A CASE STUDY OF THE MORPHOLOGICAL CHANGE OF FOUR WARDS OF DHAKA CITY OVER THE LAST 60 YEARS (1947-2007)
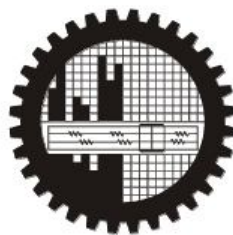
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Session: 2005-2006

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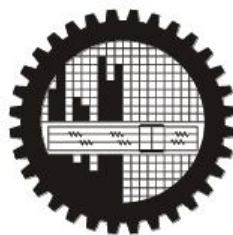**Dhaka-1000, Bangladesh**

January, 2008

A CASE STUDY OF THE MORPHOLOGICAL CHANGE OF FOUR WARDS OF DHAKA CITY OVER THE LAST 60 YEARS (1947-2007)

An undergraduate thesis submitted to
the Department of Urban and Regional Planning,
Bangladesh University of Engineering and Technology, Dhaka,
in partial fulfillment of the requirements for the degree of
Bachelor of Urban and Regional Planning

Submitted by

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Department of Urban and Regional Planning
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ABSTRACT

Dhaka City has undergone radical changes in its physical form, not only by territorial expansion, but also through internal physical transformations over the last decades. These have created entirely new kinds of fabric. With these changes, the elements of urban form have changed. Plots and open spaces have been transformed into building areas, open squares into car parks, low land and water bodies into reclaimed built-up land etc.

This thesis has its general interest in the morphologic change of Dhaka City. It focuses on the spatial dynamics of urban growth of Dhaka over the last 60 years from 1947-2007. The main objective of this thesis is to study the transformation of urban form and analyze the modern urban fabric of Dhaka City from 1947-2007.

This particular research has attempted to employ both empirical methods as well as configurational analysis in combination. To conduct this research, Wards 18, 19, 49 and 72 of Dhaka City Corporation, have been selected as the study areas. Ward 72 is an indigenous type of settlement, whereas ward 49 and 19 are planned and ward 18 represents a combination of both planned and informal type of settlement.

In this research, the transformation of urban form has been examined through space syntax. The aim behind using this technique is to describe aspects of relationships between the morphological structure of man-made environments and social structures and events. Therefore, the intervention of space syntax analysis with its quantitative syntactic measures ascertains the qualitative morphological attributes as well as the spatial configuration of spaces.

Time affects differently the layout of cities and the architecture of buildings. Of the many human creations, street systems are among the most resistant to change. This has been emphasized in this study, thereby facilitating the comparison of urban layouts across space and time. The interpretation of history in the light of quantitative accounts, as demonstrated in this study, will be of value to urban planners and urban designers for the future planning of modern Dhaka City.

ACKNOWLEDGEMENT

DEPARTMENT OF URBAN AND REGIONAL PLANNING
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DHAKA-1000, BANGLADESH

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ABBREVIATIONS AND ACRONYMS

ADPS	Architecture Department Photographic Society
BBS	Bangladesh Bureau of Statistics
BCAS	Bangladesh Centre for Advanced Studies
BPI	Bangladesh Photographic Institution
BSO	Bangladesh Survey Organization Limited
BUET	Bangladesh University of Engineering and Technology
CBD	Central Business District
CS	Cadastral Survey
CUS	Centre for Urban Studies
DC	District Commissioner
DCC	Dhaka City Corporation
DIT	Dhaka Improvement Trust
DOE	Department of Environment
DRA	Dhanmondi Residential Area
DSMA	Dhaka Statistical Metropolitan Area
DUPS	Dhaka University Photographic Society
DWASA	Dhaka Water Supply and Sewerage Authority
GIS	Geographical Information Systems
GoB	Government of the People's Republic of Bangladesh
IRS	Indian Remote Sensing
LGED	Local Government Engineering Department
NAB	National Archives of Bangladesh
PWD	Public Works Department
RAJUK	Rajdhani Unnayan Kartripakkha
RS	Revised Survey
SA	State Acquisition
SOB	Survey of Bangladesh
Tk	Taka
UN	United Nations
URL	Universal Resource Locator

TERMINOLOGIES AND GLOSSARIES

Bazar: Market Place.

Bigha: Unit of land measurement (1 bigha=0.33 acres/ 33 decimals).

Kutcha: Structure of temporary building materials.

Moholla: The English term 'Neighbourhood' is commonly known as 'Moholla' (in Urdu) or 'Para' (in Bengali) in Dhaka society. These two terms 'Moholla' and 'Para', basically indicate 'Social Neighbourhoods' with primary or face to face social interaction appearing in an area as an outcome of cohabitation.

Mouza: Mouza is a revenue village with a jurisdiction list number and defined area.

Muslin: Muslin was a world famous cloth of Dhaka. Its origin goes back to time immemorial. It was exported to all parts of civilized world mainly in 1660-1813 (Taifoor, 1956, pp. 36-38).

Pucca: Structure of permanent building materials.

Semi-pucca: Structure of semi-permanent building materials.

Taka: Unit of money in Bangladesh.

Thana: Thana is the unit for Police administration in urban areas.

Union: Union is the smallest electoral unit of rural areas which are comprised of mouzas and villages. It has elected Union Councils.

Ward: Ward is the smallest electoral unit of urban areas in Bangladesh. It has elected Ward Councils under the Municipalities. There was 58 Wards under Dhaka Municipality during the 1981's Census, which has increased in 75 wards during 1991. And now there are 90 wards in Dhaka City Corporation and 10 zones.

Chapter 01

Introduction

Dhaka, the capital of Bangladesh, well known as city of fine muslin, mosques and rickshaws has a fairly long history of evolution. Dhaka with passage of time testifies different faces of history.

An ancient community of uncertain origins, Dhaka rose to importance in the 17th century when it was the Mughal capital of Bengal Province from 1608 to 1639 and again from 1660 to 1704. During that period it became known for the production of fine muslins. The city declined after the capital was moved to Murshidabad in 1704, and it came under British control in 1765. With the partition of British India in 1947, Dhaka became the capital of the Pakistan province of East Bengal, and in 1956 it was made the capital of East Pakistan. The city suffered considerable damage during the 1971 war for independence from Pakistan before becoming the capital of newly independent Bangladesh in late 1971.

Now-a-days Dhaka is the most densely populated and rapidly growing city in the third world countries. With its growth, Dhaka has been a showcase for almost every urban problem imaginable.

1.1 Background of the Study

Dhaka, the capital city of Bangladesh, is located in one of the largest delta systems of the earth formed by the Brahmaputra, Jamuna and the Ganges. The delta makes the region one of the most fertile lands on earth. The Ganges, the Jamuna and Brahmaputra with their tributaries provided excellent cross-country communication even in the days when roads were few and railways were unheard of. The rivers were divided into branches and tributaries that people could easily travel along by water transports. Situated in the center of the delta Dhaka had a command over all the water routes. It was also comparatively well placed for inland communications. The geographical location of Dhaka with its network of inland waterways made it an important location both strategically and commercially.

Like many other cities in the world modern Dhaka is also the outcome of spontaneous rapid growth without any prior or systematic planning. As the growth of population in Dhaka is taking place at an exceptionally rapid rate, it has become one of the most populous Mega cities in the world. In the process of urbanization the physical characteristics of Dhaka City is gradually changing as open spaces and water bodies are converted into built up areas.

It is necessary to track the morphological changes of Dhaka City which mainly includes the changes of physical form of the city.

The growth and development of Dhaka can be categorized into six periods, e.g. the pre-Mughal period (1205-1610), the Mughal period (1620-1757), the East India Company period (1758-1858), the British colonial period (1858-1947), the Pakistan period (1947-1971) and the Bangladesh period (from 1971). As society radically changed after British colonial period, Dhaka City underwent drastic changes over the past decades.

This study would look into the character of transformation of urban morphology of the metropolitan area of Dhaka over the last 60 years (1947-2007).

Dhaka City has undergone radical changes in its physical form, not only in its vast territorial expansion, but also through internal physical transformations over the last decades. These have created entirely new kinds of fabric. With these changes in urban form, the elements of urban form have changed. Plots and open spaces have been transformed into building areas, open squares into car parks, low land and water bodies into reclaimed built-up land etc.

This study tries to identify those new urban elements and refine and develop the transformation typology. This new urban fabric is to be analyzed to understand the changes that have led to its creation.

1.2 Objectives of the Study

The study has been conducted to achieve the following objectives:

- To study the transformation of urban form of Dhaka City over the last 60 years (1947-2007).

- To analyze the modern urban fabric of Dhaka City.

1.3 Rationale of the Study

In a developing country like Bangladesh urban areas are rapidly expanding. For this reason urban form, i.e., the shape and extent of urban built-up area, is changing very fast. According to the Population Census 2001, about 23.4% people live in urban areas of Bangladesh (BBS, 2001) and the aggregate size of urban population is 28.8 million. Now by 2006, more than one-fourth of the total population of the country lives in urban areas (Basak, 2006).

The most important development that has taken place in Dhaka City's recent history is the overwhelming growth of its population. In 1872, at the time of the first census, Dhaka had a population of 69,212; in 1881, 79,076; in 1911, 1, 25,000; and in 1941, 2, 39,000. After the Partition of 1947 the increase in population showed a steady rise with the arrival of migrants from India and in 1951 the population jumped to 3, 36,000. According to the census of 1961, the city had a population of 5, 56,000, a growth of some 44.63% during a decade. This growth rose dramatically after 1971. By 1974, the population increased to 16, 80,000; in 1981 it reached 34, 40,000; and in 1991, 61, 50,000 (Chowdhury, n.d.).

According to the 1991 census, urban population growth rate in Bangladesh was 5.4% with 6.8% of area expansion per annum (1981-1991). At that time, urban population was about 22 million, i.e. 20.1% of total population of the country (BBS, 1997). By the year 2001, it increased to 28 million (nearly 23.4% of national population), which indicates that urban population growth rate, in the last 10 years (1991-2001), was only about 3.2% per annum (BBS, 2001).

United Nation's Human Settlements Programme (UN-HABITAT) projected that Bangladesh might have 4.5, 3.6 and 2.8 percent urban population growth rate in the year of 2000, 2015 and 2025 respectively (Basak, 2006).

The unprecedented growth of the city and the lure of jobs and opportunities, real or imaginary, led enormous numbers of rural migrants from all over the country to come to Dhaka. This enormous growth in population has had its impact upon the city's streets & roads, urban pattern, open space, housing and various service sectors as well as upon its social and economic life, especially upon its environment throughout different periods of time. In this regard this research tries to study the transformation of urban forms of Dhaka City from 1947-2007, with a view to understand how the urban fabric of this city has changed from time to time.

1.4 Limitations of the Study

This report has been prepared based on secondary data and information collected from relevant organizations and published reports. Some of the key issues were only supported with updated data. On the other hand, many of the relevant organizations and reports show the different figure of the same data for the same. Therefore, some of the data are incorporated based on assumption. These may lead to certain limitations in the report. The following may be the limitations of the report:

➢ Limitation due to the inadequacy of the research materials such as maps, photographs and other relevant documents.

➢ However, due to time limitation, this research basically takes help from secondary resources.

➢ Different organizations show the different figures for the same issues for the same period.

➢ The data that have been used in this report from different sources may have some inaccuracies.

Chapter 02

Theoretical Framework

In this chapter the technical terms that have been used throughout the whole thesis, are discussed in brief. Moreover, a brief discussion is also conducted on the theories and concepts of formation of various types of cities and the method that is applied in this study.

2.1 Urban Area

An urban area is an area with an increased density of human-created structures in comparison to the areas surrounding it. This term is at one end of the spectrum of suburban and rural areas. An urban area is more frequently called a city or town.

The definition of what constitutes a city changes from time to time and place to place, but it is most usual to explain the term as a matter of demographics. The United Nations has recommended that countries regard all places with more than 20,000 inhabitants living close together as urban; but in fact, nations compile their statistics on the basis of many different standards. [URL: 1]

In Japan urbanized areas are defined as contiguous areas of densely inhabited districts (DIDs) using census enumeration districts as units with a density requirement of 4,000 people per square kilometer. The United States, for instance, "uses urban place to mean any locality where more than 2,500 people live". [URL: 2]

According to the Paurashava Ordinance 1977, the Government of Bangladesh shall not declare any rural area to be an urban area unless it is satisfied that:

- Three-fourths of the adult male population of the area to which it refers are chiefly employed in pursuits other than agriculture,
- Such area contains not less than fifteen thousand population and
- An average number of not less than two thousand inhabitants per square mile.

2.2 City

A city is an urban settlement with a particularly important status which differentiates it from a town. City is primarily used to designate an urban settlement with a large population. However, city may also indicate a special administrative, legal, or historical status.

There is no one standard international definition of a city: the term may be used for a town possessing city status or for an urban locality exceeding an arbitrary population size; for a town dominating other towns with particular regional economic or administrative significance.

Although city can refer to an agglomeration including suburban and satellite areas, the term is not usually applied to a conurbation (cluster) of distinct urban places, nor for a wider metropolitan area including more than one city, each acting as a focus for parts of the area. And the word "town" (also "downtown") may mean the center of the city. [URL: 3]

2.3 Urban Fabric

The urban fabric is the physical form of towns and cities. In walkable communities, the urban fabric encourages walking as the primary mode of transportation by ensuring that most people's needs are within walking distance, and providing an environment which is safe and pleasant for pedestrians. [URL: 4]

2.4 Urbanization

Urbanization or Urbanisation means the removal of the rural characteristics of a town or area, a process associated with the development of civilization. Demographically, the term denotes redistribution of populations from rural to urban settlements. [URL: 5]

2.5 Urban Morphology

Urban morphology is the study of the physical form of a city, which consists of street patterns, building sizes and shapes, architecture, population density and patterns of residential, commercial, industrial and other uses, among other things.

Special attention is given to how the physical form of a city changes over time and to how different cities compare to each other. Another significant part of this subfield deals with the study of the social forms which are expressed in the physical layout of a city and conversely, how physical form produces or reproduces various social forms. [URL: 6]

2.5.1 An Emerging Issue

Urban morphology is the study of the city as human habitat. Urban morphologists concur: they analyse a city's evolution from its formative years to its subsequent transformations, identifying and dissecting its various components.

The city is accumulation and integration of many individual and small group actions, themselves governed by cultural traditions and shaped by social and economic forces over time. Buildings, gardens, streets, parks and monuments, are among the main elements of morphological analysis.

These elements, however, are considered as organisms which are constantly used and hence transformed through time. They also exist in a state of tight and dynamic interrelationship: built structures shaping and being shaped by the open spaces, public streets serving and being used by private land owners along them. The dynamic state of the city and the pervasive relationship among its elements, have led many urban morphologists to prefer the term 'Urban Morphogenesis' to describe their field of study (Moudon, 1997).

2.5.2 Theoretical Basis

Morphological analysis is based on three principles (Moudon, 1997).

1. Urban form is defined by three fundamental physical elements: buildings and their related open spaces, plots or lots, and streets.
2. Urban form can be understood at different levels of resolution. Commonly four are recognized, corresponding to the building/lot, the street/block, the city and the region.
3. Urban form can only be understood historically since the elements of which it is comprised undergo continuous transformation and replacement.

