CHAPTER 5
MORPHOLOGICAL PATTERNS

The word morphology is derived from the Greek word 'morphē' which translates as 'form' or 'shape'. In geography, morphology is defined as 'the science of form and structure and developments which influence the form' (1). The terms 'townscape' and 'urban landscape' have often been used as synonyms of morphology (2). These terms denote the 'physical form and arrangement of spaces and buildings in an urban area' (3).

The importance of the study of urban morphology lies not only in the fact of its being there, but also in its significance in interpreting the nature of an urban society in a specific habitat. The morphology of an urban place, in addition to being a physical construct, is also a record of the pattern of aspirations and decision-making of successive generations of residents. Further, the human group, occupying the city at any specific time, inherits a system which it refines according to its needs. This refinement is usually within the constraints of long-established social mores. This blend of bequeathed values and habitual behaviour on the one hand, and modifications necessitated by changed circumstances on the other, contribute to the particular identity of a city. This personality of the city is most effectively transmitted in the symbolism of the built environment, buildings, their styles, material and spatial arrangement and open spaces (4).

The internal arrangement and diversity of an urban area can be studied within the broad framework of the following components:

(a) the ground plan or layout,
(b) the landuse pattern, and
(c) the architectural style or building pattern (5)

These components do not exist in isolation, but are interdependent, each conditioning the others in terms of origin, structure and functional significance at any given time period (6). The ground plan is defined as 'the topographical arrangement of an urban built-up area in all its manmade features' (7). Its sub-attributes include streets, street patterns, plots and their aggregation into individual buildings and building blocks. The ground plan is, thus, the most encompassing of the three elements and brings the
entire plan into close relation with the landuse pattern and the building fabric. Landuse is the most ephemeral of the three components. It owes its character to immediate needs, and hence, breaks down along functional lines alone (8). The landuse pattern of an urban area is the product of varying needs of the urban society for specialized use of space in different proportions and locations. The building fabric or architectural style reflects the original purpose and period of construction. Its sub-components can be analysed on the basis of functional types and architectural style (9). Identification and comprehension of the entire plan structure in terms of these three components forms the core of townscape analysis.

It needs to be reiterated here that the study of urban landscapes is not a static inventory of its various observable components. The townscape is a thriving social, cultural and economic entity, which originates, develops and functions within a physical and human context (10). This brings into focus the influence of varying economic climates, social values and technological changes, forces which affect and characterize the urban landscape. In reality, therefore, the built environment is the spatial expression of time-specific socio-economic and cultural environments (11).


The traditional approach to the study of townscape has been morphogenetic in nature. This involves a description of the evolution, growth and development of the existing townscape. This could be through historical periods, as is the case with most
Indian studies, or through the identification of various growth phases, as is generally the case with studies by western scholars (14).

It must be pointed out here that while planned cities have been consciously conceived and founded as towns, the evolved cities generally do not have the element of conscious planning. This latter group of towns, often referred to as ‘spontaneous’ or ‘organic’ towns, evolve in response to specific needs at different points in time. Their layout is generally the product of the process of accretion of urban structures and functions around some pre-urban or other nucleus (15). The townscape of evolved towns can, therefore, be studied within the framework of the morphogenetic approach. This approach would also be suitable for most of the traditional Indian cities, which are almost always the product of centuries of urban growth.

In comparison to the evolved towns, the planned towns lack the element of historicity and the consequent organic growth. This pre-empts the application of the morphogenetic approach. For such towns, therefore, an approach focused mainly on a functional assessment of the spatial structure of the plan framework, in terms of the plan provisions established and the demand generated, would be much more appropriate. However, as with evolved towns, the morphology of planned cities should not be viewed as static merely because it has emerged within an established framework. In fact, changing regional conditions, addition of functions and the nature of actual growth of population vis a vis the planned growth are expected to have distinct spatial expressions and requirements, necessitating a dynamic interpretation of the landscape.

In the light of the perspectives detailed above, the main thrust in this chapter is on (a) the planning provisions for various morphological attributes in Chandigarh, and (b) an understanding of the impact of the dynamics of socio-economic growth of the city on the planned physical framework. It is suggested that such a study would help in a better understanding of such issues as management of planned towns, the flexibility of the plan framework in adapting to changing circumstances, conditions and requirements, and the suitability of Occidental planning concepts in an Oriental sitting.

**Methodology and Sources of Data**

The details of the plan provisions in Chandigarh have already been elucidated in Chapter 2 and have been only briefly re-emphasised here. The Chandigarh plan is
CHANDIGARH CITY
Landuse

Residential
Educational
Administrative
Public/Semi-public
Retail
Wholesale
Industrial
Open spaces
Choe/Water body/Stream

Fig. 53
essentially based on the principle of zoning, that is, the allocation of land for various
landuses and functions of individual buildings. These functions and landuses can be
broadly grouped into two categories, Residential and Non-Residential. The former
relates to the location, nature, quality and quantity of housing in Chandigarh. The latter
includes the use of land for Circulation, Commercial (wholesale and retail), Institutional
(utilities, services, facilities), Recreation (open spaces and cultural places), Industrial and
land reserved for future use. Thus, although the discussion in this chapter is broadly
based on these two groups of landuse, the details of the elements of morphology –
buildings, streets, architectural style – are described within the purview of these landuse
groups itself.

The data used in the discussion have been taken from publications by different
agencies and institutions such as the Chandigarh Administration, Census of India,
Chandigarh College of Architecture etc. Reference to these and other sources has been
made at appropriate places. The primary sources comprised of frequent traverses through
the study area, and informal interviews with a cross-section of residents and officials
connected with the process of planning of the city.

GENERALITIES

Zoning is a contemporary technique of urban planning for the legal regulation
of the use of land (16). It specifies the division of urban land into various functional
zones. Thus, each zone in an urban area represents a functional system dominated by one
function.

The spatial form of Chandigarh is based on a unifunctional separation of
landuses. Corbusier proposed to counteract the bane of modern life, namely the
confusion of its functions, by developing the town as a living organism, with its various
limbs interconnected to each other and yet performing their distinctive functions (17).
At the town level, zoning in Chandigarh related firstly to the determination of location of
various functions. For example, the Capitol Complex in the north, the Industrial Area
towards the east, the Educational Zone in the west and the Civic Centre in the centre of
the city (Fig.53). The objective was to provide the ‘best possible man-made environment
in which to work, reside and relax’ (18). With the development of the city, these zones
were expected to act as morphological and social nuclei (Fig.2d). The locational
separation of different city-level functions in Chandigarh is in contrast to the pattern in the traditional Indian towns, in which a mixing of functions is a characteristic feature. It has been suggested that this latter pattern offers such advantages as reduction in distances and travel time, an intensive use of land, stabilization of land values and economy of expenditure in the provision of utilities and services (19). It has, therefore, been felt that functional segregation of landuse is unsuitable for traditional societies, where there has not been a change in the production process and the socio-economic structure (20).

The basic residential unit in the Chandigarh plan is the Sector, a self-contained inward looking neighbourhood. The homogeneity within the Sector and in its subdivisions, A, B, C and D, was proposed to be provided by a general similarity of income levels of the resident population. This contrasts with the traditional Indian neighbourhood concept of Mohalla, the basis of which was caste, occupation, language or religion (21). Further, excluding the Industrial Area and certain institutions such as the Panjab University and PGI, the location of Sectors in the city plan seems to ignore the concept of economy of travel. For example, it has been pointed out that the residential areas of lower ranked government employees are so located that they have to cross much of the city to reach the Capitol Complex, in comparison to car-owning senior officers who have been provided residences in Sectors adjacent to the Capitol Complex (22). This is contrary to the general attribute of proximity of residences to work areas in evolved towns (23).

The plan of Chandigarh specified the target population and population densities of various Sectors. The three levels of density, 75, 50 and 25 persons per acre, adopted in the plan were based on the broad income groups of population in various Sectors, and thus, divided the city into high, middle and low income group areas. Similarly, the target population of different Sectors, as fixed in the plan proposals, varied between 600 persons in the low density high income group northern Sectors and 20,000 or more persons in the middle and lower income group Sectors.

Regulations regarding plot size, height and architectural style of the buildings were also formulated with the objective of regulating the intensity of construction and controlling vertical expansion, the two basic elements contributing to overcrowding in residential areas. At the individual building level, the use of a plot for which it was sold
as specified in the zoning plans, could not be changed (24). By adopting this measure, the planners hoped to prevent mixing of landuses as well as the illegal use of land. Further, the extent of living space for each category of residential units was also specified. The objectives of this proposal were two fold, to provide open space at the individual building level, and to induce control over the intensity of construction and, thus, on the density of population.

I. RESIDENTIAL LANDUSE

The use of land for residential purposes is the single largest user of built-up urban space. Its basic component, housing, is both simple and complex in nature. It is simple because of its easy visibility, its importance as the central element of daily living, and as one of the primary requirements of humanity. At the same time, it derives its complexity from its intimate relationship with the socio-economic and political environment. The awareness of and societal action on urban housing problems, which began during the social reform movements of the late nineteenth century, articulated a sense of responsibility on society to intervene for an improvement in living conditions, and resulted in the establishment of explicit minimum standards of living (25).

Residential landuse in traditional Indian cities comprises approximately 48 to 53 per cent of the total built-up area, and represents highly complex spatial patterns produced by interaction between historical, social, cultural, political and economic factors (26). Only planned towns such as Chandigarh provide an opportunity for completely planning housing for various sections of society. In other towns, such attempts are restricted mainly to areas planned in the Post-Independence period and various housing schemes undertaken by state Housing Boards, Urban Development Authorities and private developers.

Housing provisions in Chandigarh

Since the Capital Project office in Chandigarh itself undertook the role of the developer, housing provisions received detailed attention. ‘Living’ as an urban function was allocated 28.09 per cent of the total area in the city. The salient features of housing provisions in Chandigarh are as follows:

i) Specification of Minimum Standards: The minimum accommodation to be provided in Chandigarh was specified as two rooms, with a kitchen, bathroom and open yard with
water, sewerage and electricity connections at the individual building level. By making this minimum standard mandatory, it was assumed that conditions of overcrowding, prevalent in most parts of urban India, would not occur in Chandigarh (27).

ii) Government Housing: The city plan proposed fourteen categories of government housing, based on salary scales (Table 3). It was perhaps for the first time in the history of town planning in India that those employed in such lowly occupations as sweepers and peons received a consideration in the government’s housing programme (28). However, the difference in the size of plots was enormous, the smallest plot was 2.5 marlas (37.5 sq. yards) and the largest 10 kanals (5000 sq. yards) or 80 times larger (29). Later, these fourteen categories for government employees were reduced to five (Table 25).

