INFRASTRUCTURE DEVELOPMENT STRATEGIES FOR RAIPUR: 2035

A DISSERTATION

Submitted in partial fulfillment of the

Requirements for the award of the degree

Of

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By

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CERTIFICATE

Certified that report entitled **"INFRASTRUCTURE DEVELOPMENT STRATEGIES FOR RAIPUR CITY: 2035"** which has been submitted by **Mr. NOMAN MANSURI**, for partial fulfillment of the requirement for the award of the degree of **Master of urban and Rural Planning**, submitted in Department of Architecture and Planning, Indian Institute of Technology- Roorkee, is the student's own work by him under my supervision and guidance. The matter embodied in this dissertation has not been submitted by him for the award of any other degree of this or any other institute.

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CANDIDATES DECLARATION

I hereby certify that this report entitled "**INFRASTRUCTURE DEVELOPMENT STRATEGIES FOR RAIPUR CITY: 2035**" which has been submitted in partial fulfillment of the requirement for the award of the degree of Master of Urban and Rural Planning, submitted in Department of Architecture and Planning, Indian Institute of Technology- Roorkee, is an authentic record of my own work carried out during the period from July 2013 to June 2014, under supervision and guidance of Prof. Uttam. K. Roy, Department of Architecture and Planning, Indian Institute of Technology, Roorkee, India. The matter embodied in this dissertation has not been submitted by me for the award of any other degree of this or any other institute.

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

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CHAPTER : 1 INTRODUCTION

1.1 Background

With the rapid growth of urban population there has been continuous accretion in number and size of urban centers both -demographically and spatially. Provision of Urban Infrastructure has however, not kept pace with increasing size of towns and cities. As a result, burgeoning urban areas are putting strain on the already secant Infrastructure leading to a point of collapse. Large urban centers, although considered to be generator of economic momentum, display a picture of squalor and unhygienic conditions. Traditionally in India, urban local bodies and parasternal agencies have generally been providing urban Infrastructure as part of social and welfare services. By now, the concept .and techniques for providing, delivery operations and maintenance of urban Infrastructure have changed considerably. It is increasingly being felt that government alone with limited budgetary resources would not be in a position to make up with the galloping backlog in urban infrastructure services which are required to be improved, augmented and upgraded to meet the emerging needs of urban areas.

With liberalization of economic policies, globalization of market economics, technological advancement, decentralization of planning and development functions, revitalization of municipal agencies, role of private sector participation in development process would be of vital importance.

Thus, at a glance, one can easily realize the need of ever increasing efforts in the direction of improving the physical infrastructure in India especially in the cities like Raipur, which is the capital city causing tremendous pressure on all services.

This study is a step in the direction of understanding the problems regarding the conditions of Infrastructure in Raipur City.

1.2 The city of raipur

Raipur is the capital city of the newly formed state of Chhattisgarh. It is the largest urban centre of the state. The city is presently functioning as a center of trade and commerce, services and educational facilities in regional context. Raipur Nagar Nigam covers an area of 143 sq. km. with a population of 10,27,264 people. The city is growing at an average rate of 5.3%.

The existing city infrastructure is woefully inadequate to cater the present population. City has acute traffic and transportation problems mainly on account of narrow roads, predominance slow moving vehicles, inadequate public

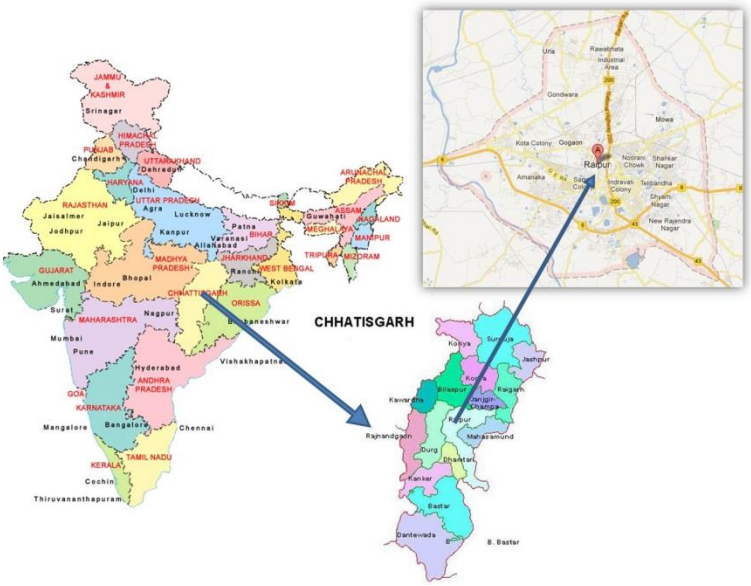


Figure 1 Location of Raipur

transport facilities, road side encroachments, lack of traffic sense and poor traffic management/ enforcement. The water supply for a considerable segment of the population is inadequate and has to deeply depend mainly on ground water supply, infilteration well and overhead tanks. The sewers and surface drains were laid long back and are usually choked during monsoon periods. Existing practice of solid waste management in the city is also not satisfactory and the pollution levels have increased significantly. The Central Pollution Control Board (CPCB) recently declared Chhattisgarh's capital Raipur as the country's most polluted city.

1.3 Regional linkages

1.3.1 Air

Raipur has its own airport named Swami Nivekananda Airport, Raipur which h is 15 km from Jai stamb Chowk.

1.3.2 Rail

Raipur is well connected by railways with major cities in India v.i.z., Delhi, Mumbai, Kolkata, Hyderabad, Vishakapatnam Nagpur, Kolkata etc.

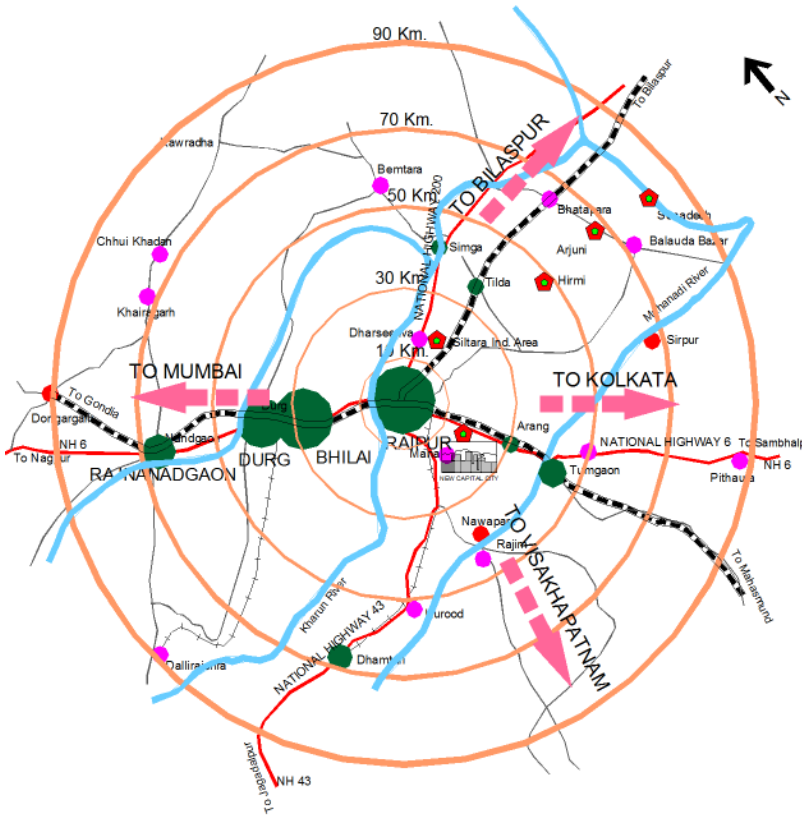


Figure 2 Regional setting of Raipur

1.3.3 Road

Raipur links many main cities of the region by Highways namely, Kolkata, Nagpur, Bilaspur, Vishakapatnam, Bhilai etc.

1.4 Historical background

Raipur was once the capital of the Haihaya kings. The earliest evidence of the existence of the city can be found back in the 9th century. Some of the ruins of evidence are still present in the southern part of modern Raipur. According to chronological records kings of Satvahana dynasty ruled Raipur from 2nd-3rd century AD. Then in 4th century AD king Samudragupta conquered the region. Later, Nala kings also dominated the region in 5th-6th century AD. Finally king Ramachandra established his kingdom over here and made Raipur as the capital of his kingdom. The city was given the name as 'Raipur' after Ramachandra's son Brahmdeo Rai. Ramachandra's dynasty came to an end after the death of king Amarsingh Deo and the dynasty was conquered by Bhonsla's of Nagpur. Then in 1854 the territory came under British rule and they made Chhattisgarh as a separate administrative area with its district headquarters at Raipur. After Independence Raipur came under Central Provinces and Berar. Then for many years it was part of Madhya Pradesh. Then on 1st November 2000, the state of Chhattisgarh was carved from Madhya Pradesh and Raipur was made the capital city of Chhattisgarh.

1.5 Chronological Growth

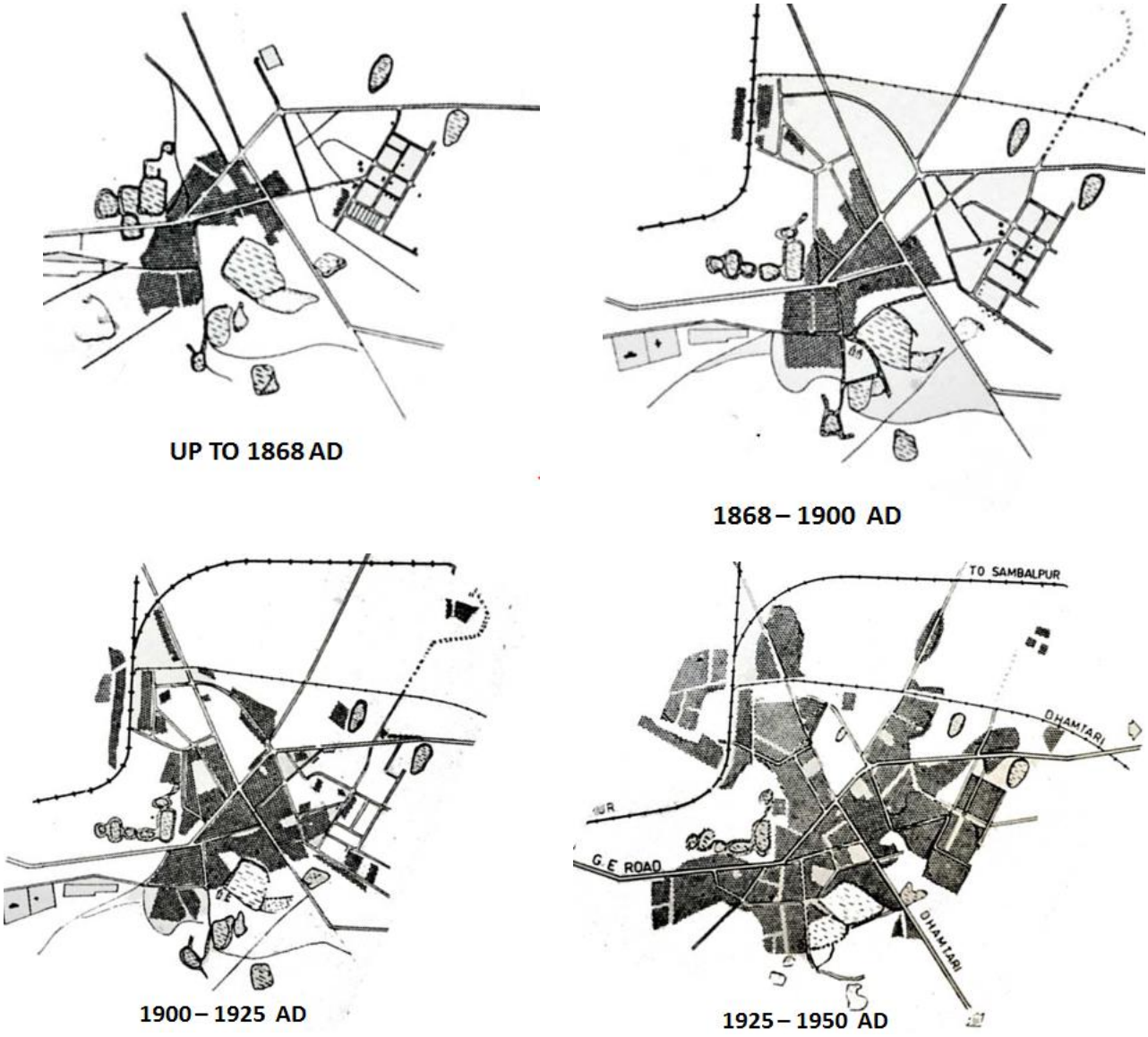


Figure 3 Chronological growth of the city

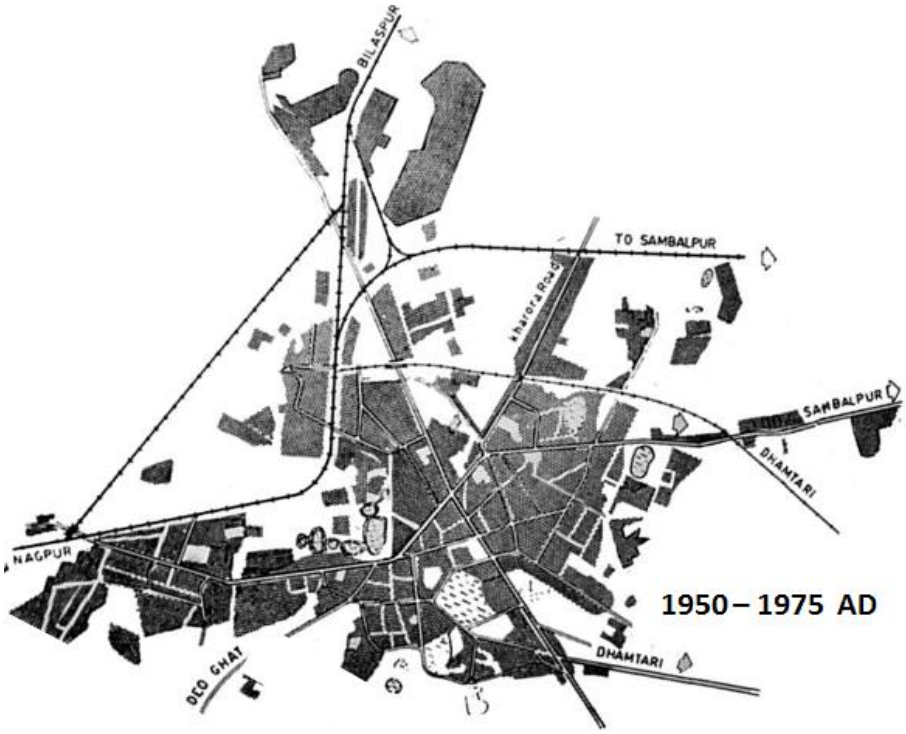


Figure 4 City plan of 1975

The chronological growth shows that expansion of the city took place along the national highways.

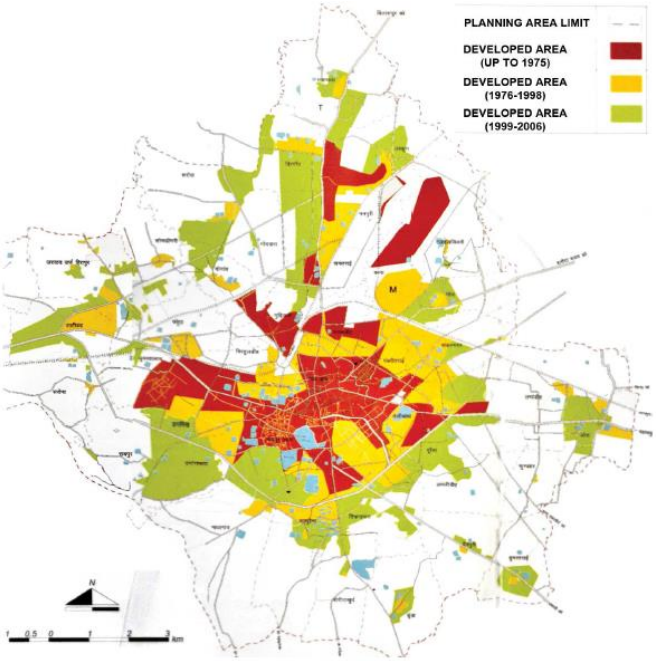


Figure 5 City plan of 2006

1.6 Identification of problems

Like many other cities in India, Raipur also faces the problem of scarcity of services in terms of Physical Infrastructure, as compared to the rate of growth of population. The lack of services in physical measures and improper hygienic conditions present a gloomy scenario in combination with the substandard health services.

To summarize, the following are the major areas of problems, which shall be included in this study to understand the situation better.

(a) Sewage Disposal

1. Sewage network is not spread to all parts of the city.
2. The capacity of treatment plant is not adequate for existing population as well as floating population.
3. Silting problems in sewer lines.
4. Surface drains are not properly designed.
5. Storm water disposal system is not efficient.

(b)Water Supply

1. In some pockets of city, water supply network is not properly designed.
2. The power of the pumping station is not adequate.
3. Difficulties in extending the water supply network to uphill areas.
4. Improper maintenance of water lines.

(c) Solid Waste

1. Dustbins are not located in proper positions.
2. Improper management for collecting the solid waste.
3. Lack of public awareness.
4. Inadequate facilities for garbage collection, transportation, treatment and disposal.
5. Modern technologies like combustion chambers etc. are not employed.