Thus form, resolution and time constitute the three fundamental components of urban morphological research.

2.6 A Brief Discussion on Organic and Planned Urbanism

Cultural, social and administrative structures and religious beliefs affect the forms of settlements. Organic settlements realize in space quite different social schemes and priorities from those of symbolically-ordered settlements. In organic settlements, the movement of people shapes the structure of space and the configuration of the streets reinforces those movements. As space plays an instrumental role in these settlements, they show different characteristics from those of towns in which space is organized more in relation to buildings of symbolic importance. In instrumental towns, space tends to be intensively used. In symbolic towns, many important spaces are much more sparsely used (Kubat, 1999).

The notion of 'organic' has its roots in modern biology and the concept of living organisms. It can begin with an analogy between the visual characteristics of cities and natural organisms. There is also another view which seeks the similarities between the human organs and elements of the urban form:

"The idea of a city as being composed of a 'heart'- the central business district, of `arteries' and 'veins' in terms of the hierarchy of transport and communications *routes, of 'lungs' in terms onscreen space and so on"* (Batty and Longley, 1994.p. 31).

However, the more appropriate definition of organic cities has been envisaged as the opposite meaning to 'planned' or 'preconceived' cities. James Vance defines these two classes as:

"The preconceived city is laid out by an emperor, bishop, or other authority possessed of the power to start a settlement from scratch, still believing strongly that of city founding, and thus needful of an elaborate and inclusive plan. The organic city includes those settlements established at a geographical point but left to evolve in physical pattern as functions and fates determine" (Vance, 1977, p. 24).

However, it is conceivable that all types of cities - even planned cities - at some stages of their lives are subjects to natural modifications. There are three determinants which help us to clarify the ambiguous boundaries of organic and planned cities: **first**, the initial layout of the city; **second,** the duration of the process of natural growth; and, **third,** the scale of development (Karimi, 1997). It can be noticed that the cities which have been laid-out in a regular manner, at some period of time, show more tendency to preserve their initial structure in later periods, whereas the cities which had started from a more, natural pattern of growth - such as villages - tend to fulfil more organic structures (Karimi, 1997). However, if there is a considerable period of natural growth, and also if there is no imposing power to control the geometrical pattern of the city, even the artificially planned cities can adopt organic patterns. The scale of development and change is also a key distinction:

"Cities which grow naturally are formed from a myriad of individual decisions at a much smaller scale than those which lead to planned growth which embody the actions of somewhat larger agencies. Planned cities or their parts are usually more monumental, more focused and more regular, reflecting the will of one upon which many, or at best, reflecting the will of the majority through their selected representatives" (Batty and Longley 1994, p. 8).

It is difficult to say how many years or what situations provide the conditions necessary for natural growth, but the key point here lies between two modes of the dominant nature of urban structure: the city as a product of limited ideas based on a preconceived organisation, or the city as a product of numerous thoughts operating more randomly and over a long period of time (Karimi, 1997).

Perhaps the primary concept which distinguishes organic cities from the other types is the notion of 'irregularity'. Unlike regular patterns, organic forms do not follow geometrical orders. They cannot be easily measured, since they lack basic properties such as repetition, symmetry, parallel elements, alignment and so on. However, the notion of irregularity has not been conceived equal to 'disorder', 'chaos' or 'disorganization' by recent urban theorists; on the contrary, the freedom from a predetermined urban grid, many urbanist believe, can create a highly flexible system of urban growth which intermingles the demands for various functions with the customary social conventions, and cannot be obtained in regular patterns (Karimi, 1997).

If the city is considered as the physical manifestation of various determinants, it is apparent that the physical structure of the city is a complicated product which is unlikely to be easily tackled just by the superficial geometrical order. Geometry is the way of representing the physical organisation, but it is neither the creator of urban life, nor the logic behind its behaviour. There are two ways of approaching this problem. It can be done either by employing a new form of geometry which seeks deeper patterns of order, or by adding new dimensions to the concept of order in the city (Karimi, 1997).

There is also a second way of dealing with the problem of irregularity and order by providing a new interpretation of order. Julienne Hanson introduces a new dimension by differentiating between 'order' and 'structure':"... order, in the sense of principles based on some generally accepted notion of sameness, repetition, geometry, grid, *rhythm, symmetry, harmony and the like..... structure,* in the sense of making places intelligible through creating local difference which give both a sense of identity and a grasp of relation between the parts and whole, such we are able reliably to infer the global form from any position within it " (Hanson, 1989).

2. Another type of development known as **'Formal/Planned'** schemes/ geometric layout has been introduced in Dhaka city after 1950's. Their street layout follows a rigid grid-iron pattern with some semi-circular areas. The high space and service standards and physical shapes of these schemes have an aura of Western suburbia, modernity and status.

   The formal settlement, on the other hand, is very much use-specific (separate zone for residential/commercial/industrial/institutional etc.) and compartmentalized. For example areas like Dhanmondi, Tejgaon, Gulshan, Banani, Baridhara, Lalmatia, and Mohammadpur and so on.

3. In the newer extensions of Dhaka, outside the historic core, similar organic morphological patterns are prevalent which have been spontaneously developed without any rigid planning proposal. However, the social as well as the morphological impetus of these newly generated extemporaneous areas still remain unknown as little has been extracted from their living urban fabric (Nilufar, 1997).

   In terms of established planning principles the character of these areas is seen as a confused urban sprawl. There remains quite a lot of prejudice attached to these unplanned areas; and they are customarily described as **'Informal'** development. These new generation organic areas are generally developed according to aspiration of their inhabitants just like that of the historic city itself (Nilufar, 1997).

   The informal settlement lies in between the two, which ranges from a formal variation to indigenous variation according to need of time and place. Areas like Ramna, Shantinagar, Moghbazar, and Badda are examples of this type of settlement.

These three types of settlements in the context of Dhaka City are depicted (Figure 2.1) below.

a. Indigenous Pattern of Old Dhaka

b. Informal Layout in New Dhaka

c. Planned Layout in New Dhaka

Figure 2.1: Different Spatial Patterns of Dhaka City

Source: Google Earth Image, 2007

2.8 Space Syntax

The adopted methodology in this thesis, space syntax, investigates the configurational properties of urban structure by measuring the relationship between each component of the urban system and all other components.

The term **Space Syntax** encompasses a set of theories and techniques for the analysis of spatial configurations. Originally it was conceived by Bill Hillier, Julienne Hanson and colleagues at the Bartlett, University College London in the late 1970s to early 1980s as a tool to help architects simulate the likely social effects of their designs. [URL: 7]

It has since grown to become a tool used around the world in a variety of research and areas and design applications in the fields of architecture, urban design, planning, transport and interior design. In general, the analysis uses one of many software programs that allow researchers to analyse graphs of one (or more) of the primary spatial components.

The general idea is that spaces can be broken down into components, analyzed as networks of choices, and then represented as maps and graphs that describe the relative connectivity and integration of those spaces. It rests on three basic conceptions of space [URL: 7]:

- an **isovist**, or view shed or visibility polygon, the field of view from any particular point,
- **axial space**, a straight sight-line and possible path, and
- **convex space**, an occupiable void where, if imagined as a wire frame diagram, no line between two of its points goes outside its perimeter, in other words, all points within the polygon are visible to all other points within the polygon.

Space syntax is a set of descriptive techniques for representing, quantifying and modelling spatial configuration in buildings and settlements. Three transcriptions - axial, convex and visual fields - are commonly used to break up at layout into its constituent elements, Figure 2.2.

Axial Line

Convex Space

Convex Isovist
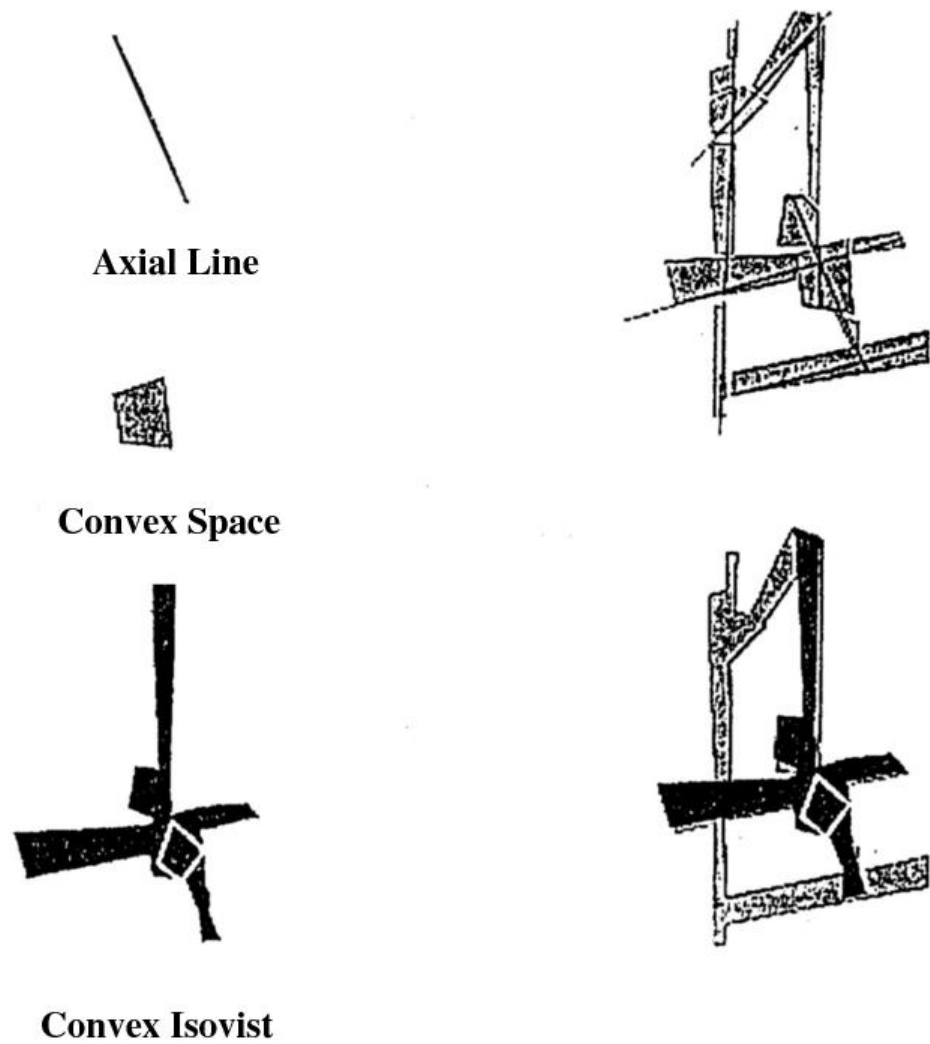
[The Model Adopted in this Thesis is Axial Representation]

Figure 2.2: Axial, Convex and Visual Field in Syntactic Representation

Source: Nilufar, 1997

In what follows, the analysis of urban grids is based on the **Axial Map**. An axial map records the least set of longest and straightest lines of sight and access which covers the public system of open spaces of the city and makes all the street intersections which are present in the urban grid. Every island or urban block is surrounded by axial lines, and every street intersection within the urban grid is recorded as an intersection of axial lines. Thus, the axial structure might be considered as all objective transcription of the structure of the urban grid. An axial nap is basically different from a street map in that it expresses the importance of sight, and so the

representation joins two roads along the same axis into one and breaks one curvilinear road -into a number of connected lines. These axial maps are used in the space syntax method as the basis for deriving a series of measures of the properties of the configuration of the street grid. There are four first order or direct measures, and these four may in turn be correlated together to form second order measures, as set out below (Nilufar, 1997).

The most important measure is **'Integration'**, which is the relative depth or shallowness of any spatial system seen from any particular point within it. Integration is a global static measure in that every axial line is assigned value which characterises its relation to all other lines in the grid, thus providing a global index of relative integration or segregation for that line relative to all others, (R=n).

Therefore, integration of a line is by definition a value which indicates the degree to which a line is more integrated, or segregated/inaccessible, from a system as a whole. The measure is actually based on a more basic notion called depth. Depth is more generally a topological distance in a graph. If two lines are directly connected, then the distance between them is equal to one, and the distance of a pair of lines which are not directly connected is the shortest path between them (Ferdous, 2007). Integration is a global measure, as the calculation of integration is based on the total depth from the current. However, if a number of depths, instead of all depth, are considered, then the integration is called local integration.

The numerical value is usually number varying between 1 and the lowest positive figure (higher than 0) and within this range higher values indicate low integration and vice verse (Nilufar, 1997). It is calculated by the formula:

$$\frac{2\,(MD-1)}{K-2}$$

Where MD is tile 'mean depth' or mean number of spaces away from all the other spaces in the system from the selected space, and k is the total number of spaces in the system. A correcting factor is then applied to eliminate the empirical effects of size (Hillier and Hanson, 1984).

The integration values are then rank ordered from the most integrated to the most segregated line, divided into five integration bands and each band is assigned a 'grey scale' tone to represent its degree of integration, with black representing the most integrated band and palest grey the most segregated. These tones are then transferred to the axial map as a distribution of integration which will show in black the set most integrated streets which draw the urban grid together, and which are collectively known as an **'Integration Core'**. The nature of the integration core, its shape, size, coverage and so on, depends basically on the shape, connectedness and geometry of the urban system, and on its mode of growth (Nilufar, 1997).

In addition to looking at the integration pattern of the city overall, the method is also used to understand the structure of locally integrated lines (R=3), by computing a more immediate measure giving a value for integration among the spaces up to three steps away from the root. It is conjectured that, to the extent that parts of an urban grid are differentially connected within and between themselves, this should be revealed by the rank order of the local integration values (Nilufar, 1997).

The integration core of a city is most of the time coincide with the functional core of the city. However, depending on the size and segment of axial map urban core formed with 1 to 10% highest integrated line of urban grid (Ferdous, 2007). Global integration consider the total city structure as a whole, while local integration only characterises the pattern of locality based integration in small scale (Ferdous, 2007).

The second measure is **'Choice' (CH)**, which express the extent to which a particular space (axial line) figures as a choice on all shortest routes from all spaces to all other spaces in the system (Nilufar, 1997). The higher choice lines influence global relations of through movement, thus it is considered to be a global dynamic measure.

There are parallel local measures as well. **Connectivity (CN)** is literally the number of axial lines which connect to, or intersect with, each line in the system. It is a local static measure. On the other hand, the measure of local **Control (CV)** represents the amount of choice of a space represents to its immediate neighbours as somewhere to go. Thus it gives rise to a local dynamic measure. Control is expressed with values

varying about 1 in which high values indicate strong control, i.e. how much better or worse connected a space is than its neighbours (Nilufar, 1997).

In addition to these four first order syntactic measures, a second order measure, **'Intelligibility'**, is also applied in particular part of work. It is the correlation between the local and the global properties of spaces which expresses the degree to which the local properties of space are a good guide to their properties in terms of the system as a whole (Nilufar, 1997). The stronger the correlation, the more we can infer the global position of a space from its directly observable local connections (Kubat, 1999).

The relationship between the first and second order measures is best understood from the Figure 2.3 (Nilufar, 1997). Thus the second order measures even have sociological potential, such as the correlation between integration (R=n) and connectivity (CN) express the extent to which the axial information which is available to an individual moving through a particular space about how it relates to its neighbours locally, also gives reliable information about the large scale global structure of the grid.