TABLE 25: CHANDIGARH CITY: REVISED CATEGORIES OF GOVERNMENT HOUSING

<table>
<thead>
<tr>
<th>Types</th>
<th>Area (in sq.m)</th>
<th>Pay Range (Jan.1, 1986 onwards)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>34</td>
<td>Upto Rs.949/-</td>
</tr>
<tr>
<td>II</td>
<td>45</td>
<td>Rs.950-1499</td>
</tr>
<tr>
<td>III</td>
<td>55.75</td>
<td>Rs.1500-2039</td>
</tr>
<tr>
<td>IV</td>
<td>83.60</td>
<td>Rs.2040-2659</td>
</tr>
<tr>
<td>V</td>
<td>158.10</td>
<td>Rs.2660-3199</td>
</tr>
</tbody>
</table>


iii) Private Housing: The role of private housing was to be regulated through a system of controls laid down in the Capital of Punjab (Development and Regulation) Act and Building Rules, 1952. These rules governed the maximum permissible height (2½ storeys), building lines, built-up area, open spaces etc. for individual houses. The provision of services on the second floor was prohibited to discourage excessive subletting (30). The practice of auction of plots for private construction began in 1960. The sale of plots on the leasehold basis was introduced in 1972. At present, regulations have been introduced to facilitate and permit conversion of plots from leasehold to a freehold basis (31).
The plan provisions envisaged that ultimately 70 per cent of all housing in Chandigarh would be in the private sector. In 1964, the allocation of residential plots was 50.4 per cent for private, 44.5 per cent for public and 5.1 per cent for institutional and industrial use (32). In 1991, four decades after the city’s inception, private and CHB constructed flats formed 52.40 per cent of the total residential plots, and public and institutional housing comprised 47.6 per cent (33).

iv) Institutional Housing: Provision of land was made to such institutions as the Panjab University, PGI, CSIO, IMTECH, banks and government departments as the PWD and P & T for providing housing to their employees. In this case also, the housing is scaled according to the rank and salary of the employee.

v) Intermixing of Housing Categories: The planning for housing in Chandigarh provided for some amount of mixing of different categories of public and private houses within a Sector. The objective was to ensure that the city would not get divided into watertight compartments of various classes of society (34).

vi) Chandigarh Housing Board (CHB): An autonomous body, the Chandigarh Housing Board (CHB), was constituted in 1976 with the objective of providing built-up flats of one or two standard designs for four income groups, high, middle, low and economically weaker sections (EWS), on a hire-purchase basis. The land for this purpose is provided on a 99-year lease (35). The activities of the CHB are concentrated in the Phase II Sectors, located in the southern part of the city. Interestingly, the norm of two and a half storey building height has not been applied to the units built by the Board. The buildings containing these flats have a height of three storeys or more. Upto March 1998, the Board had constructed 40,544 housing units in the entire U.T, of which 51.68 per cent were in the city (36).

vii) Cooperative Housing: In recent years, a number of cooperative housing societies have emerged in the city. The Administration allocates land to these societies in the southern Sectors of the city.

viii) Architectural Style: The architectural design of various categories of government houses was prepared by Pierre Jeanneret, Maxwell Fry and Jane Drew. The initial design, with minor modifications, still governs all government construction and gives the city its visual character. Houses from Type XIV to VIII were built in row formation,
Type VII was semi-detached, while the higher types followed the detached form of arrangement. It was hoped that the designs developed for government housing might also be used by private developers. Therefore, all government house plans were made available free of cost. Houses on plots upto 250 sq. yards were to be constructed as row housing subject to ‘Frame Control’ which (i) regulated façade designs, roof and street lines, (ii) prohibited extensions and (iii) instituted controls on size and type of door and window openings (37). The Chandigarh Housing Board flats have been designed on the principle of cluster housing. The cluster design, generally in a series of three or more storied blocks, is able to achieve high densities of nearly 250 units per hectare. In addition, the Chandigarh Housing Board has also built terraced apartments on the pyramid principle (38).

In terms of specified use, the state of housing in Chandigarh is impressive. The city has the highest percentage of houses being used exclusively for residential purposes, 81.3 per cent, against the national average of 71 per cent. Further, the proportion of households living in pucca houses in Chandigarh (96 per cent) is far higher than the figure for urban India (58 per cent) (39). Nevertheless, the housing requirements in Chandigarh have to be viewed in terms of the quantity, quality and type of housing in different parts of the city, and also as an important component of the entire town planning experience. It is around the housing provisions that other infrastructure develop and in their totality, determine the residential quality of an area.

The success of housing provisions in Chandigarh has been examined below in terms of:

(a) Levels of Residential Crowding,
(b) Housing as a factor in creating spatial and socio-economic differentiation in the city,
(c) Architectural Style, and
(d) Housing for the poor.

(a) Levels of Residential Crowding: The housing provisions in Chandigarh have been lauded for establishing a fairly high minimum standard and adopting measures to pre­empt the overcrowded and congested conditions characteristic of most Indian cities (40). However, there are indications to suggest that these provisions have only partially
fulfilled the plan objectives. One of the major reasons for this has been the rapid population growth (471.60 per cent during 1961-91) promoted by the triple administrative headquarter status of the city and its emergence as a regional and national centre for education, culture, business and commerce. Initially, the residential areas in Chandigarh were laid on the principle of one household per plot. However, it soon became apparent that this standard was too high to meet the massive housing needs, and, was changed to two families per plot (41). In recent years, multistoried buildings containing flats have been constructed, particularly in the southern Sectors. This change in the norms has been succinctly described in the following lines:

'First went overboard the Barsati
Bringing with it the terrace
To the lower floor,
Then tumbled one bedroom
To the floor below.
Thus, emerged a pattern
Of a floor – and – a half house..........
Population growth outstripped economic growth..........
Out went vertical living
And we are settling down
To living in flats
A family above another
And another above another' (42).

Overcrowding and congestion in Chandigarh are not recent occurrences. These were reported as far back as the mid 1960s. In 1964, of the 3041 government employees on the house waiting list, 88 per cent were for the small sized houses (Types IX to XIII). Further, out of the 8301 government houses allotted, 3637 or 43.8 per cent were being shared by more than one household. This sharing was mainly among the lower ranked employees (43). Similar problems have also been reported for private housing, that is, an acute and increasing shortage, due to which overcrowding is rampant and buildings with planning permission for two dwellings are frequently occupied by between 4 to 8 households (44). In 1970, a study of 97.5 sq. yards private houses in Sector 20 reported
that 50.8 per cent of the households lived in shared accommodation (45). The 1971 census of the city reported that 38 per cent of Chandigarh's households occupied only one room, and a further 35 per cent had two rooms (46). Thus, as far back as three decades ago, various studies highlighted the residential overcrowding in Chandigarh. Recent data and indices continue to suggest the same. According to the 1991 census, 37.72 per cent of Chandigarh's households have only one room. Further, as compared to the city average of 4.6 persons per house, based on the census data for 1991, the number of persons per house on the basis of modified data has been recorded as 7.71 (47). Sectors with a high or very high number of persons per house also had a high or very high density of houses (more than the city average of 1184.2 houses per sq. km.). This suggests a high level of intensity of development as well as crowding. Sectors 7,15,20,21,24,27,28,35,37 and 41 typically exhibit such conditions. All these Sectors, excluding Sectors 24, 28, 35 and 37, had exceeded their planned population in 1991.

The ratio between the number of occupied census houses and number of houses computed as physical units is more than one for all the Sectors in the city, except Sector 25, an area dominated by slums and labour colonies. This implies a high and consistent degree of vertical development and apportioning of houses (48). It is suggested that the difference between the number of computed house structures and occupied census houses is indicative of the extent of site construction for residential use. The correlation value of \( r = +0.40 \), significant at 0.01 level of confidence for the 1991 data, validates this hypothesis. For the 1981 data, the value of \( r \) was slightly higher at +0.66 and significant at a similar level of confidence (49). Another indicator of the intensity of construction is capacity utilization. A survey conducted in 1998 reported that Sectors with a large proportion of small sized plots, irrespective of the age of the Sector, have a higher percentage of fully built houses. The survey cited Sectors 15,20,21,23,27,37 and 38, all of which are densely populated areas, as having a high intensity of construction (50).

The provision of open space at the individual building level forms an integral part of the Chandigarh plan. For meeting this objective, the planners imposed certain norms on the extent of area that could be built on various plot sizes (Table 26). The floor space index was also specified in order to reduce vertical density and, thus, control the
Table 26: Chandigarh City: Plot Area, Built up Area and Floor Space of Houses

<table>
<thead>
<tr>
<th>Phase</th>
<th>Plot Area (Sq. Yds)</th>
<th>Built up Area (Sq. Yds)</th>
<th>Ground Floor</th>
<th>I Floor</th>
<th>II Floor</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>457.4</td>
<td>251.3 (50.2)</td>
<td>137.0 (27.4)</td>
<td>68.5 (13.7)</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>457.4</td>
<td>269.6 (53.9)</td>
<td>117.0 (23.4)</td>
<td>33.0 (6.6)</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>305.0</td>
<td>165.0 (33.0)</td>
<td>89.1 (17.8)</td>
<td>35.5 (7.1)</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>305.0</td>
<td>177.0 (35.4)</td>
<td>76.0 (15.2)</td>
<td>21.0 (4.2)</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>228.7</td>
<td>125.6 (25.1)</td>
<td>68.5 (13.7)</td>
<td>34.2 (6.8)</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>228.7</td>
<td>134.8 (26.9)</td>
<td>58.5 (11.7)</td>
<td>16.5 (3.3)</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>152.5</td>
<td>82.5 (16.5)</td>
<td>44.5 (8.9)</td>
<td>17.7 (3.5)</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>152.5</td>
<td>88.5 (17.7)</td>
<td>38.0 (7.6)</td>
<td>10.5 (2.1)</td>
<td></td>
</tr>
</tbody>
</table>

Note: Figures in brackets indicate built up area per person taking five persons per household.


Level of residential crowding. The data in Table 26 suggests that with vertical expansion, the space available per person decreases. However, the expected reduction in the number of persons does not take place. This is particularly true in the Phase II Sectors, which were planned for higher densities of population. In these Sectors, the floor space per person in the upper floors ranges from 6.6 sq. yards in the largest plot to 2.1 sq. yards in the smallest plot. The situation is worse where apportioning of a floor for rent is done (51).

Rental values provide another indication of the level of housing shortage and overcrowding in a city. In Chandigarh, residential rents operate at three scales (i) at the city level, high rents are commensurate with the socio-economic status of different Sectors, for example, Sectors 2, 3, 4 and 5, which were planned as high income group Sectors (ii) at the Sector level, rents are higher in Sectors which are located in close proximity to work areas, for example, Sectors 7, 11, 15, 22, 35, and (iii) within Sectors, houses located close to shopping centres command higher rents (52).
On the basis of the indices and studies mentioned above, the following groups of Sectors can be considered as being residentially overcrowded:

i) Sectors with small sized plots and planned as high density areas (Sectors 19,20,21,22,23,27). The high residential crowding in these Sectors is mainly due to apportioning. Despite planning, two to three independent living sets for two or more families have been built at different floors of private plots in order to acquire a higher exchange value. In the government houses in these Sectors, one house has often been allotted to more than one family due to acute housing shortages (53).

ii) The entire northern limit of the city formed by Sectors 2,3,4 and 5. These Sectors were planned as low density Sectors for high income groups. These Sectors have a fair degree of vertical development or apportioning. This is suggested by the ratio between the number of occupied census houses and computed number of houses as physical structures. The difference is related to the numerous annexes and servants quarters constructed in these Sectors. The ratio values are 1: 1.81 in Sector 2, 1:1.86 in Sector 3 and 1:2.35 in Sector 5. The number of persons per house in some of these Sectors (9.46 in Sector 3, and 8.76 persons in Sector 5) is comparable to such high density Sectors as 8 or 18.

iii) In Sectors with predominantly private housing, the extent of vertical development as well as apportioning is even higher. On a pro-rata basis, vertical development in these is more than two storeys, although numerically there is only one house structure. The number of persons per house is as high as 10 in Sectors 15 and 21 as compared to the city average of 7.71 persons.

iv) Some of the newly developed Sectors, for example, numbers 35, 37, 38 and 41, have a high number of persons per house (on an average more than 10) as well as a high density of buildings. These Sectors also have multistoried residential development.

It emerges, therefore, that in Chandigarh, the norm of one household per housing structure does not exist in many of the Sectors. This is irrespective of the extent of vertical development. Further, the stage of development of a Sector or its economic status are not major determinants of residential crowding (54).

(b) Housing and Socio-Economic Differentiation: As a determining element of the social fabric of a city, housing is expected to promote a sense of neighbourliness among
its residents. This is often sought to be generated through a manipulation of plot sizes, economic status of the resident population and the socio-economic character of the area being planned (55). The traditional Indian cities have for long been characterized by residential areas, where the social identity of the occupants is reinforced through physical containment creating social areas (mohallas) in the city. Economic interdependence brings these divergent groups together in some physical proximity, and much of the interaction, mainly functional, reflects a symbiotic relationship. Since the citizens of Chandigarh were to be from different parts of India, having a variety of socio-religious considerations, planning for the city provided an ideal ground for an attempt to break many of the traditional social and religious barriers that for long have isolated Indians from one another (56). However, housing provisions in Chandigarh have perpetuated several barriers that are spatially manifested in the city. This socio-economic segregation can be identified both at the inter and intra-Sector levels.