1.7 Aim

Planning for 2035 for the Infrastructure Development strategies of Raipur city.

1.8 Objectives

- To study the origin, evolution and growth pattern of the city.
- To study and analyze the existing infrastructure facilities w.r.t. their provision efficiency and maintenance.
- To study the gaps and short comings in the present system like management/ availability of resources/ usage.
- To give, guidelines for a better service network.

1.9 Scope and limitations

- The study will confine itself to movement patterns, needs etc, of the existing population within municipal area of Raipur.
- The study is limited to the existing infrastructure network of some selected urban services only.
- To planning and layout design aspect to be emphasized more than the financial and management aspects.
- Municipal area will be treated as the planning area of the project.
- The sample size for primary survey is low due to time and budget constraints, hence broad guidelines and recommendations will be given based on available data.

1.10 Methodology

The project will start with the collection, assimilation and analysis of various relevant data collected from the secondary sources. The identification of data gaps will lead to the required field study-survey, interviews to complete the information base, which in turn leads to the final analysis descriptive, statistical and graphic.

This analysis plus the cause-effect relationship in the form of network diagrams will provide material for making a base for planning. The area of study comprised mainly the Raipur municipal area.

1.11 Current approach

Infrastructure services in India are, by and large, the responsibility of the local governments. At present in most of the cities Municipal authorities, State government departments at local levels such as PWD, Public Health, Medical, Education etc. and parastatal agencies v.i.z., Electricity Board, Housing Board etc are providing Infrastructure facilities and services. Urban Local Bodies generally take care of water supply, drainage and waste disposal. The state electricity board provides bulk supply of power and the local authorities expected to maintain supply. Local bodies are generally concerned with layout of streets and maintaining them in good order while major link road are provided by state public works department and development authority.

CHAPTER 2 : LITERATURE REVIEW

2.1 Managing Urban Drainage System by B.S. Sckhon

This paper give emphasis on the provision of drains, their maintenance, role of agencies involved in the development of roads/streets and drains which are often overlooked the planning and development process. A brief idea of this concept is as follow; the complexity of agencies involved in the provision, maintenance and management of drains uncontrolled & haphazard development of cities generally caused uncontrolled plinth level buildings. The drainage behavior is affected with this differential plinth level development. In this paper drainage character of Amritsar have been studied and a strategy of level controls is suggested to manage the urban drainage problems.

2.1.1 Issues Involve in Drainage

In Amritsar it has been observed that drains are functioning well in planned residential areas. The education of people, their awareness about the protection of drains helps the smooth flow of water in the area. The problems become more serious in Old City having 40% area are unsaved with underground sewer lines. All over the city both in planned and unplanned areas, problems are very high in commercial areas, the road side open drains are encroached by the shop keepers, that bock the flow of the surface water the drains after results in water accumulation and flooding during rains.

Generally, the plinth level is kept about 1 1/2' feet above the road surface level. But keeping in mind the successive rise of road surface, the plinth level of buildings is higher than this, In Amritsar. These higher plinth levels not only disturb the drains but also needs huge quantity of earthwork. This increases the cost of development and large-scale land destabilization in surrounding areas.

The following approach is suggested by the author to manage the drainage effectively.

- The city has insufficient size of drains. In the design of drains complete landuse analysis and socio-economic behavior of the people should be included.
- The density controls and building regulation should be managed strictly as in Amritsar; high-density areas have more impervious areas that generate more water.
- The majority of the problem of maintenance can be solved with proper coordination among different agencies and involving people in the management of drains.

2.1.2 Level Control in Cities

To manage the developed areas in future a system of level controls should be ensured. Permanent control points are to be fixed in the different parts of the city. These control levels will help to fix the formation level of all roads, plinth of buildings in different areas and depth of drains in the area.

2.2 Planning For Urban Infrastructure And Its Management Problems, Issues And New Directions by A. Arora

In this paper author has tried to reveal the acuteness of the problem arising urbanization in urban infrastructure development & its remedial measures. The main points discussed in this paper are as follows: -

Total population of India has been estimated as given in Table below

Table 1 Population projection of India

Year	Projected Population (million)
2000	1042
2025	1442
2050	1699
2075	1820
2100	1870

If we take the urbanization at 55 percent by 2025 and 75 percent by 2050, the total urban population in 2025 and 2050 would be 790 and 1274 million respectively.

Rapid population growth contributes to stress the urban infrastructure. How will India cope with the inevitable 18-19 million annual addition or 1.6 million per month or 60,000 per day in the coming years? Several explanations can be offered for this widespread surge of interest in the physical infrastructure. Nearly 30% of the total population of about 98

crores is living in towns cities in India. Today, India has 6 mega cities and 23 metropolitan cities, which are expected to increase to 40 by year 200 I. There are also 300 large towns and 3,396 medium and small towns. The urban areas in India presently face severe concerns arising from the gap between the demand and supply of urban services, housing, population, environmental etc.

No infrastructure should be provided free. Infrastructure is more likely to be economically efficient when it is subject to user charges. User charges should be based on economic prices and willingness to pay.

The cost of development, operation and maintenance of four basic infrastructures networks namely railway; highway, power grid and communication are highly sensitive to the location and structure of cities. The available infrastructure and its potential should be identified and prepared for future urbanization and to achieve sustainable development.

Providing more funds to this scheme should strengthen the scheme of Urban Basic Services for the poor (UBSP).

There should be attempts to involve all the stakeholders in urban development in urban infrastructure development projects through Public-Private-People-Participation (PPPP).

2.3 The Involvement of Local Bodies in the Provision of Infrastructure Services with Special Reference to Water Supply and Sewerage System by S. Ramarao and D.Benarjee

This paper deals with the necessity of augmenting the financial resources of the Local Bodies for improving and sustaining the system offering some minimum level of service through appropriate price mechanism. The brief idea of the paper is as follows:

2.3.1 Problems

- Pricing mechanism is poorly organized Tariff rates not reflecting the true market costs. It is therefore revealed that there are perennially accumulated arrears under the current account.

- High main tenance bill (including wages / salaries and electricity charges skyrocketing), resulting in high unit costs.

- Leafages (for instance, aged and corroded pipe lines leading to profuse leakage's of water getting undetected), pilferage due to mushrooming growth of slums and illegal connections.

- Large component of the slum population necessitating increases in provision of the services as a social commitment with nil or no financial returns.

2.3.2 Objectives

The Specific objectives set forth for the paper are as follows:

- To review the patterns of pricing, cost recovery and the related management issues.
- To examine the financial performance.
- To assess performance of services and improvements (reliability, service hours, etc.) and Willingness To Pay (WTP) for these services by different user categories .
- To suggest the required institutional arrangement.

2.3.3 Institutional Reforms

Some of the important measures are described below:

Short Term Measures

Improvement in collection mechanism could be brought about through collection targets those involved in bill collection. Incentives may be allowed in those cases achieving 100% collection of the given current demand.

Manpower Management

It is widely acknowledged that the Agencies are overstaffed. The result is low output per employee and increasing maintenance cost. The ways to deal with the situation is to initiage detailed work-studies and downsizing the excess manpower and thus reduce the 0 & M costs.

Management Information System (MIS)

Development of database in more unconventional manner is required. For instance, user typifies income Group Wise, number of metered and non-metered connections, meters working and not working revenue and maintenance expenditure by user category, is the type of data needed for various planning policy making purposes. Delhi has attempted updating of data and computerizing resulting in the recovery of substantial sums of arrears.

Delayed Payment

Levying penalty on the delayed payments at the prevailing Bank rate of interest would tend to improve the collection performance. it is all the more essential to enter into a variety of contractual arrangements with the private operators in services delivery, management, leasing and concessions.

Long Term Measures

It is necessary to make the WS & SW system a purely private operated one in a BOO or BOT sense, the political acceptability becomes an important question.

2.4 The Process of Integrated Infrasturcture Planning

The process of planning and implementing a multispectral and multiyear investment program entails a number of steps, which are as follows:

1. Define a local government lead agency for the planning exercise and assign authorities to inter-agency coordination with this lead agency.

2. Take existing national and regional development plans into account and review existing urban master plans in order to define through a rapid urban appraisal the expected urban development scenario.
3. Identify infrastructure needs on the basis already known deficiencies and through community surveys (real demand surveys).
4. Compile information about ongoing and already committed projects and investment.
5. Prioritize projects for each sector and prepare 'long list' with projected revenue and subsidy position of the local government.
6. Tally desired investment program with projected revenue and subsidy position of the local government.
7. Development a Revenue improvement action plans, which will help to raise local income within the planning period.
8. Tally the expected results of the revenue improvement action plan with the draft investment plan, and prepare a realistic short list of prioritized projects.
9. Prepare an institutional development Action plan that takes into account the coordination and integration of various local agencies for the implementation of various local agencies of the investment program and for the revenue improvement action plan.
10. Conduct with the assistance/supervision of higher levels of government an appraisal multi-year investment program.
11. Make necessary, additional institutional and legal arraignment for the implementation of the program by establishing temporary functional project management and monitoring units.

CHAPTER 3 : OVERALL SCENARIO OF INDIA

3.1 Status of Infrastructure

Infrastructure may be defined as the physical framework of facilities, utilities and Support system though which goods and services are provided to the public. Infrastructure facilities are generally grouped into three major categories.

(i) Physical Infrastructure

- Water supply
- Drainage
- Sewerage
- Water disposal system
- Transportation and power supply
- Solid waste management

(ii) Social Infrastructure

- Education
- Health
- Telecommunication
- Firefighting services
- Socio-cultural, recreation parks

(iii) Economic Infrastructure

- Banks and financial institution
- Housing and other services

3.2 Indian Scenario

In, Indian context, on an aggregate, 21 percent of urban population is living in slum and squatter, where access to basic services is extremely poor.

3.2.1 Water supply

Although 83% of urban population is reported to have access to safe drinking water, there severe deficiencies in quantity and quality of water available to urban residents. About 49% of urban population is covered with sanitation facilities while rest of the urban population is devoid of such services.

3.2.2 Waste water management

- Nearly 46% of urban house hold use water borne toilets but only 26% of the urban households are connected to the public sewerage system.
- According to CPCB (Central Pollution Control Board) even among metros only metropolitan cities house have proper wastewater collection system.

- Ten metropolitan cities house reported to have sewage treatment facilities of which each have partial primary and partial secondary treatment facilities while the remaining two have secondary treatment facilities only.

Delhi	78% waste water treated
Bangalore	75%
Chennai	63%
Calcutta	50%

- A survey of mode of disposal conducted by CPCB for 142 class- I-city reveal interesting picture.

80% of class I cities	disposal is on agricultural land
30% of class I cities	discharged into rivers either directly or through drains.
22% of class I cities	discharged on both agricultural land river, lakes, sea and ponds etc.

- None of metropolitan cities in the country have 100% underground Sewerage system.

Lucknow	33%
Kanpur	97%
Nagpur	24%
Pune	85%

- Nearly 300 urban centres have sewerage system in which only 70 towns/ city have sewage treatment facilities.

- As for as sanitary facilities are concerned about

  35% of urban resident have access to sewerage system

  15% have septic tank system

  20% have service latrines.

  39% use the open spaces.

3.2.3 Solid waste management

- Total solid waste generated in the cities = 80,00 metric tonns.
- 60% of solid waste generated is collected for proper disposal. Approximately Rs.130-260 per tonne is spend on collection, transportation and disposal of solid waste in Indian cities.
- The scenario of solid waste management in mega cities is as follows

Table 2 Scenario of Solid Waste Management

Name of city	Solid waste percentage Generated (MT/day)	Percentage
Mumbai	5000	87
Delhi	4600	90
Chennai	3500	90
Kolkata	3500	75
Hyderabad	2800	75
Bangalore	1800	70

- For garbage collection and disposal 1.16 scavengers are employed per thousands of urban population as against the norms of 3-5 scavengers/l000 urban population.

3.2.4 Urban Transport System

In central areas of majority of the metropolitan cities in our country the speed is as low 5-10 km per hour.

3.2.5 Electricity

In 1947	1362MW
1n 1995	81164 MW

The per capita consumption of electricity, which was less than 15 units in 1951, 314 units 1995.

CHAPTER 4 : STUDY AREA CHARACTERISTICS

Raipur is the capital city of the newly formed state of Chhattisgarh. It is the main economic centre of trade and commerce for the state of Chhattisgarh. It is the marketing centre for Steel and Iron of the state. It is situated on the bank of Kharon river. It is situated between 22 deg 33' N to 21 deg 14'N latitude and 82 deg 6' to 81 deg 38'E longitude. It is also the educational hub for the state. It has shown tremendous growth after its formation as the state capital.

Area under municipal boundary – 143 sq. Km.

4.1 Slope of the Area

The slope of the land is towards South direction. Mahanadi is the main river of the region. Pari, Shivnath and Jok rivers are the tributaries of Mahanadi in the region. Kharun river being the tributary of Shivnath river flows 8 km towards south-west of Raipur city. To provide water to the city Kharun river is dammed at Mahadev ghat.

4.2 Climate

Raipur has hot and dry climate. Winter starts from December and continues till February. The climate of the city is too hot from March till June. Rainfall occurs from late June till September. In summers, due to extreme temperature, people are required to sleep in open on the roof terraces. In monsoon season, humidity goes to 75–100 % The winters are dry. Average annual rainfall in the region is 1400 mm. It rains

heavily from July to August. Average annual rainy days account to 61 days a year.

4.3 Demography

The growth and decay of the town largely depends upon the population studies. Through these studies one can assess the future land requirements, amenities, facilities and various other requirements of the city. The population of the city as per census 2011 is 10,27,264.

4.4 Population Growth Over Decades

The city has shown the tremendous decadal growth of 53.3% from 2001 to 2011. The Indian urban decadal growth rate from 2001 to 2011 is 31.8%. This shows that the city is growing faster as compared to other urban centres of the country. The table below shows the decadal growth of the city over decades.

Table 3 Population decadal growth of the city

Sr. No.	Year	Population	Decadal Growth %
1	1901	32000	-
2	1911	35000	10.03
3	1921	38000	8.57
4	1931	45000	18.39

5	1941	63000	39.32
6	1951	89000	41.5
7	1961	139000	55.6
8	1971	206000	47.35
9	1981	338000	64.21
10	1991	463000	36.79
11	2001	670000	44.7
12	2011	1027264	53.3

