3.1 Urban Growth:

Urban growth can be defined as the spread of developments in the area surrounding the land and the process of increasing concentration of population within a town or city starting in a small way but spreading in different directions (Silva & Clarke, 2002; Paul & Dasgupta, 2013). The growth pattern varies from one urban place to another and it is necessary to study such phenomenon for an appropriate urban planning. It occurs due to the movement of people from rural areas to towns, smaller towns to bigger towns or cities, and peripheral villages to towns. Such a movement is generated due to the pull factors which attract immigrants towards urban centers and push factors which cause outmigration (Ahmad & Ali, 2006). Transformation of land caused by urban growth requires considerable attention and prioritization, especially in a developing country like India. It is responsible for the disorganized use of land resources and energy, and large-scale intrusion on the agricultural land. The rapid urban growth through economic development has been an issue of concern to the planners all over the world (Singh, 2012). It has changed the scenario also and the landscape has felt the consequence of land conversion. Various causes of urban growth, for example, population growth, economic development, migration and infrastructural innovations are leading to the transformation of villages into towns, towns into cities, and cities into metro cities (Singh & Siddiqui, 2008).

In the last decade, more attention has been paid to urban change as the impact of human behavior is affecting urban ecosystems (Deal & Schunk, 2004). Urbanisation can be defined as changes in the territorial and socio-economic progress of an area (Weber, 2001). Rapid urbanisation in the world is quite alarming, especially, in developing countries like India. It is a process through which the productive agricultural lands, forest, surface water bodies and ground water prospects are being irretrievably lost (Pathan, Jothimahi, Kumar & Pendhrkar, 1991). This is mainly due to uncontrolled population growth which is resulting in serious problem viz. scarcity of foods, unplanned settlement, environmental pollutions and unemployment (Maktav & Erber, 2005). The rate of population growth differs from
decade to decade due to many factors and this growth will have its impact on the spatial pattern of population distribution in the rural as well as urban settlements. This kind of hysterical, haphazard, low-density human settlement will lead to urban sprawl which is characterized by haphazard patchwork of development. The improper development in any city usually happens due to land conversion in which the growth rate of urbanized land significantly exceeds the rate of population growth over a specified period with a dominance of low density impervious surface (Bernes, Morgan & Roberge, 2000). Urban expansion is driven by population growth, and social and economic development (Shenghe & Sylvia, 2002; Sekar & Kanchanamala, 2011).

In countries like India, urbanisation is due to the increase in population, industrialization leading to increase in employment opportunities which demands for workmanship, due to which people from various locations --regional or global--are employed. Higher employment opportunities increase the demand for settlements and hence lead to urban growth. Growth normally takes place in radial direction around the city centre or in linear direction along the highways and ring roads. The built-up area is generally considered as the parameter to measure the urban growth (Vinay, Bharath & Ramachandra, 2012). In India, the percentage of people living in cities and urban areas has almost doubled to 27.8 per cent in 2001 from 14 per cent at the time of independence. This is expected to accelerate even further, and by 2021 over 40 per cent of people will be in urban areas (Census of India, 2001). To sustain this rapid urban growth, development should be planned in a sustainable manner to fulfill all the facilities like infrastructure, drainage, water supply, sanitation etc. (Barredo & Demicheli, 2003). Taking into account the future planning or urban development, the administrators and planners should have the knowledge of the present trend of urban growth. Therefore, to understand the urban growth, the city should be properly monitored from the past to the present through different time series data. It is primarily because the information on the existing land use/land cover plays a major role for urban planning and management (Zhang, Wang, Peng, Gang & Fang, 2002). Due to this process of urbanisation and industrialization, India is changing and the consequence of land conversion is being felt on the landscape. Analyzing the urban growth satellite data through remote sensing technology provides effective ways to
understand the current environmental status of an area and ongoing changes. Urban growth can be mapped, measured and modeled by using remote sensing data and GIS techniques along with several statistical measures. The application of new techniques has created opportunities to analyse urban growth process which has considerable significance to understand space organization, transformation of landscape and socio-economic structure of the area concerned (Paul & Dasgupta, 2013). The area of Sonipat city has increased due to the rapid pace of urbanisation; landscape of the city has also changed rapidly due to urban growth and the surrounding rural areas are getting converted into urban area during the last three decades.