LOCAL   GLOBAL

Intelligibility

State   Connectivity (CN) $\longrightarrow$ Integration (RA)

Local Predictability

Global Predictability

Dynamic   Control (CV) $\longrightarrow$ Choice (CH)

Interface Potential
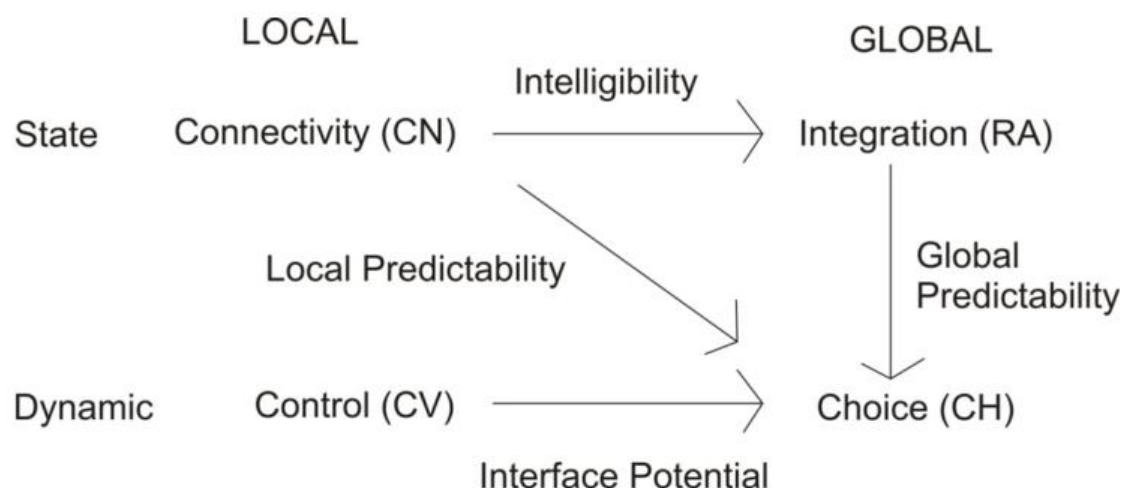
Figure 2.3: A Model of the Relationship between First and Second Order Syntactic Measures

Source: Nilufar, 1997

However, the basic components of syntactic measures are defined below:

Axial Map depicts the least number of straight lines that possibly follow on foot and covering all convex spaces or meeting places of a layout with their connections.

Convex Map is the set of fattest spaces that covers the open space structure of the urban system (Kubat, 1999).

Isovist Map depicts the area that can be viewed from a point of convex space or axial lines.

Integration describes the average depth of a space to all other spaces in the system and can be rank from most integrated to the most segregated.

Integration Core of a settlement is 10-25 percent of the most integrated lines, numbered in order of integration. It can be treated as a representation of syntactic centrality (Kubat, 1999).

Connectivity measures the number of immediate neighbours that are directly connected to a space.

Control measures the degree to which a space controls access to its immediate neighbours taking into account the number of alternative connections that each of these neighbours his.

Intelligibility of an urban system is the degree of correlation between global and local properties of each line in the system.

Chapter 03

Dhaka: An Overview of its Historical Physical Growth

Dhaka, the capital and the most populated city of Bangladesh, is now a member of the "mega-city" family of the world. Dhaka, the fifth largest mega city, comprises of Dhaka City Corporation (DCC) and five adjacent municipal areas i.e. Savar, Narayanganj, Gazipur, Kadamrasul and Tongi (BBS, 1991). The area of Dhaka of which DCC occupies mega city is 1,353 km (BBS, 2001).

3.1 Geographical Location

Dhaka is located in central Bangladesh at 23°42′0″N, 90°22′30″E, on the eastern banks of the Buriganga River. The city lies on the lower reaches of the Ganges Delta and covers a total area of 815.85 square kilometres (315 sq mi). It consists of seven principal thanas — Dhanmondi, Kotwali, Motijheel, Paltan, Ramna, Mohammadpur, Sutrapur, Tejgaon — and 14 auxiliary thanas. In total the city has 90 wards and 725 mohallas. Dhaka district has an area of 1463.60 square kilometres (565 sq mi); and is bounded by the districts of Gazipur, Tangail, Munshiganj, Rajbari, Narayanganj, Manikganj. [URL: 8]

Tropical vegetation and moist soils characterise the land, which is flat and close to sea level. This leaves Dhaka susceptible to flooding during the monsoon seasons owing to heavy rainfall and cyclones. The geographical location and administrative units of the city is given in Figure 3.1, Figure 3.2 and Figure 3.3.

3.2 A Brief History of Dhaka City

Historians disagree on when the city of Dhaka was founded. The official date is 1610, when it was turned into a capital of the Bengal province by Mughal rulers who once controlled most of what is modern-day India. Previous to that, there had been other various Hindu, Buddhist and Muslim kingdoms (Mamun, 1989).

Figure 3.1: Map of Dhaka District

Source: http://www.dcdhaka.gov.bd/mapofdhaka.html

Dhaka City Corporation Area

DCC Boundary
Ward Boundary
River

Dhaka Metropolitan Area

Name of Thana

BADDA	HAZARIBAGH	MIRPUR	KHILGAON
CANTONMENT	KAFRUL	MOHAMMADPUR	SABUJBAGH
DEMRA	KAMRANGIRCHAR	MOTIJHEEL	SHYAMPUR
DHANMONDI	KOTWALI	PALLABI	SUTRAPUR
GULSHAN	LALBAGH	RAMNA	TEJGAON
			UTTARA

Dhaka Statistical Metropolitan Area

Thanas Under
Dhaka Metropolitan Area and
BANDAR
GAZIPUR SADAR
KERANIGANJ
NARAYANGANJ SADAR

Dhaka Metropolitan Development Planning (DMDP) Area

Thanas Under Dhaka
Metropolitan Area and
BANDAR   RUPGANJ
GAZIPUR SADAR   SAVAR
KERANIGANJ   SONARGAON
NARAYANGANJ SADAR

DHAKA CITY

Organizational Definition
of Boundary

2   0   2   4 km

Data: Population Census 2001, National Report

Figure 3.2: Area under Jurisdiction of Different Authorities

Source: GIS division, BCAS
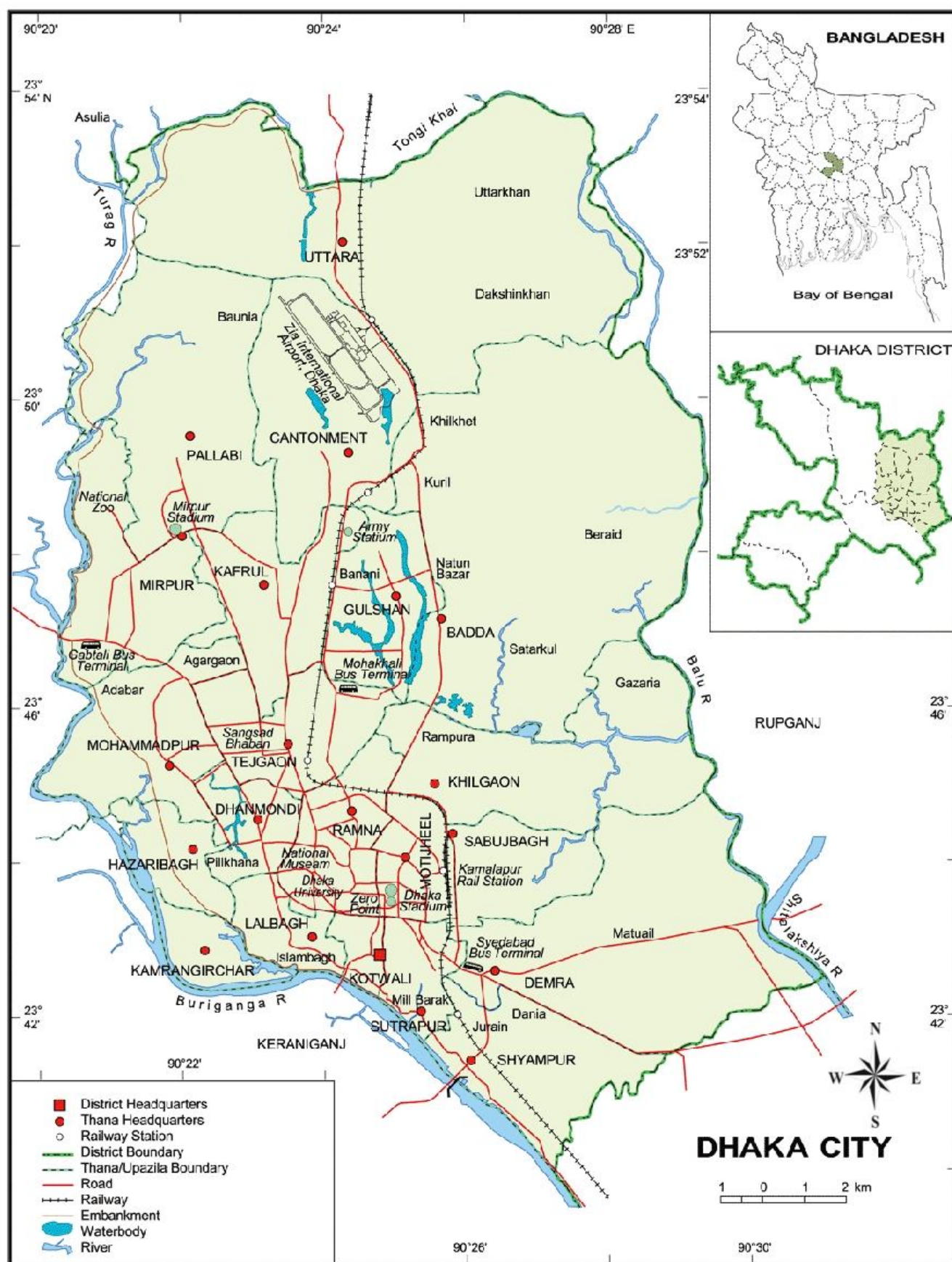
Figure 3.3: Map of Dhaka City

Source: http://banglapedia.org.html

There is also dispute on where the name Dhaka, previously spelled "Dacca," comes from. The word means "covered" in Bengali. Its name is said to refer to the dhak tree, once common in the area, or to Dhakeshwari ("The Hidden Goddess"), whose shrine is located in the western part of the city. The Romanized spelling of the Bengali name was changed from Dacca to Dhaka in 1982 (Mamun, 1993).

Dhaka carries a very long history dating back from the 7th century A.D. to present times (Ahmed, 1991). The city actually faced a dramatic historical turn-up from its beginnings as a small city with few people, to the tremendously expanded demographic and topographic structure it is today with distinct spatial and demographic characteristics.

Under Mughal rule in the 17th century, the city was also known as Jahangir Nagar, and was both a provincial capital and a centre of the world-wide muslin trade. The modern city, however, was developed chiefly under British rule in the 19th century, and soon became the second-largest city in Bengal after Calcutta. With the partition of India in 1947, Dhaka became the administrative capital of East Pakistan, and later, in 1972, the capital of an independent Bangladesh. During the intervening period, the city witnessed widespread turmoil; this included many impositions of martial law, the declaration of Bangladesh's independence, military suppression, devastation during war, and natural calamities.

3.3 Physical Growth of Dhaka City

The surface of Dhaka is almost flat. The major part of the city lies between 20 and 50 feet above sea level and it is free from flood (normal flood level being 18' 16"). Only small parts of Dhaka lying in the north, east and south west are inundated during the rainy season (Islam and Khan, 1964).

Dhaka stands on the northern bank of the Buriganga River, about 13 km above its confluence with the Dhaleswari. It commands connection by navigable waterways with the Padma, the Brahmaputra and the Meghna river-system that affords the convenience of water carriage to and from any principal place of the Bangladesh (Chowdhury, n.d.).

The Buriganga, branching off from the Dhaleswari little below Sabhar, comes through the western and southern side of the city and curving rightward it again meets the Dhaleswari beyond Fatullah, thus forming the southern and western boundary of the city. A number of other water channels (mainly Dulai channel, Pandu River and Baloo River) criss-crossed through and around the city. Thus an important topographical constraint was created for the growth of the city (Chowdhury, n.d.).

Dhaka stretches from the Buriganga bank in the south towards the north practically to the Tongi River and the stretch of high land is flanked on either side by low-lying marshes and old river beds. The low-lying swamps have crept right into the hearts of the high areas, as in the case of the Mirpur to Cantonment depression from the west to the east as also the Baridhara-Khilkhet-Uttara depression from the east to the west. As a result the physical expansion of the city has not been easy and without difficulty. Topographical considerations dictated the growth of the city in its different phases of existence (Chowdhury, n.d.).

Historically, the development of Dhaka city started from the southern part, that is, the present "old town" (Pre-Mughal period), then the extension continued toward the west and the north (Mughal and British period). During Pakistan period, the development advanced primarily towards the north (Chowdhury, n.d.) and it continued rapidly and in an unplanned way towards every side of the city. Figure 3.4 shows changing pattern of Dhaka City and its population and the following section provides a brief on city's physical development at different stages of its growth.

Below the growth of Dhaka City, from pre-mughal period has been described briefly. Although the study concerns from 1947-2007, but to understand the pattern of the morphological change of Dhaka City, it is necessary to go through the overall stages.