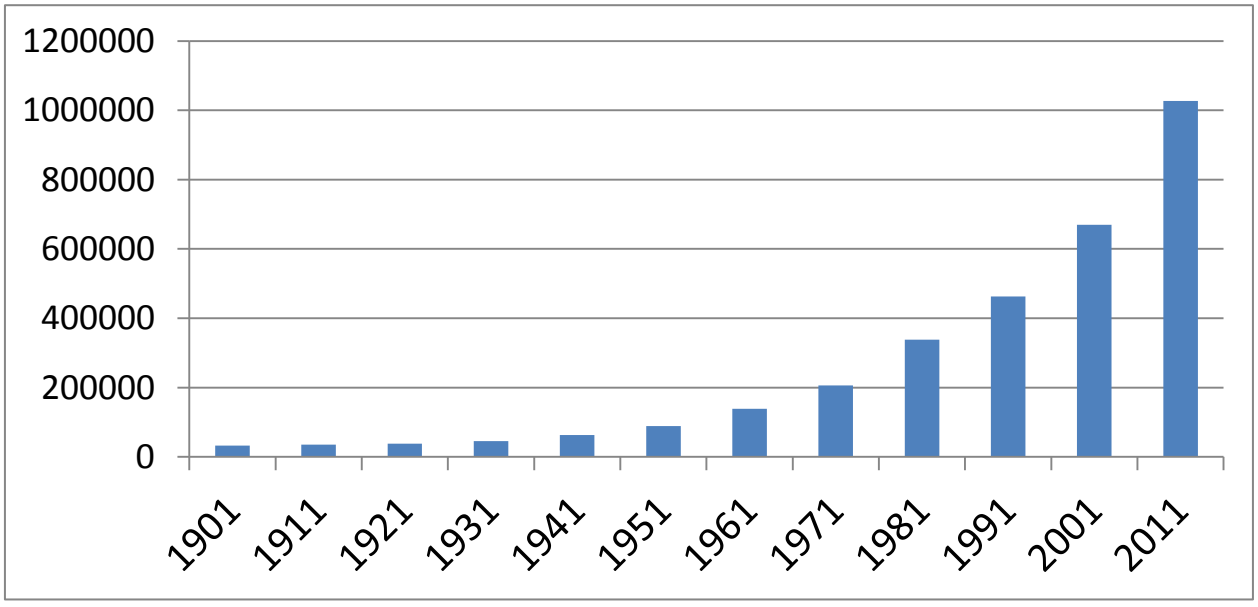


Figure 6 Population decadal growth of the city

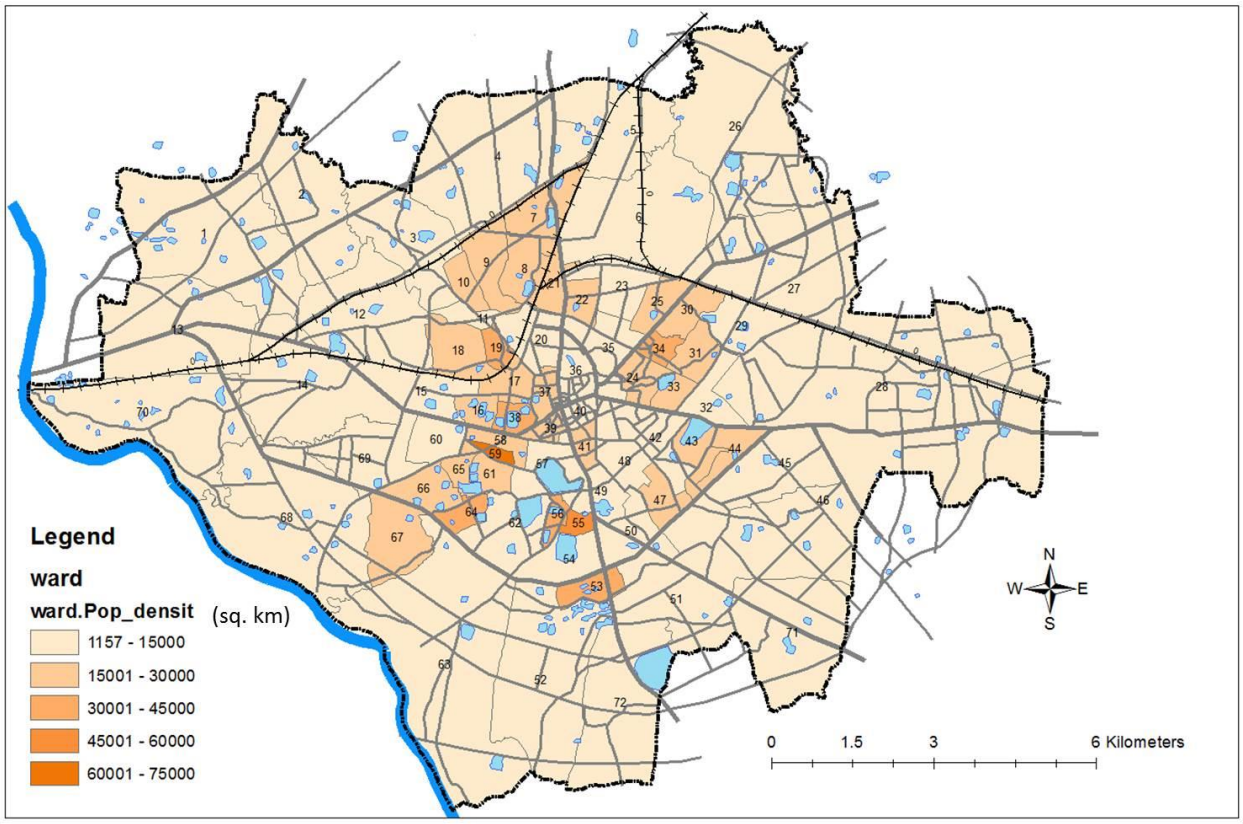


Figure 7 Ward wise population density

The average density of the city is 7184 persons per sq. km. From the above figure we can clearly see that the average density in the core of the city is higher than the fringe areas. The population of the city is concentrated within the ring road of the city.

4.5 Sex Ratio

Sex ratio of the area as per census 2011 is 946 females per 1000 males. It is higher than the national urban sex ratio which is 929 females.

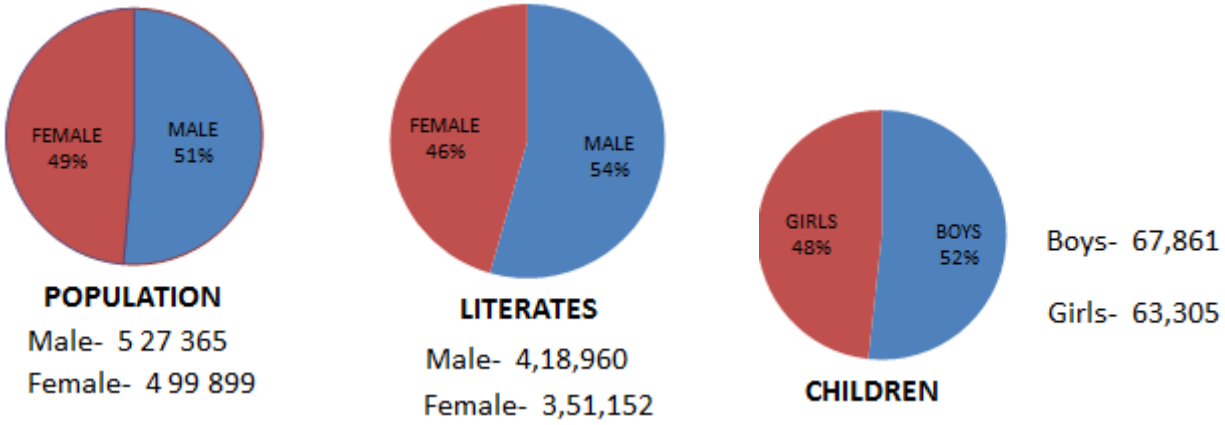


Figure 8 Distribution of population, literates and children

4.6 Literacy Rate

According to 2011 census, the literacy rate in Raipur city is 74.96%. Average literacy rate of Indian urban centers is 84.11%. This shows that Raipur city has less literacy rate than average urban literacy. Out of the total literates, male share counts to 54%. Total no. of male literates is 4,18,960 and female literates is 3,51,152. Figure below shows the literacy rate in different wards of the city.

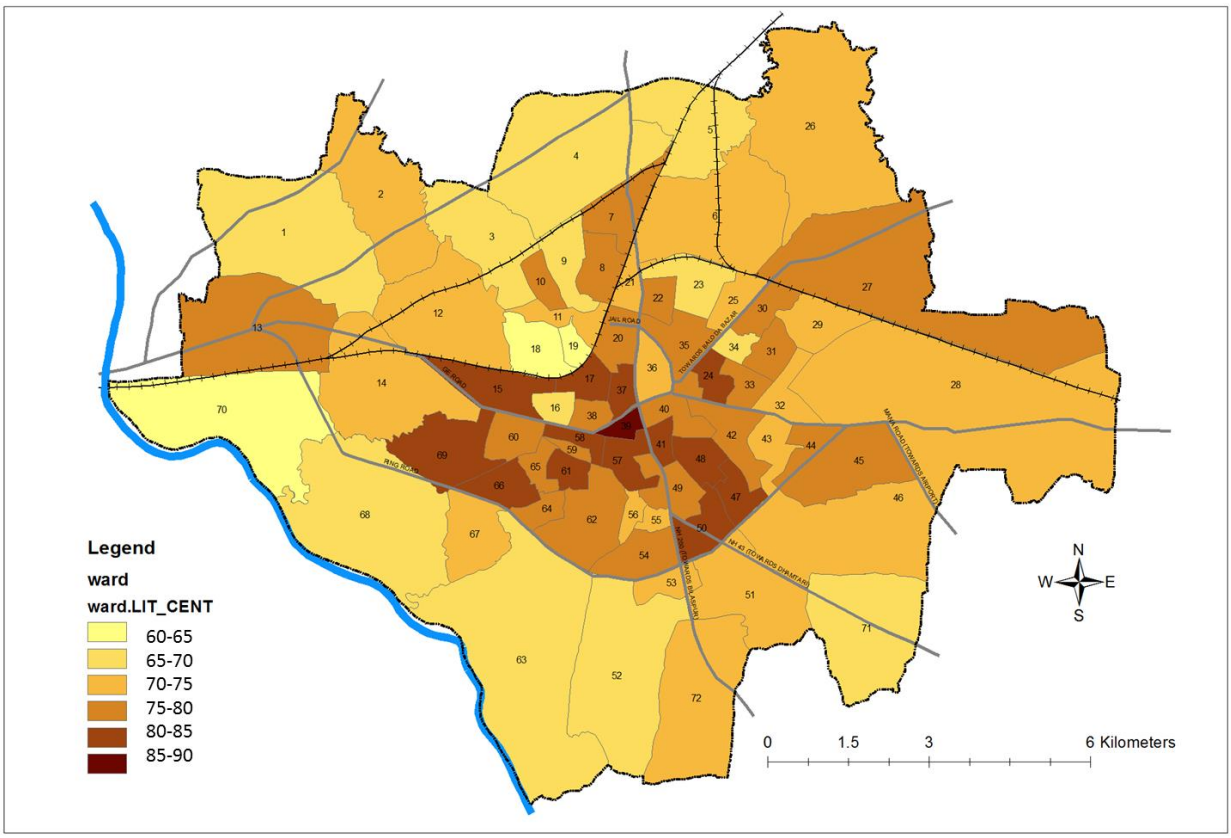


Figure 9 Ward wise Literacy Rate

From the above figure we can see that literacy rate is more in the core city area as compared to fringe areas of the city.

4.7 Occupational Pattern

According to census of 2011, the number of workers are increasing, which represents the more probability of getting employment with ever-increasing permanent population as shown in table below.

Table 4 Percentage of workers over years

Year	Total Population	Total workers	%age of workers
1991	463000	137223	29.63
2001	670000	217614	32.48
2011	1027264	376468	36.65

Now, according to census of 2011, 55.07% of males are working and only 17.21% of females are engaged in any work.

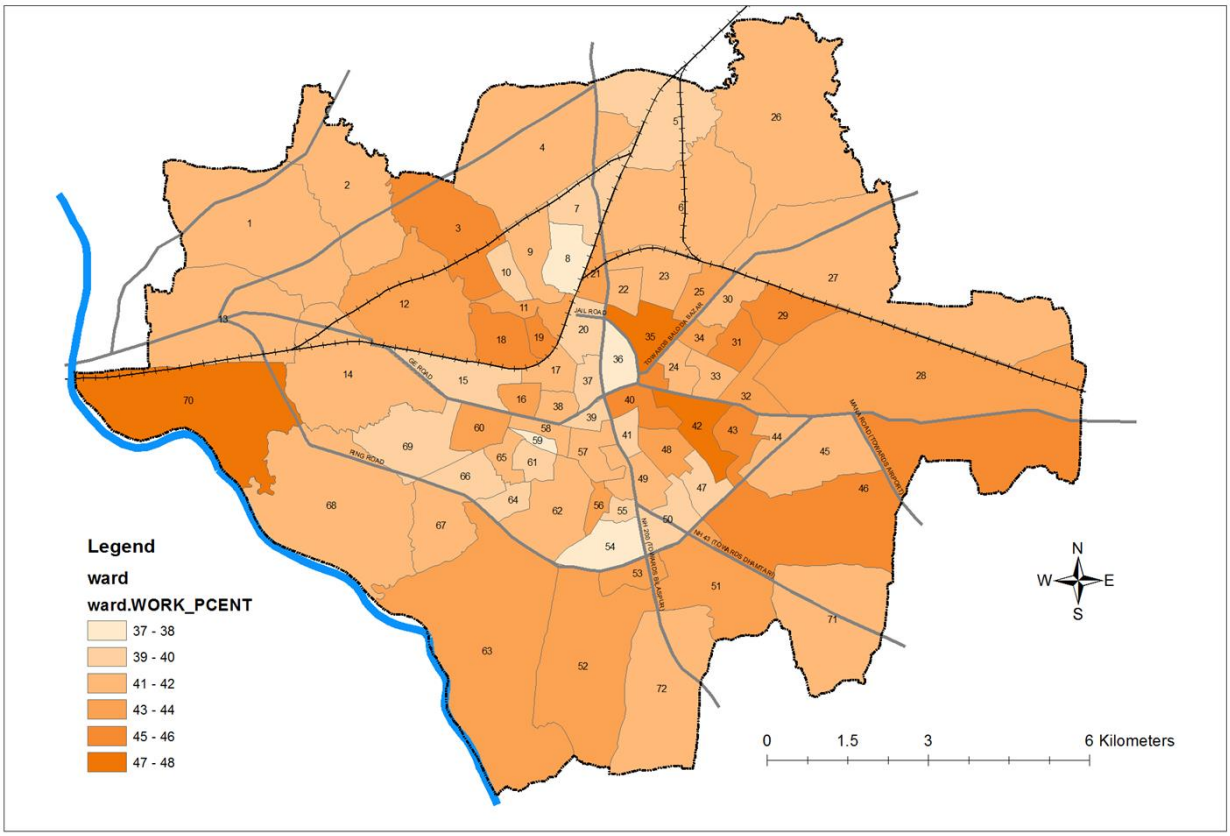


Figure 10 Ward wise workers distribution

From the above figure we can see that working percentage of population is more in fringe areas as compared to core area of the city. This shows that in core area only 1-2 members of a household are working whereas in fringe areas more members of a household are working.

Table 5 Distribution of workers

Sectors	Category	1991		2001		2011	
		No.	% of total workers	No.	% of total workers	No.	% of total workers
	Cultivation	2493	1.81	1523	0.7	2259	0.6
	Agricultural Laborers	3278	2.38	4135	1.9	5647	1.5
	Live stock, fisheries, forestry etc. and allied activities.	3899	2.8	5223	2.4	7793	2.07
	Mining and Quarrying	437	0.31	653	0.3	1129	0.3
Primary	Total	**10107**	**7.3**	**11664**	**5.36**	**16828**	**4.47**
	Manufacturing and processing in Household industry	26959	19.64	35057	16.11	56207	14.93
	Construction	8023	5.84	7179	3.3	9299	2.47
Secondary	Total	**34982**	**25.49**	**42456**	**19.51**	**65506**	**17.4**
	Trade and Commerce	36623	26.68	61868	28.43	109703	29.14
	Transport. Storage and communication	18277	13.31	25439	15.56	60122	15.97
	Other services	37234	27.13	76187	31.14	124309	33.02
Tertiary	Total	**92134**	**67.14**	**163494**	**75.13**	**294134**	**78.13**
	Grand Total	**137223**	**100**	**217614**	**100**	**376468**	**100**

Now, from the above table we can see that number of workers are increasing in all the sectors, but the share of Primary and Secondary is decreasing. The share of Primary sector has decreased from 7.3% in 1991 to 5.36% in 2001 and further decreased to 4.47% in 2011. The share of Secondary sector has also decreased from 25.49% in 1991 to 19.51% in 2001 and further decreased to 17.4% in 2001. Tertiary sector is increasing over decades. It was 67.14% in 1991, then increased to 75.13% in 2001, and further increased to 78.13% in 2011. The city is becoming the trade and commerce hub for the whole of Chhattisgarh.

4.8 Land Use Pattern

Land use pattern of any city or town is a direct measure of its function efficiency, which is governed by deposition of amenities and facilities, land utilization rate, inter-relationship of work residence and priority for various uses. Land use pattern of Raipur is of mixed type like any other old Indian city as shown in table below.