3.2 Urbanisation in Sonipat District and Sonipat City:

In the last 40 years, a number of factors have led to increase in the population growth which led to growth in Sonipat city. The rapid urbanisation through industrial development is responsible for unsystematic and unplanned growth of cities and the pressure of urban population in the city has a direct (positive and negative) impact on its adjoining rural area. This type of urban growth creates unwelcome problems like unhealthy slums, infected environment, industrial and commercial areas resulting in traffic bottle-necks and many other problems.

The analysis of spatial and temporal changes in land use/land cover is one of the effectual ways to understand the current environmental status of an area and its ongoing changes. Urbanisation makes unpredictable and long lasting changes on the landscape (Singh & Kumar, 2012). In this regard, Sonipat city is no exception because of its prime location on N.H.1 and its easy accessibility and connectivity to both National Capital of New Delhi and Union Territory of Chandigarh. The new economic environment of the city demands sustainable land management and spatial information of land use and their change over the time are important for planning and management. The association between urban growth and land use changes and their impact on cityscape has been analyzed in the present study. Therefore, satellite data of different time periods is useful to city planners for monitoring urban growth and development of a sustainable land use plan for the future. The urban population in Sonipat district, during the decade (1901-1911), decreased by 2505 persons. In the next decade, the urban population increased by 636 persons from 17,552 to 18,088. The population rose enormously during the period of twenty years (1961-1981). The
general factors which influence the trends of population growth are: severe attack of malaria and plague during 1901-1911, mass migration of people in the wake of Partition during 1941-1951, and health measures adopted by the Government.

Table 3.1

Urban Population and its Growth Rate in Sonipat District and Sonipat City, 1901-2011

<table>
<thead>
<tr>
<th>Census Year</th>
<th>Sonipat District</th>
<th>Sonipat City</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Urban Population</td>
<td>Variation in Population</td>
</tr>
<tr>
<td>1901</td>
<td>19,957</td>
<td>-----</td>
</tr>
<tr>
<td>1911</td>
<td>17,452</td>
<td>-2,505</td>
</tr>
<tr>
<td>1921</td>
<td>18,088</td>
<td>636</td>
</tr>
<tr>
<td>1931</td>
<td>20,095</td>
<td>2,007</td>
</tr>
<tr>
<td>1941</td>
<td>24,599</td>
<td>4,504</td>
</tr>
<tr>
<td>1951</td>
<td>38,965</td>
<td>14,366</td>
</tr>
<tr>
<td>1961</td>
<td>56,958</td>
<td>17,993</td>
</tr>
<tr>
<td>1971</td>
<td>87,546</td>
<td>30,588</td>
</tr>
<tr>
<td>1981</td>
<td>1,52,046</td>
<td>64,500</td>
</tr>
<tr>
<td>1991</td>
<td>1,78,025</td>
<td>25,979</td>
</tr>
<tr>
<td>2001</td>
<td>3,21,375</td>
<td>1,43,350</td>
</tr>
<tr>
<td>2011</td>
<td>4,53,364</td>
<td>1,31,989</td>
</tr>
</tbody>
</table>

Sources: Census of India, District Gazetteer Sonipat 1990, Chandigarh, Haryana, Primary Census Abstract 1991, 2001 and 2011, Chandigarh, Haryana

Because of the proximity to Delhi the Sonipat district had a good scope for gainful employment, and attracted a large number of refugees. Besides, there was general trend of population rise in the country. During the decade (1901-1911), there was a great ravage of disease and drought which took a toll of the population by death. Consequently, the population of major towns (Sonipat and Gohana) decreased. There was nominal increase in population of both during two decades (1921-1941). During the post-independence period (1951-1981), there was a steep rise in the population and urban population got a boom, in district as well as in the city (Table 3.1). This may be attributed to the health measures adopted by the Government. Many people do not find such facilities in the villages. It has been observed that a large number of persons shift from surrounding villages to the towns for studies and livelihood.
3.3 Urban Growth and Spatial Extension 1968:

Till 1968, Sonipat city was the part of district of Rohtak. At that time, one National Highway-1 (Grand Truck Road) connecting New Delhi and Chandigarh passed nearby Sonipat. This city was also linked with roads to its neighboring towns such as Rohtak, Panipat, Jind, Bahadurgarh, and Gohana. On the other hand, the city was also connected with Delhi and Chandigarh by rail network. The total built up area in this period was 4.61 sq. km. Most of the part during this period was constructed without any proper plan whereas Model town on the city was planned. It is situated in southern side of the original part of the city.