3.3.1 Pre-Mughal Dhaka (Before 1608)

Dhaka was under the Buddhist Kingdom of Kamrup in the 7th and 8th centuries. From about the 9th century A.D. is was governed by the Sena Kings of Vikrampur. Some indications of human habitation of the area of the said period have been discovered which provide the evidence of existence of this town or settlement (Dani, 1962).
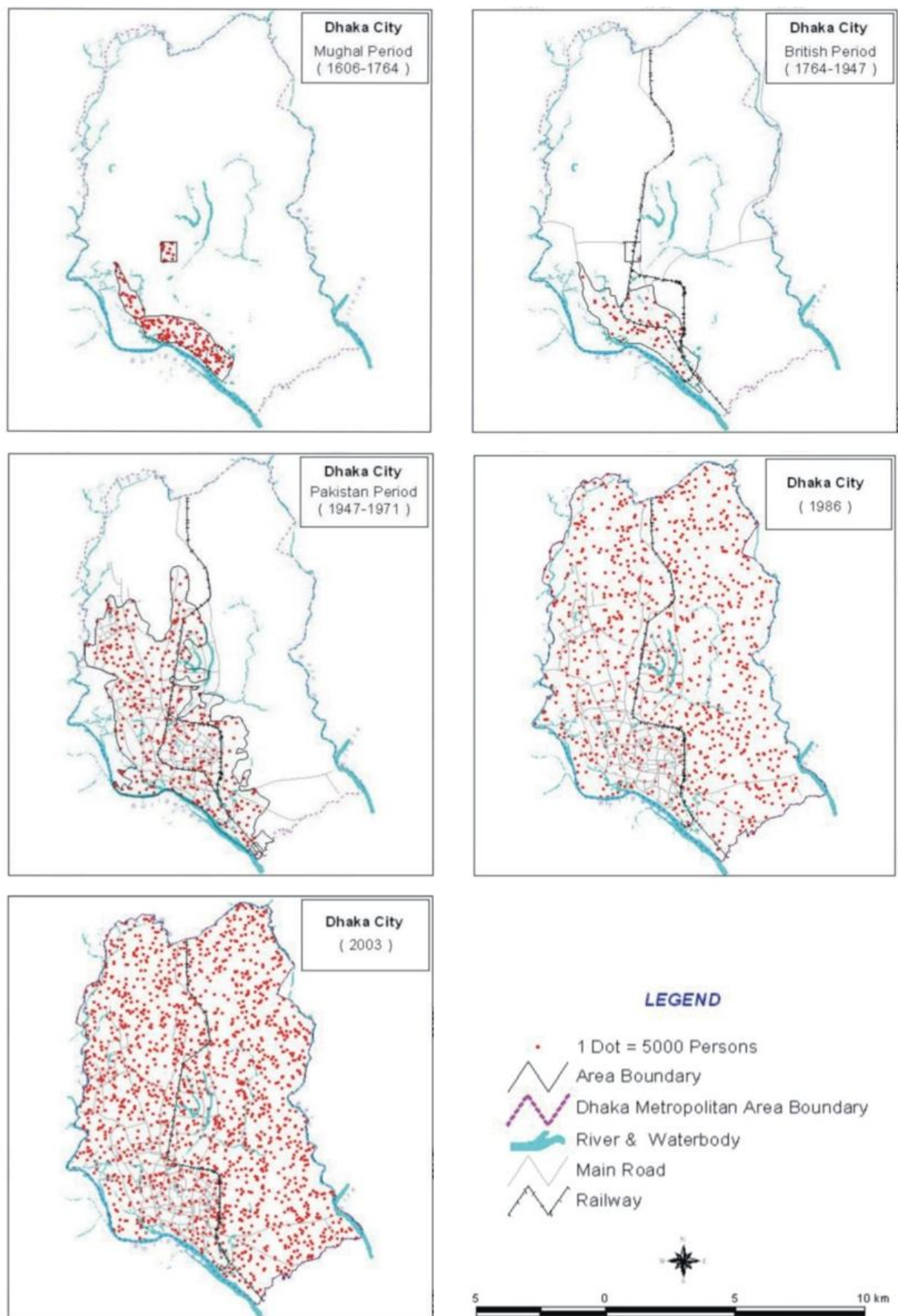
Figure 3.4 Changing patterns of Dhaka City and its population

Source: GIS division, BCAS

It is around that time the name of Dhaka originated from the name of "Dhakeshwari Temple" which was built by Raja Ballal Sen. Dhaka of that time was identified as Bengalla and was probably a small town (with "fifty two bazars and fifty three lanes") lying between the river and what is now the Dulai Khal with its center near the present Bangla Bazar (Birt 1906 p. 94).

The town consisted of a few market centers like Lakshmi Bazar, Shankhari Bazar, Tanti Bazar, and a few localities of other craftsmen and businessmen like Patuatuli and Kumartuli, Bania Nagar and Goal Nagar (Islam and Khan, 1964).

After the Hindu rulers, Dhaka was successively under the Turks and Pathans for a long time (1299 to 1608) before the arrival of the Mughals. The Afghan Fort in Dhaka was located at the present Central Jail. After the Pathans, Dhaka went under the rulers of Sonargaon from whom the sovereignty of the area was acquired by the Mughals (Islam and Khan, 1964).

3.3.2 Dhaka City under the Mughals (1608-1764)

Islam Khan (1608-1613) was appointed the first Mughal Viceroy of Bengal in 1608. He shifted his capital from Rajmahal further eastward to Dhaka in 1610 with a view to subjugate the disturbing landlords of Bengal. Islam Khan renamed the new capital as Jahangir Nagar after the name of the ruling emperor Jahangir (Taifoor 1956).

During the rule of Ibrahim Khan (1616-1620), Dhaka attained great commercial importance and became a trading centre of the whole of South East Asia. The European traders started to come to the city from 1616. In the 1640s the capital was shifted back to Rajmahal by Shah Shuja and in 1600 the old robes were returned to Dhaka with Mir Jumla as the Viceroy (Islam and Khan, 1964).

However the greatest development of the city took place under Shaista Khan (1662-1677 and 1679-1689). The city then stretched for 12 miles in length and 8 miles in breadth and is said to have nearly a million people (Islam and Khan, 1964).

The European settlers came in the late 17th century. They were largely Portuguese, Dutch, English and French traders. In 1717 the capital was again shifted from Dhaka to Rajmahal (Murshidabad). In a result Dhaka started to decline and experienced a long sleep of more than a century (Islam and Khan, 1964).

Administrative Areas: The old Afghan Fort, reconstructed by Islam Khan, became the administrative headquarters of the Mughals.

Business Areas: The Chauk, which was to the immediate south of the Fort, served as the central business district and was, called Badshahi Bazar (Royal Market). This was rich in merchandise and colourful in appearance. The Chauk was well located to serve both the upper class and the lower class residential areas. It was also close to the Buriganga River, which served as the principal means of communication. Another commercial centre was located at Bangla Bazar. This was the main shopping centre before the Mughals, but yielded its supremacy to Chauk in the Mughal period. It however, continued to cater to the needs of people living around it and also the European factories situated close by (Islam and Khan, 1964).

Industries: An important aspect of the city's economic life was the cottage industries. They were located largely in the area falling between the two shopping centres, Bangla Bazar and Chauk. The artisans also lived there. In most cases, the same house was used for the factory and the residence. Within the industrial area different localities specialized in different crafts. Some of the names, which persist until today, speak of the different types of specialized industries that then flourished. Some of the names of these localities are Sankhari Bazar (shell cutter's locality), Kumartoli (potter's locality), Patuatuli (jute-silk painters areas), Sutrapur (carpenter's area), Tanti Bazar (weaver's market), Bania Nagar (trader's area), Jalua Nagar (fisherman's locality), Churi Hatta (bangle market), and Sanchi Pander (betel leaf market).

Low Class Residential Areas: All these specialized industrial and trading areas and some other localities which were surrounded by the Dulai Khal and the Buriganga River used to house the major part of the city's low class population consisting of artisans, labourers and petty traders. Pill Khana (elephant stable) and Mahut Tuli used to be the other low class areas of the time. Here lived the keepers of the animals.

High Class Residential Areas: The upper crust of the society during the Mughal times comprised of the ministers, high civil and military officials, landlords and wealthy merchants. They preferred to live in a different area from the low class people.

Location Pattern: The old Fort formed the nucleus around which the high officials lived. Thus Bakshi Bazar housed the residences of provincial ministers and secretaries (Taifoor 1956, p. 41). The Fort itself housed a palace (Dani 1962, p. 48). Rich but comparatively ordinary citizens who often could be identified with the Mughal nobilities and who owned large palatial buildings, used to live close to the ministers quarters. Such areas were in close proximity to the low class residences and thus they formed a barrier between the Mughal nobilities and the poor artisans and labourers. The most prized residential area was the riverfront. The Buriganga River, at that time, had a more northerly course through Lalbagh and Nawabganj. The Princes, Nawabs and Ameers (wealthy aristocrats) all coveted to have a house near the riverside and had built palaces along the river front about six miles westward from Chotakatra (Islam and Khan, 1964).

The European settlement in Dhaka City started with the Portuguese who established their mission here as early as 1616. After them Dutch, English, French, Armenians and the Greeks came. Of them the English, French, and Dutch traders had factories at the riverside for ease of transport. The low paid workers lived in the factories or close by and carried their business. The entrepreneurs however, lived in spacious bungalows in Tejgaon. The Europeans preferred to live in brick-built structures mainly as a measure of protection than of ease (Islam and Khan, 1964).

Road Pattern: During Mughal days, there was no well-developed system of roads in Dhaka City. The city was divided into a number of mohallas (neighborhoods) which was a cluster of houses webbed with intricate narrow lanes. The mohallas were interconnected with dirt roads, which were paved with bricks in 1677-79 (Dani 1962, p. 75). There were two principal roads: one running parallel to the river from Victoria Park to the western fringe of the city and the other ran from the Park to Tejgaon. The roads had no name but the mohallas had names. The roads were named after the establishment of Dhaka Municipality in 1864.

During the Mughal days, there was very little of vehicular traffic in Dhaka City. This accounts for the absence of any well-developed road system. The traffic mainly consisted of pedestrians. Horses formed the chief means of conveyance. On festive and ceremonial occasions elephant-ride was preferred by the nobles.

The Burhiganga River and the Dulai Khal served as communication lines. Country boats used to ply on them with goods and passengers (Islam and Khan, 1964).

House Types: During the Mughal times in Dhaka, the nobles used to live in bungalows built with bamboo and grass and decorated with elegant designs. Due to heavy rainfall and high temperature, these bungalows required repair every year and had a maximum life span of about 15 years (Islam and Khan, 1964).

The Katras were built as the resting-place for the caravan (Dani 1962, pp. 198-200). There are two Katras in Dhaka. Bara Katra was built in 1644 by Abul Qasim and Chota Katra was built in 1663 by Nawab Shaista Khan. They were located at the bank of the Burhiganga River near Chauk. The two Katras are identical in architectural design and layout but Chota Katra is smaller in size than Bara Katra.

The forts were meant either to house the soldiers or were used as palaces for the Viceroy or the nobles. Some remnants of Lalbagh Fort in the form of gateways and southern boundary walls remain to speak of its Mughal architecture with minarets, domes and arches (Islam and Khan, 1964).

3.3.3 Dhaka under the East India Company (1764-1858)

At the tail end of the Mughal rule and the inception of British power around 1765, Dhaka began to decline in importance and contract in size. The city experienced disastrous famines, floods and fires. Calcutta was growing in importance and it was difficult for Dhaka to compete with Calcutta, which as the Capital of British India enjoyed the patronage of the rulers (Islam and Khan, 1964).

The fate of Dhaka was determined as a declining urban centre under the control of the East India Company after the decisive battle of Polashi in 1757. During that time (1757-1864), being an old centre of trade, Dhaka witnessed a tremendous decrease in population and its area. The population of Dhaka which was estimated to be nearly two lakh in 1800 dropped to about 68,038 in 1838 and 58,636 in 1867 (Table 3.1). The urbanized space started to encroach towards north on the high lands during this time mainly for residential and recreational purposes (i.e., Ramna, Paribagh and Shahbagh areas).

Table 3.1: Growth of Dhaka in Population and Area

Year	Total Population	Approximate Area (square miles)
1600	-	1
1640	200,000	-
1700	900,000	50
1800	200,000	8
1814	200,000	-
1824	300,000	-
1838	68,038	-
1867	51,636	8
1872	69,212	-
1881	80,358	-
1891	83,358	-
1901	104,385	10
1911	125,733	10
1921	137,908	12
1931	161,922	12
1941	239,728	12
1951*	335,928	15
1961*	550,143	26
1974*	1,679,572	40
1981*	3,430,311	155.4

1991*	6,950,920	522.34
1981**	2,475,710	50
1991**	3,839,000	54.5
2001*	8,511,228	563.54
*DSMA: Dhaka Statistical Metropolitan Area; **DCC: Dhaka City Corporation		

Source: Islam and Khan, 1964; Nilufar, 1997 and BBS, 1991 & 2001

3.3.4 Dhaka City under the British (1858-1947)

Dhaka City, by the end of the 19th century, was hemmed in between the Burhiganga River and the railway line. The extension of the city to the east went up to the eastern fringes of Gandaria and to the west up to Nawabganj.

But a phase of revival came when Charles Dawes, the Collector, began to take interest in the development of Dhaka City. He laid out the Race Course in Ramna in 1825. Subsequently in 1829, some roads within the city were widened and new buildings were erected for administrative and educational purposes near the Victoria Park.

Finally with the transfer of power from the East India Company to the Crown in 1858, Dhaka started to grow more rapidly.

Dhaka was connected for the first time with Narayanganj by railways in 1885 and later in 1886 the railways extended up to Mymensingh. Dhaka City was for the first time electrified in 1878 and facilities of water supply started to be offered to the residences since 1874 (Islam and Khan, 1964).

After the annulment of the partition in 1911 Dhaka reverted back to the status of a district town. The establishment of the University of Dhaka (1921), which came to occupy most of the new buildings in the Ramna area, was the only important event in Dhaka's history till 1947, when Dhaka again attained the status of a provincial capital.

a. Dhaka: Pre-Mughal Period

b. Dhaka: The Mughal Capital

c. Dhaka in 1859- under British Occupation

d. Dhaka: Capital of East Bengal and Assam during 1905-11
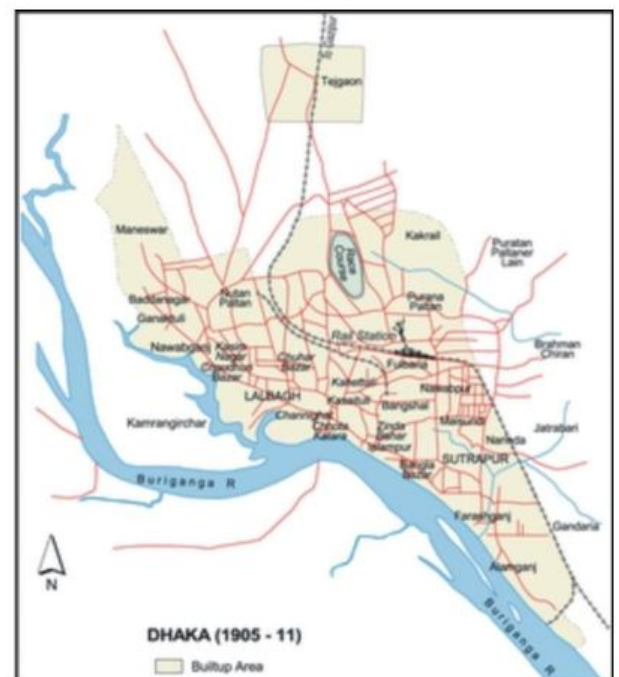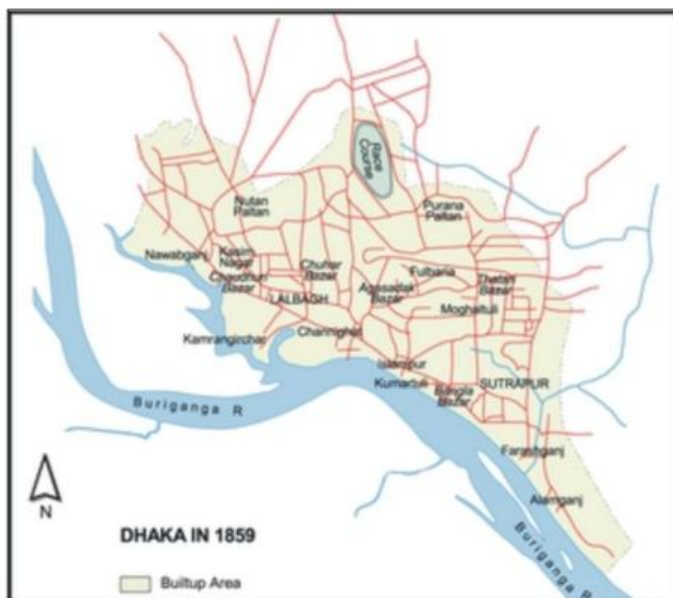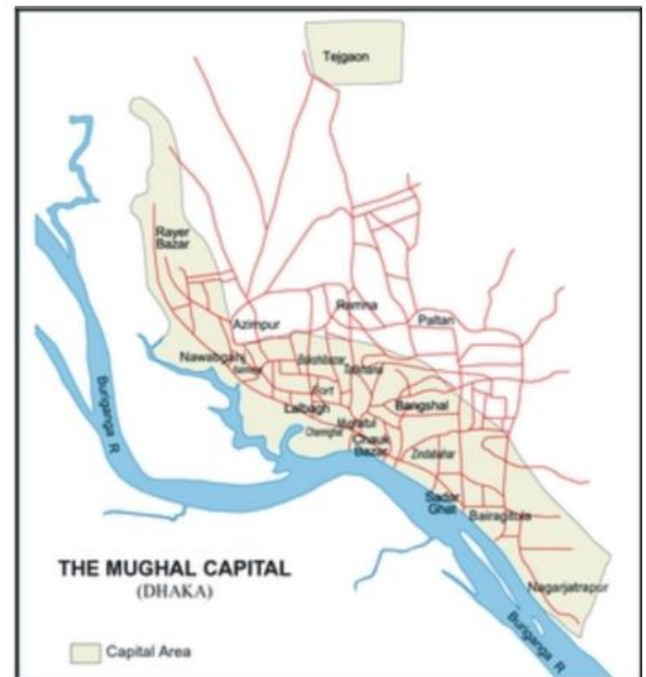
Figure 3.5: Dhaka at Different Phases

Source: Ahmed, 2006

Administrative Areas: The Fort, which during the Mughal times formed the administrative nucleus, was turned into a jail by the British. The new administrative district grew up near the Victoria Park.