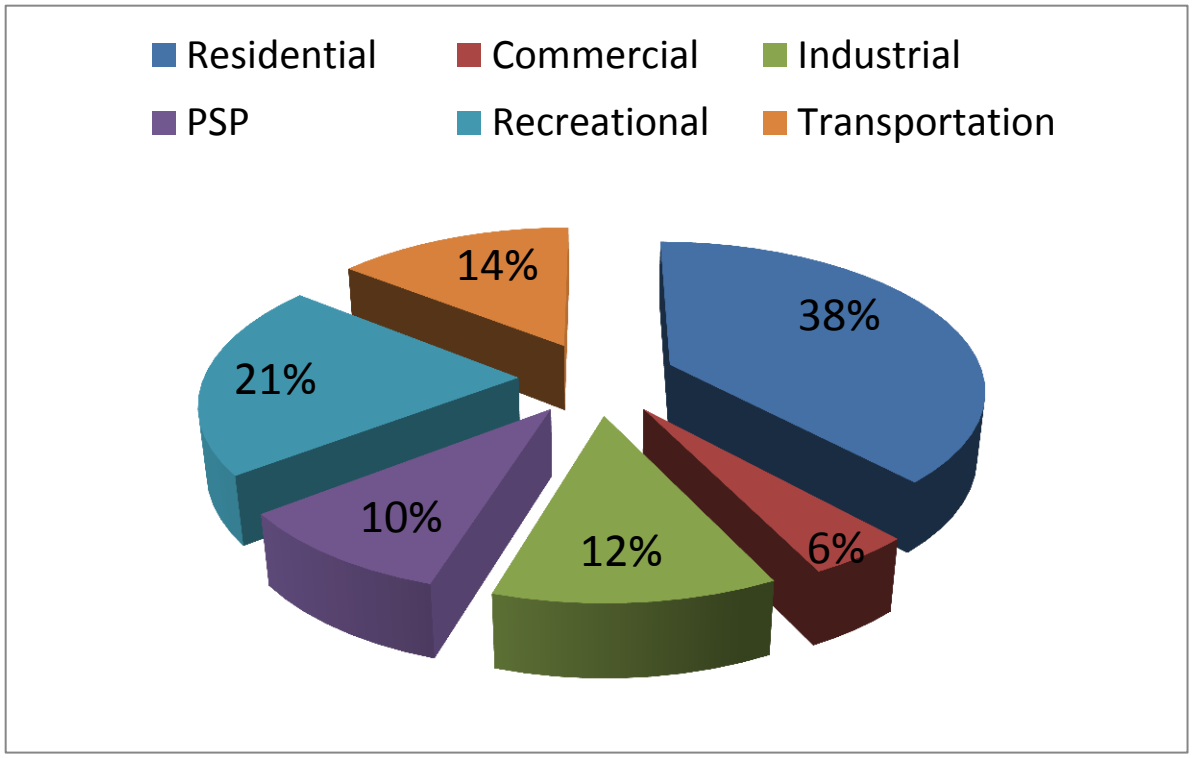


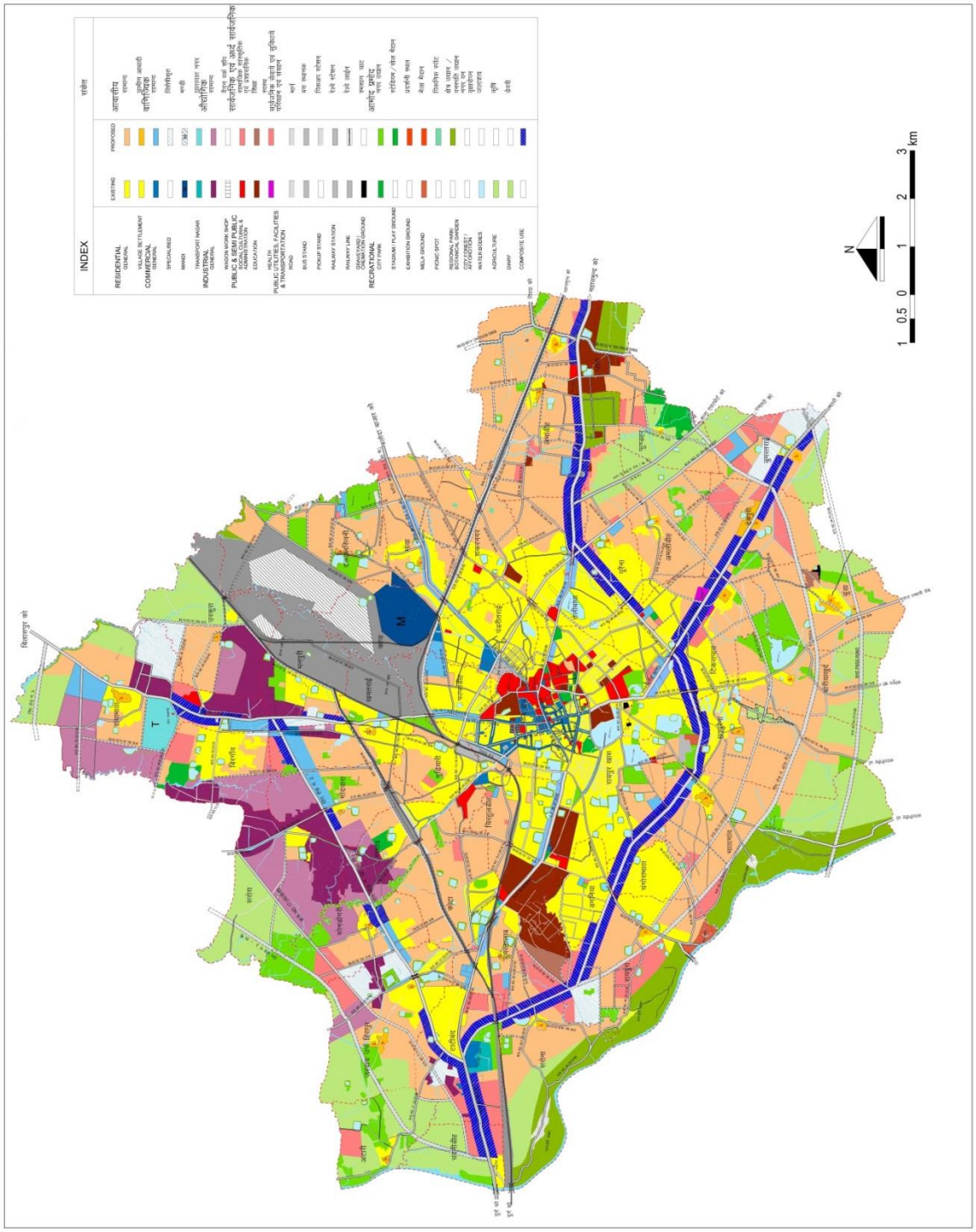
Figure 11 Existing land use distribution

Table 6 Land use distribution for towns

Land use category	Small (< 50,000)	Medium (50, 000-5,00,000)	**Large cities (> 5,00,000)**	Metro Cities
Residential	45-50	40-45	**35-40**	35-40
Commercial	2-3	3-4	**4-5**	4-5
Industrial	8-10	8-10	**10-12**	12-14
Pub. & Semi pub.	6-8	10-12	**12-14**	14-16
Recreational	12-14	18-20	**18-20**	20-25
Transport & Communication	10-12	12-14	**12-14**	15-18
Agriculture and water bodies	Balance	Balance	**Balance**	Balance
Total Developed area	100	100	**100**	100

Now, when we compare the existing land use pattern with the guidelines, we can see that it is in accordance to the guidelines. This shows that the city is growing in all the sectors proportionally.

Existing land use plan



CHAPTER 5 :
EXISTING SCENARIO OF INFRASTRUCTURE SYSTEM

5.1 Water Supply

Water supply is one of the crucial items of the infrastructure required for urban development. Without guaranteed supply of safe water large-scale urban development cannot be successfully planned. There are various uses of water such as for domestic, industrial, mining and irrigation purposes. Urban water supply generally caters to the domestic and industrial needs. Therefore, while planning for any city or town, it is necessary to have long range plan of water supply for industry and domestic consumption continued and systematic growth of towns and cities.

Urban water needs can be divided into various sectors on the basis of the diverse kind of uses.
The water demand of a city in two aspects are as follws:
a) Domestic water demand.
b) Water demand at city level.

The following tables are various standards for water demand and their breakup population wise.

Table 7 Water consumption standards

Sr. No.	USE	CONSUMPTION (LPCD)
1	Drinking	5
2	Cooking	5
3	Bathing	55
4	Washing of cloths	20
5	Washing of utensils	10
6	Washing and Cleaning of houses and residences	10
7	Flushing of latrines	30
	Total	**135**

Source: Bureau of Indian standards (IS : 1172-1971)

The city level demand varies according to the population size. On an average, the per capita demand for Indian cities may vary as shown in the following table. It must be noted that there is a big gap between urban and rural demands. As urban demand is about 150 lpcd to 300 lpcd, rural demand is 70 to 100 lpcd. On an average, world's urban water demand is 150 lpcd or about 55 cum per year and average rural water consumption is only 50 lpcd or 18 cum per year.

Table 8 Water requirement for towns

	Small Cities (<50000)	**Medium Cities (>50000-100000)**	**Large Cities & Metros (>10 lakhs)**
Absolute minimum	70 LPCD	40-100 LPCD	135 LPCD(can be reduced to 70 LPCD)
Desirable	100 LPCD	135-150 LPCD	150-200 LPCD

Source: UDPFI guidelines.

5.1.1 Present status of sources

The water Supply is the basic instrument for urbanization and development of the cities. In ancient times the settlements or the villages grew on the bank of the existing river or natural water bodies. The Raipur city is located almost on the bank of river Kharun. The main source of water for the city is through Kharun river. It is being dammed at Mahadev ghat. The Gangarel dam, which is built on the Mahanadi River is also used as the main source of water for the city.

Table 9 Status of existing sources of water

Total no. of household connections	131936 (60% households)
Connections concerned to commercial and industrial purposes	6283
Public taps	9457
Hand pumps	1133
Power pumps	1434
In slum areas	310 hand pumps 300 power pumps 800 public taps

60% of the households are having water connections. In fringe areas where there is no network of private taps, Public taps are used for water supply. There are 9457 public taps in the whole city.

Total length of the distribution system is 363 Km. The Municipal Corporation of Raipur has provided around 1400 tube wells through out the city for ground water extraction. 277 MLD filtration plant is proposed at Ravanbhata. The level of coverage in slum areas is about 25%. Water is supplied for 3-4 hours every day.

Table 10 Water consumption and deficiency

Year	Population	Existing Supply (MLD)	Consumption (lpcd)	Total Demand (MLD)	Deficiency (MLD)
2011-12	1027264	127	123.5	174.63	47.63

The existing supply in the whole city at present is 127 MLD. So the average consumption of water by the public is 13.5 lpcd. According to the population of the city as per census 2011, there is a deficiency of 47.63 MLD.

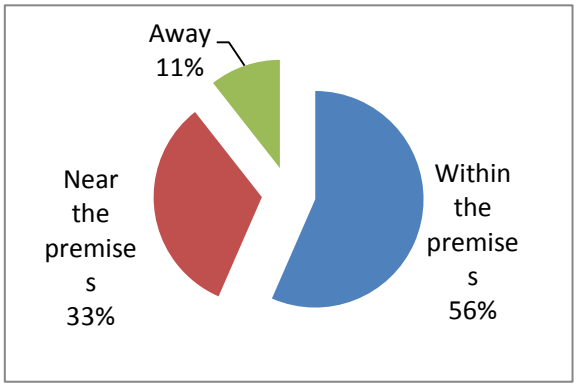


Figure 12 Location of water supply

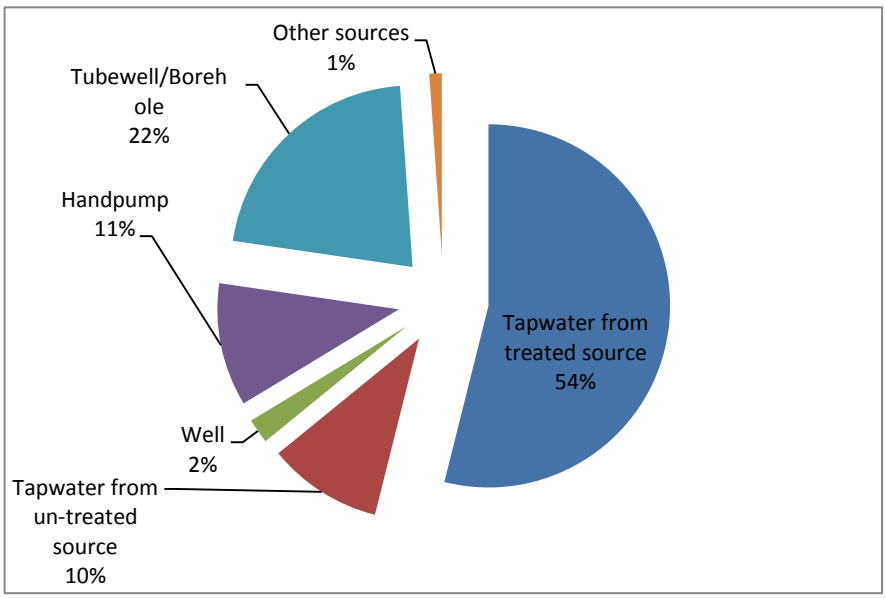


Figure 13 Source of water supply

From the above pie-chart, we can see that 56% of the households are having water connections within the premises. Only 11% of the households have water connections away from the premises. 54% of the households are using tapwater from treated sources.

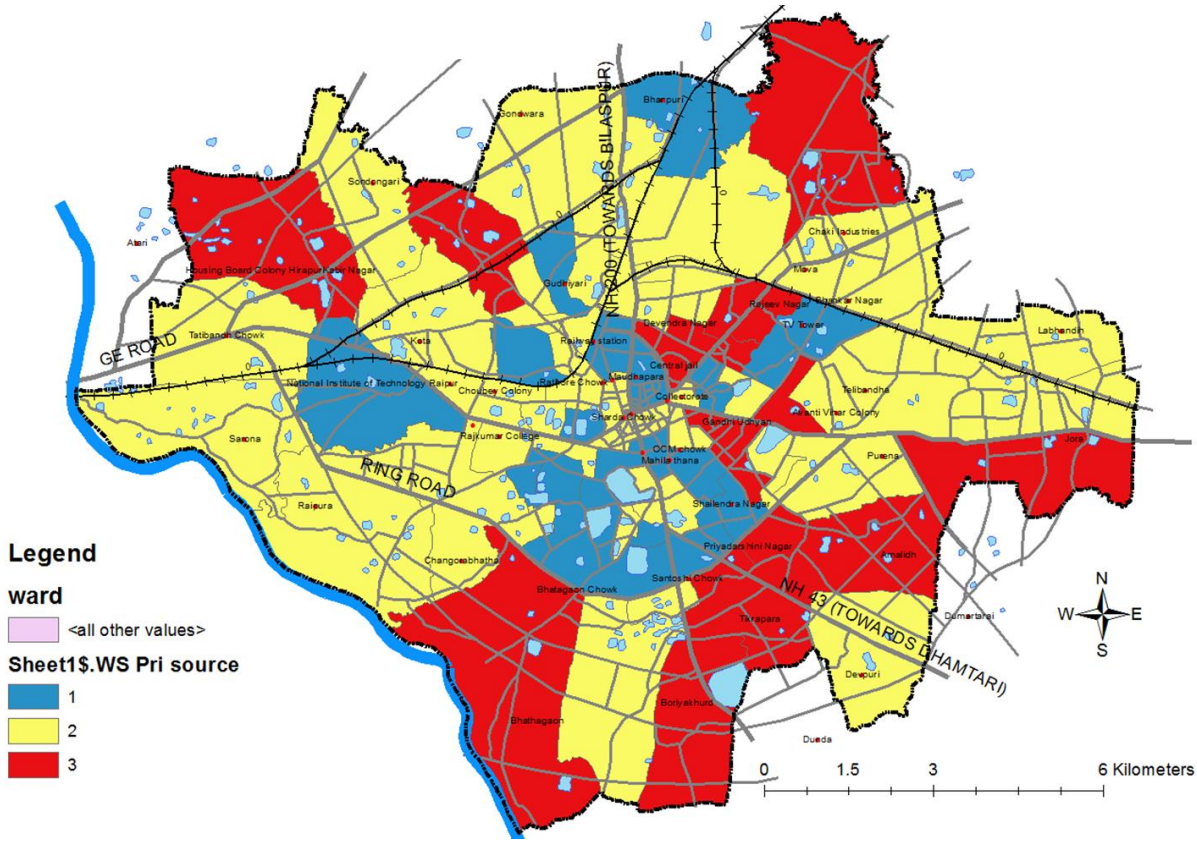


Figure 14 Ward wise water supply conditions

Now, from the above figure, we can see that many of the fringe area wards are still dependent on Nagar nigam tankers for water. Majority of the wards are dependent on Community taps. Only few wards of the core city area have access to individual taps.

5.2 Sewerage Facilities

With the growth of the cities, the more primitive methods of excreta disposal have necessarily given place to the water sewage system. Even in the small towns the greater safety of sewerage, its convenience, and freedom from nuisance have caused it to be adopted wherever finances permit.

5.2.1 Sewage

It is the liquid waste from the community and is generally conveyed by the sewer. Sewage again is differently classified depending on its nature and sources.

- Domestic sewage (from dwellings units, business or institutions)
- Industrial sewage (from industrials viz. chemical refuse)

The domestic and industrial sewage collectively is termed as the sanitary sewage. Storm water is the liquid flowing in sewers during or following a period of rainfall and resulting there form. Some underground water may find its way through joints into sewerage system is termed as infiltration.

5.2.2 Sludge

Sludge is the spent up water from kitchen, wash basin etc., It will not include the waste from, urinals, water closets, stables etc., It is normally carried along with the domestic sewage where sewer system exists. But as the sludge may be carried though surface drains for

disposal whereas excreta disposal may be done by means of septic tank.

5.2.3 Sewerage system

This is the system of sewers including all appurtenances required for sewage disposal. Namely:-

- **Collection works:** Collection works are provided for collection sewage from different points of occurrence and conveying sewage to any desired points with the help of a sewer system.

- **Sewage treatment:** Sewage treatment covers any artificial process to which the sewage is subjected in order to remove or alter its objectionable constituents so as to render it less dangerous or offensive.

- **Sewage disposal:** Sewage disposal applies to the act of disposing of sewage by any method may be to a body of water or on land. It may be done with or without any previous treatment of the sewage. The last stretch of truck sewer carrying sewage to the disposal point is known as outfall sewer.

5.2.4 Aims and Objectives of Sewerage Works

- To provide a good sanitary environmental condition in a city.
- To dispose off human excreta to a safe place by a safe and productive means.

- To dispose off all liquid wastes from a community to a proper place to prevent harmful breeding of flies, mosquitoes, bacteria etc.
- To treat the sewage if required so as not to endanger the body of water, or land to get polluted where it is finally disposed off.
- Proper disposal method should be adopted to protect sub soil water getting polluted.

5.2.5 Sewerage System in Raipur

At present the collection, treatment and disposal of the sewage is being looked after
mainly by the Nagar nigam. Sewerage treatment system was implemented at Raipur in 1992. About 25% of the area is covered by it. About 101 MLD of sewerage is generated from the city.

From the figure below we can see that very few wards have the facility of individual toilets. The city core area have individual toilets. Almost all the wards in the fringe areas don't even have community toilet facilities.

