level too. These are:

a. Reserving areas potentially good for recharging & water harvesting

The areas which are good for water recharging and harvesting should be developed as green areas, forests or recreational areas. The rocky ridges and hilly tracts need to be given special attention and their degradation needs to be stopped. Forest cover should be provided on such tracts to reduce soil erosion. For this, a massive aforestation drive needs to be taken up.

b. Protection of low-lying areas

Natural drainage channels, rivulets, water-bodies, low-lying areas prone to flooding need to be preserved, and wherever possible green cover should be provided.

c. Revival of old water channels

The old water channels feeding the lakes and water bodies need to be reclaimed and refurbished.

d. Discouragement of industrial activities in urban area

Industrial activities requiring large quantities of water should be discouraged from functioning in urban areas and located at appropriate locations in the region. The regulations as mentioned in the Master Plan-2011 need to be followed strictly in this regard.

c. Identification of Drainage Zones

The drainage zones for storm water drainage need to be identified and drainage system planned to bring about proper utilization of water for recharging and recycling.

d. Minimizing the losses

The pilferage and wastage be reduced to minimum. For this, the distribution system needs to be refurbished and repaired continuously to provide for proper service.

e. Generation of public awareness

Enough publicity should be given to encourage each individual/institution/ public authority to participate in conservation of water and consuming less to provide more.

8.4 RECOMMENDATIONS FOR SOLID WASTE MANAGEMENT

8.4.1 Strategies: The following strategies may be practiced for effective solid waste management practices. They are:

(i) House to house collection for domestic wastes by private parties should be introduced in phased manner. Households need to be pursued to store their household wastes in two separate covered bins. One for left out food materials, vegetable peels, etc. and the other for paper, glass cans, etc. Labourers employed by private parties and provided with wheelbarrows tri-cycle rickshaws containing bins made of reasonably inert materials will collect the household garbage at a fixed time of a day (duly notified to the community in advance). The bins will be in two distinct colors and people from household are to dispose the garbage properly bagged in separate bins. The labourers will then carry the bins and empty the contents in separate stacks in intermediate collection points or transfer stations.

(ii) In the congested low income group housing colonies and slums, where there are a few proper approach roads to facilitate house-to-house collection, this can be organized in similar way as above, with the exception that the private operators will visit fixed places in the community at a fixed time of the day to collect the garbage. This will, however, require strong motivation of the dwellers preferably developed through a group of people selected from the community itself.

(iii) For Sabzi Mandis (vegetable markets) and other commercial complexes, the owners are to dispose their wastes either to dumping vehicles visiting the areas at pre-decided time of the day and parked at specific locations or themselves carrying to intermediate collection points. Strong involvements of market societies/traders association in strict adherence to the system by traders are expected to bring good results. Depending on type of wastes generated the traders may be advised to segregate the wastes.

(iv) Door-to-door collection for hotels and restaurants needs to be organized in a manner similar to house-to-house collection. Alternately they are to carry their garbage to intermediate collection points

(v) All infectious hospital wastes should be incinerated. This may be done by constructing an incinerator in a large hospital (e.g. a medical college). All other hospital and nursing homes need to be required to transport their wastes of their own in properly designed closed containers to the incinerator. The incinerator can be set up and maintained by a private party and to be used on cost sharing basis.

(vi) Rubbish generating from construction activities should be collected and transported by the municipal vehicles

(vii) Safai Karamacharis sweeps streets and clean drains. They should be equipped with better cleaning and collecting implements and tools. Improvement is expected by making same person responsible for transporting the sweepings in small bins to collection depots. The drain cleaning gang should be promptly followed by the collection vehicles for transportation and disposal of silts arising out of drain cleaning. The silt will be directly transported to disposal site and the contractor will be paid only on disposal. This will eliminate the accumulation of the sweepings and silt on the roadsides, thereby reducing the chance of scattering the sweepings or return silt to drains via wind and / or by moving vehicles.

(viii) For intermediate collection points either brick masonry enclosures or properly designed garage could be constructed. Brick masonry enclosures should be covered with a light grill on the top and provided with a gate to prevent the animals and birds from entering. The enclosures should be lined with glazed tiles for easy cleaning. Arrangements for regular disinfecting are also needed. Waste segregation can be done at these locations. Private contractors will collect and transport waste from intermediate collection depots.