Low Class Residences: The low class residences of the Mughal times continued to be low class and expanded to swallow some parts of the surrounding areas. Some high-class areas like Nawabganj also deteriorated to low class. The cause of the demotion of Nawabganj to low class was the shifting of the river southward (Islam and Khan, 1964).

Middle Class Residences: Areas with middle class characteristics were located mainly at Bakshi Bazar. Dewan Bazar, Nawab Katra, Aga Sadeq Road, Begum Bazar, Armanitola, Bangla Bazar and Lakshmi Bazar. These areas were primarily inhabited by local people of respectable means.

High Class Residential Areas: Ever since the Mughal times, the riverbank was a prize location for high-class residences. The charm of the riverfront continued up to the beginning of the present century and the most important high-class residential areas at the bank of the Burhiganga River for half a mile from North Brook Hall to the Ahsan Manzil.

High European civil officers used to live there. Three upper class residential areas at Gandaria, Wari and Purana Paltan were developed by the local population (Islam and Khan, 1964).

Road Pattern: The layout of the Ramna area consists of two roughly concentric roads at the centre of which is the Race Course. To the south is a somewhat irregular road pattern which serves the main buildings while to the north-east is a number of well planned parallel residential streets.

The gird pattern of road was introduced in Dhaka City for the first time in Wari and Gandaria. Roads in these areas were wider than those in the Mughal Dhaka but not as wide as those of the Ramna Civil Lines.

House Types: The European houses near the waterfront were all done in western pattern. They had wide-open compound spaces and gardens. The houses were massive in structure with huge pillars and sometimes with round towers and verandas.

The residential houses in Ramna had the best available contemporary living facilities. In construction design they had the peculiar colonial look. But with these houses red brick began to appear against the old Grey and also against the green foliage all around (Islam and Khan, 1964). The houses in Gandaria and Wari were large buildings with high and thick compound walls and open spaces. Architecture showed combination of Mughal and European styles.

3.3.5 Dhaka as the Provincial Capital of East Pakistan (1947-1971)

Pakistan was created on the 14th August 1947 and Dhaka was made the capital of the province of East Pakistan. Dhaka was thus suddenly called upon to shoulder many responsibilities. Needs of the officials, the business communities and above all the residential needs growing out of a sudden onrush of people to the new provincial capital contributed to the growth of the city. The arrival of large numbers of Muslim population from India led to a 103% increase of population, which in turn led to new settlements in the vacant areas within the city as well as in the outskirts.

Dhaka's urban area increased from 6 square miles in 1947 to 25 square miles within two decades in 1962. Initially the official needs were fulfilled by appropriating the government buildings in the Ramna area. The University was allocated the whole of Nilkhet and a part of the Shah-Bagh for its own development. The construction of government quarters started in the Dhakeshwari, Polashi Barrack (established by the English in the post-Sipahi war period) and Azimpur areas. The construction of the New Market was completed in 1954. The areas of Purana Paltan to Naya Paltan; Eskaton to Moghbazar; Shiddheswari and Kakrail to Kamlapur through Rajar Bagh and Shantinagar; the Shegun Bagicha - all came to be occupied. The sudden inflow of people in the post-1947 period created the 'new Dhaka' in the available highland north, north-east and north-west of Ramna. The 'old Dhaka' of the Mughals, nourished by the Nawab family in the late 19th and early 20th century, reverberated with life.

Motijheel, once desolate and on the fringe of marshes and swamps, came to be earmarked as the commercial area in 1954. By that time the area north of the Nawabpur Railway crossing up to the Purana Paltan was developed as an open area with the stadium (present Bangabandhu National Stadium) forming the nerve centre of sporting activities and the Jinnah Avenue (now Bangabandhu Avenue) was laid to form the main thoroughfare by the western side of this expansive open area.

In the 1950s for the first time a dual carriageway was built along the Jinnah Avenue and extended up to the Airport. Several other roads were broadened. The Baitul Mukarram, the national mosque, was built as a landmark in the area in the early 1960s. During the Pakistani days some other landmarks of this area were the DIT Building, the seven-storied Adamjee Court, the office of the Pakistan International Airlines, and Pakistan Industrial Development Corporation building.

To cater to the ever-increasing residential needs of the new capital, Dhanmondi was developed as a planned residential area after 1955. The Mirpur road formed an axis and the high land on its either side came under a residential belt right up to Mohammadpur and Mirpur, and these two localities came to be developed by the government in mid-1960s mainly to accommodate the migrant Muslim population. The Tejgaon Airport and the Tejgaon industrial area came under governmental schemes in the early 1950s (Islam and Khan, 1964).

The rich Muslim businessmen found accommodation in the newly built Ispahani colony and Bilalabad. Then came the turn of Eskaton Gardens, where on one side private houses and on the other government flats were built right up to the Ladies' Club. Still ahead the Holy Family Hospital was founded in March 1953 forming a new generation of modern medical facilities in the city.

About the same time the government started building staff quarters in Rajar Bagh for the Police and for employees of Post and Telegraph and others in Shantinagar. The public came along to fill the gaps, and the whole area of Shiddheswari, Kakrail, right up to Kamlapur, grew up into a large residential colony.

In the second half of the 1960s the decision to locate a second capital of Pakistan at Dhaka was taken and Sher-e-Bangla Nagar was established in the area west of the Tejgaon Farm and the Airport. The project, designed by Louis I. Kahn, though started in the sixties was finally completed in the mid-1980s. The 400 hectares area of Sher-e-Bangla Nagar is beautifully landscaped with two lakes and wide tree-lined avenues. The most characteristic feature of the whole area is that it is typically low rise except for the massive Sangsad Bhaban (Parliament House), a landmark in Dhaka modern architecture.

With the creation of the Dhaka Improvement Trust (DIT) in 1956 [transformed into Rajdhani Unnayan Katripakhay (RAJUK)/ Capital City Development Authority in 1987] it started planned development of the city. DIT developed the Gulshan Model Town in 1961, Banani in 1964, Uttara in 1965 and Baridhara in 1972 (first conceived in 1962). The Dilkusha Gardens, adjacent to Motijheel, came to be engulfed by the ever-growing commercial needs. It is noticeable that in selecting the sites for Gulshan, Banani, Baridhara and Uttara the method of picking the highlands along the Dhaka-Tongi axis road was followed.

Actually the government entered into the scene with piece meal planning of the city: an industrial district in Tejgaon, a shopping centre at Azimpur, a stadium at Jinnah Avenue, a commercial area next to the stadium, flats for government employees at Motijheel and Azimpur, and high class residential area for the public in Dhanmondi. No attempt was made to evaluate the future growth of the city. No land use survey was conducted to find the available land, their present use and their future utilization.

In the mid-1960s the railway track was shifted; it turned eastward after Tejgaon and rejoined the old track near Swamibagh-Jatrabari cutting through Rajarbagh, Kamalapur and Basabo. A new Railway station was built at Kamalapur. The old railway track has since been transformed into a link road connecting Karwanbazar with Jatrabari through Nilkhet, Palashi Fulbaria and north of Wari and Narinda, bearing the name of Sonargaon Road. All these developments in the north brought about a fundamental change in the character of the city.
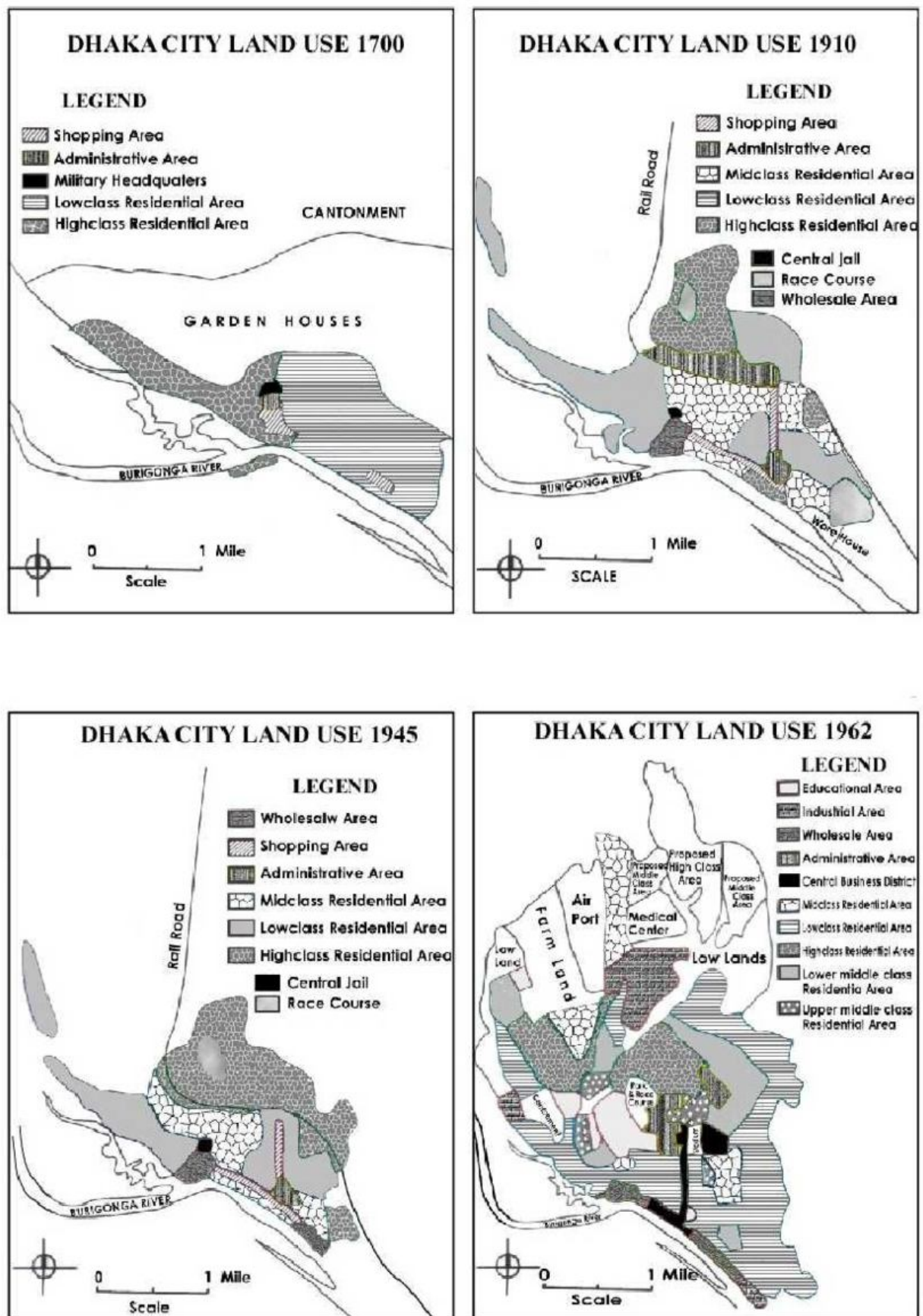
Figure 3.6: Land Use Pattern of Dhaka City (1700-1962)

Source: Islam and Khan, 1964

The old Mughal city remained most of it as before with narrow and winding streets and crowded dwellings, shopping centres and bazaars and in sharp contrast to the spacious and planned new extensions in the north. This contrast made Mughal Dhaka the 'old Dhaka' and the northern extension the 'new Dhaka'.

3.3.6 The Bangladesh Period (From 1971)

The creation of the independent state of Bangladesh in 1971 bestowed on Dhaka the glory and prestige of the capital of a sovereign country. This led to Dhaka's phenomenal growth. The earlier planned areas of Gulshan, Banani, Baridhara and Uttara came to be fully occupied, leaving very little open space.

The growth of Dhaka city in the 50's could very well be termed as slow and gradual, in the 60's the pace picked up and in the period after the emergence of Bangladesh it could be said to be phenomenal. Recently Nikunja has been added to the list of RAJUK developed area and Uttara has been further extended to the north up to the Tongi River and leftwards towards Ashulia. Nikunja occupies the low-lying area between the Kurmitola cantonment and the new airport and earth filling had to be undertaken to make it habitable. The airport had to be shifted to its new location to the southwest of Uttara in the early 1980s.

Low-lying areas on the east - Jurain, Goran, Badda, Khilgaon, Rampura - and on the west - Kamrangir Char, Shyamoli, Kalyanpur - all were brought under habitation. Dhaka's growth picked up tremendous pace since 1971 and private initiative played a dominant role in the development of these areas and hence lack of planning is evident. Planned growth in the private sector is noticeable recently in the area east of Baridhara - the Basundhara, where considerable low-lying areas were raised for housing.

Since 1971 the pressure on Dhaka has been enormous. The city registered a steady growth in the number of residents. Along with it there is large floating population, the pressure of which has resulted in the growth of slums in all vacant pockets in between the built-up areas.

However, the expansion of Dhaka City is constrained by physical barriers such as the low-lying flood prone areas around the city. Also, valuable agricultural and forested land will have to be sacrificed if the built-up area is to increase. The population of the city is increasing very rapidly due mainly to rural-urban migration. The population of the city reached to 10.7 million in 2001 and the population growth of Dhaka has been 56.5% in the last decade, which is very high (BBS, 2001). Understandably, these additional people have created tremendous pressure on the urban utility services and other amenities of urban life. This has resulted in an adverse effect on the urban environment where a large number of people have settled in slums and squatter settlements where they live below the poverty line.