The origin/core part of the city was unplanned. The streets were narrow and four-wheeler could not enter such streets. During that time, the city spread in the southern side, between its origin and Atlas factory. The city did not spread in the eastern side due to the barrier of drainage. The MC area in 1971 was 4.01 sq. km. (Fig. 3.1). The maximum built up area of the city was spread between MC boundaries in 1968 but some eastern part of the city was spread out of MC boundary. During the post-independence periods (1951-1971), the population increased to 32204 persons, whereas it was 30189 persons in 1951, but there was decline in population growth rate. This may be attributed to the health measures adopted by the Government. Due to health schemes, death rate was reduced in whole of the country. Before independence, the city had no large scale industry. The economy of the city was agricultural based. The industries were mainly confined to the cottage sector. The partition shattered the entire economic structure of the Punjab; the Sonipat area was a part of Rohtak District. After independence, by acquiring 148.5 acres of land Industrial Area was established in Sonipat city. Just after partition with a view to rehabilitation the displaced persons from Pakistan, the area at Sonipat had 123 plots which were sold on free hold basis and on easy terms. An ‘Industrial-cum-housing’ scheme at Sonipat was considered by the Government in 1961. Various factors such as the requirement of land for the new industries, housing facilities for workers, controlling industrial overcrowding and solving the problems of industrial development led to the origin of this scheme. For this purpose, Government acquired 500 acres of land at Bandepur on Rathdhana road.
A number of small scale industries connected with bicycles parts, assembling of bicycles, hand tools, barbed wire, sewing machine parts, bolts and nuts, steel re-rolling, glass and ceramics, rubber goods, food processing and cotton textiles. The proximity of Sonipat to Delhi which is a big market for consumer goods gives the city advantageous position and has greatly contributed to its industrial growth such as The Atlas Cycles Industries Limited (1952), The Milton cycle Industries Limited (1963), Macro Private Limited Industries (1956), The rubber reclam of India Ltd,(1968) etc. The educational institutes (Chhotu Ram Arya College (1951), Hindu College (1956) and Government Industrial School for Girls and Training Centre for Adult Blind) also attracted the people from peripheral parts of the city.

3.4 Urban Growth and Spatial Extension 1968 -1981:

The city growth has taken place on the edging parts, considerably, at the boundaries of the city and along the transport network. It is the most active region; here the land is always likely to change into built-up land. The unplanned growth of the city makes it difficult for the government to plan and there is pressure on basic services. In 1968, the total urban built-up area was 4.61 sq. km. and it increased to 7.80 sq. km during the thirteen years under reference. Most of the newly urban built-up area was constructed along the State Highway 11 (also known as Gohana Road) and the road going towards Bhalgarh which is situated in the south eastern part of the city (Fig. 3.2). After that, most of the built up area was constructed in the surrounding parts of Atlas factory along with Jagdishpur road in the southern direction. In this period, the minimum growth in urban area has been observed in the south western and north eastern direction. Some newly built up areas came up along the periphery of city in eastern direction, between Model Town and Sector 14. According to Census, 1981, the slum areas in Sonipat city were like Bhim Nagar, Mahavir Colony, Dev Nagar, Gadhi Gashita, Ram Nagar, Sham Nagar and Subhash Nagar.
Figure 3.1 Urban Growth and Spatial Extension 1968

Source: Toposheet 1968, Survey of India, Dehradun
The slum population to total population of Sonipat city was 8.87 per cent and the area was near about 0.58 sq. km whereas the density of slum population was 16791 persons per sq. km. After the formation of Haryana, during the period of 1968-1981, the city made rapid progress in the field of industrial, educational, and infrastructural development. The Atlas Auto Industries, Rasoi (1976), M/S Sooraj Steel Industries (1973), The Haryana Steel and Alloys Ltd. (1971-1972), M/s ECE lamp division (1973) and The Sonipat Co-operative Sugar Mills (1977) provided the employment and became a magnet for migration from adjoining villages to the city.