(ix) All waste transportation vehicles should be covered with tarpaulins to avoid spillage, unpleasant sights, and air pollution.

(x) Industries should treat their wastes as needed, and transport these wastes to the disposal site.

(xi) Costs for collection, transportation and disposal should be recovered. The Municipal body is to fix up the rates depending on the type of services provided and costs incurred.

(xii) Appropriate legislation (including necessary modifications of existing municipal bylaws) may be necessary to enforce the recommendations. Strict implementation of the laws and impositions of fines and punitive actions for offenders are necessary.

(xiii) Waste can be disposed partly by composting / making bio-fertilizers and sanitary landfills. Private parties should manage both schemes. Garbage should be segregated at intermediate collection points/transfer stations and at disposal sites as necessary.

(xiv) Suitable lands having a minimum possibility of ground or surface water pollution need to be identified for the disposal. The local body should provide an approach road, fencing, lighting, arrangement for water, a weighbridge and office for the disposal site.

(xv) The Municipality should be primarily for supervising and having overall control. They should monitor the operations so that the desired service level is obtained. Also some specialized transportation vehicles like compactor and collection / disposal equipment e.g. excavator, front wheel loader, bulldozer, etc. can be procured by the local bodies to be given on rent to private parties involved in Solid Waste Management.

(xvi) Contracts need to be drawn between the private contractors and municipal bodies so that interest of the local body is fully safeguarded and the publics are provided with the desired level of service. Joint venture agreements can also be prepared for composting and disposal sites for sanitary landfills. This can reduce the initial capital expenditure in establishing the plants and provide regular earnings for the municipal body.

(xvii) The contract should provide for heavy penalties. In the event the contractors fail to provide desired level of service, the clause will strictly be enforced.

The municipal body should prepare comprehensive solid waste management plans based on these recommendations. The plans should be able to clearly indicate the proposed actions, the role of the local body, the private parties, details of land for disposal, cost of the improvements, operation and maintenance cost, charges to be levied, revenue generation and financial plan.

8.4.2 Regulations: Plausible regulations may be developed to have feasible solid waste management system based on the followings:

- The city needs to identify a solid waste disposal criteria which should be at reasonable distance away from the urban area. The city should be preferably in the leeward direction of wind with respect to the solid waste disposal site.
- Encroachment on ecological, historical, cultural or religious area should be avoided at the disposal sites. Though some temporary loss of scenic beauty will occur at the proposed landfill sites, this could be reduced by prudent planning and management of the sites, such as the construction of fencing and horticulture activities.

- Pollution of surface and ground water can be minimized by controlled tipping, even spreading waste evenly, and by providing sufficient cover material at regular intervals. Providing surface drainage, coupled with toe drains and earth bunds, turfing of exposed areas, and diversion of any streams will also facilitate leachate control. Bitumen surfacing of access roads will assist in controlling dust generated by vehicles.
- Lack of cover material should not be a problem in a well-planned landfill site. Controlled tipping will have to be ensured because random disposal, apart from causing environmental hazards, also limits the potential use of the reclaimed land. Positive control measures should be proposed to minimize or arrest pollution of surface or groundwater, erosion, siltation, dust, odors, vermin and flies at the proposed disposal sites.
- The solid waste management project will enhance the overall environment of the urban centres. But like any environmental improvement which collects waste for disposal at one point, the concentration of waste can pose an environmental hazard. Appropriate measures should be taken to prevent leaching of polluted water from the landfill site to ground or surface waters as well as transmitting waste by air to the surrounding areas.

8.5 SEWERAGE AND SANITATION

To solve the sewerage & sanitation problems the following guidelines are drawn:

- Waste water should be discharged into sewers.
- Sewerage should not be discharged into natural drain / nullah. It should be discharged after proper treatment.
- All the sullage from households should be discharged into sewers.
- Rehabilitation and replacement of sewer should be done in the walled city area.
- Sanitation facility should be provided to slum dwellers and poor.
- To promote safe and environment friendly city, effective treatment and disposal of waste water system should be ensured.
- Sewage treatment plant (STP) capacity should be upgraded and one more sewage treatment plant should be provided in the South Zone.
- The treated effluent from the STP should not be discharged into Jalmahal Lake.