The most striking dichotomy discernable in the city plan is between the Phase I and Phase II Sectors. The twenty-nine Phase I Sectors were planned for a population of 1,50,000 persons. In comparison, the seventeen Phase II Sectors were planned for a population of 3,50,000 persons, or 70 per cent of the planned population of 5,00,000 persons for the entire city. This naturally implied higher densities in the Phase II Sectors to be mediated through smaller plot sizes. Further, eight Phase II Sectors were planned as high density areas, whereas only three Phase I Sectors were planned for similar density levels. As regards plot size, 20 per cent of the private plots in Phase I Sectors have an area of more than 500 sq. yards (1 kanal), while only 3.5 per cent of the private plots in Phase II Sectors are of a comparable size. There are at least 730 private plots in the Phase I Sectors which measure more than 1000 sq. yards (2 kanals). Out of these 73 have an area of 3000 sq yards (6 kanals). In comparison, no private plot in the Phase II Sectors measures more than 1000 sq. yards (2 kanals). The spatial manifestation of this distribution of plots is a clear indication of the segregation of the city population, evidently on economic lines, but in a society in which social and economic status have for long overlapped.

The activities of the Chandigarh Housing Board, confined to the Phase II Sectors only, have been mainly in the form of the construction and supply of multi-
storied blocks of flats. This has resulted in a marked difference in the skyline of Phase I and Phase II Sectors. The availability of floor space in similarly sized Phase I and II Sector plots varies considerably (Table 26). In the Phase II Sectors, the objective of maintaining the same extent of open space at the individual building level has been achieved by reducing the floor space per person, especially in the upper floors and small-sized plots (57). This factor, coupled with the existence of multistoried development, has contributed to a higher level of congestion in the Phase II Sectors of the city.

The city plan had euphorically proposed to reduce social stratification in residential areas by mixing private and public plots, of varying sizes, within a Sector. On the ground however, the largest public and private plots are located on the northern periphery of the city, and more than half of the middle and lower categories of government housing are concentrated in six Sectors (numbers 19,20,22,23,24,27). These facts belie the attempt of mixing house types, sizes and categories (58). It has also been suggested that the sharply defined fourteen categories of government housing are themselves responsible for promoting an economic segregation within the city. The houses in each category are self-consciously clustered together, making them quite aloof from those in another category. The external differences in house styles and their distinct numbering makes the status and wealth of each resident immediately obvious (59). This has resulted in a geometric hierarchy based on Sectors, identified by the social and economic status of the inhabitants. Locationally, the hierarchy works from north-east to south-west. With ascending Sector numbers, the density increases and the social and economic status of the inhabitants decreases (60). It has been suggested that in Chandigarh, the old caste system has been replaced by a new and equally formidable one, founded on an economic basis (61).

The social and economic segregation of the city population operates at the intra-Sector level as well. Locationally, the density and plot size generally decreases as one moves from A to D sub-units of a Sector. It is fairly easy, by means of the site, type and size of a house, to classify the status of its inhabitants (62).

(c) Architectural Style: The government housing in the city gives Chandigarh its definitive character, partly because of its extent and partly through the effect it has exerted on private house designs. This influence has been sufficiently pervasive to have
produced a style of modern building design which may be termed ‘Chandigarh Architecture’ (63). The government house designs were controlled not so much by aesthetic considerations as by economy, technology and climate. Economy was achieved through design and construction technology. Every house had a fixed price which was virtually impossible to exceed (64). The constraint of finances dictated that locally available material, mainly brick, and technology, manual labour, be used. This resulted in the standardization of roofs, doors, windows and ventilators. The greatest control was, however, exercised by climate in an area where the sun was more of an enemy than a friend and ideally one would require three separate interconnected houses (65). All the house designs, therefore, represent a compromise solution oriented towards the hottest season. This has resulted in houses, which although shady in summer, are gloomy, dark and cold in winter (66).

The ubiquitous standardization of the government house designs, substantially extended to private houses as well, resulted in a bland regimentation and monotony of visual expression. This contrasts to the architectural diversity generally found in evolved cities. It has been suggested that a variety of house designs would have given the city an architectural diversity and aided the visual identification of different streets and Sectors, which otherwise is difficult (67). In the Phase II Sectors, the multistoried blocks of flats, constructed by the Chandigarh Housing Board, mask the essence of the Chandigarh environment of sun, space and verdure. It has also been felt that the architects ignored vernacular traditions of both design and social pattern, for example, an inner central courtyard, a verandah and the requirements of extended families. The inclusion of such aspects would have been more suitable to the Indian climate and way of life (68).

(d) Housing for the poor: Corbusier deemed Chandigarh as a ‘city offering all amenities to the poorest of the poor of its citizens to lead a dignified life’ (69). However, the creditable housing provisions for the city completely overlooked the presence of the informal sector, an integral part of the urban economy in India and most other developing countries (70). This costly overview highlights the short-sighted vision of the societal structure inherent to Indian life (71).

In Chandigarh, the informal sector initially comprised mainly of construction labourers who were the first to arrive at the site in the early 1950s. Within two years of
CHANDIGARH CITY
Slums and Resettlement Sites

Source: Sarin, M. (1982), p. 111; Fig. 54
Chandigarh Informograph (1995), pp. 16, 22;
Krishan, G. (1998), Map 15 and
Chandigarh Tribune (1999), Nov., 29, 1:2

* V >

Location of non-plan settlements before 1959
R Relocation sites (1959-1975)
Dollar Resettlement scheme sites (1975 onwards)
S Present slum areas
* Post - 1991 resettlement sites

Chandigarh Informograph (1995), pp. 16, 22;
Krishan, G. (1998), Map 15 and
Chandigarh Tribune (1999), Nov., 29, 1:2
the commencement of construction, an estimated 30,000 workers, men, women and children, were engaged in raising the city (72). As temporary shelter, these workers built clusters of thatch huts adjoining major construction sites. Two of the first such clusters to emerge were in Sectors 17 and 22. However, it was soon realized that, with their low wages, even the cheapest planned houses (Type XIV) would be inaccessible to these workers. As early as 1955, Maxwell Fry admitted, ‘When we began to move about, we realized that there were vast masses of people who were not included in the project estimate. We tried to make provision for them, but in a certain sense we failed. There was no economy on which we could do it, even with the smallest house’ (73). A system of parallel construction, those being constructed by the government, and the ones of those who were doing the construction, continued for the first seven or eight years. However, as the construction of major work areas neared completion, the labour settlements came to be viewed as setting a precedence of encroachment on public land and as undesirable elements. In 1958, the Capital Project Office (CPO) decided to remove all non-plan settlements. The labourers demanded alternative sites. A compromise was reached, and these settlements were shifted to peripheral locations in the Industrial Area, Sectors 14 and 26 and later to Sector 25. The labourers were allotted plots measuring 19'6" by 14'7.5" in these temporary labour colonies. The temporary status of these colonies meant that practically no infrastructural facilities were provided. This marked a major negation of one of the plan proposals, which promised access to publicly provided infrastructural services to all sections of society. This also marked the beginning of what are today among the city’s oldest slums and squatter settlements.

In 1965, the city authorities stopped further allotment of plots in these labour colonies, and embarked upon the policy of removal of unauthorized settlements (jhuggis). During the 1970s, some of these colonies were relocated and shifted to villages and ‘milkmen colonies’ beyond the two river beds on either side of the plan area (Fig.54). This was, however, in violation of the city’s concept against suburbanization (74). Recently, the Administration has prepared a three-tier scheme to help provide a clean environment and basic services for the slum dwellers. This includes the improvement of facilities at the existing sites, rehabilitation to other sites and the development of colonies by providing parcels of land at the existing sites (75). By mid-1999, two colonies had
been rehabilitated, 1700 residents of Korsan Colony to Sector 52, and 2500 residents of Sector 31 colony to Mauli Jagran. Another 5400 residents of Kumhar and Janta colonies in Sector 25 are also to be rehabilitated to the area west of Sector 38. Some labour colonies have also been shifted to the southern peripheries of the city bordering Mohali in Punjab (76). In addition to these, the EWS housing units provided by the Chandigarh Housing Board also cater to the lower income groups. Till 1991, the Board had constructed 6522 EWS units in the city in Sectors 12, 26, 29, 32, 37, 38 and 40. Incidentally all these Sectors are located on the peripheries of the city. In 1998, the U.T. had approximately 18,650 EWS units (77).

However, it has been virtually impossible to curb the growth of labour colonies, authorized or unauthorized (78). Between 1961 and 1971, while the population of the city grew by 144.89 per cent, that of the non-plan settlements increased by 230 per cent (79). In 1971, the Estate Office reported 4480 dwellings in the original labour colonies and an additional 1586 dwellings in unauthorized settlements located in various Sectors (80). Recent statistics indicate a seven-fold increase in the number of jhuggi settlers over the last twenty-eight years. In 1998, 47.56 per cent of the dwellings in labour colonies comprised authorized settlements, the rest 52.44 per cent being unauthorized settlements (81). The pattern of distribution of these settlements that has emerged over the years resembles the one found in the evolved towns, that is, a concentration on the peripheries.

There has been a gradual change in the policy perspective regarding the status and nature of the unplanned settlements in the city. Such basic issues as the concept of urban development and planning inclusive of social justice, the status of the informal sector and the urban poor in the structure of a planned city, mechanisms of ensuring access of land to this section of society etc., remain unsolved.

II. NON-RESIDENTIAL LANDUSE

In the indigenous parts of evolved Indian towns, the complex patterns of non-residential landuse are related to the varying influence of historical, cultural, social and economic factors. The horizontal rather than vertical zoning was the consequence of a long history of compact development and the lack of separation between work and residence. In addition, such urban amenities as electricity, water supply and open spaces
were restricted in their distribution. It is only in the extra-mural areas that functional segregation and a fairly high development of urban infrastructure is noticed (82). In comparison, the plan of Chandigarh envisioned a well-ordered city, with an efficient and conducive urban environment. To this end, specific plan provisions were made for the various non-residential landuses within the purview of the functions of modern urbanism, that is Work, Recreation and Circulation. Thus, the locations of these functions were specified at the city as well as Sector level. Importantly, the extent of area allocated to certain non-residential landuses, such as open spaces and circulation, was considerably higher than the one found in evolved cities (Table 1).

The discussion on non-residential landuses in Chandigarh includes the following:

A. Circulation
B. Commercial (a) Wholesale, Storage (b) Retail
C. Institutional (a) Utilities: Water and Electricity (b) Services: Administration (c)Facilities: Educational and Medical
D. Recreational (a) Open space (b) Cultural places
E. Industrial
F. Reserved and Vacant Land

A. Circulation

Cities have for long been considered living entities by virtue of the constant flow and movement that takes place within them. As such, an efficient circulation system plays a basic and vital role in the evolution and functioning of a city. The circulation system in a city is expected to provide mobility to people and goods, while maintaining economy, efficiency and safety. In addition, it should be able to meet the requirements of various functional systems operating within cities as well as cater to the demands of inter-urban traffic. Intensive transport planning has, therefore, become a pre-requisite in the successful functioning of cities. Of the various circulation patterns, the grid iron system is perhaps the oldest surviving system in planned towns throughout urban history. Its existence can be traced to Mohenjodaro, the early Roman towns, the Bastide towns of southern France, Medieval British towns and the more recent American city, Philadelphia (83). In the planning of Chandigarh, the grid iron pattern of circulation has been adopted,
though with minor changes. The introduction of this pattern is in sharp contrast to the amorphous circulation pattern found in most traditional Indian cities (84). The importance given to the circulation system in Chandigarh can be gauged from the fact that 23.7 per cent of the total area was allocated for this function. In comparison, in traditional evolved towns, the circulation system comprises only 6 to 10 per cent of the total area.

An all pervading theme in Corbusier’s vision of architecture and planning was his desire to plan for the machine age and define a city by its traffic plan (85). Hence, the streets in the Chandigarh plan were to function not merely as traffic or transport lines, but comprise a part of the landscape and determine the layout and Sector orientation. The circulation system in the city is based on the CIAM (International Congress of Modern Architects) approved system, in which the different types of roads and traffic are classified, beginning from the town-to-town traffic at the highest level and ending with cycle routes and pedestrian tracks through the city (86). In Corbusier’s words, ‘with seven types of roads, the man of the mechanical civilization can

Cross continents and arrive in town: the V1
Go to special public places: the V2
Cross at full speed, without interruption, the territory of the town: the V3
Dispose of immediate access to daily needs: the V4
Reach the door of his dwelling: the V5 and V6
And send the youth to the green areas of each Sector where schools and sports grounds are located: the V7’ (87)

Later cycle tracks or V8s were added to the V2 roads. The objective of such a hierarchy of roads was the segregation of traffic according to speed, volume and destination and thus, to pre-empt the mélangé of traffic modes and resultant congestion characteristic of most evolved cities in India.