3.5 Urban Growth and Spatial Extension 1981-1991:

In 1981, the total urban built-up area was 7.80 sq. km and it increased to 10.36 sq. km in 1991. Most of the newly constructed area came up in the north-eastern direction of the city in the form of Mini Secretariat and District Sudhar Ghar. This sprawl has taken place on both sides of Gohana Road and between Gohana and Bhatgaon roads (Fig 3.3).

After that, the second major built-up area came up in the south-eastern direction of the city due to migration from adjoining villages of city for working in factories as a source of employment and settled in this part of the city. Another newly built-up area came up along the State Highway 20 and the road going towards Murthal which is found in the eastern part of the city. This growth has taken place along the roads as well as along the periphery of continuous built-up area. Between 1981 to 1991, it was noticed that the low density urban area was also changing into higher density in for the most part the core area/old city centre. Urban built-up area had shifted from the inner core/older part of the city to the peripheral part over the agricultural land. During these ten years, the minimum growth in urban built-up area has been observed in the north and south-western direction.

3.6 Urban Growth and Spatial Extension 1991-2002:

In 1991, the total urban built-up area was 10.36 sq. km, whereas it increased to 17.13 sq. km in 2002, which reveals that it has nearly doubled during this period and also that the direction of urban growth has also changed. The growth of urban built-up area has come up along the Murthal road located in the north-eastern direction and along the State Highway 20 and north, north-western and western part of the Sonipat city. The planned (Sector 14, Sector 15 and Sector 23) as well as unplanned (Malviya
Nagar, Vikas Nagar, Maya Puri, Indra Colony, Kirti Nagar, Bhagat Singh Colony, Govind Nagar, Patel Nagar, Rajiv Nagar, Shiv Colony and Manchand Colony) residential construction have also taken place. In this ten year span, the growth of the city has been noticed due to the development of Sectors by HUDA in the north-eastern and south-western direction along the Murthal road and Bhatgaon road. Sector 14 and 15 were developed in the north eastern direction, whereas Sector 23 was developed in the south west direction between Bhatgaon and Rohtak roads (Fig.3.4).

The other major built-up areas came up in the western, northern, north-southern and south-western direction of the city. In the western direction, the growth of the city extended due to the construction of Shashtri colony, Lakshmi Colony, Indian Colony and Mayur Vihar between the Sugar Mill and Gohana Road. Sarswati Vihar was also constructed between Gohana Road and Bhatgaon Road. In the northern part of the city, a newly constructed area has been noticed surrounding the Sugar Mill within road network.

3.7 Urban Growth and Spatial Extension 2002-2011:

In 2002, the total urban built-up area was 17.13 sq. kms which increased to 25.50 sq. kms in 2011. During this period, the spatial extension has been noticed all around the city along the edges of the continuous built-up area and along the major roads. But most of the newly built-up area has been reported in the south-eastern part and south western part of the city (Fig. 3.5). Due to urban development, the agricultural land of adjoining villages has reduced and has a direct impact on food production. Because of the sprawl and extension of city limits by Government of Haryana from time to time, a number of nearby villages have become a part of the city. However, there are some villages whose agricultural land is partly acquired by the government and private builders (Fig. 3.6).

3.8 Sonipat City: Extension of Spatial Limit 1971-2011:

Table 3.2 and Fig. 3.7 show the extension of spatial limit observed during the period of 40 years, i.e. from 1971 to 2011. The population growth is a main factor for the extension of spatial limit in Sonipat city because administration of the city has extended the city boundary to manage the population pressure.
Figure 3.2 Urban Growth and Spatial Extension 1968-1981

Figure 3.3 Urban Growth and Spatial Extension 1981-1991

Figure 3.4 Urban Growth and Spatial Extension 1991-2002

There is significant positive relationship between population growth and areal extension. There is increase of 81529 persons in the population from 1971 to 1991, whereas the area has increased to 10.59 sq. kms during the same period. There was increase of 7.92 sq. kms from 1991 to 2001, whereas the increase of population was 81152 persons.