8.6 HERITAGE & CONSERVATION

To protect heritage & promote tourism the following guidelines are drawn:

A nodal institute for heritage conservation should be created. The role of the agency should

be:

- ✓ Database Management should be done regarding all projects related to heritage and the implementing agencies;
- ✓ Co-ordination among different departments;
- ✓ Increase awareness;
- ✓ Capacity building;
- ✓ Formulation of special legislative measures towards heritage; and
- ✓ Strict regulations and restriction in walled city area to maintain its heritage fabric

- Multiple agency participation in conservation activities should be discouraged.
- Private sector participation should be encouraged.
- A database for heritage conservation should be generated.
- Restoration manuals and guidelines should be prepared.
- Public awareness about long term value of heritage conservation should be created.
- Technical support should be provided to owners for maintaining heritage structures.
- Conversion of heritage buildings into modern buildings should be stopped.
- The walled city area is famous for its heritage and culture, which is neglected in the buildings, forts, palaces, temples, etc. These should be conserved to attract both domestic as well as international tourists.
- Government offices within heritage buildings need to be vacated. Such buildings should be used as heritage hotels or put to uses of tourism.
- In old city, at least, the routes connecting tourist spots should be pedestrianised. All the encroachments should be removed. All the cable and utilities should be made underground to restore the old flavor of the place.
- The facade of the old city needed preservation, for this the government should offer technical inputs and financial incentives to building owners for the same.
- State and City Road network's quality need to be improved. This would increase the tourist movement through out the city and in the State.

8.7 ENVIRONMENTAL CONSIDERATIONS

Vehicles on roads in urban areas adversely affect the environment. They cause noise and air pollution both physically and visually, however they play major part in the economic and social life. There are two basic aspects of road traffic affecting the environment, which need considerations and are:

1. **NOISE:**

Noise screens such as grass, trees or shrubs are planned to be planted alongside the street to serve as barriers to the propagation of sound, apart from the improvement of the general scenery they bring about.

2. **AIR POLLUTION:**

By improving and widening of roads and bridges the flow of traffic shall be improved, thereby reducing the emission of hydrocarbons and exhaust gases, thus improving the environment.

8.7.1 Environment Protection Measures

For preserving the environment and mitigate the ill - effects of air pollution it is planned to plant trees and shrubs. Planting also improves the appearance and aesthetics of the road, and provides shade in summer.

For proper thriving and growth those species which have already flourished in the area are proposed to be used, keeping the following points in view:

- Trees should be sufficiently set back from the ultimate edge of the road so that it does not create obstruction.
- Considerations of sight distance and safety are of prime importance. Trees & shrubs should not obstruct the sight of approaching vehicle.
- Trees & shrub should be planted in such a way that does not interfere with the drainage system.
- The species to be planted should require minimum water, having deep roots to be able to suck water from greater depths.
- Flower bearing, ever green species which do not shed leaves during summer should be preferred.
- Set standards for vehicle emission.
- Protection of natural Recharge areas.
- Ecological considerations.
- Ecologically fragile zone should be identified and developed.
- Stringent norms should be implemented for pollution control.
- Dense plantation buffers should be developed in city along the natural drainage, railway lines, national highways and around the existing hills.

8.8 THE GENERAL CITY DEVELOPMENT GUIDELINES AND POLICIES

The following general city development guidelines and policies are recommended:

1. Overall city development should encourage a more balanced pattern of land uses. The present concentration of commercial activities in the walled city should be reduced and commercial nodes developed in other parts of town.
2. Informal sector activities should be treated as a priority area for integration into the main stream of land use.
3. Conservation of historical monuments as well as development of places of tourist interest and cultural significance are to be declared priority areas for development. There is a need for a more forward looking planning policy for tourist infrastructure (including hotels, services, and other supporting facilities).
4. Areas determined to be of ecological importance should be safeguarded against inappropriate encroachments and developed only as a major recreational facilities, tourist destinations, or ecological reserves.
5. High potential agricultural land should be protected against indiscriminate urbanization. This will further support the greenbelt concept for Jaipur.