Though Corbusier preferred a geometric ordering, the lateral streets in Chandigarh are slightly curved (Fig.55). The credit for this modification is given to Maxwell Fry. Thus, all the ‘up and down’ roads have a clear view of the Himalayas in the north-east, and so prevent a loss of orientation common to New Delhi’s radial system. In addition, the crossing roads, being slightly curved, shield drivers from the low rays of
the setting sun (88). To automatically regulate the traffic, roundabouts were constructed at the intersections of the V2, V3 and V4 roads. The intersections, occurring at intervals of 900 by 1300 yards, are suitable for motorized traffic, and are in contrast to the intersections in evolved towns, which are at roughly 100 yards, and related to pedestrian and animal traffic (89). There are only four entry points to every Sector from the V3 roads. Although the plan did not provide for naming of roads, the V2 and V3 roads in the city have been named according to their location or areas connected by them (Fig.55).

The roads running east to west, starting from the north are Uttar Marg (Northern Avenue), Vigyan Path (Street of Science terminating at the Engineering College), Madhya Marg (Central Avenue), Udyog Path (Street of Endeavour, terminating at the Industrial Area), and Dakshin Marg (Southern Avenue). The roads running north to south, starting from the west of the city have been named as Paschim Marg (Western Avenue), Vidya Path (Street of Knowledge bordering the University), Udian Path (Street of Arising), LokJan Path (People’s Street) which becomes Jan Marg (Avenue of the People) north of Sector 17, Himalaya Path (Street of the Himalayas), Sarovar Path (Lake Street, referring to the artificial lake, Sukhna, in the north-east of the city), Sukhna Path (the Street named after the dry river bed at this end of the city), Chandi Path (Street named after the goddess Chandi, after whom the city has also been named) and Purv Marg (Eastern Avenue). A detailed landscape plan was also prepared for the roads of Chandigarh (90).

It must be emphasized that at the time of formulation of the transport system for the city no statistical information regarding the potential volume of motor traffic was available. As a result, the street widths, road intersections etc. had to be developed arbitrarily, without regard to any specific extent of estimated use and intensity of traffic (91).

A functional assessment of the circulation system in Chandigarh can be made on the basis of such aspects as the temporal, economic and cultural lag between the planned and actual use, the extent of traffic segregation achieved and the success of the public transport system. This is discussed under the following headings:

i) The Grid Pattern

ii) The V8 System
iii) Volume and Heterogeneity of Traffic
iv) Parking
v) Intersections
vi) Social Aspects
vii) Public Transport System

i) The Grid Pattern: The selection of the grid pattern as the basic generator of the city form and layout in Chandigarh has been criticized on several counts. Firstly, due to the necessity of covering longer distances, this extensive layout and pattern makes the provision of an efficient public transport, an essential requirement for any Third World city, difficult to achieve since the operation costs are higher. In addition, the dispersed layout, combined with the functional segregation of landuse has greatly magnified the concept of distance in Chandigarh. The dense and compact spatial form of the traditional evolved Indian city, in comparison, permitted short journeys, especially to work (92).

ii) The V8 System: The V8 system was applied in Chandigarh to specifically resolve the urban congestion characteristic of most Indian towns. However, serious functional problems associated with this system have emerged. Considerable unplanned growth has taken place along the V1 or Inter-State Arteries on the peripheries of Chandigarh. The V1s function as major highways connecting Ambala/Delhi and Shimla on the south-east side and Ludhiana/Ropar on the north-west side to the city. They, thus, serve not only the Chandigarh urban population, but also thousands of residents from surrounding towns and villages. The massive unplanned growth along these roads has radically changed their character, converting these into ordinary roads, which carry a medley of traffic (93). For example, the V1 that links Madhya Marg with the NH 21, connecting the city to Delhi and Shimla, has been converted into a dual carriageway in response to the tremendous traffic pressure generated by Manimajra and Panchkula towns.

A 13-meter wide slow carriageway was proposed along the V2 roads, so that the traffic emerging from the entry points on the V2s would not join these directly, thereby obstructing the fast-moving traffic on it. However, the slow carriageways on the Madhya Marg, Dakshin Marg and Jan Marg have not been fully developed. Consequently, traffic emerging from the V5 roads of the adjacent Sectors joins the V2 directly, causing an obstruction in the flow of traffic, a reduction in speed and an increase
in the volume of traffic on the V2 roads (94). Among the V2 roads in the city, the Madhya Marg is the most prestigious artery. It is also the most congested. It runs from the University and PGI campuses in the west, along the business and administrative complexes located in Sectors 9 and 17, the shop rows in Sectors 7,8 and 9 and to the wholesale markets in Sector 26 in the east. From here, the road serves as the major link for the traffic to and from the Industrial Area. This road is also the only link to the Chandigarh Railway Station and Panchkula and Manimajra townships. It, therefore, carries a high volume of traffic, making it a traffic hazard zone.

The V3 roads, meant to carry fast traffic, establish the grid pattern of the city by functioning as dividing roads between Sectors. Each Sector is, thus, encompassed by a V3 road on all its sides. In a way the V3 network elucidates Corbusier’s statement, ‘a city made for speed is made for success’ (95). Entry to these roads from a Sector is restricted to only four points, one on each side of the Sector. This necessitates the undertaking of a circuitous route, increasing the travel distance by about one kilometer. Consequently, a number of shortcuts for reaching the V2 streets have come into existence, particularly near the roundabouts as well as between two roundabouts. This has defeated the very purpose for which direct access to these streets was restricted, that is, to help maintain speed and avoid frequent direct mixing of traffic.

The V4 or Sector shopping roads are no longer the streets one can leisurely move on, as intended in the master plan. Corbusier, probably, naively believed that ‘transit traffic would take place outside the Sector’ (96). The V4 has, however, actually emerged as an alternative to the V3 route as it connects various Sector markets, and has emerged as a carrier of fast, mixed and through traffic. The character of V4 roads in Sectors with specialized shopping areas, for example, Sector 21, has completely changed.

The V5, the main traffic distributor within a Sector, provides direct access to the V3 and V4 roads, making them fast-traffic roads with transit vehicular traffic. These roads have, thus become accident – prone and extremely unsafe for children and the elderly. Interestingly, many of the schools in various Sectors are located on these roads. The open space along and on the V5 and V6 roads is commonly used for weddings and other social functions, resulting in a disruption in the movement of traffic. The V7 and V8 are yet to be fully developed in different parts of the city. On the whole, the road
system in Chandigarh is in a poor structural condition—approximately 52 per cent of the roads have been classified as ‘poor’ and ‘very poor’ (97).

iii) **Volume and Heterogeneity of Traffic:** The location of the city has made it the focal point for neighbouring towns and states. This, and its function as a triple administrative headquarters has contributed to the high volume of traffic in the city. The largely middle-class character of the city’s population and a rise in living standards is reflected, among other things, in the fact that every household has at least two or more vehicles. It has been estimated that for every two persons living in the city, there is one registered vehicle. The situation is further aggravated by the fact that a number of residential and work areas, located in close proximity to the city, for example, the Cantonment, the Air Force Base, Panchkula and Mohali towns, have close functional interaction with the city. The number of vehicles registered in Chandigarh forms only about 60 per cent of the total number of private vehicles plying in the city during the day (98). It is not surprising that the roads carry an estimated three times more traffic than their planned capacities. Such a situation was not anticipated a few years ago, when the large area set aside for roads was criticized as an unnecessary gesture (99).

During the initial stages of the development of Chandigarh, no attempt was made to enforce traffic separation. As far back as 1964 the misuse of roads, by allowing mixed traffic and the resultant disastrous consequences due to the lack of enforcement, was reported (100). The misuse, however, perpetuated to the extent that at present many busy roads in the city carry slow traffic and slow roads have to cater to heavy traffic (101). The heterogeneity of traffic is most obvious on the V4 roads. The plying of local buses within the Sectors on the V4 roads has added to the traffic congestion. An obvious consequence of the increase in volume of traffic and its heterogeneous nature is accidents. In the first half of 1999, 70 people were killed and 250 injured in road accidents (102).

iv) **Parking:** The provision of parking space for vehicles forms an integral part of urban transport planning. In Chandigarh, the inadequacy of parking space is emerging as a major area of concern, reflecting an important lacuna between the plan proposals and actual requirements. The parking area provided outside public places is limited, resulting in the parking of vehicles on adjoining roads. This, in turn, reduces road spaces and adds
to the congestion. Attempts made to introduce paid parking in the Sector 17 shopping area have resulted in the parking of vehicles outside the shopping area on the V4 roads. The curvilinear layout of V4 roads has the disadvantage of limiting parking space in front of the shopping area. This situation is aggravated in Sectors with a high density of population, for example, Sectors 15,19,20,21,22,37, and those performing institutional functions, for example, Sectors 10,11,14. In addition, the conversion of houses facing the V4 roads into commercial establishments has further aggravated the parking problem on these roads.

A number of Sector-level markets in the city have developed into specialized markets, for example, the scooter and car repair market in Sectors 21 and 28 respectively and the furniture market in Sector 34. The traffic in such specialized commercial areas creates its own demands in terms of specific road requirements and parking facilities. These are non-existent in the plan proposals. In most of the smaller marla houses, the vehicles are parked either on the pedestrian walkways just outside the house or in the open spaces within the house compound. The former condition creates a traffic hazard, and, the latter, in the conversion of open space in the houses, a matter of pride for the planners, into parking space.

v) Intersections: Roundabouts constructed at the junction of the V2 and V3 roads were expected to regulate traffic and impart a sense of grace and beauty to the landscape. However, these have emerged as bottlenecks in the free flow of traffic. The traffic density near certain roundabouts during the peak hours has been a matter of concern, for example, near the Bus Terminus in Sector 17 (103). At some of the junctions, the roundabouts had to be demolished and traffic lights installed in their place, for example, at the intersection of Sectors 9,10,17 and 18 on Madhya Marg and near the bulk transport and Industrial Area at the intersection of Sectors 26 and 28. Roundabouts, comparable to chowks in traditional Indian cities, have also attracted itinerant fruit and vegetable sellers. This is particularly true of the roundabouts located in the southern Sectors adjoining Mohali. Recently, some of the roundabouts have been handed over to various private concerns for beautification and maintenance.

Some of the intersections between the V3 and V4 roads are staggered, particularly in the Phase I Sectors. For example, between Sectors 22 and 23, 17 and 18,
14 and 15, and 15 and 16. The objective was to force a reduction in the speed of traffic moving from one Sector to another. However, since this did not happen, traffic lights had to be introduced at many of these.

vi) Social Aspects: The street in traditional Indian cities is not only a means of circulation, but also provides social and cultural space (104). This, however, is not true of Chandigarh. The V4 road splits a Sector into two parts, marring the integral unity of the Sector and acting as a dividing line rather than a uniting linkage. The northern and southern parts of a Sector have, thus, generally developed distinct social identities (105).

vii) Public Transport System: In view of the relatively longer distances involved in daily commuting in Chandigarh, an efficient mass public transport system was considered essential. The criticism of the public transport system made more than two decades ago is largely valid even today: ‘bus services are hopelessly uneconomic and inefficient. To collect passengers, the buses have to go to the centre of each Sector. This involves a series of zig-zags to the employment areas, since the desire lines are broadly north-south and the collector lines are exclusively east-west’ (106). The local and inter-state bus termini are located in Sector 17. This location, however, does not align with any of the V1 roads, and the inter-state bus traffic has to pass through the major roads of the city (107). A second ISBT has been proposed in Sector 43, on the southern edge of the city.

Railways and Airways: The Chandigarh Railway Station is located about 8 kms from the City Centre. The city has seven important railway connections (108). The Airport is located 11 kms from the City Centre. Daily flights connect Chandigarh with Mumbai, New Delhi, Amritsar, Jammu and Leh. The distance to both these termini from the city centre and inadequate transport facilities are problems related to the location of these services. On the positive side, the location of these, particularly the railway station, has pre-empted the emergence of a congested residential area around it, a characteristic feature of the area found around railways stations in most Indian cities.