**Table 3.2**

**Extensions of Spatial Limit and Population Density**

<table>
<thead>
<tr>
<th>Year</th>
<th>MC Area (sq. km)</th>
<th>Growth Rate of M.C. Area (Per cent)</th>
<th>Population</th>
<th>Growth Rate (Per cent)</th>
<th>Density Per sq. k.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1971</td>
<td>4.01</td>
<td>-----</td>
<td>62,393</td>
<td>-----</td>
<td>15,559</td>
</tr>
<tr>
<td>1981</td>
<td>6.02</td>
<td>50.12</td>
<td>1,09,369</td>
<td>75.29</td>
<td>18,168</td>
</tr>
<tr>
<td>1991</td>
<td>14.6</td>
<td>142.52</td>
<td>1,43,922</td>
<td>31.59</td>
<td>9,858</td>
</tr>
<tr>
<td>2001</td>
<td>22.52</td>
<td>54.25</td>
<td>2,25,074</td>
<td>56.39</td>
<td>9,994</td>
</tr>
<tr>
<td>2011</td>
<td>32.04</td>
<td>42.27</td>
<td>2,78,149</td>
<td>23.58</td>
<td>8,681</td>
</tr>
</tbody>
</table>


In 2001, the population was recorded 225074 persons which increased to 278149 in 2011. There was a significant increase of 9.52 sq. km in area within MC boundary during 2001 to 2011 (Table 3.2 and Fig. 3.7), whereas the growth of population was 53075 persons during the same time. It has also been observed that the density of population (1971 -2011) has decreased because of outward expansion of Municipal Limit.

**3.9 Population Growth and Spatial Extension:**

Table 3.3 shows the population growth and spatial extension in terms of built up area of the city. It has been seen that in 1968 the built up area of the city was 4.61 sq. km which has increased to 7.8 sq. km in 1981, whereas there was increase of 50279 persons in total population from 1968 to 1981.
Figure 3.5 Urban Growths and Spatial Extension 2002-2011

Figure 3.6 Location of Villages in Periphery of Sonipat city

Sources: Based on Toposheet 1968 and 2005-2006, Survey of India, Dehradun
Figure 3.7 Sonipat City: Extension of Spatial Limit 1971-2011

Source: Municipal Council, Office, Sonipat city
Table 3.3
Population Growths and Spatial Extension

<table>
<thead>
<tr>
<th>Year</th>
<th>Population</th>
<th>Per cent Growth Rate</th>
<th>Year</th>
<th>Built up Area (in sq.k.m.)</th>
<th>Per cent Growth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1968</td>
<td>59,090*</td>
<td>---------------------</td>
<td>1968</td>
<td>4.61</td>
<td>---------------------</td>
</tr>
<tr>
<td>1981</td>
<td>1,09,369</td>
<td>75.29</td>
<td>1981</td>
<td>7.8</td>
<td>69.2</td>
</tr>
<tr>
<td>1991</td>
<td>1,43,922</td>
<td>31.59</td>
<td>1991</td>
<td>10.36</td>
<td>32.82</td>
</tr>
<tr>
<td>2002</td>
<td>2,35,689*</td>
<td>56.39</td>
<td>2002</td>
<td>17.13</td>
<td>65.35</td>
</tr>
<tr>
<td>2011</td>
<td>2,78,149</td>
<td>23.58</td>
<td>2011</td>
<td>25.5</td>
<td>48.86</td>
</tr>
</tbody>
</table>


Note: *Projected Population.

There was a remarkable increase in population as well as built up area of the city during the period of 1991 to 2002. During this time, the population reached to 235689 persons in 2002 from 143922 in 1991, while the built up area has increased to 17.13 sq. km in 2002 from 10.36 sq. km in 1991. From 2002 to 2011, there was an addition of 42460 persons in population while this increase was 8.27 sq. km in built up area (Table 3.3).

3.10 Urban Growth and Land Use Models:

Urban growth identifies the nature and functional composition of a city passing through different factors, processes and stages. These factors make the solo identity of the city at spatio-temporal and regional level. The urban growth models represent the real expansion of the cities on the bases of some assumptions. So it is not essential that the pattern of world urban growth is similar to the predicted models because the forces, processes and stages of expansion vary according to different spatio-temporal and regional perspective and are of a great importance to understand the urban growth and land use pattern of the city. A number of classification schemes have been evolved by many scholars time to time. Many scholars like Burgess, Hoyt, Ullman, Hurd, and Colby have presented urban growth and land use model to express city structure and to generalize the arrangement of land use regions within a city. These models have been affected by physical, economic, political and cultural factors of the urban area in shaping the form and structure of cities over decades. These
variables are interlinked with the process of feedback mechanism in the repetitive land use patterns in all urban centers. Three well known models are as follows:

3.11 **Concentric Zone Theory:**

A hypothetical model of urban growth and land use was developed by E.W. Burgess, a Sociologist, in 1923. This model suggests that any urban area tends to expand radically from its central commercial core to outer periphery, so as to form a series of concentric circular zones which are as follows:

3.11.1 **The Central Business District:**

It has been considered as the focus of commercial, social, civic life and transportation. This is the commercial hub with its down town retail districts, stores, shops, office building, clubs, banks, hotels, theatres, museums and other organizational headquarters. This zone of retail business is encircled by wholesale business.

3.11.2 **The Zone of Transition:**

It is known as the areas of residential deterioration where business and light manufacturing encroach upon residential areas. Here slum areas prevail with their scattered pockets of poverty, degradation, diseases and underworlds of vice. In American as well as Indian cities, it has been observed that immigrants inhabited these regions because of lower house rent and easy access to the business centre.

3.11.3 **The Zone of Workingmen’s Homes:**

In this zone mainly industrial worker live in American cities, who desire to live within easy access of their work.

3.11.4 **The Zone of Better Residence:**

This is known as restricted areas of high class building, where mainly single families reside.

3.11.5 **The Commuters Zone:**

In areas of rural-urban fringe, the spotty development of high class residences along transport routes is known as commuter’s zone. In accordance with E.W. Burgess, urban growth is a process of extension and reconversion of land uses, with a tendency of each inner zone to expand in the outer zone. Although the Burgess model is simple and elegant, it has drawn numerous criticisms:
The model is partially designed for the chronological and cultural application up to the 1950s and that was formation time.

The model was developed for rapidly rising American cities in demographic sense, and due to lack of motorized vehicles, people like to use public transportation. So, it has poor practicability in contemporary (from the second half to the 20th century) context where highways have facilitated urban development to escape the reconversion practice and to take place directly in the suburbs.

Though there are a lot of spatial dissimilarity in terms of ethnic, social and professional status, yet it has low incidences of the functional differences in land use patterns. The concentric model assumes a spatial separation of place of work and place of residence, which is not generalized in present.
However, though the Burgess model has been criticized on different perspectives, yet it remains useful as a concept explaining concentric urban development, as a way to introduce the complexity of urban land use and urban growth in American cities in the early-mid 20th century.

3.12 **Sector Theory:**

This model of sector or wedge is called the Hurd-Hoyt hypothesis after R.M. Hurd and Homer Hoyt in 1939. The model explains that zones expand outward from the city center along railways, highways, and other transportation arteries.

![Sector Theory (Homer Hoyt, 1939)](image)

**Figure 3.9** Sector Theory (Homer Hoyt, 1939)

**Source:** (Kauls, 2013)

Chicago city as an example, an upper class residential sector evolved outward along the desirable Lake Michigan shoreline north of the central business district, while industry extended southward in sectors that followed railways and road network. Hoyt on the bases of study of 142 American cities developed a “sector theory” of residential locality according to which the various economic status of the
cities of America shown a kinship to locate in certain areas, which is called sectors of a circle attracted towards the central business district. Thus economic factor has been found more responsible for the development of the residential pattern of American cities.

It is an improvement over concentric zone theory because of consideration of both distance and direction from the city core. In this hypothesis, land use and population patterns are likely to develop in the identical way, outward from the centre of the sectors, and growing in a circular zonal form.

### 3.13 Multiple Nuclei Theory:

This theory was propounded by Mckenzie in 1933 and was developed by two geographers, Harris and Ullman in 1945, who considered that land use pattern of a city has essentially cellular structure and develop around several discrete nuclei in spite of around a single centre.

![Multiple Nuclei Theory](image)

**Figure 3.10** Multiple Nuclei Theory (Harris and Ullman, 1945)

**Source:** (Kauls, 2013)
Harris and Ullman made the argument that the importance of city's central business district declines in relation to the rest of the city and should be seen less as the focal point. The automobile revolution has reduced the distance to the suburbs. The multiple-nuclei model is a good fit for sprawling and expansive cities as the concept helps in elaboration of the structure of Indian cities which habitually restrain an old and new colony and is marked by well-defined periods of growth.