The growth of Dhaka from 1949-1989 followed the limits determined the Mughals (towards north up to Tongi, up to Mirpur in north-west and up to Postogola in south-east). However the growth caused many low lands to be filled up and all the low lying areas on the eastern and western side came under occupation. With the rise of population pressure the high lands spreading towards the north came to be occupied. No serious efforts has been undertaken to create a planned city. Dhaka has now been growing by its own demand (Nilufar, 1997).

The recent phenomenon of high rise buildings, both in the commercial and residential sectors, clearly manifest that highlands within the city have been exhausted. To cope up with ever-increasing pressure Dhaka has started going upwards, an inevitable and common phenomenon in all modern cities with dense population and little scope for horizontal expansion due to topographical reasons.

Dhaka is on the verge of a change in its urban character, vertical growth taking the place of horizontal expansion. Thus from a small suburban town Dhaka has emerged as a Mega City in course of about four centuries.

Some maps of Dhaka City at its different phases are given from Figure 3.8-3.14.

LEGEND

- Slum Area
- Urban Fringe
- Educational Area
- Water Body
- Transportation Area
- Industrial Area
- Administrative Area
- Central Business District
- Midclass Residential Area
- Low class Residential Area
- High class Residential Area

10000 500 0 10000 Yards

LAND USE MAP OF DHAKA CITY 1975

LEGEND

- Water Body
- Urban Fringe
- Educational Area
- Open Space
- Transportation Area
- Industrial Area
- Wholesale Area
- Administrative Area
- Central Business District
- Mixed Residential Area
- High class Residential Area

10000 500 0 10000 Yards

LAND USE MAP OF DHAKA CITY 1995

Figure 3.7: Land Use Pattern of Dhaka City (1975-1995)

Source: CUS
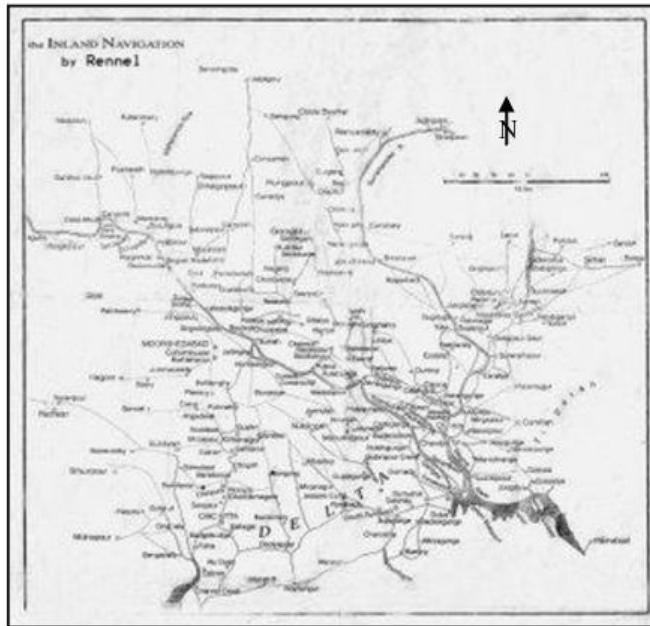
Figure 3.8: James Rennel's Map of Bengal showing Inland Navigation (1776); Source: Ahmed, 2006
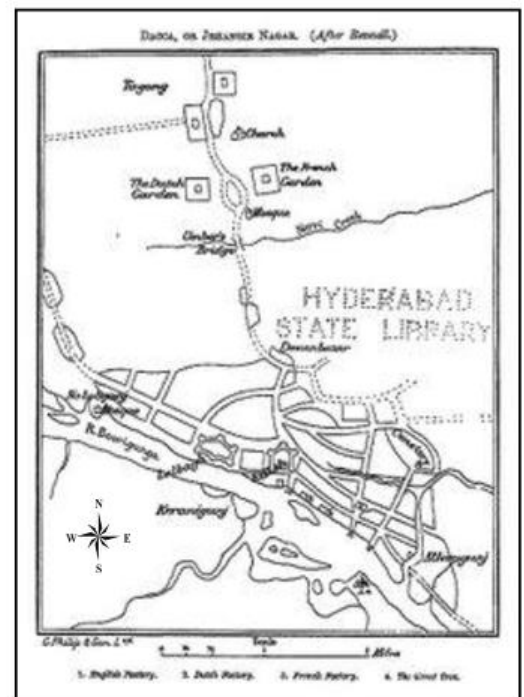
Figure 3.9: Rennel's Dhaka City map of late 18th century; Source: Ahmed, 2006

Figure 3.10: Dhaka in1859; Source: NAB

Figure 3.11: Dhaka in1914; Source: Geddes, 1917

Figure 3.12: Dhaka in1921; Source: NAB
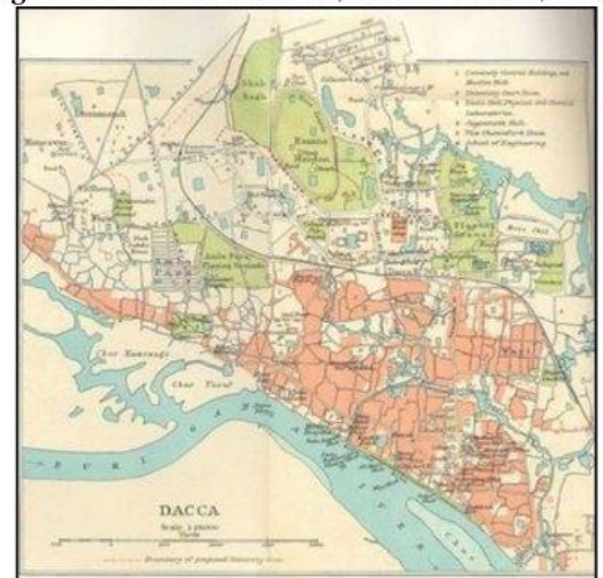
Figure 3.13: Dhaka in1924; Source: Ahmed, 2006
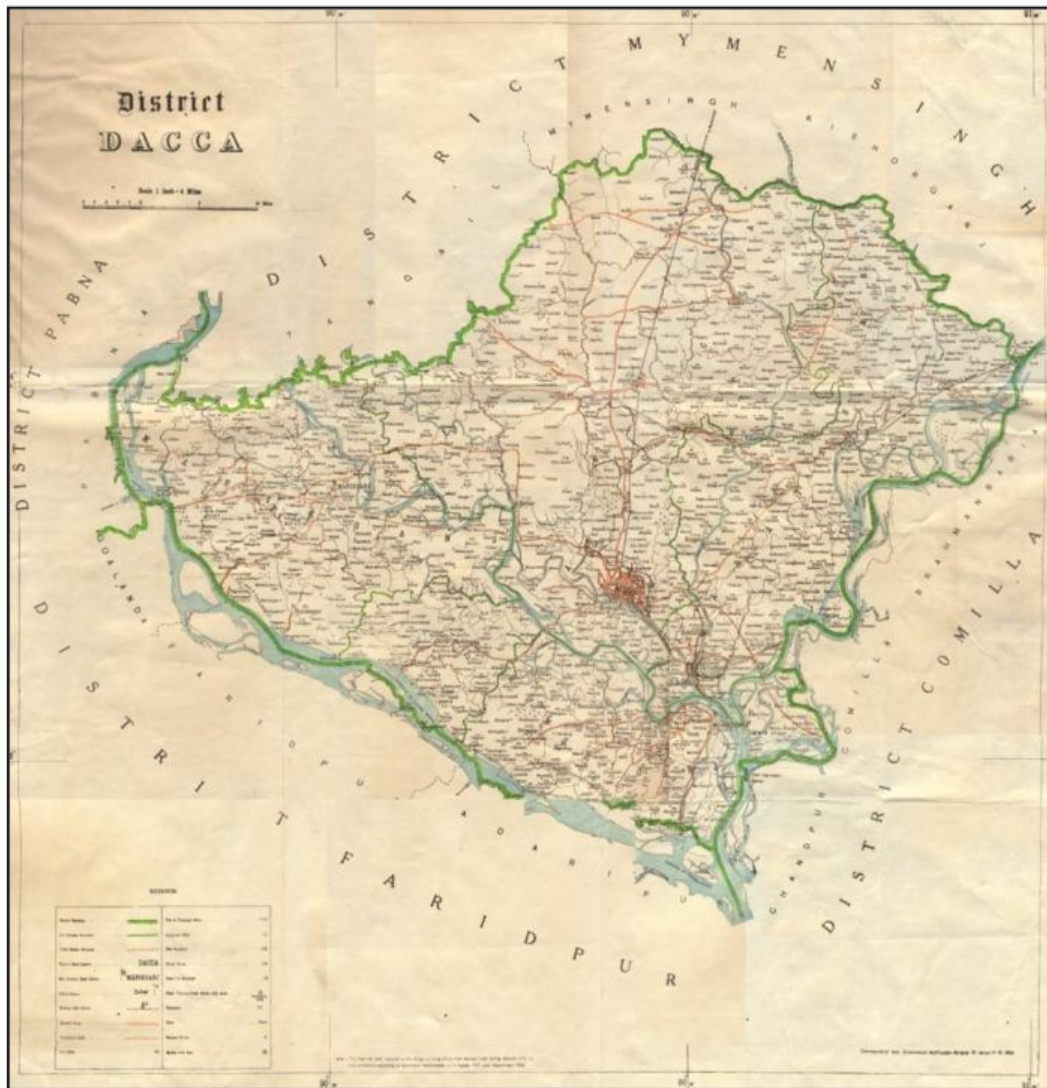
Figure 3.14: Dhaka in1949; Source: NAB
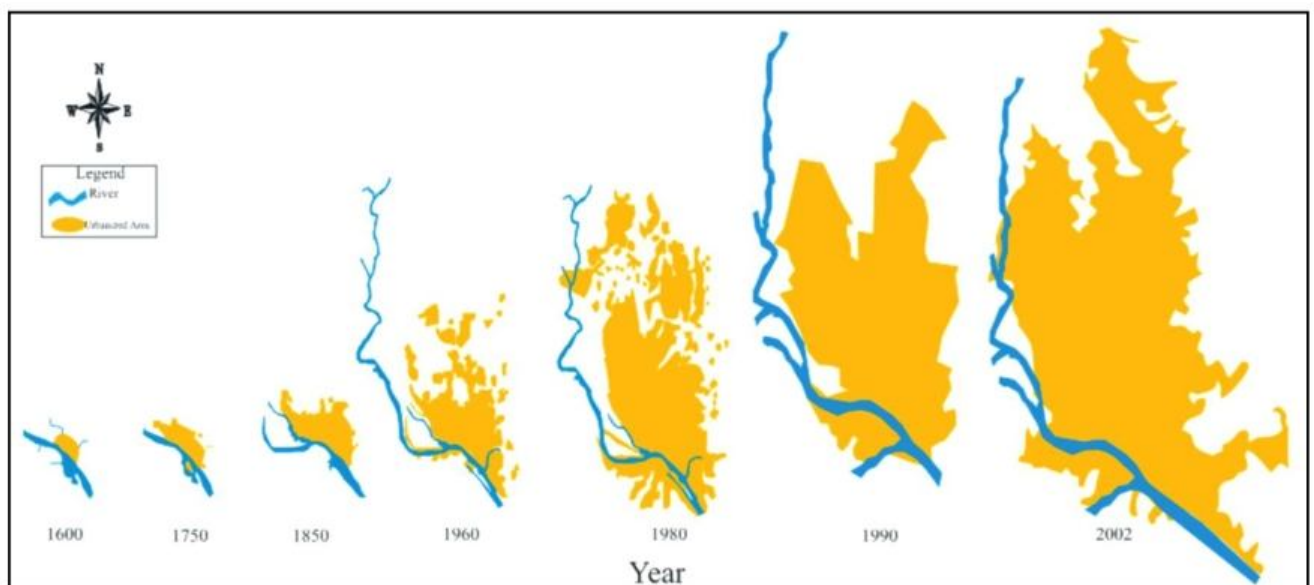
Figure 3.15: Historical Growth of Dhaka

Source: Urban Planning Department, DCC, 2004
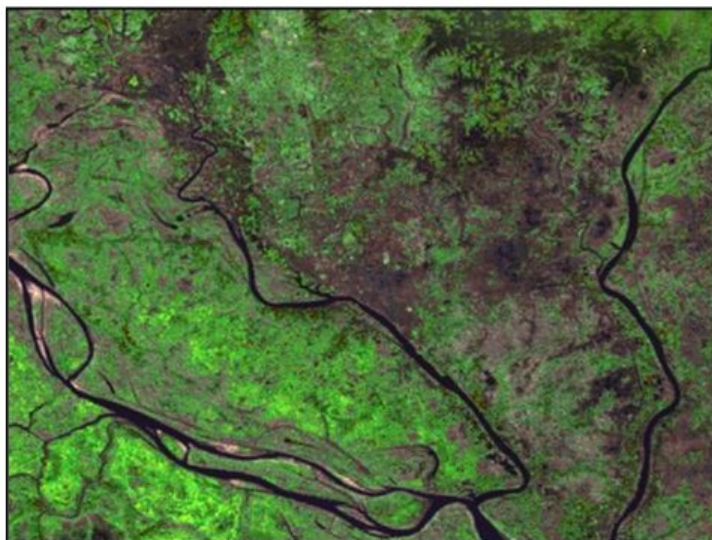
a. Dhaka on 12-28-1972 taken by Landsat-1-MSS

b. Dhaka taken on 2-13-1989 by Landsat-5-TM showing further growth since 1972

c. Dhaka on 1-29-2001 taken by Landsat-7-ETM+ showing further urban growth since 1989

Figure 3.16: Satellite Images Showing Urban Growth in Dhaka, from 1972 to 2001

Source: http://svs.gsfc.nasa.gov/index.html

Chapter 04

Methodology of the Study

The procedures which are followed to achieve the objectives and carry out the entire study are described in this chapter. A flow chart is also given showing the steps concisely relating to carry out the study is attached at the end of this chapter.

This particular research has attempted to employ both empirical methods as well as configurational analysis in combination. The first part of this study is attempted to delineate the evolutionary phases of Dhaka as organic development as well as planned development. The methodological framework of this phase is mainly concentrated on documenting the evolutionary process through parallel study of critical reading and interpreting published texts, analysing the history and adaptation of activity pattern of space. The last part is the empirical and syntactic analysis of study areas to identify different factors and contextual component that mainly focus on analysis and interpretation of maps and resources, analysis of physical environment, morphological qualities and interpretations of syntactic measures.

4.1 Selection of the Project

Organic pattern characterises, in general, the urban morphology of Dhaka. The historic city of Dhaka reveals an organic structure; and in the newer extensions of Dhaka, outside the historic core, organic morphological patterns are also prevalent which have been spontaneously developed. Moreover after 1950's some planned areas also developed in Dhaka City. The main objective of this present research is to consider, the old and new generation naturally-grown and also the planned areas of Dhaka to examine how the spatial growth of the city is constructed with the passage of time particularly from 1947-2007.

4.1.1 Formulation of Objectives

To carry out this project effectively and efficiently and to reach the goal, some objectives are confronted before the commencement of the project on the study area.