B. Commercial Landuse

In addition to the residential landuse, the commercial landuse is the most ubiquitous feature of urban places. The main commercial area, the CBD, is regarded as the morphological nuclei around which the rest of the city gets spatially structured. The location of the main commercial area has been used as a diagnostic feature in the
identification of city patterns and structure (109). The study of the patterns of commercial landuse and location of commercial areas have been an important theme in urban geography studies (110).

Traditional Indian towns have almost always evolved around the main commercial area. The lack of segregation of landuses in such cities implies that the commercial areas are generally congested localities, having a high density of population and mixing with other landuses. With the expansion of the city, and developments in transportation, commercial (retail) areas get established in other parts of the city as well. It is, therefore, possible to identify a hierarchy of commercial areas in evolved cities, based on the variety of goods sold and the price range (111). The location of the wholesale markets in a city is governed by the specific demands of storage space, low land values, and proximity to bulk transport facilities etc.

The commercial landuse in Chandigarh, at the city and Sector levels, contrasts to the one generally associated with evolved towns in terms of layout and functional characteristics. The area under commercial landuse and the location of commercial centres in Chandigarh can be described under the following sub-sections:

a) Wholesale and Storage, and
b) Retail Trade

a) Wholesale and Storage: In Chandigarh, the wholesale grain, timber, iron, fruit and vegetable markets are located on the north-eastern periphery of the city in Sector 26. This location proximates the Railway Terminus and the arterial roads. Following the development of institutions in Sector 26, some of the wholesale markets and godowns, for example, those dealing in timber and iron, have been shifted to the adjacent Sector 26 East and East extension. There is a proposal for establishing a new grain market in Sector 39 on the south-western periphery of the city. The selection of this location is influenced by the fact that the bulk of the food grains come to the city from the adjoining villages in Punjab located on this side of the city. It is expected that the new location would eliminate the necessity of traversing the entire city, thereby reducing traffic movement as well as congestion.

b) Retail Trade: i) THE CITY CENTRE: Since the earliest times, the civic core has always received special attention from town planners, manifesting the pride and valued
position it holds in the urban structure. Commercial centres in traditional Indian cities not only form the nucleus, but also provide sites for physical, social and religious institutions. They are characteristically congested localities, having numerous streets offering specialized services (112).

The City Centre in Chandigarh is located in Sector 17, at the junction of the main axes, the Jan Marg and the Madhya Marg (Fig.53). While this Sector was developing, the adjoining Sector 22, the earliest Sector to be developed in the city, functioned as the main commercial and business area of the city. Spread over 240 acres, Sector 17 is divided by a V4 road into two parts. The area south of the road has civic functions, offices of the district administration, district courts, fire station headquarters, offices of the Municipal Corporation, the Registering Authority and the Inter State and Local Bus Terminii. The area north of the V4 road has business and commercial establishments, shops, banks, offices, the General Post Office, the Central Telegraph Office, the Estate Office, the Telephone Exchange etc. The City Centre in Chandigarh also has such establishments as cinema halls, libraries and restaurants. At the centre of the Sector is a piazza, 414 feet by 360 feet, and restricted only to pedestrian traffic. Residential facilities in Sector 17 are limited only to essential staff, which contrasts with the densely populated commercial centres in evolved Indian cities. Architectural and planning controls restricted the height of buildings to four storeys in the City Centre and specified the building use at each floor. In terms of architectural style, the City Centre is a salient illustration of regimentation. The uniform building facades make the establishment of landmarks difficult. There is a deadly uniformity of buildings, precluding variety and colour, and producing a monotonous atmosphere. The City Centre was intended to be the physical counterpart of the Capital Complex. However, none of the structures in the area are architecturally compelling enough to dominate the setting. The City Centre landscape is also unrelieved by substantial vegetation. The concrete buildings, thus, reflect the glare and heat in summer and are bleak and windswept in winter (113). In an attempt to decentralize business and commercial functions, the first sub-centre in the city is being developed in Sector 34. Apart from the many offices, commercial and business enterprises now functioning from Sector 34, a five star hotel and cultural centre are also proposed to be built (114). A second sub-centre is planned to
CHANDIGARH CITY
Commercial Areas: Types of Structures
1998

Fig. 56a
be located in Sector 43. In addition to Sectors 17, 22 and 34, important commercial and business establishments have developed along Madhya Marg in Sectors 7, 8, 9 and 26, and along the V3 road in Sectors 20 and 35 (Fig. 56a).

ii) SECTOR SHOPPING CENTRES: The V4 roads crossing each Sector from west to east, form the Sector shopping streets. These were planned to cater to local commercial and business requirements, adding to the self-sufficiency of a Sector. In the Sector markets, the shops are located only along the southern flank of the street to eliminate the necessity of frequent street crossings. Also the Sector market shops were planned to face north-east, so that ample sunlight could become available for a major part of the forenoon. The shops have a minimum height of three storeys and, like other buildings, are architecturally controlled. The shops are a mixture of booths, SCOs (shop-cum-offices) and SCFs (shop-cum-flats) (Fig. 56a). The latter are in keeping with the traditional practice of shop-owners living above their business premises. They provide living space on the upper floors. The SCFs are mainly located in the Phase I Sectors, while the Phase II Sectors have a predominance of SCOs (115). In addition to the Sector markets, in the Phase II Sectors, clusters of shops in each sub-unit of a Sector, that is, A, B, C, D, called service shops, have also been planned. In 1961, there were approximately 1200 planned shops in the city; by 1998, the number of SCOs, SCFs and booths had increased to nearly 5000 (116).

The functional aspect of the Sector shopping streets have been criticized on several counts. First, the planners do not seem to have considered or understood the traditional and practical economics of the bazaar trade that is dependent on support and competition between specialist services. For certain businesses to function, a concentration of specialized use is required (117). The master plan of the city did not have such provisions. Consequently, city wide specialist functions have developed in several Sector markets, for example, Sanitaryware market in Sector 18, Scooter and Car Repair markets in Sectors 21 and 28 respectively, Fish and Meat market in Sector 21 etc. As a result, the component of daily shopping by the residents of these Sectors has been reduced considerably. In addition, these specialized markets make their own demands in terms of space requirements, storage, parking areas and traffic generated. Since none of these markets was designed to cope with such requirements, these are not in functional
harmony with the residential functioning of the Sectors of their location. Second, the location of commercial uses to only one side of the V4 streets has proved fairly difficult to enforce. In a major change in policy, the U.T. Administration in 1998 decided to relax building bye laws and allowed a part of the residential building, particularly those facing or adjoining a shopping centre, to be used for non-residential purposes. This decision legalizes the use of residential buildings for commercial purposes. It also presents a host of problems related to congestion and additional pressure on infrastructure and services which in turn, would further aggravate the pressure on housing shortage.

Third, as noted earlier, the master plan completely overlooked the necessity of making provision for the informal sector, which forms an important and traditional aspect of the Indian bazaar scene, either as street hawkers or rehri wallahs or small time tea stalls and eating places, to name only a few. In the absence of planned provisions, unauthorized, informal shopping centres have emerged at different locations. Functioning on minimum overheads, these shanty shopping centres or rehri markets are extremely popular with a large section of the population. In Chandigarh, probably the most famous of such markets are in Sectors 22 and 19. The informal market in Sector 22 developed at a fairly early stage of the development of the city, and soon grew into a street of small shops in the open ground near the main road. The City Administration demolished the market in 1978 and the shop owners were given tenancies in various other Sector centres. However by mid-1978, the market, known as Shastri market, was well on its way to being re-built at its original illegal site. Permanent shopping booths were later constructed and allotted to shopkeepers in this and many other shop markets (118).

Further, in India, ‘Shopping is not merely a matter of meeting daily needs of living -
It is in India a way of life,
It is an institution which caters to
social needs, physical needs, indeed spiritual needs’ (119).

In this context, the bazaar areas in Chandigarh lack the excitement and colour of the traditional market areas in evolved Indian towns (120).
C. Institutional Landuse

The provision of institutional infrastructure, utilities, services and facilities at a suitable level and standard, forms an important aspect of modern town planning. The provision of these is governed by considerations of safety, economy, efficiency and convenience. Since Chandigarh was visualized as a city offering a high level of amenities to all its citizens, specific provision for these was made in the master plan. The following institutional amenities in Chandigarh are discussed below (a) Utilities (Electricity and Water Supply), (b) Services (Administration), and (c) Facilities (Educational and Medical).


<table>
<thead>
<tr>
<th>Uses</th>
<th>Consumption (mkw/hr)</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic</td>
<td>189.65</td>
<td>33.87</td>
</tr>
<tr>
<td>Commercial</td>
<td>117.91</td>
<td>21.06</td>
</tr>
<tr>
<td>Industrial</td>
<td>192.69</td>
<td>34.42</td>
</tr>
<tr>
<td>Public Lighting</td>
<td>19.01</td>
<td>3.40</td>
</tr>
<tr>
<td>Bulk Supply</td>
<td>21.95</td>
<td>3.92</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>18.68</td>
<td>3.33</td>
</tr>
<tr>
<td>Total</td>
<td>559.89</td>
<td>100</td>
</tr>
</tbody>
</table>


**TABLE 28: CHANDIGARH CITY: NUMBER OF ELECTRICITY CONNECTIONS**

<table>
<thead>
<tr>
<th>Category</th>
<th>Upto 1977 (%)</th>
<th>1995-96 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic</td>
<td>51,280 (85.35)</td>
<td>133,369 (86.55)</td>
</tr>
<tr>
<td>Commercial</td>
<td>7,297 (12.15)</td>
<td>176,97 (11.48)</td>
</tr>
<tr>
<td>Industrial</td>
<td>838 (1.40)</td>
<td>2,101 (1.36)</td>
</tr>
<tr>
<td>Public Lighting</td>
<td>91 (0.15)</td>
<td>379 (0.25)</td>
</tr>
<tr>
<td>Public Water Works</td>
<td>131 (0.21)</td>
<td>247 (0.16)</td>
</tr>
<tr>
<td>Irrigation</td>
<td>370 (0.61)</td>
<td>NA (-)</td>
</tr>
<tr>
<td>Others</td>
<td>81 (0.13)</td>
<td>310 (0.20)</td>
</tr>
<tr>
<td>Total</td>
<td>60,088 (100)</td>
<td>154,103 (100)</td>
</tr>
</tbody>
</table>

(a) **Utilities**

**ELECTRICITY:** At present, the power requirements in Chandigarh are mainly being met from the Bhakra-Nangal project, with some power also being supplied by the Punjab and Haryana State Electricity Boards and the Bhakra-Beas Management Board. Tables 27 and 28 show the consumption of electricity by types of uses and the number of connections in the city. In spite of the growth of the city and a proliferation in many of its functions, there has not been a major change in the structure of demand for electricity. This is evidenced by the fact that there has been only a marginal change in the proportion of electricity connections for various uses and the domestic sector is the second largest consumer after industries.

One of the fallouts of absence of provision for the poor in Chandigarh, as elsewhere, is that the labour colonies and slums do not have legal electricity supply. As a result, pilfering through illegal connections is rampant. Only a quarter of the jhuggis and hutments have regular electricity connections. It is been estimated that nearly 1.5 crore rupees worth electricity is pilfered every month (121).

**WATER SUPPLY:** The Chandigarh Plan laid down that every household in the city would be provided access to piped water supply. This was a rare privilege to the city residents, as nearly one-fourth of the urban population in India does not have access to piped water supply. Before the commencement of any appreciable construction activity in the city, an overall framework of roads, drainage and water supply was laid down to ensure a standard of cleanliness and hygienic values which otherwise would have been unattainable (122). The two important aspects of water supply in Chandigarh are (i) no private agency can draw water on its own, a restriction that does not operate in other major Indian cities, and (ii) the extensive open space and green belts require large amounts of water for their maintenance.