Both Sector and Multi Nuclei theory are alteration of the Concentric Zone theory. In Hoyt concept, residential area expands outwards concentrically and Harris and Ullman’s theory is basically the same as that of Burgess, so far as a nucleus is concerned.

3.14 Pattern of Development in Sonipat City:

According to Hindu literature, Sonipat was established during Mahabharata by Pandavas and some evidences define its existence around 600 B.C. also. Some description about Sonipat city is found in Harshavardhan period, Paniniya’s Ashtadhyayi as well as earlier in Gazetter of Delhi where it was assigned different names. During British period, Sonipat was handed over to East India Company under the treaty of Surji Arjungaon in 1803. After this the British rulers developed the infrastructure of the city by starting the Delhi-Ambala-Kalka railway line via Sonipat on 14th October, 1870, which almost follows the N.H. 1 and during that time the city was expanded towards the east of railway line which helped in the growth of this area. In its initial stage, the city was characterized by narrow streets and dominance of Muslim worker’s population but at present the same area is under low residential land use category having high population density. The real expansion of the city started after independence due to growth of population and partition. During Indo-Pak division, a number of plots were allotted in Sonipat also to settle the affected Hindu population coming from Pakistan. This process of reconciling made an abrupt transformation in land use pattern of the city. The change in educational scene of the city started with the establishment of many institutes such as Chhotu Ram Arya College (1951), Hindu College (1956) and Industrial Training Institute and Vocational Education Institute (ITI) (1988-89) and schools at local level in different phase of time. Yet some industries like M/S B.K. Iron and Steel Private Limited, (1932) for the production of alloy iron and casting was working in the city before
independence though the real growth has taken place after sovereignty with the establishment of ‘industrial estate’. This provided a wide scope to extend the urban growth and after that many industries were set up by different organization, such as Atlas Cycle Industries Limited, (1952), Maco Private Limited Industries, (1956) for creation of piston, gudgeon pins and other kind of pins, Milton Cycle Industries (1962) for manufacturing of bicycle which is working as an ancillary to the Atlas Cycle Industries, Haryana Steel and Alloys Limited, (1971-72) for production of steel ingots, Sooraj Steel Industries, (1973) for iron and steel casting, M/S ECE Lamp Division, (1973) for transformers and lamp making, Atlas Auto Industries (1976) for construction of mopeds, Sonipat Co-operative Suger Mills (1977).

The large and small scale industries in country as well as the Sonipat achieved a big jump after the new economic reforms (1991) of Government of India related to liberalization, privatization and globalization schemes, launching of FDI, and contribution of Haryana Urban Development Authority (HUDA) in context to well-organized growth of industrial, commercial, and residential sectors. The nearness to national capital, New Delhi, also played a significant role in urban expansion because the city has emerged as an easy alternative for the people who cannot afford high land cost. Second, to avoid the overcrowding in Delhi, commuters prefer to settle in Sonipat due to well connectivity, availability and accessibility of transportation. This attraction of people from peripheral area of the city as well as natural growth later leads to urban growth and change in land use pattern.

3.15 Land Use Pattern of Sonipat City:

3.15.1 Central Business District:

This area is situated in the oldest part of the city around Geeta Bhawan Chowk and between Delhi-Ambala Railway Line and Sikka Colony. The main market of CBD is known as Kutche Quarter. The area provides the service to its surrounding areas as Model Town in South, Brahm Colony and 8 Marla in south-east, New Housing Board Colony in North-east and New Mahavir Colony and Balmiki Basti in North-west direction. The location of bus stand in North and the Railway Station in the west provides easy accessibility to goods and services to the residents.
3.15.2 Wholesale and Small/Large Scale Industries (Transition Zone):

The surrounding area of CBD is used for residential as well as commercial purpose. Due to short distance from road networks in this area the buildings are designed as shop-cum-house pattern and wholesaling and marketing activities exist there. The main extension of the industry is in south and south-east of core area that is known as ‘industrial estate’ and in north there is sugar mill. Nearly the whole industrialized part is attached with low and middle class residential category of land use.

3.15.3 Low Class Residential Area (Zone of Labour workers):

The oldest part located far in north of CBD is characterised with high density of population, open drainage system, and narrow streets (having vertically extended houses) due to uneven relief structure. Ward nos. 3, 4, 5, 7 and 8 are areas where generally labour classes live.