4.1.2 Selection of the Study Area

For the purpose of carrying out the project and to attain the objectives, wards 18, 19, 49 and 72 have been chosen as the study areas. Ward 72 represents an area that grew in the Pre-Mughal period; whereas Ward 49 is Dhanmondi residential area that was developed as a planned residential area after 1955. Ward 19 consists of Gulshan and Banani residential areas. DIT developed the Gulshan Model Town in 1961 and Banani in 1964. And finally ward 19 that is Baridhara Residential Area that was developed by RAJUK in 1990.

Thus Ward 72 has an indigenous type of settlement, whereas Ward 49 and 19 are planned and Ward 18 has both formal and informal (Shahzadpur and Kalachadpur) type of settlement.

4.2 Collection of Data

4.2.1 Primary Data Collection

This study is mainly dependent on secondary data. But some primary data collection methods like reconnaissance survey, taking photographs and most importantly taking interview of the local people of the wards, have been applied for this research.

4.2.1.1 Reconnaissance Survey

To form an idea about the overall situation of the wards, a reconnaissance survey was conducted first. This survey also helped in planning the working procedure to execute the entire project.

4.2.1.2 Field Survey

Field survey is helpful to get some specific information like the settlement pattern, physical condition and overall idea of the project area. That is why field survey is important. Throughout the field survey the project team had gone to many public and private officials and institutions of the selected wards.

4.2.1.3 Taking Interview of the Local People

A small sample of respondents had been interviewed (5 from each ward) in this stage. The sample was selected from the people who are familiar with the area and have been living in those areas for long periods of time.

No formal questionnaire was prepared and only questions were asked to the respondents about the area before years. The respondents were asked to describe how the physical growth of that particular area has changed that particular area over time (1947-2007) as they have seen it. The whole conversation was recorded as were their name, age and place of residence.

4.2.2 Secondary Data Collection

Data from secondary sources are of great help in executing any project. And more importantly this study is primarily based on secondary data. To study the transformation of urban form of Dhaka City over the last 60 years, some secondary data and maps such as Cadastral Survey (CS) maps (1912-14), State Acquisition (SA) maps (1958-62), Revised Survey (RS) maps (1965-85), Dhaka City Ward & Guide maps, photographs and some satellite images have been collected from concerned public and private institutions/organisations.

4.2.2.1 Collection of Base Maps

The major task to conduct this research was to collect base maps of the wards. The project team moved to many organisations and institutions; like Goni Bangla Private Limited, Sheltech Private Limited, Bangladesh National Archives (BNA), Dhaka City Corporation (DCC), Local Government Engineering Department (LGED), Rajdhani Unnayan Kartripakkha (RAJUK), Survey of Bangladesh (SOB), Public Works Department (PWD), Department of Land Record and Survey, Land Record Section of District Commissioner Office of Dhaka, Bangladesh Centre for Advanced Studies (BCAS), Centre for Urban Studies (CUS), Dhaka Centre, Bangladesh Survey Organization Limited (BSO) and Chevron Bangladesh; for collecting maps.

4.2.2.2 Photographs and other Secondary Data

For collecting photographs from the past related to the project; different institutions like Bangladesh Photographic Institution (BPI), Drik Gallery, Architecture Department Photographic Society (ADPS) of Bangladesh University of Engineering and Technology (BUET) and Dhaka University Photographic Society (DUPS) and also the local ward photo studios; have been visited. But no related photographs could be collected. Some photos have been collected from different books and internet.

To realize the concept of urban morphology, and collect some other information many papers and documents have been collected from the internet and libraries. In this regard various journal papers, reports, conference papers and dissertations have been overviewed. The libraries of department of Urban and Regional Planning and Architecture of BUET, CUS, Dhaka Centre, the Research Library of BUET, the Asiatic Society of Bangladesh, Dhaka City Museum Publication Section, Dhaka History Research Centre, library of the Department of Geography and Science Library of Dhaka University and Goni Bangla Private Limited; provided relevant material.

4.3 Analysis and Interpretation

The morphological structure has been examined through the use of space syntax method for this study. The aim behind the technique is to describe different aspects of relationships between the morphological structure of man-made environments and social structures and events. Thus space syntax offers a theory and method for investigating society-space relations. The main theoretical argument is that settlement patterns originate in the social life of the user. Accordingly, the analysis of the spatial patterns of settlements can lead to knowledge about the social norms of societies.

The analytical method is based on the transformation of plans into graphs and the quantifying of the spatial qualities of nodes using mathematical formulae. Such a method offers a simple objective procedure for describing, comparing and interpreting settlements.

A number of characteristics make this method a powerful research tool. **First,** it provides a simple, analysable, and realistic spatial model of a settlement. **Secondly,** it entails analysis of the elements of a city as related parts of a system. **Thirdly,** it gives quantitative values to elements and provides statistical and graphical comparisons within the system. **Finally,** its computations provide values that allow systems of different sizes to be compared. Apart from the diagrammatic representation of plans, the analytical procedures of space syntax offer a variety of mathematical measurements that quantify various attributes: integration, connectivity, control and intelligibility values of spatial patterns.

The plans of settlements are represented graphically and compared in terms of their patterns of continuous open space in order to analyse the patterns of the urban layouts syntactically. That's why, space syntax method has been chosen for this research. For this syntactic analysis section, softwares like ArcView GIS 3.2, extension named Axwoman3.0 (Axwoman30.avx), Depthmap 4 and Microsoft Excel have been used. And later the axial maps, graphs and their interpretations have been discussed.

4.4 Preparation of Report

After getting all relevant data and information related to the concerned aspects, data analysis and the subsequent interpretations; all these are presented in this report.

To achieve the above mentioned objectives in the described methodology, the systematic study is followed the process summarized in the following flow diagram (Figure 4.1).
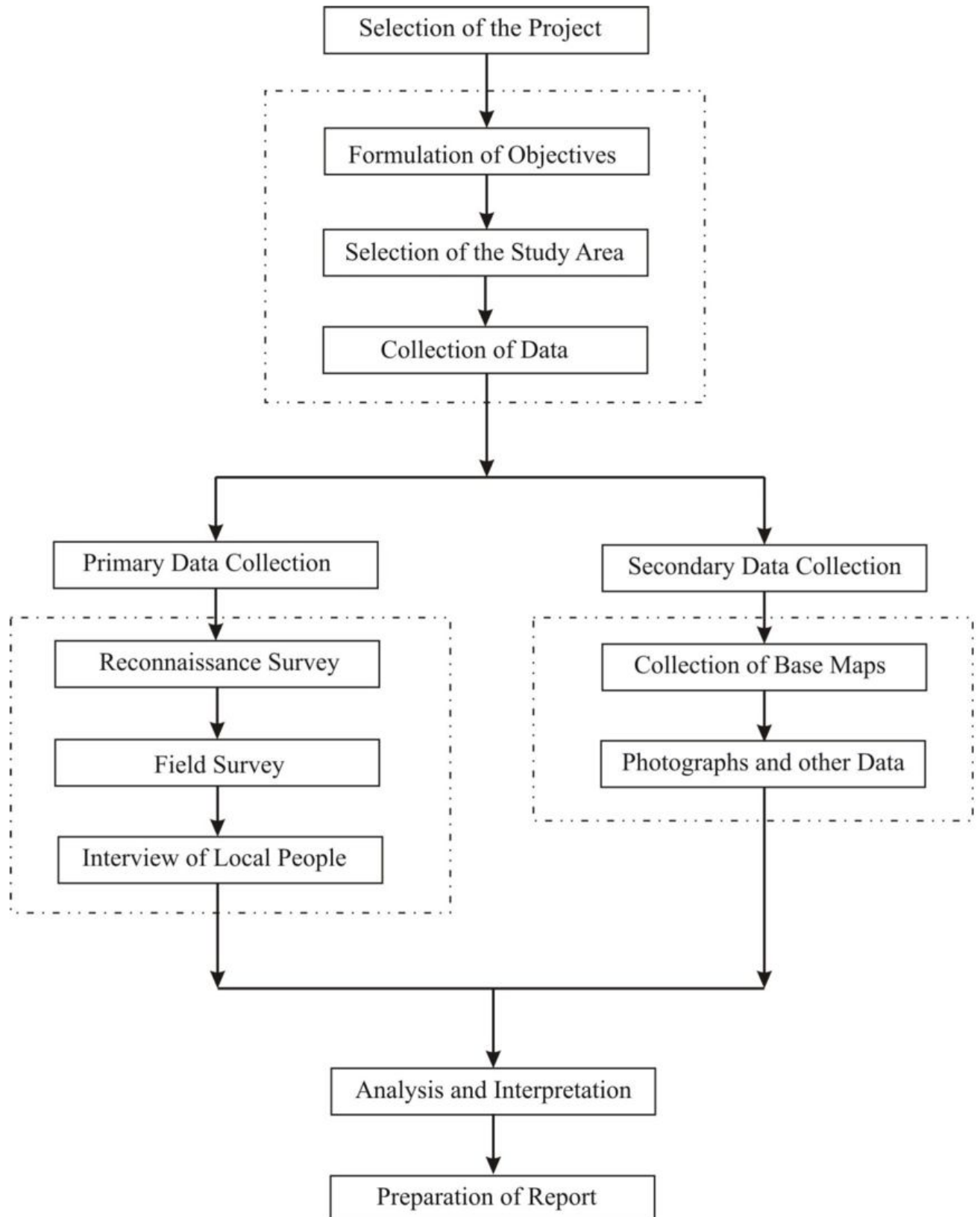
Figure 4.1: Flow Chart of Methodology

Chapter 05
Ward 49: A Detailed Morphological Analysis

Dhanmondi (Ward 49) is one of the high-class residential areas in Dhaka city. The area was planned and developed in the early fifties to provide residential accommodation for high and higher middle income groups of population in Dhaka city. The area was designed with large plots, wide roads and good environment, within five kilometers from the Central Business District (CBD) of Dhaka City. After liberation in 1971, the characteristics of the residential area were being changed and the area was gradually being invaded by non-residential uses like commercial and professional offices, private hospitals and clinics, community centers, educational institutions (private schools, colleges and universities) etc.

5.1 Geographic Location

Dhanmondi is a thana of Dhaka City. It is located at 23.7389° N 90.3847° E . It has 33451 units of household and total area 9.74 km², bounded by Tejgaon and Mohammadpur thanas on the north, Lalbagh thana on the south, Ramna thana on the east, Hazaribagh and Mohammadpur thanas on the west (Figure 5.1). Dhanmondi Thana was established in 1976. It consists of three wards (wards 49, 51 and 52) and 20 mouzas (Ahmed, n.d. and URL: 10). Ward 49, the selected study area, is Dhanmondi Residential Area that is located in Gulshan thana (Figure 5.2).

5.2 History

Though Dhaka was one of the capital cities of Bengal, it had lost its glory during the colonial period and was reduced over time to being merely a district town. Dhaka was once again made a capital, this time of East Pakistan, after the Partition of Bengal in 1947. The dictates of the new capital necessitated the establishment of offices and physical infrastructure. An autonomous authority, Dhaka Improvement Trust (DIT), was established in 1956 to turn Dhaka town into a planned metropolis. With this objective in view, a Master Plan was drawn in 1959.
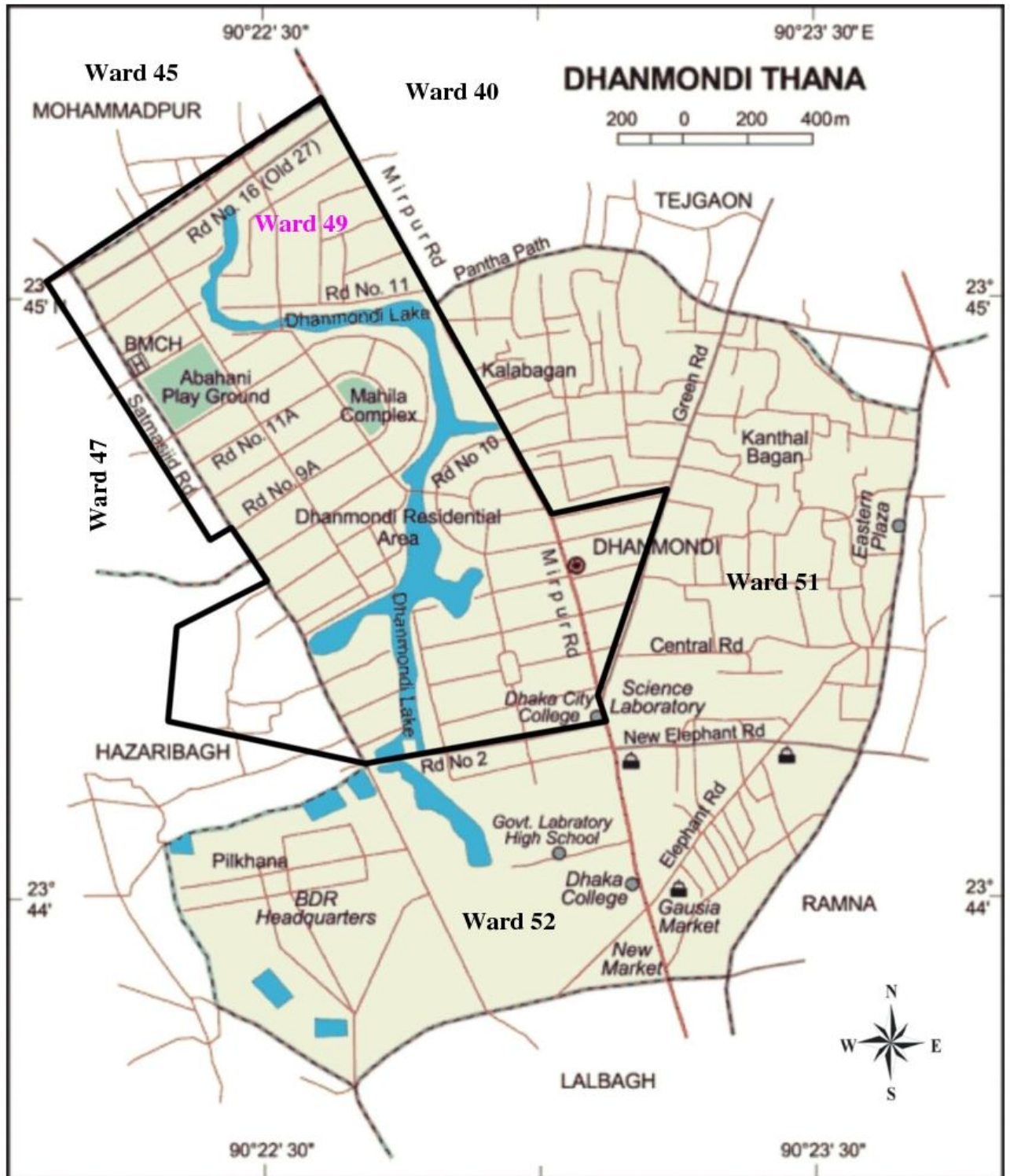
Figure 5.1: Map of Dhanmondi Thana

Source: http://www.bangladesh.gov.bd/maps/images/dhaka/DhanmondiT.gif

A project to develop a residential area in Dhanmondi had been undertaken earlier in 1949. The PWD of East Pakistan in that time, acquired about 500 acres of agricultural and horticultural lands in 1950, levelled them, and allocated plots to people according to approved criteria. The area was divided into blocks, which were in turn sub-divided into individual plots measuring approximately a bigha each. The plots were allotted to ministers, government officials, public leaders, professionals, and businessmen. Grid pattern wide roads were built and vegetation was planted on roadside and other public places. The plots were leased out to allottees for 99 years at a payment of Tk 5,000 per bigha (Islam, n.d.).