The current per capita water requirement for various uses has been estimated at 460 litres per head per day in Chandigarh. In 1993, the average annual supply was 312 litres per head per day. The PWD, the Chandigarh Administration, and the Chandigarh Municipal Corporation are jointly responsible for the production, maintenance and distribution of water in the city. Initially, ground water drawn by tubewells was the only source of water supply in Chandigarh. About 76.9 per cent comes from the Bhakra
Mainline Canal and the remainder from the tubewells scattered in the city (123). With the growing demand, surface water from the Bhakra Mainline Canal, located 27 kms from the city, was tapped and a pipeline from Kajauli (27kms away) to Chandigarh laid. The various phases of the Water Augmentation Scheme for the city included an increase in the amount of water brought in from Kajauli and the recycling of waste water. The Municipal Corporation of the city had an additional plan for further argumenting the water supply to the city by 60 million gallons per day from Kajauli waterworks. However, this proposal was rejected by the Central Government, in view of the fact that Chandigarh was already drawing sufficient amounts of water, to the extent that even by 2021, the water supply in the city would be more than the Government of India norms of 150 litres per head per day. Moreover, the revenue generated by the Corporation was proving inadequate to meet even the existing costs, and pumping more water from Kajauli against gravity would have further increased production and maintenance costs (124). The water tariffs in the city are fairly low and reflect the element of subsidy involved (Table 29). The Ministry of Urban Development has recommended an upward revision in these rates, with an inbuilt provision for an automatic increase by 10 to 15 per cent every year to meet the increasing costs of operation and maintenance.

The water brought in from Kajauli is taken to the Sector 39 waterworks for treatment before being sent to the water headworks located in Sectors 12, 26, 32 and 37 for distribution in the city. However, the water availability in the city invariably falls short of the demand, especially during the summer season. The problem of water is most acute in multi-storied residential blocks. In 1994-95, there were 75,830 metered and 19,471 unmetered connections in the city (125).

**TABLE 29: CHANDIGARH CITY : WATER TARIFF STRUCTURE**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic</td>
<td>22p/kl</td>
<td>Upto 25 kl – 48 p/kl</td>
<td>Upto 15kl – 0.70 p/kl</td>
</tr>
<tr>
<td></td>
<td></td>
<td>above 50kl – 78 p/kl</td>
<td>above 30 kl – 1.80 p/kl</td>
</tr>
<tr>
<td>Commercial</td>
<td>60p/kl</td>
<td>Rs.2.03/kl</td>
<td>Rs.3/kl</td>
</tr>
<tr>
<td>Industrial</td>
<td>80p/kl</td>
<td>Rs.2.03/kl</td>
<td>Rs.3/kl</td>
</tr>
</tbody>
</table>

ADMINISTRATION: The raison d'être of Chandigarh manifests itself spatially in the Capitol Complex which, located at the head of the city plan, resembles an acropolis of monuments which radiate their dominance for miles (126). The importance of the Capitol Complex is not only limited to its being the reason for the existence of the city or for providing most of the inhabitants their livelihood, but it also has to be visualized as embodying the newly acquired spirit of self-governance of India. Symbolically, the buildings of the Complex express power, authority and permanence.

The Capitol Complex also represents a personal triumph for Corbusier, who took on the responsibility for its design and construction and was able to realize the fruits of his twenty-five years of effort (127). The Capitol Complex in Chandigarh, covering approximately 220 acres in Sector 1, consists of three main buildings, the Assembly or the State Legislative Building, the High Court and the Secretariat. In addition there are three symbolic monuments, the Open Hand, the Tower of Shadows and the Martyrs Memorial. The Capitol Complex is linked with the Civic Centre by the Jan Marg, which may be compared to the ceremonial approach of Kingsway in New Delhi, the Princess street of Edinburgh or the Champs Elysees of Paris (128). The Capitol Complex as a whole was designed as a pedestrian plaza with vehicular traffic separated into sunken trenches leading to parking areas.

The High Court Building symbolizes three ideas in its structure, the majesty, the shelter and the power of law. The magnificent entrance, consisting of three monumental sized columns reaching to the roof, signifies the majesty of law, the cantilevered roof provides the feel of shelter, and a small serpent fountain at the entrance signifies the power of law. In an effort to provide shade to the entire structure, Corbusier designed a double roof with the upper balanced out over the block like a parasol shading the lower roof. However, soon after its inauguration in 1955, several functional inadequacies of the building came to light, for example, the courtrooms are entered directly from outside, leaving those approaching the courts exposed to the weather elements; the narrow curving ramp forming the main circulation is partially exposed, and the inadequacy of the parking areas. In addition, the building soon proved to be
inadequate in space and an annexe had to be constructed in 1962 (129). The new block is located behind the main building.

The Secretariat building bears a striking similarity to Corbusier’s Marseilles apartment block designed in 1945. The Secretariat building is 800 feet long and eight stories high, and gives the impression of a massive wall enclosing the Complex on one side. The Secretariat also proved inadequate to accommodate the offices of three administrative units that emerged after the Reorganization of Punjab State in 1966. As a result, additional buildings were developed along the Jan Marg in Sector 9.

The Assembly Building was conceived as a horizontal rectilinear structure, square in plan, and with a monumental portico facing the main plaza. The building is a geometric play of concrete cubes against free-form elements. The relationship between the upper and lower houses of the Assembly has been imaginatively expressed. The former is a small four-sided pyramidal prism; the latter a huge hyperbolic form, similar in shape to the industrial cooling towers. The upper portion of the tower extends above the roof line, breaking the enclosed silhouette of the building and adding a sculptural element to play against the distant hills. Of all the buildings in the Capitol Complex, the Assembly Building in the most intricate in plan. Symbolically, the Assembly represents a coming together of citizens. Functionally, though, the building seems an elaborately contrived means of keeping them separated (130).

The most frequently made criticism of the Capitol Complex pertains to its excessive monumentality and inhuman scale. However, the ‘monumentality’ of buildings has to be seen in the context of the crisis which resulted in the creation of Chandigarh. Even though the scale is vast, it is in keeping with the surrounding landscape. Further, the Capitol Complex was designed more for visual impact rather than the ease of physical communication (131). Secondly, though the basic layout of the Complex was large enough, it was not designed for further expansion. Additional government offices have therefore had to be developed in Sector 9. Thirdly, since the Complex stands aloof and distinct from the fabric of the city, greening the areas between the buildings of the Complex was proposed in order to integrate the monuments with the city (132). Fourthly, the buildings have been criticized as ‘highly individualistic expressions of a personality whose impulses were more attuned to his own environment and who refused...
CHANDIGARH CITY
Location of
Urban Amenities and Facilities

- Temple
- Mosque
- Church
- Gurudwara

*Only Government High/Sr. Secondary school

Fig. 56b
compromise of any sort (133). Plan proposals for building a Museum of Knowledge and the Governors’ Palace as a part of the Complex were shelved. The other monuments in the Complex showcase Corbusier’s philosophical thoughts and ideas on urbanism. The Martyrs Memorial symbolizes gratitude and is a reminder of the principles of sacrifice. Architecturally, the Tower of Shadows is a study of the sun’s shadows. The Open Hand, widely referred to as the symbol of the city, is an artistic sculpture upheld against the rugged profile of the Shiwaliks. The Open Hand was conceived in 1943 when Hitler’s mailed fist had imposed atrocities on the Parisians. It symbolizes non-violence, for an open hand can hold no weapon. It is also indicative of man’s need to be free from greed, ‘with a full hand I have received, with a full hand I give’ (134).

In the final analysis, the Capitol Complex is a grandly scaled ensemble, symbolic of the freedom of India. It also marks an epoch-making culmination of the various directions of Corbusier’s work.

OTHER SERVICES: From the point of view of maintaining law and order, there are eleven police stations in the city or one for each 6.33 sq kms of area and for every 46,415 persons. These are located in Sectors 3,7,11,17,19,26,29,31,34,36 and 39 (Fig.56b). The City Police Headquarters is in Sector 9. There are five Fire Stations in Chandigarh, located in Sectors 11,17,32,38 and the Industrial Area. The main Fire station is in Sector 17 (Fig.56b). There are 89 Posts and Telegraph offices in the city or one P & T office for 13,000 persons. The General Post Office is in Sector 17. The city has emerged as the regional headquarters for a number of private and nationalized banks. The city has 54 banks, out of which 28 are located in Sector 17 and the others distributed in various Sectors of the city (135).

c) Facilities

EDUCATION: The city was envisaged as a major centre of education, and 7.20 per cent of land was allocated for the performance of this function. In the zoning plan, the educational landuse was located to the west of the city, with Sectors 10,11,12 and 14 forming the Educational Zone. At least one school was proposed to be located in each Sector, the basic unit in the city. The provision of educational facilities in the city can be assessed in terms of the hierarchical level of education function, namely School (Primary, High School), Graduate, Professional, Technical and Post-graduate Education.
School: The plan proposals specifically laid down that (i) each Sector school would accommodate the school-going population of that Sector and (ii) the schools would be located along the green belts of the Sector. These proposals were designed to ensure that the schools would be located within easy walking distance and the children would not have to cross the main roads. The entire network of educational buildings, up to the higher secondary level, was planned on the basis of the population residing in a Sector. It has been estimated that for an average-sized Sector in Chandigarh, there should be one high school and two primary schools to sufficiently meet the requirements of the school-going population (136). In 1991, there were 33 primary schools in the city. However, since most of the middle and high schools also provide primary school level education, the number of schools imparting such education becomes 129. Generally, the distribution of primary schools is proportional to the population of Sectors, for example, Sector 20, the most populous Sector in the city, has four primary schools. There were 83 high schools in Chandigarh in 1991 of which 42 were run by private organizations and 41 by the government. Every Sector has one or two Government High Schools. While Sectors 37 and 20 have three each, Sectors 9, 12, 14, 39 and 42 do not have any (Fig.56b). In comparison, the privately-run high schools are concentrated in the high and middle income group Sectors (137). The choice of schools, especially at the high school level is governed not so much by proximity to residence as by the socio-economic status of the parents and the reputation enjoyed by the school. This runs contrary to the plan proposal regarding the location of schools within easy walking distance in each Sector.

Graduate, Technical and Professional Education: The city has 10 graduate colleges, providing education in Arts, Science and Commerce streams. These include government and private colleges, the latter established by such societies as the D.A.V., Sanatam Dharam, the Guru Gobind Singh Trust etc. The city has eight professional and technical institutions offering courses in education, engineering, architecture, medicine, home science, fine arts and industrial training. There is a marked concentration of these institutions in Sectors 10, 11 and 12, which comprise a part of the Educational Zone in the city. In addition, Sector 26 in the east and Sectors 32, 36 and 42 in the south of the city also have a concentration of graduate and professional colleges and institutions.
Post-graduate Education: The PGI in Sector 12 (established 1960-62) is a referral medical research and training centre for the entire north-western region of the country. It has post-graduate courses in nursing, dentistry, clinical and non-clinical medicine. The Panjab University, formerly located at Lahore in Pakistan, was relocated following the Partition of the country in 1947. Its various departments temporarily functioned from Amritsar, Jalandhar, Ludhiana, Hoshiarpur and Delhi, while its offices were located in Solan, now in Himachal Pradesh. Apart from administrative difficulties due to such an arrangement, the University received a setback in the fields of research and post-graduate education. In 1954, the Senate of the University decided to move the dispersed functions to Chandigarh and purchased an area of 306 acres, forming Sector 14 in the city, for the establishment of teaching departments, offices and residential accommodation for staff and students. Sector 25, adjoining Sector 14, was allotted to the University a little later. However, vast portions of Sector 25 were occupied by slums and labour colonies, effectively preventing the full expansion of the University campus.

The concentration of a large number of educational institutions in the city has made Chandigarh a major centre of higher education in the region. This, in turn, has influenced the socio-economic characteristics of the city.

MEDICAL FACILITIES: The Chandigarh master plan envisaged that the self-sufficiency of every Sector should include the provision of medical facilities within a Sector. This was proposed to be provided through a health centre or a polyclinic located adjacent to a green area in a Sector. In 1998, the city had 49 public health centres, ranging from hospitals to health centres. The city has five hospitals, PGI (Sector 12), General Hospital (Sector 16), Government Medical College and Hospital (Sector 32), the Homeopathic College and Hospital (Sector 26) and the Ayurvedic College and Hospital (Sector 46). The city has one polyclinic, located in Sector 22. It is the oldest medical centre in the city. In addition, there are nineteen government dispensaries located in different parts of the city (Fig.56b). The presence of a number of public and semi-public institutions in the city has resulted in the development of 24 institutional health centres which cater to the basic medical requirements of the employees of these institutions, for example, for banks, the University, the Tribune etc. Like other amenities and services in the city, the public medical services are highly subsidized. In 1992-93, Rs.9.9 crore was
allocated for expenditure on public health services in the city, while the income generated from these was only Rs.3 crore (138). In addition to the public medical facilities, there were approximately 725 private health centres in 1998. These included nursing homes, polyclinics, clinical laboratories, homeopathy and ayurvedic clinics. In addition, Chandigarh has nearly 240 pharmacies or medical stores (139).