The Balmiki Basti, Ram Gali, Bhim Nagar, Malviya Nagar, Eidgah Colony, Jatwara mohalla, Pargati Nagar, Mohalla Kalan are main residential areas where dominance of scheduled caste and Muslim population is found.

3.15.4 Low and Middle Class Residential Area:

The low and middle class residential area is located along the periphery of the city and both sides of Gohana Road in west, Mehlana Road in south-west, Narela Road in south and Bhalgarh Road in south-east. The main colonies of this category are Indian Colony, Om Nagar, Shastri Colony, Mayur Vihar, Lakshami Nagar, Roop Nagar, Gandhi Nagar, Ram Nagar, Dahiya Nagar, Jawahar Nagar, Harinder Nagar, Narrinder Nagar, Patel Nagar, Govind Nagar, Rajiv Nagar and Defence Colony.

3.15.5 Middle Class Residential Area:

This type of area is spread mainly in the west and south-east of CBD. In this class the Prabhu Nagar, Gopal Nagar, Dev Nagar, Maya Puri, Brahm Nagar, and Vishal Nagar are located between Kakroi and Rohtak Road, whereas the areas between Kakroi and Mahalana Road are Vikash Nagar, Shayam Nagar and Batra Colony. In north-west of core area, between Mehlana and Purkhash Road along with low class residential area, the main localities are Police Line Colony, Chhotu Ram Colony, Ashok Vihar, Bagha Colony and Gian Nagar whereas in south, Mohan pura, Nandwah Nagar, Sikka Nagar, Baram Nagar, Musad Mohalla, Bhagat Pura, Tara
Nagar, Basant Vihar, Punchan Nagar, Diwan Nagar are attached with high class area.
Chawala Colony, Shiv Colony, Housing Board Colony, Jeevan Vihar, Manchanda Colony are situated between Ganda Nala and Murthal Road.

![Figure 3.11](image)

**Figure 3.11** Land Use Pattern 2011 (Case of Sonipat city)

**Source:** GeoEye Image, 2011

### 3.15.6 High and Middle Class Residential Area:

High and middle class residential areas are situated just east of CBD between the sector area of 14-15 including Khanna Colony, Nandhi Nagari, Eight Marla Colony, Hem Nagar and Delhi Camp.

### 3.15.7 High Class Residential Area:

This is a well-planned sector area developed by HUDA and private builders namely Model Town in South of CBD, Sector 14 and 15, Parasvnath and TDI builders in east and Sector 23 in west between Mehlana and Kakroi Road.
3.16 Application of Urban Growth and Land Use Model in Context of Sonipat:

The development of Sonipat as an urban centre in Sonipat district of Haryana is due to the connection of Delhi-Chandigarh railway lines, National Highway-I, State Highway 11 (also known as Gohana Road) State Highway 20 and development of educational institutes and a number of industries such as bicycles parts manufacturing, assembling of bicycles, hand tools, barbed wire, sewing machine parts, bolts and nuts, steel re-rolling, glass and ceramics, rubber goods, Sugar mill, food processing and cotton textiles. In comparison with this, the land use in peripheral rural segment is mainly devoted to agriculture and residential sites. The categories of land use of city are central business district, whole sale and small/large industries, low class residential, middle class residential and high class residential. So far as the development of urban land use is concerned, there are only one location i.e. Kutche Quarter as the form of C.B.D. the evaluation of different land use models reflects that at present except sector model to some extent, no any model is applicable in context to Sonipat city.

Regarding the research question of association of urban expansion and population growth, there is no doubt that the population growth main phenomena which force the urban area to cross its limits. This study reveals that population growth of the city has remained positive with highly fluctuation except in 1911 and 1931. In 1981, the momentous growth rate (75.29 per cent) of the population was recorded whereas the expansion rate of built up area was noticed 69.20 per cent in the same time period. On one hand the populace increased more than double from 1981 (109369 persons) to 2011 (278149 persons) of the city and on another hand to meet the demand of this addition of people, the built up area of the city increased more than three times (7.8 sq. meters in 1981 to 25.5 sq. meters in 2011) in the equal point of time (Table 3.3 and 4.1).