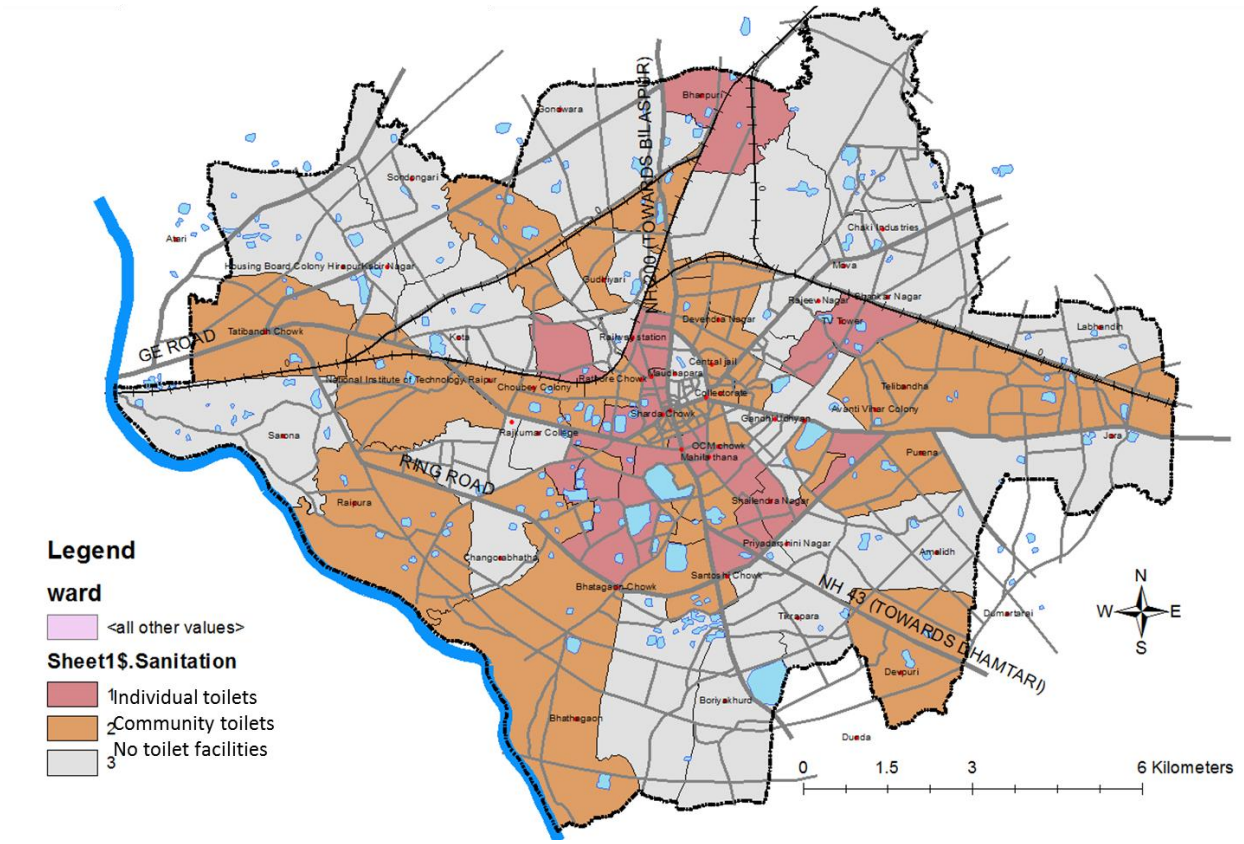


Figure 15 Ward wise sanitation conditions

From the figure we can see the location of public toilets in the whole city. There are 82 public toilets in the study area. This toilets are concentrated in the core city area and less in the fringe areas.

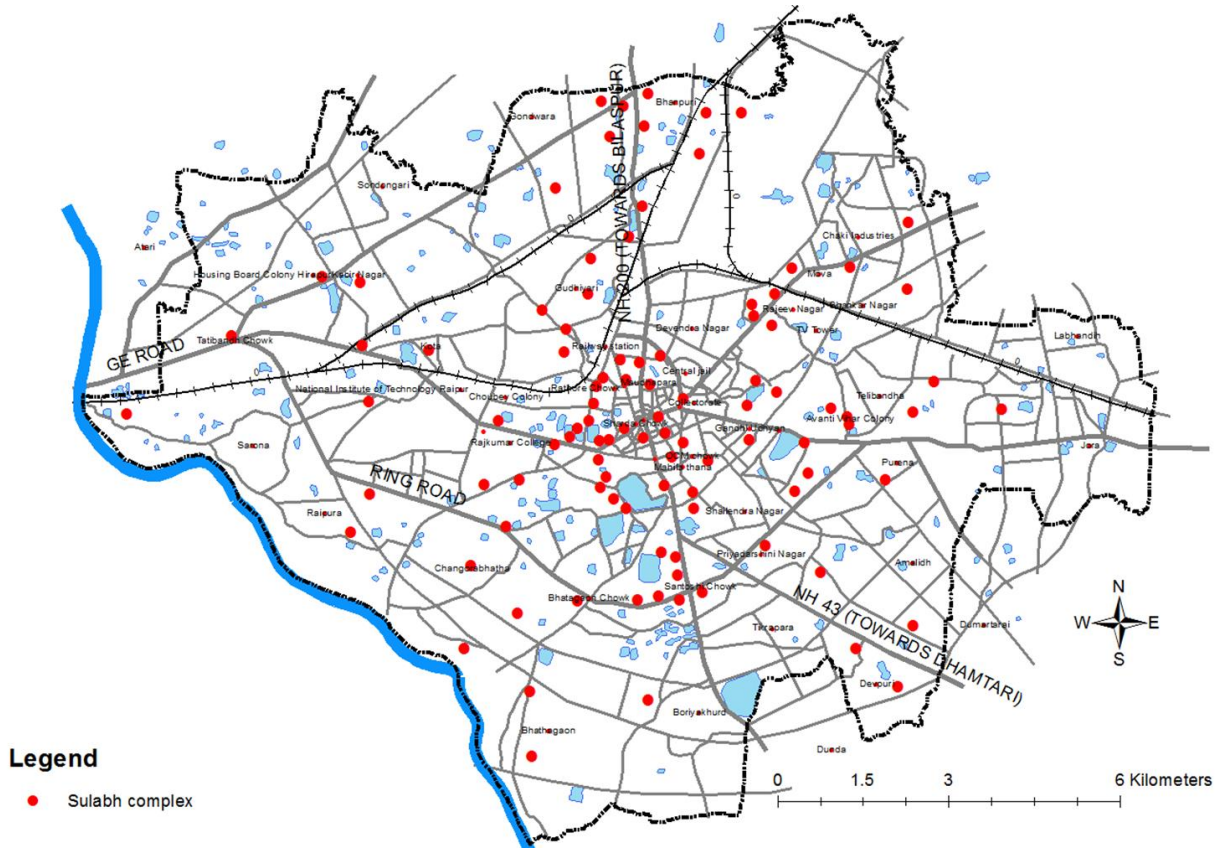
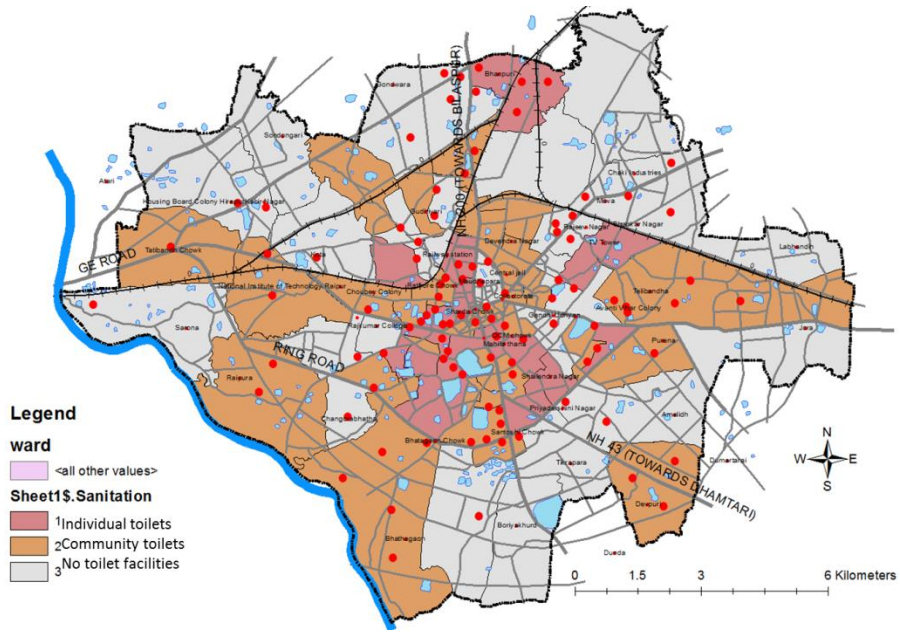


Figure 16 Location of public toilets



The above figure clearly shows that due to the absence of public toilets in the fringe areas, majority of the wards don't even have toilet facilities.

5.2.6 Latrine facility

Out of the 218937 number of households, 74% (152325) households are having latrine facilities within there premises. 9% (18481) households are using public latrine facilities and the reat 17% (34974) households decificate in the open.

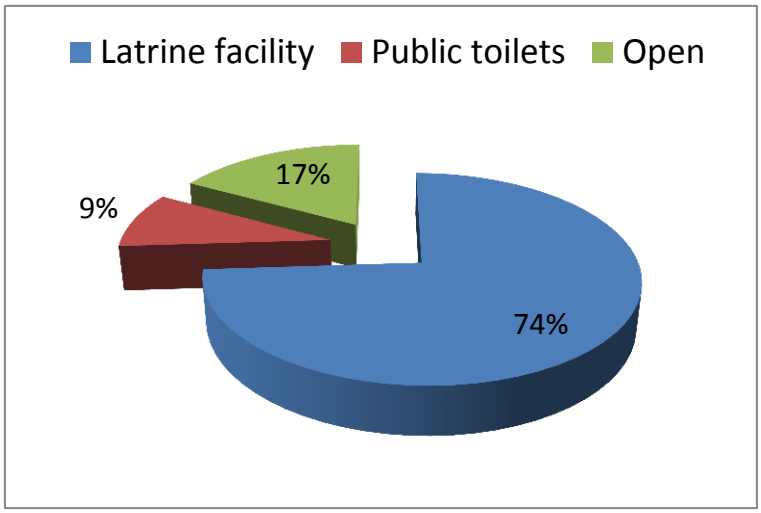


Figure 17 Distribution of Latrine facility

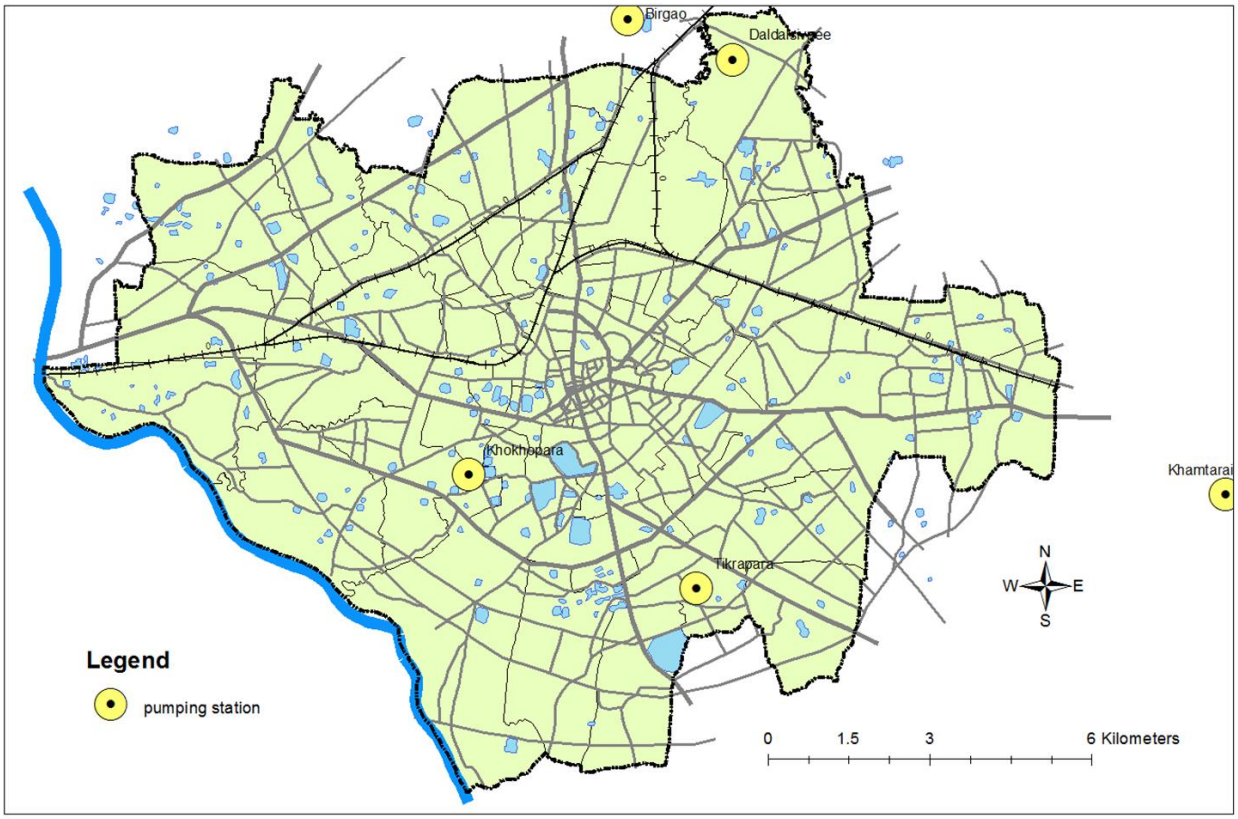


Figure 18 Location of Treatment plants

The above figure shows the location of treatment plants in the study area. There are 5 treatment plants in the city. They are as follows:

- Birgao
- Khamtarai
- Tikrapara
- Daldalsivni
- Khotrapara

5.3 Solid Waste

Everything in this world is bound to be a waste sometime or the other. How so ever important or useful anything may sound today but soon or later when it gets out of use it is bound to gain a reputation as waste matter. Every community will produce different types of solid wastes and proper disposal of these will be included in the sanitary program of the locality. The solid waste thus produced can be classified as follows:

Rubbish:

Rubbish denotes all non-putrescible wastes except ashes, VIZ., paper, cans, broken glasses, wood, cardboard, scrap metals etc., rubbish is responsible for the creation of nuisance when it is scattered by careless handling or by wind.

Garbage:

The term garbage is used to designate those pulrescible wastes resulting from food products. These include cooked and uncooked vegetables rotten fruits etc. as these may cause fly and other insect problems and also these ferment readily resulting in the production of bad odours.

Refuse:

All sorts of solid wastes from a community may be termed as refuse. Generally accepted components of refuse include all putrescrible and non-putrescrible solid wastes with the exception of body wastes i.e., excreta. Such wastes include garbage, rubbish, ashes, dead animals, and industrial wastes. When collection is done together it is termed as mixed refuse.

Collection removal and disposal of refuse is a very important aspect of urban sanitation and is becoming a challenging problem to public health engineers to provide proper health, comfort and aesthetic situations for the community. The use of mechanical equipment's in collection of the refuse and sanitary methods of its disposal are found to be essential in case of urban areas.

Effective planning of the method of collection and disposal of refuse of any urban area demands intensive of the study and quantity of refuse produced by it. It varies widely from place to place depending on the habits of people, the standard of living, climatic condition of the place, population density nature and number of industries etc.

Refuse in general may contain the different constituents for average Indian condition as given below: -

Table 11 Constituents distribution of Solid Waste

Item	**% by weight**
Garbage	45% to 50.00%
Paper	01% to 2.0%
Glass	0.25% to 1.00%
Rags	0.5% to 1.0%
Plastic	1.00% to 2.00%
Carbon	20.00% to 25.00%

Nitrogen	0.5% to 2.00%
Phosphours	0.5% to 2.00%
Potash	0.5% to 2.00%

The above table is & given only to have an idea about physical - chemical characteristic of refuge an average Indian city may produce.

5.3.1 Collection System

Collection system of solid waste can be divided into two broad categories.

Primary system

Primary collection involves the collection of solid waste from house to house i.e., the points of generation to a suitable nearly common location (dust bins Garbage vats etc.) from where the refuse is further collected and transported to the point of disposal.

- **Communal Storage:** Which may require delivery of wastes by the house-holders over a considerable distance. Communal storage bins of 1.00 to 2.00 Cu.m capacities at distance of 50-100 meters are likely to be acceptable to the residents and may junction better.

- **Block Collection:** The households deliver the waste to the vehicles at the time of collection, the time and route of the vehicles are made known to each area being severed.

- **Kerb side Collection:** where households put out and later retrieve the storage bins. Residents must place their bins on the foot ways in advance of the collection time and remove them after they have been emptied.

- **Door to Door collection:** The collector enters the gardens or courtyard carriers the bins to the vehicles empties it, and returns it to its usual place.

Secondary collection

Secondary and transportation of the solid wastes to the disposal sites is often done by heavy motor vehicles. For the purpose of transportation following vehicles/equipment's are used.

- Flat bed trucks
- Truck with tipping arrangements
- Container career system
- Dumper placer

The refuse sanitation program cannot be satisfactory until necessary measures have been taken to ensure the inoffensive disposal of these wasting. Normally the following methods are employed for the purpose of disposal:

(a) Dumping (b) sanitary land fill (c) composting (d) incineration

5.3.2 Dumping

Some components of refuse are suitable for open dumping. These include street sweeping & ashes and some rubbish. However this will result in serious hazard if garbage or moved refuse is disposed off in this manner. Dump area should be carefully chosen, so that these cause a minimum chance of complaints from the nearby residence.

Undesirable aspects of dumping area that it constitutes health hazard and create breeding ground for flies mosquito's and rodents.