8.9 CONCLUSION:

In this present investigation, the problems and prospects of the study area (walled city area) are studied carefully pertaining to physical, social, economic, ecology, environment and infrastructure aspects. Required data (both secondary and primary) were collected and analyzed thoroughly.

The control parameters, which decide the functions of the system, were identified, and forecasting analysis was done based on the same. Theoretical conceptualization of Urban System Model was employed to understand the functions of the system. Further theory of Hierarchy of Human Needs was employed to understand the importance of certain infrastructure services. The investigation concludes with a set of plausible recommendations for sustainable development of the system.

- Movement chart:

Activity	Mode of transportation (public/ Private)	Distance in Kms.	Frequency in a week
Shopping			
Recreation			
Work			

3.2 Water Supply:

- Supply system: Public/ well/ Own source/ both
- Distance from source of water & time of fetching water (hrs.)
- Time of supply (in hrs.):
- Use of equipments: filter/ zero B/ Aqua guard

3.3 Electricity:

- Available/ unavailable
- Metered/ Non-metered
- Overhead poles/ underground cables
- Tariff: monthly/ Flat rate
- Hours/Days of availability:
- voltage fluctuations

3.4 Drainage/ Sewerage:

- Availability of: Septic Tank/ Soak pit/ Sewer/ No facility
- Drains: Open/ Covered/ No drains
- Problem: Overflow/ Clogging/ Bad odour/ No Problem
- Overflow of drains during rainy season (Yes/ no)

3.5 Waste Disposal:

- Method of collection at house:
  a. Storage container b. dust-bin/ PVC bags c. burning d. throwing out
- Frequency of collection from the area:
  a. Everyday b. Alternate day c. 3 Days d. 4 days e. weekly
- Agency for collection: a. Nagar Nigam b. Private Agency c. NGO

4. Environmental characteristics:

- Water quality: Very good/ Good/ Moderate/ Poor
- Air quality: Very good/ Good/ Moderate/ Poor
- Land quality: Very good/ Good/ Moderate/ Poor
- Noise Pollution: Very high/ High/ Moderate/ Low
- Quality of Life: Very good/ Good/ Moderate/ Poor

Remark:

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Survey Schedule for Wall City Area – Jaipur

1. **Demographic Characteristics:**

1.1 Name of the family Head: 1.2 Religion:

1.3 Address: 1.4 Caste:

1.5 Family Details:

	Name of person	Relation-ship with the Head	Age (years)	Married (Yes/No)	Max. Edu. Attained	Monthly Income	Primary Occupat-ion	Sec.Occ-upation	No. of days employed in a year
1.									
2.									
3.									
4.									
5.									
6.									
7.									
8.									
9.									
10									
11									
12									
13									
14									
15									

1.6 **Monthly Expenditure** in (Rs./Month)

a. Food b. Education
c. Recreation d. Drinking
e. Transportation f. Loan Repayment
g. Clothes h. Health
i. Rent j. telephone
k. Saving l. Any other

Energy

a. LPG f. Charcoal
b. Petrol g. Fuel wood
c. Diesel
d. Electricity
e. Kerosene

Household Appliances:

Refrigerator.....T.V.....A.C.... Stove..... Mixer/Grinder.....Computer.....Washing Machine.....
Cooker.... Cooler.... Geyser... Microwave..... Solar cooker..... Tape recorder... Any other.....

2. Housing

- Type of House: Detached/ Semi Detached/ Apartment/ Row Housing
- Age of the house (in yrs.).....
- Physical Condition: Good/Livable/ Dilapidated
- Ownership: Rented/ Owned/ Other.....
- No. of rooms..... No. of floors.....
- Finance: Bank/ Self/ Ancestral/ Any other

3.1 Transportation:

- Condition of the road: Metalled/ Non-metalled
- Maintenance of road: Good/ Bad/ Worse/ Not Any
- Vehicle Owned (No.): Cycle...; 2-wheeler.....; 4-wheeler.....; Any other.....

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