The private clinics and nursing homes are mainly concentrated in three areas of the city, Sectors 20,21,22 and 23, Sectors 18, 19 and 27, and Sectors 33, 34, 35, 37 and 38. Nearly 54 per cent of the private clinics and nursing homes are located in seven Phase I Sectors, which together account for 22 per cent of the city population and are among the most densely populated areas of Chandigarh. The uneven distribution of private clinics is related to the demand, daily accessibility and economic viability associated with different areas (140).

D. Recreation

Of the total area of the city, 18.50 per cent was allocated for the development of recreational activities. The traditional evolved towns, in comparison, have on an average, less than 5 per cent of the area under such landuse.

According to Corbusier 'Care of the Body and Spirit' comprised an equally important function of urbanism along with Living, Work and Circulation. Corbusier believed that the sun, space and verdure were the ancient influences which have fashioned man’s body and spirit, and unless the conditions of nature were re-established in man’s life, he could not be healthy in body and spirit (141). The Recreational landuse in Chandigarh can be considered under two sub-sections (i) Open Spaces and (ii) Cultural Places.

(i) Open Spaces: The indigenous part of evolved Indian towns are characterized by a distinct lack of public open space, except that in front of religious places and the one provided by streets and roads (142). The practice of maintaining open spaces was adopted in the British enclaves, for example, in the Civil Lines and Cantonments. In comparison to this general pattern, open spaces in Chandigarh have been provided at the city, Sector and individual building levels. At the city level, the most extensive open space is in the form of the Leisure Valley, a park developed along an eroded stream bed which runs across the entire city passing through Sector numbers 1,3,10,16,23,36 and 42.
from north to south. In its different segments, the Leisure Valley includes the following parks and gardens, Rajindra Park (Sector 1), the 20 acre Bougainvillae garden (Sector 3), a Fitness Trail, Tennis Stadium, Sculpture Park and Open Air Theatre (all in Sector 10), the 30 acre Rose Garden, Shanti Kunj and Cricket Stadium (all in Sector 16), Bal Bhawan and the Traffic Park (Sector 23), Hibiscus Garden and the Garden of Fragrance (Sector 36), and an up-coming Garden of Rare Plants in Sector 42. Along the southern edge of the Leisure Valley, a cultural complex in the memory of a former Chief Minister of Punjab is being developed. Other gardens in the city include the Smriti Upavan, Rock Garden and Botanical Garden (Sector 1), Topiary Garden (Sector 35), and Terraced Garden (Sector 38). The generous amount of parks, gardens and open space is proving expensive to maintain, especially in terms of water requirements.

The city plan also provided for open spaces and green belts at the Sector level along streets, in front of houses and an open playground area. Functionally, however, the maintenance of the Sector greens has proved to be a major problem. These have generally developed into barren, dusty and little used tracts of land. The Sector greens have not been integrated with the housing, and have been left to themselves, without any attempt to design them for special activities (143). Secondly, there is obviously a variance between the almost identical extent of area provided as open space in a Sector and the actual number of people using it. This is particularly true of the southern Phase II Sectors, which were planned for a much higher density of population as compared to the Phase I Sectors.

At the individual building level also, some amount of open space was provided both within and outside the houses. This open space, has more often than not, been converted into extra living space or garages. Consequently, as in the case of evolved towns, most of the house structures in Chandigarh, especially the small sized marla houses have a direct relationship with the roads.

(ii) Cultural Places: At the city level, the Sukhna Lake, an artificial water body, developed by damming a seasonal stream, is located on the northern periphery of the city. It is a popular recreational area. The city has seven cinema halls, three of which are in Sector 17, the City Centre, and of the remaining four, one each in Sectors 22, 32, 34 and 37. There are three libraries, the Central State Library (Sector 17), the Lajpat Rai Bhavan
Library (Sector 15) and the State Library (Sector 34), three museums/galleries, the Museum and Art Gallery (Sector 10), the National Gallery of Portraits (Sector 17) and the Doll Museum (Sector 23) (Fig.56b). The city has five theatres, three in the Rock Garden Complex (Sector 1), one each in the Leisure Valley (Sector 10) and Sector 18 (Tagore Theatre). There are 16 Sports Centres and 6 major clubs. The city has 15 Community Centres, the majority of which are in the Phase II Sectors. These have been constructed to provide a site for secular and social uses by the residents of a Sector. Among the places of religious worship, Chandigarh has 79 Temples, 31 Gurudwaras, 10 Churches, 8 Masjids and Dargahs and 3 Jain Temples. In addition there are also 11 places of religious congregation, for example, ISKCON, Satsang Bhavan etc. Sectors 1 to 6 do not have any place of worship.

E. Industrial Landuse

In the evolved Indian cities, there has been little effective control over location of such units in urban areas. It is only recently that planned industrial estates have been developed, and towns have been planned specifically as Industrial Towns (for example NOIDA, Nangal, Chittaranjan). In the planning of Chandigarh, the role of industries was seen as a limited one, since the city was essentially planned as an Administrative, Educational and Cultural centre. The type of industries permitted was strictly regulated, and excluded all noxious and heavy industries. The Industrial Area in the city was located to the east of the city, in close proximity to the Railway Station to facilitate the bulk transfer of raw materials and finished goods. Nearly 580 acres was reserved for Industrial landuse. Of this, 336 acres were developed during the First Phase and the remainder during the second Phase. The entire Industrial Zone is buffered by a 500 feet thick belt of trees to prevent any noise or industrial menace entering the residential area (144). In the initial years, promoting industrial development of the comparatively small Industrial Area proved difficult because Chandigarh’s location offered few advantages to industrialists by way of the availability of raw materials, market or links with other major industrial complexes in and outside the region. Restrictions imposed on the type of industries and the fuels that could be used in these were added disincentives. However, persistent efforts directed towards individual industrialists and such inducements as allotment of cheap land, credit facilities and import licenses promoted the development of
the Industrial Area. In 1975, the City Administration permitted Cottage Industries producing such items as, pens, paper candles, ink etc. to function within the residential areas in the City (145). In 1977, there were 188 registered factories and 577 industrial units, providing employment to nearly 15,000 persons. By 1995, the number of factories had increased to 582, and that of employees, 24000 persons (146). According to the 1991 census, the industrial workers engaged in Manufacturing other than Household Industries comprised 17.08 per cent of the workforce in the city.

F. Land Reserved for Future Use

In the landuse allocations, 9.6 per cent of the land was reserved for specified future uses. This land is concentrated in the Phase II Sectors, and includes areas reserved for commercial establishments, such institutional uses as the second city subcentre and ISBT, both located in Sector 43, and for housing to be allotted to institutions or cooperative societies. Unlike other Indian cities, there is no land earmarked as vacant (unspecifed reservation) in the master plan. However, as in other towns, vacant lands in the city exist mainly due to economic speculation.

SUMMARY

The study of morphology has a long tradition in urban studies and is probably the only indigenous area of study to have evolved from within the sub-field of urban geography. The existence of a plan framework pre-empts the familiar morphogenetic approach from being applied in a study of the morphology of planned towns. However, changing contexts, circumstances and demographic growth necessitate a dynamic interpretation of the townscape and its attributes. Thus, a more appropriate approach in a morphological study of Chandigarh and other planned towns is by means of a functional interpretation of the provisions and implications of the formal plan framework.

In the present chapter, a functional assessment of plan provisions under the categories of Residential and Non-Residential Landuses has been attempted. The former includes housing, while the latter considers circulation, commercial, institutional, recreational and industrial landuses and land reserved for future use. The morphological attributes of the city are described within these two broad categories.
Zoning, the unifunctional separation of landuses, is the guiding principle in the Chandigarh plan, and was seen as the best means of creating urban order. As a part of the zoning plan at the town level, the location of major functions, the Administrative Complex in the north, the wholesale market in the north-east, the Industrial Area in the east, the Educational Zone in the west and the Civic Centre in the centre of the city, was specified. Further, the city was divided into forty-seven units called Sectors, and the population densities and landuse within each Sector was also specified. At the individual building level, the architectural style, extent of built area, permissible height of buildings etc. was clearly stated. The use of zoning in Chandigarh is in striking contrast to the intermixing of landuses characteristic of evolved towns. The basic attribute of zoning, the separation of work and residential areas, contravenes the traditional attribute of proximity of residence and work areas, a basic determinant of morphological patterns in most Indian towns. It has been suggested that the functional segregation of landuses, with its attendant problems, is inappropriate for developing societies which lack the required change in social structure and production processes.

The Residential landuse is the largest user of land in urban India. The salient features of the housing provisions in Chandigarh include, a minimum standard of accommodation, different categories of public housing scaled to the rank and income of the government employees, strict control on private house construction, the provision of institutional housing in all major institutions and intermixing of different plot sizes and types of housing in various Sectors. In 1976, the Chandigarh Housing Board was established with the objective of providing flats for four income groups, namely High, Middle, Low and for the Economically Weaker Sections. The Housing Board flats are multistoried, the norm of two and a half storeys not having been applied to them. Further, these flats use the architectural technique of cluster housing to accommodate higher densities of population over small areas. Recently, the Administration has started allotting land to various cooperative housing societies. The activities of the Housing Board as well as the cooperative societies are concentrated in the Phase II Sectors. The state of housing in Chandigarh is impressive, 96 per cent of the houses in the city are pucca as against 58 per cent for urban India. Further, 81.3 per cent of the houses in
Chandigarh are used exclusively for residential purposes, while the national figure is 71 per cent.

A functional assessment of the quantity and quality of housing in Chandigarh reveals the partial effectiveness of planning measures and proposals to pre-empt the development of conditions of overcrowding and congestion. Initially, the residential areas in Chandigarh were laid out on the basis of one household per plot. This was soon changed to two households per plot. At present, most of the southern Sectors have multistoried housing blocks. According to the 1991 census, 37.72 per cent of the households in Chandigarh occupy only one room. Further, the number of persons per house structure was 7.71 persons in 1991. The Sectors with a high number of persons per house also had a high density of houses (more than 1184.2 houses per sq. km). This implies a high intensity of development, promoting crowding. In addition, the ratio between the number of census houses and actual number of house structures was more than 1 for all the Sectors in Chandigarh, except Sector 25, which is dominated by slums and labour colonies. This implies a high and consistent degree of vertical development and apportioning. The plan proposals have inadvertently increased the levels of congestion. The specified amount of open space on each floor has been maintained by reducing the available floor space per person. This is especially true of the Phase II Sectors which were planned for higher densities of population. The rent values also give an indication of the housing shortage and levels of crowding. The rents are highest in Sectors located in proximity to major work areas and institutions, for example, Sectors 7, 11, 15, 22, 35 and 41. These Sectors, incidentally, are densely populated areas and have a high density of buildings. The reasons for the emergence of these attributes include the rapid rate of growth of the city’s population, regional circumstances which made the city a triple administrative unit, and the diversification of the functional base of the city. Consequently, apportioning of residential structures, irrespective of the size of house, the stage of development and status of a Sector can be identified in (a) the high density central Sectors, which developed during Phase I, and have the smallest plot sizes, and where the number of persons per house and ratio between the census houses and actual house structures are as high as 10.25 persons and 1:2.26 respectively; (b) low density high income group Sectors, which have large sized public and private houses, where the
construction of annexes and servants quarters has resulted in a high number of persons per house (for example, 9.46 persons in Sector 3); (c) Sectors with predominantly private housing, where the number of persons per house is generally more than 10, and (d) the southern Sectors, which have a high intensity of construction due to multistoried residential development and small size of plots.