5.3.3 Sanitary Landfill

Sanitary landfill differs from ordinary dumping. In this system material is placed in trench and properly compacted and covered with earth at the end of the working day.

5.3.4 CompostIng

Organic solid wastes received from a community are converted into stable humus like end product having a high fertility value. During composting exothermic, thermophilic complex biochemical reaction take place which occurs naturally in the biodegradable solid organic matters under both anaerobic and aerobic conditions.

5.3.5 Incineration

In this method of refuse disposal the' refuse is burnt off and the volume is much reduced. So the refuse containing harmful microorganisms are turned into quite harmless material.

5.3.6 Existing situation

The present arrangement for collection and disposal of solid waste is inadequate and in many areas inefficient. At present, the garbage is piled up on the sides of the roads, from where it off-loaded into handcarts and later into garbage containers.

The domestic solid waste collected from 205780 households is 513 TPD. There are approximately 500 hospitals in the city. Medical waste in the form of swabs, bandages, syringes etc. comes from this hospitals.

There are around 1100 dustbins in the city. Collection at door step is done only in few wards, rest wards don’t have door to door collection facility. They dispose in community dustbins. The table below shows the infrastructure facilities for solid waste management.

Table 12 Existing condition of Infrastructure

Sr. No	Description	Number
Storage	No. of Dustbins (R.C.C)	600

	No. of Dustbins (Metal)	500
Collection	Tricycles	200
	Wheel barrows	500
	Loaders	10
Transportation	Tractors	8
	Tippers	10
	Skip Loaders	10

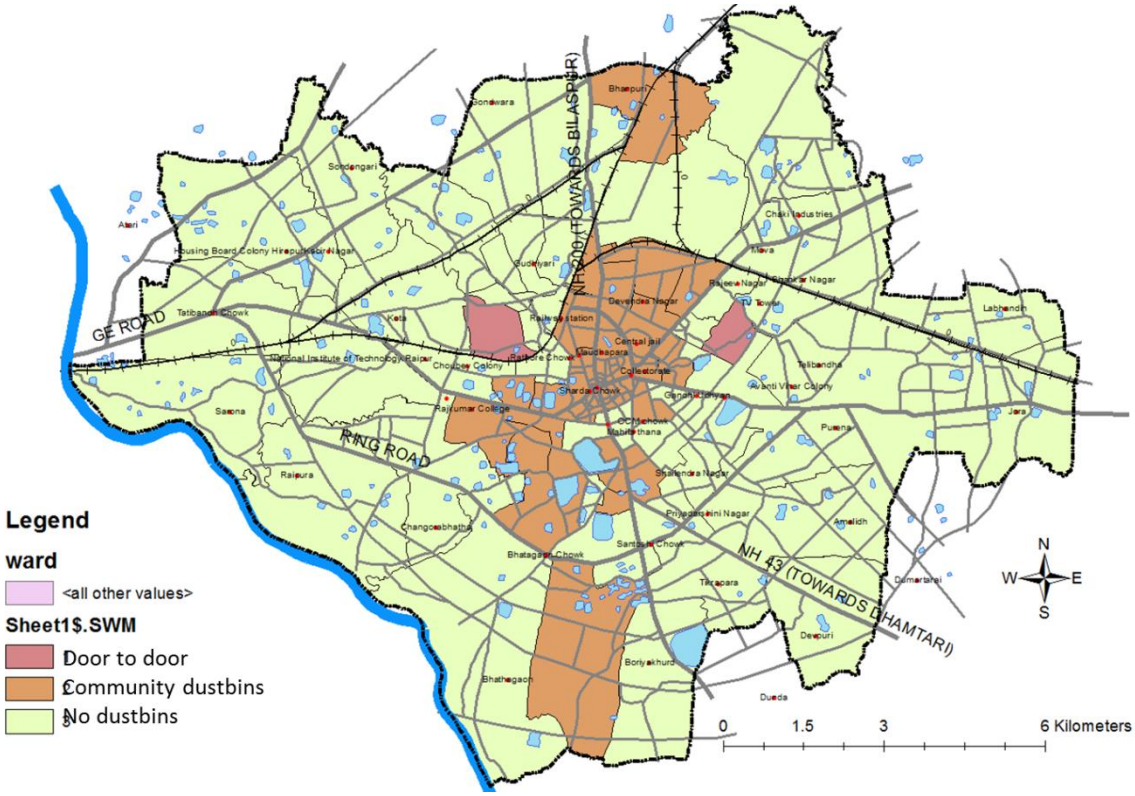


Figure 19 Ward wise solid waste management status

The above figure clearly shows that almost the whole city don't even have community dustbins. They throw the waste in open spaces or on the road side. Few of the wards in the central city region have facility of community dustbins and in two wards door to door collection is being done. This shows that the condition of solid waste management in the city is pathetic and some immediate measures need to be taken to manage the solid waste.

5.4 Housing

The total number of households in the study area are 205780. Out of the total households 71% are in good condition, 26% are in livable condition and rest 3% are in dilapidated condition.

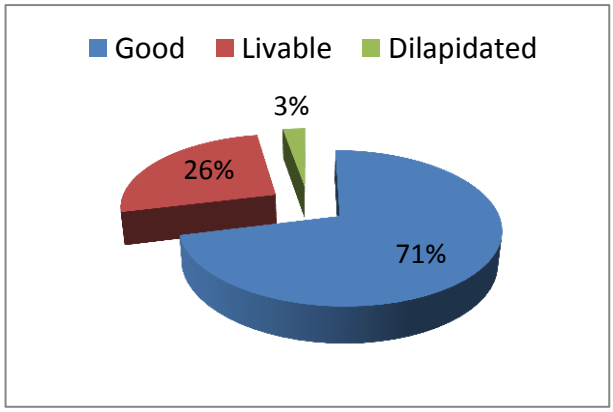


Figure 20 Housing condition

5.4.1 Slums

40% of the population of the city lives in slums. The total number of households in slums is 86003. 406571 peoples of the city lives in slums.

Table 13 Slums statistics of Raipur

	Slums	
Households	86003	
Population	406571	**39.57%**
Sex ratio	956 females per 1000 males	946 (Raipur)
Child percentage	13.6	12.76 (Raipur)
Slum literacy rate	70.3	74.96 (Raipur)
Working population	37.55	36.65 (Raipur)

5.5 Transportation

Raipur city plays an important role in the National transportation. It has direct rail links to important cities like New Delhi, Mumbai, Kolkata, Vishakapatnam, Ahmedabad, Bhopal, Jaipur and Nagpur. It has direct air links to Mumbai, New Delhi, Kolkata, Nagpur, Ahmedabad and Indore. It is connected to the whole Chhattisgarh either by rail or by roads.

Raipur is linked to major cities by National Highways. The city is divided into four parts by intersection of two National Highways. National highway no. 43 and 200 starts from the city. National highway no. 6 is the backbone of the city. Majors road links of the city are as follows:-

Table 14 Roads passing from Raipur

Mumbai – Kolkata highway	NH 6
Raipur – Vishakapatnam highway	NH 43
Raipur – Bilaspur highway	NH 200
Raipur – Balodabazar road	State highway
Raipur – Abhanpur road	Old Dhamtari road
Raipur – Abhanpur Deobhog road	NH 43

5.5.1 Registration of Vehicles

A common man generally uses Bicycle, Scooter or Moped for transportation in his day to day life. Other vehicles include Cars, Auto Rickshaw, Bus etc. Registration of vehicles has drastically increased in the city. The registered vehicles in the year 2003-04 was 18596, which has increased to 54313 in the year 2012-13. In the last 10 years the city has registered 3.6 lakh new vehicles. Car and Motor cycle combined share to the total no. of registered vehicles is 70-75 per cent. In 2003-04, the total no. of two wheelers registered was 12155 but when we compare it with the no. of two wheelers registered in 2012-13 which is 40889, it increasing tremendously. No. of cars have also increased to large no. It is increasing around 10 per cent annually. The table below shows the no. of vehicles registered over the decade.

Table 15 Registration of different vehicles over years

Year	Two wheeler	Three wheeler	Car / Taxi	Jeep	Bus (Including Mini bus)	Light vehicles	Heavy vehicles	Tractor	Trailer	Others	Total
2003-04	12155	202	796	53	882	385	1264	1477	1341	41	18596
2004-05	17172	189	980	120	399	260	581	1463	1342	44	22550
2005-06	13830	199	1237	33	307	243	689	887	792	22	18239
2006-07	14941	180	1263	96	396	231	700	632	557	18	19014
2007-08	20146	251	1434	42	902	402	1110	845	729	31	25885
2008-09	21799	321	174	65	639	375	1965	797	703	80	28518
2009-10	27060	315	2712	38	707	667	2066	1226	1080	132	36103
2010-11	34190	487	3049	14	627	1013	2828	1601	1320	176	45305
2011-12	35901	542	3098	17	743	919	2855	1771	1606	131	47583
2012-13	40889	746	3729	11	627	1306	3429	1904	1337	335	54313
											316106

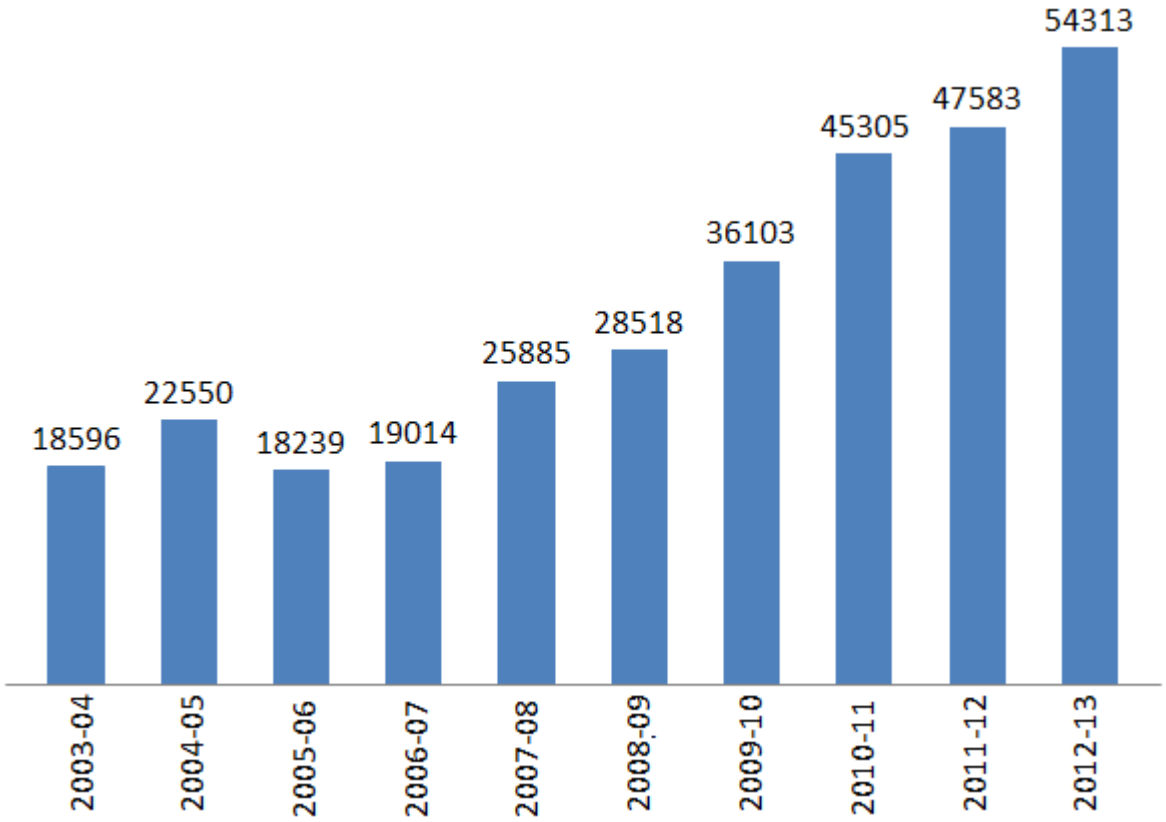


Figure 21 Increase in registration of vehicles

Now, when we see the table in graphical form, we can see the increase in no. of vehicles over the years. The graph below shows the vehicles registered per year.

5.5.2 Volume of Traffic

Craft's consultants, New Delhi did the pick hour traffic volume survey at 40 different locations in the city. Out of the 40 locations 17 points were from the inner city area and 13 points were from the fringe area of the city. Jaistambh chowk is the heart of the city. It recorded the highest traffic volume of 20851. Shrada chowk recorded the highest traffic in morning hours. Sharda chowk, kotwali chowk, Chikni mandir chowk

were among the other busy locations of the city. The table below shows the traffic volume of different locations of the city.

Table 16 Traffic volume at different locations of the city

Sr. no.	Name of chowk	Traffic volume (PCU) Morning	Traffic volume (PCU) Evening
1	Tatibandh	2375	3112
2	University gate	1860	2026
3	Amapara	8374	9351
4	Azad chowk	8099	4929
5	Tatyapara chowk	5534	6814
6	Sharrrda chowk	14628	5323
7	Jai stambh chowk	13457	20851
8	Shastrri chowk	8913	11963
9	Gandhi chowk	8003	8412
10	Police headquarters chowk	3411	3964
11	Shanker nagar chowk	7840	7488
12	Telibandha chowk	4063	1791
13	Fafadih chowk	8817	9465

14	Masjid mode	4312	4400
15	Gol bazar chowk	6742	8257
16	Chikni mandir chowk	10817	14680
17	Kotwali chowk	11946	12921
18	Kalibadi chowk	5892	4774
19	Police line chowk	6586	7605
20	Tikrapara chowk	7307	5323
21	Raipura chowk	2220	3665
22	Pachmedi naka chowk	5918	5888
23	Gudhiyari chowk	1728	4793
24	Telghani naka chowk	9317	7030
25	Railway station chowk	9133	10406
26	Guru nanak chowk	9494	10645
27	Kacheri chowk	12094	11011
28	Bus stand	5129	6485
29	Banzari chowk	6784	6538
30	Fire brigade chowk	12383	11185
31	Madhusudan chowk	10476	9434
32	Akashwani chowk	5894	4813

33	Chudi line chowk	59487	4920
34	Sadar bazar chowk	6826	7363
35	KK road chowk	5144	4200
36	NIT chowk	2158	1827
37	Mid kalibadi chowk	2742	3462
38	Chowk between police headquarter and shanker nagar	2488	3405
39	Chowk between telibandha and shanker nagar	3404	2510
40	Chowk between pachpedi naka and telibandha	1914	2157

Source: Craft's consultants, New Delhi

From the above survey of traffic volume we get to know that traffic moves from fringe areas to the city core area. In morning peak hours Sharda chowk has traffic volume of 15164 PCU and at the same time Tatibandh chowk has the traffic volume of 1996 PCU. This clearly shows that the traffic in the core city is much higher than the fringe areas. In evening Jai stamb chowk records the maximum traffic volume of 20672 PCU and at the same time Tatibandh chowh has the traffic volume of 1693 PCU. The core city area chowks need to be redesigned and maintained properly.

The report by Craft's consultants, New Delhi also state that Sadar bazar road carries 3.89 times more traffic than its carrying capacity. Subhash

marg carries 2.59 times more traffic than its carrying capacity. From Amapara to Shastri chowk the GE road carries two times more traffic than its carrying capacity. This creates traffijams and time is wasted of the passengers. This roads needs redesigned or some other alternate solution.

5.5.3 Pedestrian Traffic

To evaluate the number of pedestrians on the streets the Craft's consultants, New Delhi did the survey at ten different locations of the city. The table below shows the traffic of pedestrians.

Table 17 Pedestrian volume at different locations of the city

Sr. no.	Location	Peak hour	No. of Pedestrians
1	Jai stamb chowk	12:30 – 13:30	5407
2	Sharda chowk	18:45 – 19:45	2420
3	Shastri chowk	12:30 – 13:30	4649
4	New bus stand	17:45 – 18:45	3739
5	Station road	19:00 – 20:00	4268
6	Kalibadi chowk	10:45 – 11:45	1820
7	Fafadih chowk	12:30 – 13:30	1796
8	Kotwali chowk	17:00 – 18:00	2808
9	Golbazar chowk	19:00 – 20:00	3783
10	University gate	10:00 – 11:00	1199

Source: Craft's consultants, New Delhi

From the table it is clear that the no. of pedestrians are more on Jai stamb chowk, Shastri chowk, Station chowk, New bus stand and Gol bazar. There is no provision of pedestrial walkways of foot over bridge in whole of the city. Zabra crossing is present on few roads, but no one is following it.

5.5.4 Parking Conditions

New bus stand, Railway station, MG road are the major locations of parking in the city. There is parking problem for trucks along the ring road. Improper utilizing of the parking space has also created problems in few locations of the city. Due to lack of parking spaces in the core city it has created the problem on roads. Parking spaces are only functional at Sharda chowk, Ravi bhawan, Jawahar bazar, Shastri bazar and Lal ganga complex. Few areas such as Gandhi maidan, Old ganj mandi and Bus stand are being proposed for off- street parking, but the commercial areas in the core city does not have any arrangements for parking. Parking conditions at few locations of the city had been surveyed by Craft's consultants, New Delhi and is presened in the table below.

Table 18 Parking conditions at different location of the city

Sr. no.	Traffic corridors	Peak hour	ECS
1	Fool chowk	17:00 -17:30	25
2	Sharda chowk to Jai stamb chowk	18:00 – 18:30	547

3	MG road (Sharda chowk to Guru Nanak chowk)	16:30 – 17:00	706
4	Jai stamb chowk to Shastri chowk	11:30 – 12:00	570
5	New Bombay market	12:00 -12:30	225
6	Shastri chowk to Kachari chowk	12:30 – 13:00	146
7	Sadar bazar	18:30 – 19:00	154
8	Kotwali chowk to Jai stamb chowk	18:00 – 18:30	510
9	Chikni mandir to Banjari chowk	12:30 – 13:00	584

Source: Craft's consultants, New Delhi

(Note: E.C.S. values – Car -1.0, Motorcycle or Bicycle – 0.5, Truck – 0.5, Auto rikshaw – 0.75, Rickshaw – 2, Minibus – 2)

Due to lack of off -street parking spaces in the core city vehicles are parked along the road side, which disturbs the traffic. On MG road (between Sharda chowk to Guru Nanak chowk) 706 E.C.S. vehicles are parked in peak hour, which obstructs the moving traffic.

5.5.5 Public Transport

In present, there is a huge shortage of public transport in the city. Due to this shortage the public faces many problems to go to their workplaces or to the new colonies on the fringe areas of the city. After the fornation of Raipur as the capital town, auauto rickshaws have increased on the roads as public transport. According to the records of Nagar Nigam, there are 1436 registered auto- rickshaws running in the city.

Recently, Nagar Nigam has introduced 100 (35 semi lower floor buses 65 mini buses) buses in the city. This buses are showing some good sign of public transport in the city. This buses operate on 9 routes in the city. It has 62 stopages throught the city. The frequency of the buses is 5-20 minutes depending on the route. It operates from 7:00 AM till 8:30 PM.

5.6 Electricity

Raipur is connected to national power grid. Electricity in the city is supplied from the Korba thermal power plant. The city gets sufficient amount of electricity for its different sectors. Electricity consumption under different sectors is given in table below.

Table 19 Electricity consumption under different sectors

Sr. no.	Sectors	Electricity consumption (kV)
1	Residential	7,280.088
2	Commercial	2,150.211
3	Industrial	2,950.805
4	Others	508.599
	Total	12,889.703

Source: Chhattisgarh state electricity board.

Electricity consumption of the city is increasing by 10% annually. So to fulfill the future requirement of electricity Chhattisgarh electricity board has proposed few power sub-stations. The proposed power sub-stations are as follows:-

Table 20 Proposed power sub-stations

Sr. no.	Capacity of Sub-station	No. of Sub-stations	Area required (ha)
1	45 MVA	9	10.90
2	60 MVA	12	14.60

3	70 MVA	14	17.00
4	175 MVA	45	4.50

Source: Chhattisgarh state electricity board.

5.7 Health

Raipur provides the best health facilities in the whole of Chhattisgarh state. Public from the neighboring state of Orissa also uses the health facilities of the city. The Raipur government medical college is working from past 5 decades. It also have Government Ayurvedic and Dental college. From past 5 years Escorts heart hospital is also providing its services in the city. All India Institute of Medical Sciences (AIIMS) had also started its services in the city from last year. Some of the private hospitals such as Apollo and Care have also started in the city. There are approximately 50 nursing homes functional in the city.

5.8 Education

Raipur is the main centre of education for the state of Chhattisgarh. It has many reputed colleges and universities. Many on the national level institutes are present in Raipur. Some of them are as follows:

- National Institute of Technology, Raipur.
- Indian Institute of Management, Raipur.
- All India Institute of Medical Sciences, Raipur.
- Hidayatullah National Law University, Raipur.

There are 28 government schools in the whole city. 124 private schools are also present in the city, but all these private schools are concentrated in the city core. Government schools are spread over the area but are less in number. The fringe area does not have school facilities.

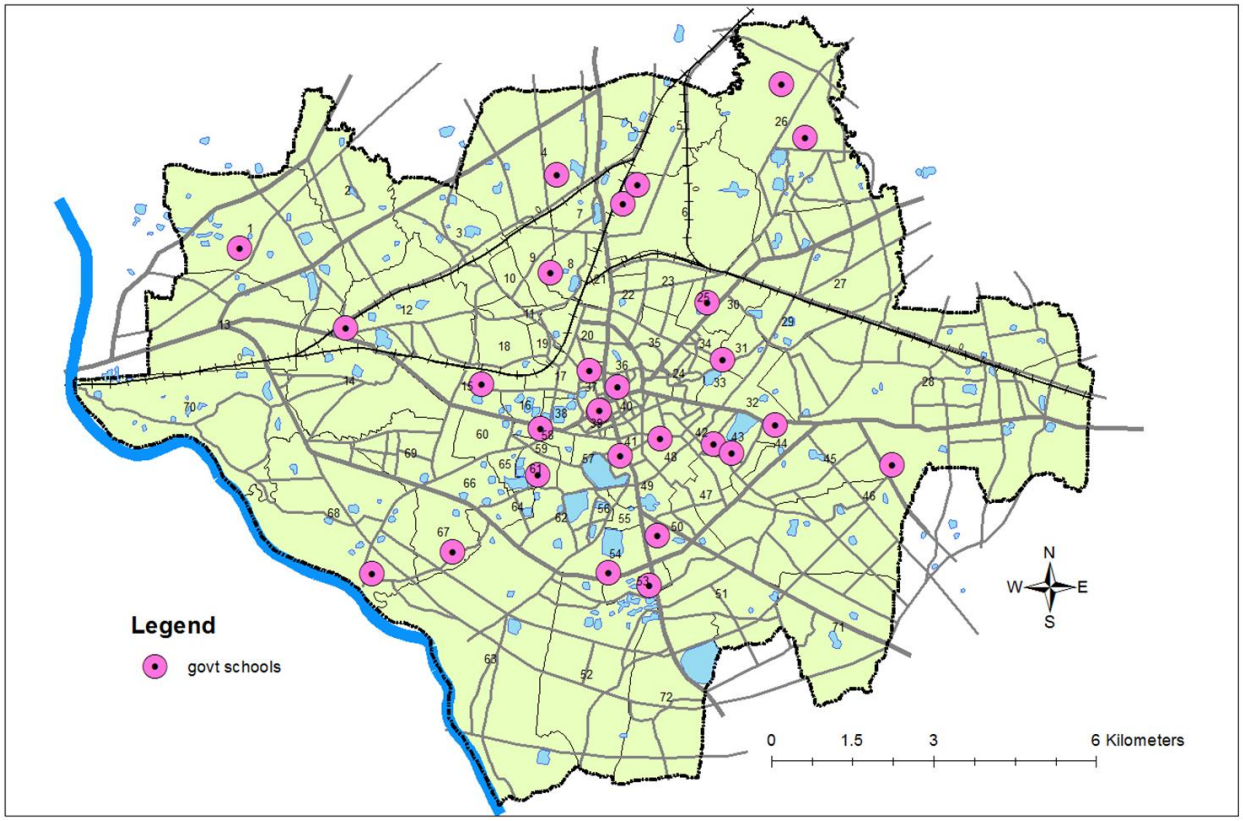


Figure 22 Location of government schools

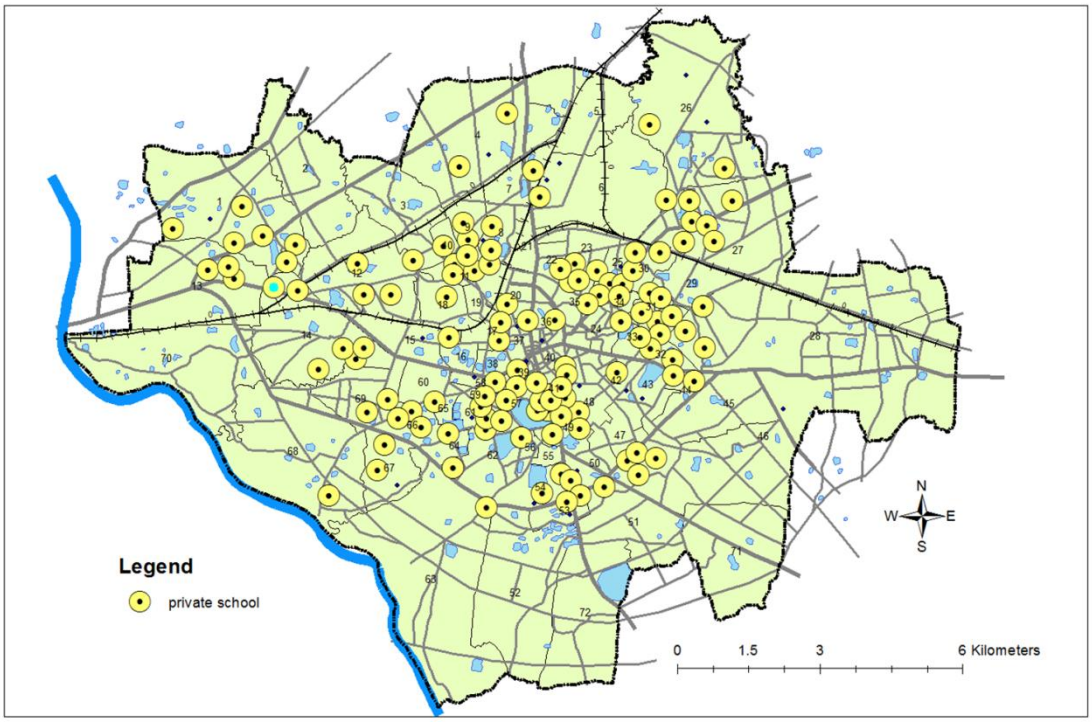


Figure 23 Location of Private schools

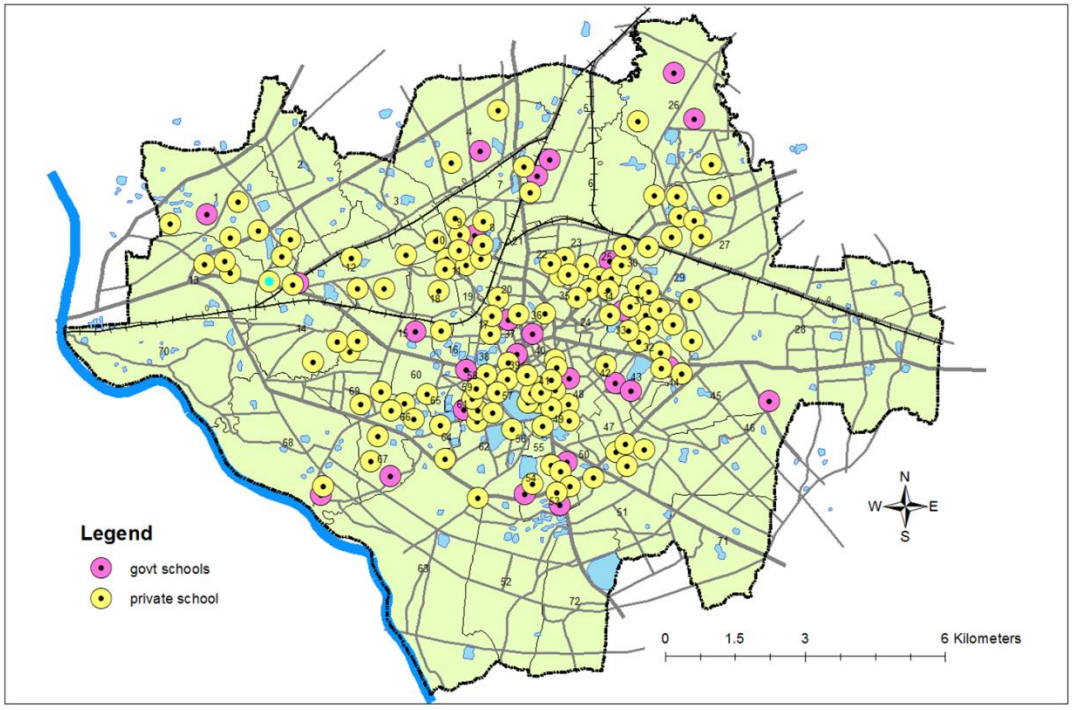


Figure 24 Location of all the schools

5.9 Banks

There are 115 banks in the whole city. All the banks are concentrated in the city core and along the national highway. Majority of the banks are commercial banks. Few co-operative banks are present in the city.

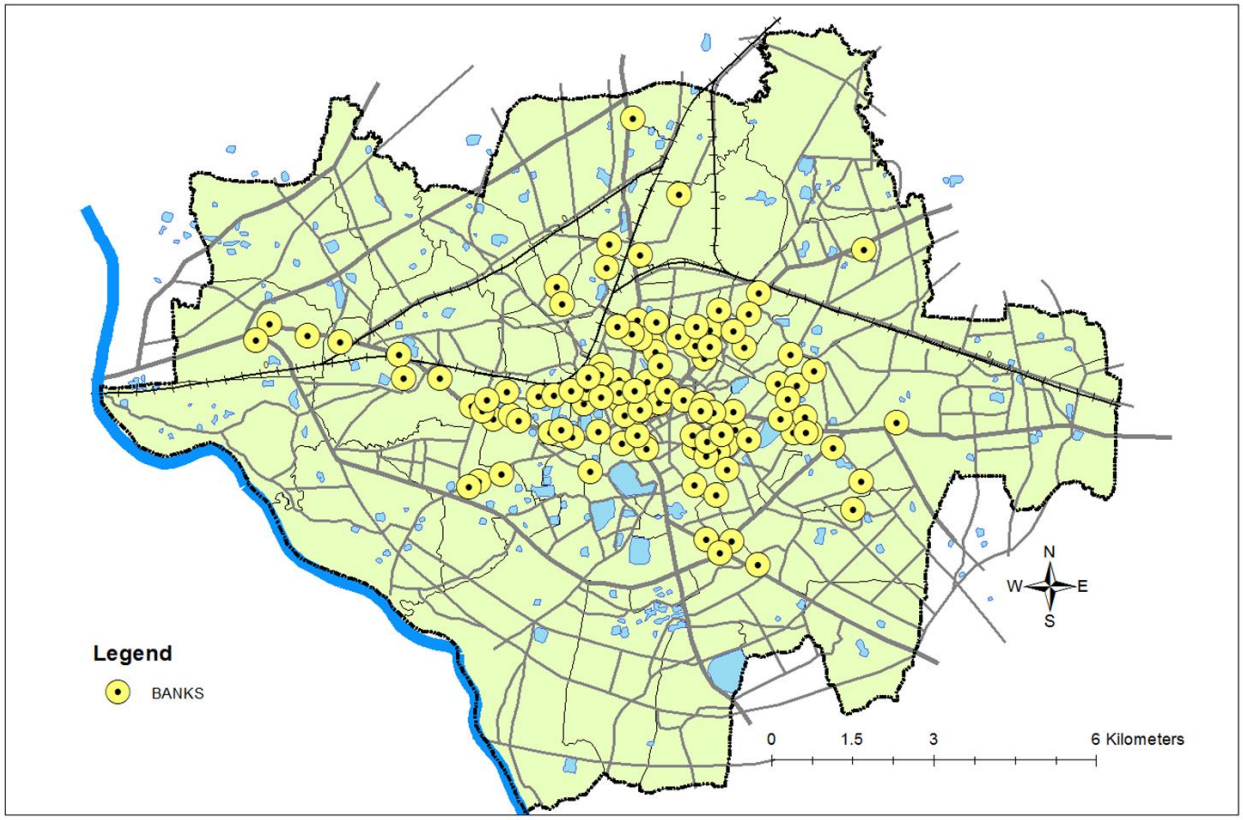


Figure 25 Location of Banks in the city

CHAPTER 6 : ANALYSIS

6.1 Water Supply

- Inadequate resource exploration in the study area causing water shortage.
- In adequate water pressure and irregular water supply hours.
- Because of irregular and winding street pattern (especially built-up area of Raipur) the water supply is not uniform. There were high head losses thus resulting in reduction of water pressure and this is further accentuated by non-uniform network distribution. There are other problems for losses in head due to variation of topography.
- Many HHs have private water motors illegal water connections to such more quality of water from water main thus the cumulative effect of this is tremendous reduction of water pressure during peak hours. Authority is well aware of this fact that illegal means are being used but due to absence of any strong legal action and user interests they are not able to stop pilferage of water.
- Because of inefficiency and vested interest in the staff the organization is not efficient enough to supply water at adequ3lte pressure and for regular supply hours and stop pilferage of water.
- People participation in improving water supply condition is missing. Although most of the HHs and Hotels know and are aware of the fact that use of illegal means of water tapping is one of the reasons for water shortage but still they cannot stop using it because they are not sure of water supply. Another point is that

due to irregular water supply hours and arrogance people kept their water taps open even during no supply hours thus reducing water pressure and often, causing leakage's. As there illegal water connections are very near to ground surface and to open surface drains so water sometimes get contaminated causing various water hazards.

6.2 Sewerage Facilities

Despite the meticulous planning and maintenance jobs done by the Nagar Nigam, only around 25% of population enjoy the facility of sewer system. Also due to the organic development of the city it proves a very expensive job to lay and maintain the sewer lines in the interior parts of the city. The problem
of sewage collection and treatment disposal become acute during the rainy seasons, a huge amount of storm water is also include in the sewer system which may be as high as twenty times of the regular supplies there by causing the sewer system to overflow.