Housing is an important determinant of the social fabric of a city. Chandigarh offered the planners the rare opportunity to dismantle many traditional social and religious barriers. In effect, the housing provisions in Chandigarh have perpetuated other forms of segregation that are spatially manifested in the morphological patterns of the city. A pattern of socio-economic segregation in the city can be identified at various levels. First, there are marked differences between the thirty Phase I Sectors and seventeen Phase II Sectors: the former were planned for 30 per cent of the city’s five lakh population, the latter for 70 per cent, implying higher densities in the latter through smaller plot sizes; the largest public and private plots are concentrated in the Phase I Sectors; for example, no private plot in the Phase II Sectors measures more than 1000 sq. yards, while there are over 700 such private plots in the Phase I Sectors; the multistoried blocks of flats constructed by the Housing Board in the Phase II Sectors have resulted in marked differences in the skyline of the two areas, and the objective of maintaining open space in the Phase II Sector houses has been achieved by reducing the floor space per person, resulting in congestion.

The attempts at mixing different types of houses within Sectors has not produced the desired results. In fact, a hierarchy based on the social and economic status of the residents of the Sectors is easily identifiable. At the city level, this hierarchy follows the orientation of the city from the north-east to south-west, and with ascending Sector numbers, the population density increases and the plot size and socio-economic status of the inhabitants decreases. At the intra-sector level, this hierarchy operates from A to D sub-units. It has been suggested that in Chandigarh, the old caste system has been substituted by a new and equally formidable one based on economic status. The government house designs and architectural style represented a compromise between financial constraints, locally available construction material and the climate. The standardization of house designs was extended to private houses as well, resulting in
regimentation and monotony of visual expression. This is in striking contrast to the architectural diversity found in evolved towns. Consequently, the identification of streets and Sectors in Chandigarh is fairly difficult. Further, the house designs ignored such vernacular traditions as a central courtyard.

Housing provisions in Chandigarh completely overlooked the informal sector, believing the euphoric statements promising equality and accessibility of urban infrastructure to all sections of society. Initially, the construction workers lived next to major construction sites such as the Capitol Complex. They were later shifted to peripheral sites, where their temporary status implied a virtual lack of infrastructural facilities. Some colonies were later relocated to adjacent villages on the outskirts of the city. As the city has developed, the number of labour colonies and slums has also increased. These, locationally and functionally, resemble those found in evolved cities. Recent statistics indicate a seven-fold increase in the number of jhuggi settlers over the last twenty-eight years. Approximately 52 per cent of the dwellings in the labour colonies comprise of unauthorized settlements. At present, the administrative policy is of rehabilitation at new sites and provision of basic services in the existing colonies.

Approximately a quarter of the total area in Chandigarh was allocated for circulation, underlining the importance given to this aspect in the city plan. The city was planned on a grid iron pattern with a hierarchy of roads graded to the speed and mode of traffic. The objective was to achieve an ordered and systematic flow of traffic. An assessment of the circulation system in Chandigarh in a spatio-temporal perspective reveals otherwise. The extensive grid iron layout has only succeeded in magnifying distances and making the provision of an efficient public transport system financially unviable. The effective functioning of the system of roads has been undermined by the rapid population growth of the city, the rise in living standards and the additional pressure generated by traffic from adjacent towns and villages. It has been estimated that the roads carry three times more traffic than their planned capacities. The objective of traffic segregation has proved impossible to achieve, with the intra-sector slow traffic roads carrying mainly fast through traffic, and the fast roads carrying mixed traffic. Shortcuts to the fast traffic roads, to avoid the kilometre long detour within Sectors, have emerged, resulting in hazardous junctions. The city roads carry a large volume of
heterogeneous traffic, defeating the purpose of a graded hierarchy of roads. In addition, the inadequacy, and even complete lack, of parking space has emerged as a major lacuna between the plan provisions and actual requirements. This is particularly true of public places, the City Centre, Sector shopping centres and the smaller marla houses. The consequent parking on adjoining streets reduces road space and adds to the traffic congestion. Roundabouts constructed at the intersections of the main roads have emerged as bottlenecks in the free flow of traffic, particularly during peak hours. At some busy junctions, the roundabouts have been substituted by traffic lights. While it is true that the road system in Chandigarh determines the layout and Sector orientation, the roads have also emerged as dividing lines in contrast to their role as an important cultural space in evolved towns. The city is well connected by bus, train and air services. While the bus terminus is in the City Centre in Sector 17, the railway station and airport are located at a considerable distance from the City Centre, creating problems of efficient accessibility.

The pattern of commercial landuse in Chandigarh contrasts with the one found in evolved towns in both location and layout. The wholesale market is located on the northeastern periphery of the city, in proximity to the goods transport area, the main arteries and the railway station. The main retail centre is the City Centre located at the junction of the main cross roads of the city in Sector 17. The City Centre has both civic and commercial functions and, unlike in the evolved towns, is a residually restricted area. In this aspect, it resembles the CBD of western cities. With its regimented architectural style, the City Centre is a poor counterpart of the Capitol Complex, and also contrasts with the traditional vibrancy associated with this functional area. In an attempt to decentralize the city centre functions, two sub-centres are being developed in Sectors 34 and 43. At the Sector level are the Sector shopping centres, comprising booths, shop-cum-offices and shop-cum-flats. The shopping centres in the Phase I Sectors have shopping booths and mainly shop-cum-flats, following the tradition of having residences in the same structure as commercial establishments. Shop-cum-offices are more common in the Phase II Sectors. The plan provisions overlooked the economic advantages gained from competition and the support of specialized services, since specialized market centres were not provided for in the plan. However, some of the Sector markets have emerged as
specialized markets, generally at the cost of Sector level shopping activities. These markets make specific demands in terms of parking and storage space, which are non-existent because the Sector markets were not laid out to perform such functions. The restriction of Sector level shops only to the southern side of the V4 roads has not been very successful, since in keeping with the traditional layout of bazaars, and with good economic sense, most of the residential structures on the northern side of these streets have been converted to commercial units. In a major policy decision, the Administration recently permitted commercial use in residential areas. This is bound to have repercussions in terms of an increased pressure on housing requirements, congestion and land values. Further, the lack of provision for the informal sector commerce has resulted in the emergence of rehri markets in different parts of the city, often located adjacent to the planned shopping centres.

The city has been fairly successful in maintaining a relatively high standard of provision of such utilities as electricity and water supply. Industry and domestic uses are the largest consumers of electricity in Chandigarh. The city receives the bulk of its water supply from the Bhakra Mainline Canal. The per capita supply of water in the city (312 litres per head per day) is considerably higher than the Government of India norms (150 litres per head per day). However, the availability of water in the city invariably falls short of the demand during the summer season. This problem is particularly acute in the multistoried flats. The water tariffs in the city are fairly low and reflect the element of subsidy involved.

Among the various urban services in Chandigarh, administration, the raison d'être of the city, is the most important. The symbolism involved in the creation of a new capital city has been most powerfully expressed in the buildings of the Capitol Complex, located in Sector 1 at the head of the plan. The three buildings comprising the Complex, the Legislative Assembly, the High Court and the Secretariat, and the three monuments, the Open Hand, the Tower of Shadows, and the Martyrs Memorial, designed by Corbusier, are evocative symbols of power, permanence and authority. In comparison, the rest of the buildings in the city, related to residential, institutional and public function uses, lack in visual interest and spatial variety. The most frequently made criticism of the Capitol Complex pertains to its excessive monumentality and inhuman scale. Secondly,
the Complex was not designed for future expansion, and additional administrative offices had to be developed elsewhere in the city.

Chandigarh has emerged as a major educational centre for the entire north-western region. A large number of graduate, technical, professional and postgraduate institutions, located in the city, cater to a large resident student population. This in turn influences the socio-economic character of the city population. The plan proposals provided for the location of at least one school in each Sector, to cater to the school-going population of that Sector. Functionally, however, the choice of a school is governed not so much by proximity to residence as by the economic status of parents and the reputation enjoyed by the school. Every Sector in the city has at least one government school. However, the private schools are concentrated in the middle and high income group Sectors. The city master plan also envisaged the provision of medical facilities within each Sector. In addition to public health centres, various institutions have their own health centres. Like other services, the public medical facilities are also heavily subsided. The majority of the private clinics and nursing homes are concentrated in the densely populated Sectors.

An important component of urbanism, according to Corbusier, was ‘Care of the Body and Spirit’. Nearly 19 per cent of the total area in Chandigarh was allocated for open space and recreational activities. In comparison, the evolved towns have less than 5 per cent of their area under this landuse. In Chandigarh, open spaces have been provided at the city, Sector and individual building level. The most extensive open space at the city level is the Leisure Valley, running north to south of the city through seven Sectors and comprising of parks, gardens and stadia. The plan proposals also provided for open spaces and green belts in each Sector. However, the maintenance of these open spaces has emerged as a major problem. The open spaces within individual houses have usually been converted to extra living space or garages for parking of automobiles. The Sukhna Lake, located on the northern periphery of the city, is the most important cultural space and a major tourist attraction. The city is also well served by other avenues of recreation such as cinemas, theatres, clubs and museums. The city has a number of religious places which function as an important cultural space in the Indian context.
The industrial landuse in Chandigarh is functionally segregated and located in an Industrial Area on the eastern periphery of the city, in proximity to the railway station, arterial roads and the wholesale markets. Initially the role of industries in the city was perceived to be limited, since the city was essentially planned as an administrative centre. Further, the type of industries permitted was restricted to light and service industries only. During the initial decades of the city's development, the Industrial Area developed slowly, hampered by these restrictions and the limited advantages offered by the city's location. However, the realization of the limited economic viability of administration as a basic function led to the provision of incentives, which promoted industrial development in the city on a much larger scale than initially perceived.

Approximately 9 per cent of the city area was reserved for future specified uses. Most of this land is located in the southern Phase II Sectors, and has been reserved for such commercial and institutional uses as the second ISBT and the second city sub-centre.

The meticulously drawn plan provisions in Chandigarh were aimed to create an ordered urban environment. However, their effect has been diluted by the limited expansion possible within the plan framework, the rapid population growth of the city, and the regional status of the city. This raises the issue of the flexibility and management of the plan structure in adapting to drastically different and unforeseen circumstances.

References and Notes


9. ibid, p.152.


33. *Department of Town Planning*, Chandigarh Administration.


40. Evenson, N. (1966) op. cit, pp 55 and 90, and Raj, S.D. (1964) op.cit, p.82.


43. Kaur, Manjit (1965) op. cit, p.21.


48. Vertical Development is an increase in occupancy with some addition to the physical space, Apportioning is an increase in occupancy without any addition to the physical space. Apportioning can occur with or without vertical development.

49. Sharma, K.D. (1995) op.cit., p.137. This study considered parts of a Sector, that is, A,B,C and D in its computation of data. This possibly explains the difference in the value of rank correlation.


64. As P.N. Thapar remarked to Maxwell Fry, 'You may bring me a house design and if it is a rupee over the estimate, you will have to go back and plan it again'. Fry, M. (1955) 'Chandigarh: The Capital of the Punjab', *Journal of the Royal Institute of British Architects*, Series 3, p.92.


70. 'The dominance of a modernization - orientation among scholars and policy makers in India had led to their conviction that poor citizens, with their associated slums and hutments, should simply not exist in cities which are striving to become modern, and should certainly not exist in those areas which, according to modern western concepts do not allocate any room for the poor'. De Bruijne, G.A. and H.Schenk (1992) 'Where do the Poor Live?: An Analysis of Residential Patterns of Poor Inhabitants in Indian Cities', *The Indian Geographical Journal* Vol. 67, pp.8-9.


73. Fry, M (1955) *op.cit*, p.94.


78. The difference between authorized and unauthorized settlements is in the tenure status of the dwellings. Those allotted authorized plots in labour colonies have the status of temporary lessees of the government, the rest are illegal squatters on government land. Sarin, M (1982) *op.cit*, p.159.


80. Unauthorised settlements are located in various sectors. These settlements owe their location to a process of natural evolution in which their relationships with neighbouring areas play a significant role. See Sarin, M. (1982), *op.cit* p.117 and 143.


102. Source: Chandigarh Police


111. For example, Sharma identified the Central Business Area, Street Shop Rows and Mohalla Shop Clusters in Rohtak. See, K.D.Sharma (1985), *op. cit.*, p.125; Taneja identified a four tier hierarchy of commercial areas in most evolved Indian cities, the CBD, Sectional Business Areas, Neighbourhood Business Areas and Local Business Centres. See, K.L.Taneja (1971) *op. cit.* pp. 91-108.


123. Source: *Chief Engineer*, Chandigarh Administration.