- Due to the haphazard and organic layout of the city it has become a tough task to lay and maintain the proper working of the sewer system.
- Excess pressure due to the huge amount of floating populations, the working can't be optimized.
- Provision of pumping and treatment for the peak loads may not be economical for round the year jobs.
- The layout of sewer lines, collection, treatment, disposal and proper operation and maintenance is been devised as a job under

various agencies viz. Nagar nigam, CG pollution control board, Keevar group etc. thus it is difficult to coordinate properly and thus any planning scheme or policy, finds difficulty in implementation.

- The collection of taxes and sewer charges should be imposed and it should be made compulsory for the public to take sewer connections for better sewerage collection sewer wherever sewer exists.

6.3 Solid Waste

- There is no proper management for door to door collection of the waste in the whole city. The authorities have not even provided community dustbins in the city.
- As the solid waste collection and disposal system in Raipur is lacking in the Infrastructure requirements the huge piles of refuge provides a breeding ground for mosquito's, flies etc. which further enhances the health problems.

- The presence of non-biodegradable substances viz. polythenes etc. also makes the situation gloomy as far as the public health is concerned.

- In the absence of certain rules and regulations and at peoples own will and lack of civic sense nobody bothers about the use of dust bins etc and throw the refuse at any position, which suits them as per their convenience.

6.4 Housing

- The share of slums in housing is increasing yearly. 40% of the population of the city is living in slums. Measures needs to be taken to relocate the slum population.
- 29% of the housing needs to be reconstructed.

6.5 Transportation

- Raipur City does not have many formal 'on-street' or 'off-street' parking lots. Wherever empty spaces are available, parking is being observed, which restricts and impedes the movement of traffic besides causing severe accidents.
- The parking of vehicles can be observed through the day and more in the evening time on first cum first basis. In many parts the demand outstrips supply and causes spillover to expensive road space affecting road capacity to a great extent.
- There is a need to identify potential 'off-street' parking locations to be developed by private-public participation.
- With the increase of traffic, the road and junction geometrics will require modifications and enhancement of capacity.
- It is observed that many structures like statues have been installed at many junctions that create traffic related problems.
- For the signalised junctions, efforts will be laid to co-ordinate few signals on some important corridors.
- Junctions functioning with large rotaries/signals, these will require re-design based on the approach volume and turning movements they carry.

- Grade separator facility may also be required at strategic locations.
- Public transport in mainly dependent on auto-rickshaws, public buses needs to be increased.

6.6 Electricity

Electricity is been provided by Chhattisgarh state electricity board. The city gets 24 hours electricity supply. As the electricity consumption is increasing by 10% annually, new sub-stations needs to be proposed.

6.7 Health

Many superspeciality hospitals are present in the city, but many patients are generally referred to other cities. This superspeciality hospitals lack new technologies. The condition of government hospitals is pathetic. No hygiene is maintained in the government hospitals.

6.8 Education

The city has enough number of schools, but these schools are concentrated in the city core. The fringe areas of the city don't even have government schools. New schools need to be proposed in the fringe areas.

The national Institutes and Universities lack in infrastructure. This institutes are located within the cities. They should be placed away from the city.

6.9 Banks

- The city has many commercial banks, but all these banks are confined in the core city and on the highways. Fringe areas lack this facility.

- The city lacks in the number of co-operative banks functioning in the city.

CHAPTER 7 : PROJECTION OF POPULATION

The city has shown the tremendous decadal growth of 53.3% from 2001 to 2011. The Indian urban decadal growth rate from 2001 to 2011 is 31.8%. This shows that the city is growing faster as compared to other urban centres of the country. The table below shows the decadal growth of the city over decades.

Table 21 Decadal population growth of the city

Sr. No.	Year	Population	Decadal Growth %
1	1901	32000	-
2	1911	35000	10.03
3	1921	38000	8.57
4	1931	45000	18.39
5	1941	63000	39.32
6	1951	89000	41.5
7	1961	139000	55.6
8	1971	206000	47.35
9	1981	338000	64.21
10	1991	463000	36.79

11	2001	670000	44.7
12	2011	1027264	53.3

7.1 Arithmetic Increase Method

Average Arithmetic increase in population over 10 years is 3,57,264

Population in the year 2035 = 1027264 + (2.4 x 357264)

= 18 84 698

Say 18 84 700.

7.2 Geometrical Increase Method

Decadal growth of population from 2001 to 2011 is 53.3%

Population in the year 2011 = 1027264

Population in the year 2035 = $1027264\ (1 + 0.53)^{2.4}$

= 28 50 634

Say 28 50 600.

7.3 Exponential Rate Method

Decadal growth of population from 2001 to 2011 is 53.3%

Population in the year 2011 = 1027264

Conatant = e = 2.71828

Population in the year 2035 = $P_{2035} = P_{2011}\ e^{r*n}$

= 36 65 269

Say 36 65 300

Now, Population for the year 2035 will be the average of populations forecasted by different methods.

Population for year 2035 = 28 00 200

Say 28,00,000 (28 lakhs)

CHAPTER 8 : PROPOSALS

8.1 Water Supply

At present there is deficiency of 47.63 MLD of water. Now will take 200 lpcd as the water consumption per person.

Present supply of water = 127 MLD
Present deficiency of water = 47.63 MLD
Water requirement in 2035 = 28, 00, 000 X 200
= 56, 00, 00, 000
Say, 560 MLD.

So, by 2035 we will require 373 MLD (say 400 MLD) of water supply per day.

8.1.1 Sources Proposed

The proposed sources should be provided in three phase, i.e Phase-I, phase -II, and phase III. The works under three phases are proposed to be executed before 2021, 2028 and 2035. The total deficit is 400 MLD. So it is divided into three almost equal phases. The deficit water supply needs to be fulfilled by:

- Kharun river (dammed at Mahadev ghat)
- Mahanadi river (dammed at Gangrel dam)
- Tube well

8.1.2 Revenue generation

The existing tariff of Nagar nigam is Rs. 60 per month per household for domestic purpose and Rs. 150 – 3000 per commercial or Industry based on the size.
The existing tariff when calculated comes out to be Rs. 1 for 3 000 litres of water, which is negligible.

The tariff needs to be revised.
The present recovery rate is only 26%. It can be improved through resorting to strict measures or privatizing the billing/ collection.

8.1.3 Wastage Of Water

The present wastage of water is 25 MLD, which comes out to be 20% of the supply. This wastage of water can be reduced by proper maintenance of the water supply system.

8.2 Sewerage

Sewerage system must be provided where it does not exist.

Existing Water supply = 127 lpcd
Existing sewerage generation (80% of water supply) = 101 MLD.

Projected population for 2035 = 28,00,000.
Projected sewerage generation for 2035 = 448 MLD
Say, 450 MLD.

The proposed capacity should be provided in three phase, i.e Phase-I, phase -II, and phase III. The works under three phases are proposed to be executed before 2021, 2028 and 2035.The total deficit is 450 MLD. So it divided into three almost equal phases. Under phase I, II and III following new sources should be proposed considering population.

Table 22 Proposed Treatment facilities

Year	Proposed	Nature of treatment facilities
2021	150 MLD	Extention of existing treatment plan
2028	150 MLD	Construction of new treatment plant
2035	150 MLD	Construction of new treatment plant

8.2.1 Public Toilets

At present there are no sanitation facilities on the fringe wards of the city. There is an immediate requirement of atleast public toilets in each wards of the city.

Out of the 218937 number of households, 74% (152325) households are having latrine facilities within there premises. 9% (18481) households are using public latrine facilities and the rest 17% (34974) households decificate in the open.

Proposed number of households by 2035 = 5.6 lakhs.

Proposed number of households without latrine facility by 2035 = 1,45,600.

Say, 1.45 lakhs.

The proposed laterine facility should be provided in three phase, i.e Phase-I, phase -II, and phase III. The works under three phases are proposed to be executed before 2021, 2028 and 2035. Under phase I, II and III following new sources should be proposed considering population.

Table 23 Proposed sanitation Infrastructure

Year	Proposed
2021	Public toilets for remaining 17% of the households.
2028	72500 latrines
2035	72500 latrines

By 2035 all the households should have individual toilet facilities.

8.3 Solid Waste Management

8.3.1 Technical Aspect

Prevailing method, which is being used to treat solid waste, is inappropriate as solid waste is dumped in open trenches without covering by sand or mud. Thus sanitary landfill method of solid waste treatment is not used properly in city. This causes environmental pollution and makes nearby areas disease prone as well as it increases

the possibilities of contamination ground water. So this inappropriate method of solid waste treatment must be stopped and method of sanitary landfill should be adopted.

- Trucks or carts carry refuse from city to the disposal site.
- They are placed in trenches or low laying areas in layers.
- Each layer is placed maximum to depth of 1.5 meter.
- Each layer is covered by at least 20 cm of earth.
- Each layer shall be allowed sufficient time to settle before the next is added.
- While not filling depression, the tip shall be battered to an angle of above 45^0.
- The maximum height of tip shall be 6 meters above the surrounding land surface.
- For preventing nuisance from rodents, flies, vermins etc., the tip shall be sprayed with 50 percent solution of creosote or paraffin.

This is an economical method of refuse disposal, as it does not require large initial expenditures for implementations.

Total projected population in 2035 = 28 lakhs.
Total solid waste projected for 2035 = 14 lakhs kg per day.

8.3.2 Financial Aspects

In present situation Nagar Nigam bears the expenditure incurred on Safai Karamcharies and vehicles. Households indirectly pay for it in the form of house taxes. As levied tax on solid disposal remain unspecified in house taxes thus people generally have scant awareness that they paying tax for this services of Nagar Nigam. Many times this causes irresponsible behaviour of Safai Karamcharies as answerability towards

households remain absent due to lack of public awareness. So tax levied for solid waste disposal must be clearly specified in house tax so that people become aware of their civic rights of having the clean city.

8.4 Transportation

1. Many of the squares of the city needs improvement or redesigning. Few of the squares needs traffic signals. The following squares needs to be changed or redesigned:-

Tatibandh chowk, Picadilly square, Amapara chowk, Tatyapara chowk, Sharda chowk, Jaistamb chowk, VIP square, Pirda chowk, Shastri chowk, Ghadi chowk, Awanti square, Telibandha chowk, Fafadih chowk, Station chowk, Sanjay Gandhi chowk, Rathore chowk, Gurunanak chowk and Gol bazar chowk.

2. At present there is a bus terminal at Pandri. This bus terminal needs to be developed as an Interstate Bus terminal.

3. To improve the services of the Intercity buses, new Pick – up stands at different locations in the city needs to be developed. Few of the locations where pick-up stand needs to be executed are as follows:-

On GE road near Tatibandh transport nagar, On Mahadevghat road near Raipura, On Balodabazar road near Vidhan sabha, On GE road near Amanaka depot, On Bilaspur road near Akashwani station.

The following locations needs to develop their off-street parking:-

1. Gandhi maidan

2. Shahid Smarak area

3. Parking area of Shastri bazar

4. Area under District Panchayat and District Corporate Bank.

5. Are of Jawahar bazar

6. Are around Old bus stand

7. Area around Navin market

8. Sharda chowk (RDA building)

9. Area in front of Tehsil karyalaya

10. Area around Ambedkar chowk

11. Area around Veterinary hospital

12. Area around Jawahar garden

8.5 Housing

Total number of households at present = 205780
Total number of households at present in good condition = 144957 (71%)
Total number of households at present in livable condition = 53235 (26%)
Total number of households at present in dilapilated condition = 5588 (3%)

Total no. of Projected households by 2035 = 28,00,000/5 = 5,60,000.

Total no. of projected households in
livable and dilapilated conditions by 2035 = 1,62,400.

The proposed housing facility should be provided in three phase, i.e Phase-I, phase -II, and phase III. The works under three phases are proposed to be executed before 2021, 2028 and 2035. The total deficit will be 1,62,400 households by 2035. So it should be divided into three almost equal phases.

This households can be made under BSUP scheme.

8.6 Electricity

According to UDPFI guidelines 1 electric sub-station of 11KV is proposed for population of 15,000.

Now, total projected population by 2035 = 28,00,000.

Sub-stations of 11KV required by 2035 = 1867.

Total capacity of this sub-stations = 20537 KV.

Now to fulfill the future requirement of electricity Chhattisgarh electricity board has proposed few power sub-stations. The proposed power sub-stations are as follows:-

Table 24 Proposed sub-stations

Sr. no.	Capacity of Sub-station	No. of Sub-stations	Area required (ha)
1	45 MVA	9	10.90
2	60 MVA	12	14.60
3	70 MVA	14	17.00
4	175 MVA	45	4.50

Source: Chhattisgarh state electricity board.

This are in par to the requirements of the city for 2035.

8.7 Health

The city has many hospitals but it lacks in world class health technologies. Many patients are still referred to nearby cities like Nagpur, Kolkata etc. The hospitals needs to cope up with modern health technologies.

8.8 Education

The city has 28 government schools and 124 private schools, but these schools are concentrated in the city core area. New schools needs to be opened in the fringe areas.

Average literacy rate of the city is lower than average urban literacy rate. Emphasis should be given to educate the urban poor. The national scheme on compulsory free education to all needs to be reimplemented in the city.

The national Institutes and universities lack proper infrastructure facilities. This institutes needs to be reshifted away from the city with all new infrastructure facilities.

8.9 Banks

The city lacks co-operative banks. State government should take initiative to bring new co-operative banks on the fringe areas of the city.

All the commercial banks are concentrated in the city core area. New banks should be made to spread throught the city.

CHAPTER : 9 RECOMMENDATIONS

Although the infrastructure facilities in Raipur seem to be working at the hardest levels so as to maintain the better living condition in term of healthy, clean and aesthetic aspects still there is a deficiency in almost all the sector. The available infrastructure is not adequate to cater the permanent population in the most satisfactory manner. The revenue generated by the authorities is not adequate to keep the entire infrastructure facilities in perfect order as well as the govt. aid does a little bit to manage the expenditures.

The following are the steps suggested to maintain the proper functioning of the resources: -

9.1 Water supply

- Jal nigam and Nagar nigam must be side by side as one organization.
- Assessment of charges as per the property valuation should be fair on accurate. The authorities must enjoy some well-educated technical hand to attain fair valuation.
- Water supply shall be made available to every single house hold.
- Water supply lines should be inspected and maintained regularly so as to manage the line looser.
- Water treatment plant should be employed as on be ensure the safe drinking water to the inhabitants as the direct supply of water may contain certain impurities general due to percolation of water line.

- Illegal tapping of water lines shall be checked and the people found guilty shall be punished by law enforcing authorities.
- Public must be educated to use the water in the most efficient manners so as to avoid wastage of such a gift of nature.

9.2 Solid waste

- Collection methods should be improved upon by the use of mechanical devices such as tipper truck etc, to maintain regular cleaning of the refuse from the point of collection to the disposal chambers.
- Nagar nigam or other working authorities may figure out certain taxes to generate funds to maintain the necessary infrastructure. A very normal amount from every household may be charged on annual basis.
- The disposal of the sewage shall be inspected carefully as the uncontrolled dumping may prove to be hazardous for public health.
- The solid waste shall, as a rule, be divided into the bio degradable and non-bio degradable substances before finally disposing off.
- Law enforcing authorities shall be given certain set of controlled powers so as to ensure the act of prohibition polyphone bags in Raipur City.
- Public must be educated about the better ways to dispose off their refuse. viz. collecting the glass, polythene and other organic matter in separate containers and thus dispose off them separately.

- Household- maids/ servants should be trained/ forced to throw the refuse at proper places settled by the Nagar nigam so as to make the collection easy and effective.
- The number of public dust bins should be increased so as to maintain easy accessibility from the households/ business establishments.
- Treatment plants like incinerate for could be employed for treating the refuse before disposing it off finally if funds permit.

9.3 Sewerage

- The capacity of the sewage treatment plant needs an immediate enlargement so as to leave no amount of untreated sewage.
- All the authorities like Nagar nigam, RDA, Chhattisgarh Pollution Control Unit shall work side by side as one organization for the effective implementation of the policies and efficient use of the available resources.
- Sewer lines must be made available to all the inhabitants in every area of the city.
- Proper maintenance of the sewer lines has to be ensured as any fault may lead to serious results.
- Sewer connection shall be made compulsory to all the households in the areas where sewer lines exist.
- The authorities must collect the charges on very fair grounds and no scope for any mischief shall be left.

9.4 Education

- There is shortage of government schools in the fringe areas of the city. The government schools needs to be well spread in the whole city. Fringe areas need more schools.
- Overall Literacy rate is less than the national urban literacy rate. The quality of education needs to be improved in the government schools.
- There is shortage of Technical colleges in the city, more colleges needs to be set up.

9.5 Housing

- Housing to all by 2035 is must.
- All slums need to be rehabilitated.
- The housing scheme needs to be developed by public participation.
- Fix responsibility for any upcoming slum.
- Encourage industrial complexes to build accommodation for labour and temporary allotment.
- All the proposed residential areas need to be developed by Town Development Scheme.

9.6 Transportation

- Many of the squares of the city needs improvement or redesigning. Few of the squares needs traffic signals.
- At present there is a bus terminal at Pandri. This bus terminal needs to be developed as an Interstate Bus terminal.
- To improve the services of the Intercity buses, new Pick – up stands at different locations in the city needs to be developed.
- Junctions functioning with large rotaries/signals, these will require re-design based on the approach volume and turning movements they carry.
- For the signalised junctions, efforts needs be laid to co-ordinate few signals on some important corridors.
- There is a need to identify potential 'off-street' parking locations to be developed by private-public participation.

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