Initially, DIT (RAJUK from 1987) kept Dhanmondi plots exclusively residential and did not allow use of any plot or house for commercial purposes. But in response to tremendous pressure on city land after 1972, the rule was relaxed to the point of virtual non-application. At present, nearly half the plots of Dhanmondi Residential Area are used for non-residential purposes, which include shops and stores, government and semi-government offices, NGO offices and clinics, educational institutions and even manufacturing units.
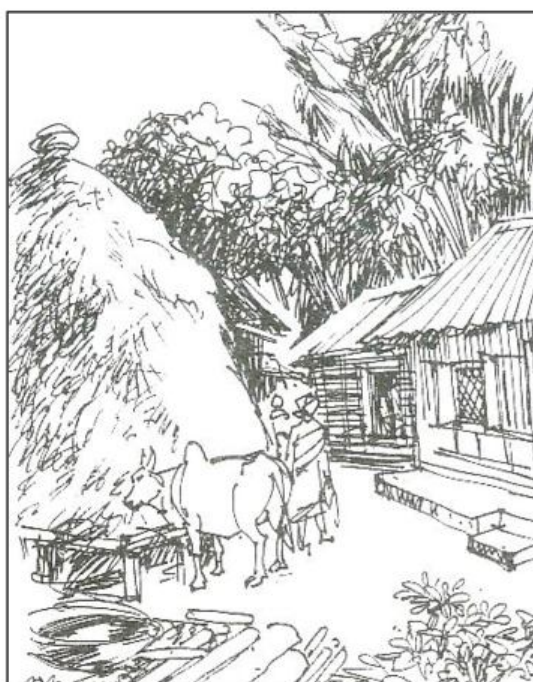
Photograph 5.1: A Sketch of Dhanmondi in Early 1950's (Source: Mamun, 1993)

Consequently, the social character of the area has changed very drastically. Socially and economically, Dhanmondi has now become a multi-purpose area. Socially, the non-residential elements of Dhanmondi are now much larger and much more influential than the owner-occupier and resident tenants. Thus the original plan of keeping Dhanmondi a purely residential area has now given way to free play of market forces. House rent is very high in the area. Land price is almost as high as the owner can ask for.

Legend
- Mosque
- Open Space
- Water Bodies

Figure 5.2 (a): Original Layout of Dhanmondi Residential Area

Source: PWD, 1958

Figure 5.2 (b): Map of Ward 49

Source: DCC, 2006

5.3 Planning Aspects of Dhanmondi Residential Area

Dhanmondi Residential Area was planned in the method of sites and services scheme with a regular system of roads to provide residential accommodation for the high and higher middle-income groups during early Fifties. Total area of' the site including water bodies, roads, etc. is about 485.9 acres. It is the first designed Residential Area in Dhaka City, developed by Public Works Department, Government of the then East Pakistan.

Dhanmondi, since the beginning (even before liberation war) has been known as upper class residential area. After the war it was mostly two storied houses everywhere and a quiet peaceful neighbourhood. The recent migration issue and aggressive real estate business policies, not to mention the ever increasing schools and 'shopping malls' have ruined its status as an upscale residential area. The location of Dhanmondi was chosen because it served as a nice suburb to city of the era.

5.3.1 Land Acquisition and Plotting

Seven mouzas (some partially and some partially) were acquired, by order dated the 9th December 1952 under section 3 of the East Bengal (Emergency) Requisition of property Act 1948. Total area of the project was divided into 1,000 nos. of plots originally ranging from 15 decimal to 33 decimal (Hashem, 2001).

5.3.2 Road Pattern

Dhanmondi has a grid pattern of roads and almost all the plots are rectangular and of the same size. Three types of roads were designed for the area i.e. Major thoroughfare (Mirpur Road and Satmasjid Road) of more than 30 metre width, Secondary roads of 15 metre width and Access roads of 10-15 metre width (Hashem, 2001).

5.3.3 Land Use

Of the total areas, more than 61.4 % land was proposed for housing purpose, 9.2% for open space, 9.2% for water bodies and more than 18.4% for internal road circulation (Hashem, 2001).

5.3.4 Development Control Measures for Dhanmondi Residential Area

About 70% of the houses were tenant occupied in Dhanmondi Residential Area (DRA). DRA was an exclusive area for housing for the upper class of the society. This distinctive character kept the middle class out of Dhanmondi. As per original plan no one was supposed to build structures of more than three storied (Hashem, 2001).

However it should also be noted that the emergence of unplanned, uncontrolled and haphazard land use have had affected adversely on the residential character of this area and day by day it loses its livable characteristics. Concerning this gradual degradation several committees formed and actions were taken by the Ministry of Housing and Public Works to control and regulate the developments from time to time.

In continuation of this, development control measures for Dhanmondi Residential area was imposed in a circular of May, 1995 by the authority Ministry of Housing and Public Works. It stated that:

Plots, adjacent to Mirpur Road may be used for commercial purpose up to 20 feet *depth, with 15% 'Conversion Fee'. This rule also will be applicabl*e for Road no.16 (old Road no.*27), Road no.2 and 'Satm*asjid Road*'.

According to this circular, all commercial institution except offices, Schools, Colleges and Mosque situated in DRA (except those above mentioned four roads) were warned to close their activities within 30 days from receiving the notice. A penalty of lease cancellation was declared due to violation of the terms and conditions of the lease agreement. This circular was considered to be effective from December 1995.

In June 1995, a committee of 16 members was formed (The Jahir Uddin Committee) to specify guidelines for Use of Land, Plot subdivision, construction of apartments, transfer of title, and height of building for DRA. The committee recommended a set of guidelines to the government. They were:

a) Building height up to 10 storeys for commercial plots, and

b) Building height up to 12 storeys for residential plots.

Again some changes were made in the circular of January 1996. According to this circular, the Ministry of Housing and Public Works, legalized all plots on both sides of Mirpur road, Satmasjid road, Road-2 and Road-16 (old 27) for commercial use with 15% "Conversion Fee". The total plot (not partial) was permitted to be used for commercial purpose.

According to another circular of January 1996, the Ministry of Housing and Public Works, withdrew the ceiling of dwelling density of 10 flats per bigha (33 decimals). According to this circular:

a) The maximum permissible number of storey in the buildings will be six but the numbers of flats may be as much as is possible to be served by the service organizations.

b) The building shall have lift facilities and parking arrangements within the plot area.

c) The size of a subdivided plot shall not be less than 5 katha.

Finally it was decided that:

a) Present rule of building height of maximum 6 stories in Dhanmondi Residential Area would continue.

b) The service giving organizations would assess the problems of providing services to high buildings and will recommend to the ministry whether the height of the buildings could be increased further. These organizations will assess the problems and their solutions at interval of 2, 5 and 10 years. After receiving the opinions of service giving organizations the Ministry would call another meeting to take decision in this regard as soon as possible.

[Hashem, 2001]

5.4 Local People's Perception

In this section, the local people's perception about DRA (Ward 49) is described. Five people, who have been living in DRA for a long time, were selected and some questions were asked about the physical and historical growth of Ward 49. No formal questionnaire was prepared. The survey was held between August and October 2007. The respondents talked about their experience about the evolution of DRA. Their accounts are described below:

> **Respondent 01**

   Name: Md. Abdus Sattar

   Age: 70 years

I have been living in Dhanmondi area from 1962. The name of this area 'Dhanmondi' came from Dhan Khet (Paddy Field), as the area during that time was totally paddy fields. During that time it was only a village. From 1950-1954 there were only a few tin shed houses in this area. The DIT started to distribute the land as plots during 1952-1953. The lake was then wide enough. There were villages in the Shonkor and Rayer Bazar. Elsewhere were paddy fields and wetlands.

From 1954 PWD started to plan the Dhanmondi as a residential area. In that period DIT authorities had high power in controlling the land development. At present what we see as a planned Dhanmondi area, was mainly the contribution of DIT during that time. So they planned the area and started to sell the plots on 'Katha (20 katha = 1 Bigha)' basis. A person had to buy minimum 5 katha of plots. My father bought 10 katha plots for 2500 taka. Plots were sold on 5 katha, 8 katha, 10 katha and 1 bigha basis. During that period many Ministers residence were in Dhanmondi area. So the area was planned very carefully.

At that time the mode of transportation was mainly rickshaw, horse driven cart and bus. Few baby taxis were seen. Some Pakistanis had their own personal cars. But this number was very low. The Dhanmondi area began to flourish during 1980-1990. People mainly started to construct new high rise buildings in this area during this period. Commercial buildings mainly started to construct after 1990.

But between 1960 and 1990 there was restriction on the construction of commercial buildings in this residential area because powerful political persons' residences were located here.

➢ **Respondent 02**

Name: Al-hajj Md. Mashiur Rahman

Age: 55 years

Dhanmondi as I had seen from 1970, the population density of that time was very low. People were mainly engaged in making pottery goods. Roads were very narrow to Rayer Bazar. Most of the buildings were one storied. 30-40 Embassies were near the Dhanmondi Lake at that time. There was only one 3 storied building of the Polish Embassy near the lake. There were lots of mango and other trees in that area at that time. Each house had a minimum of 10-12 different types of fruit trees. In 1960 there was BRTC bus service and the service was very satisfactory. The BRTC mainly used the Satmasjid and Mirpur road as its route.

In 1980 there were 10-15 multistoried buildings. Commercial buildings construction started mainly after 1995. Before that construction of commercial buildings was not allowed because then mainly retired officer lived at Dhanmondi area. They complained to the local authority if commercial building construction was permitted. For education institute there was only Dhanmondi Government Boys School. People used to go to New Market, Rayer Bazar and Mohammadpur Bazar for daily necessities.

➢ **Respondent 03**

Name: Mrs. Khadeza Haq

Age: 45 years

I am living in Dhanmondi area since 1982. When I started to live here the area was well arranged and attractive. There were lots of open spaces. The lake's width was not as small as we see it now. Young children had enough space to play and the senior citizens got enough open places for their morning and evening walk

which is not seen now-a-days. The lake was then much beautiful. There were lots of Krishnachura (kind of flowering tree with red and yellow flowers) trees beside the lake. You still may find some of them beside the lake. The Mirpur and Satmasjid Roads on both sides of Dhanmondi area were of the same width as today. The Rayer Bazar area was not so developed.

The multi storied commercial buildings started to come up here mainly after 1990. This created lots of problems. Now lots of universities, markets, office places have developed in this area. But this area was supposed to develop as a residential area. As an owner of my land I have the right to live in this area with peace and tranquility and should get adequate community facilities. There was an agreement when we purchased this 5 katha land from the government to keep it as a residential area. But all went in vain for which we have to face a lot of problems. My child does not get enough facilities to play; my old father does not get enough place/facility during morning or evening walk by the lake side. For complex characteristics of land use the utility services are not sufficient. We have to face water and electricity problems.

➢ **Respondent 04**

Name: Md. Abdul Latif

Age: 58 years

Dhanmondi area became attractive mainly after 1990. Before that the area was not so coveted. Even during the 1950-1960's there were only paddy fields in this area from which the name Dhanmondi derived. The previous name of this area was 'paddy market'. The word dhan (in Bengali) means paddy and mondi (in Bengali) means wholesale depot/ godown. The people living here in that time were very poor. There were tiny huts made of the dry stalk of grain, pulse, straw and bamboo. Some farmers used to live here and there before the acquisition of this area. DIT acquired land from the local people and as far as I know some people were not paid.

The lake was there at that time also. There were no commercial buildings in central Dhanmondi. People used to go to Rayer Bazar for their daily shopping. Mirpur Road and Satmasjid Road were the same during that time. During 1965-1975 many high profile political persons, ambassadors started living in this area. DIT was responsible for developing the Dhanmondi area. They planned the area in grid iron pattern. Population pressure during 1955-1975 was not so high. At that time there were no high rise buildings. Most of the buildings were one-two storied. Later when the high-rise buildings were permitted, the low rise buildings were converted to six storied buildings.

➢ **Respondent 05**

Name: Md. Zabbar Biswas

Age: 60 years

As far as I know about Dhanmondi area is that, it started to develop after the plan prepared by the DIT in 1950's. Before that it was a low lying area where people used to cultivate paddy. As it was a low laying land and there was water all around, the land was very suitable for paddy cultivation. The Dhanmondi area as we see today mainly began to flourish after 1985. The commercial area started to develop here after the 1990's. There was no multi storied building before 1980. The lake was not as small as it is today and it was a great recreational place for children and older people.

Before the development of this area, the New Market was built and the Mirpur Road was there. There were few people in Mohammadpur area. And then Dhanmondi gradually started to develop as an area in a planned way. Although the main purpose was to keep this area for residential uses; but when the permission was given for commercial activities then it started to decline its residential entity. Now there are lots of universities, schools, hospitals and diagnostic centers, offices, shopping malls, banks and restaurants in this area. It has become a commercial and business hub of the city. Now this area is not perfect for residential purposes at all. There is heavy traffic jam and problems with utility services too. If proper steps can not be taken, then soon this area will become dead. Still there is hope, but the concerned authority seems to be inert.

5.5 Important Features of DRA

Dhanmondi nowadays is more of a commercial area than a residential area. Although there is a growing number of apartment complexes' replacing the original two-storied houses, there are many non-residential establishments almost on every street, most of which are schools, universities, hospitals, restaurants and shopping centers.

The increasing number of commercial establishments, coupled with the lack of adequate parking facilities have given rise to a tremendous amount of traffic congestion, especially during the mornings and afternoons when children are dropped off and picked up from school, and during the evenings when shoppers from all over Dhaka throng the various shopping centres.

Dhanmondi is well known for its lake. The lakeside walkway is one of the most popular destinations in Dhaka and is usually crowded with people during the evenings. It lies within the vicinity of Dhanmondi residential area. Originally Dhanmondi Lake was an abandoned channel of the 'Karwan Bazar River' previously known as the 'Carevan River', whose alignment was possibly along Begunbari Khal-Green Road-Kalabagan-Dhanmondi Lake to the Turag River. Part of this lake still functions as a storm water drain and falls into the Begunbari Khal (Chowdhury, n.d.).

The lake is under the management of several authorities looking after its various aspects. The Ministry of Works has its ownership; the Fisheries Department looks after fishery development; the Dhaka City Corporation, being the principal civic body, exercises some responsibility in its improvement. The Department of Environment (DOE) looks after the aspects of proper environment and protection of aquatic resources of the lake. In and around Dhanmondi Lake some renovation works were carried out from 1998 to 2001 with a view to making the lake a pollution free recreation zone (Chowdhury, n.d.).

One of the more prominent features of the lakeside walkway is the Rabindra Sharabar, an open air amphitheater, where dramas, concerts, and various cultural programmes are held from time to time by both amateur and well known artistes, especially during major festivals and holidays. Some photographs on Dhanmondi are given below.

Photograph 5.2: Urban Environment of Ward 49

Photograph 5.3: Park, Playground and Dhanmondi Lake Views

5.6 Morphological Transformation of DRA

Dhaka has grown in size, scale and extent in its historical and morphological evolution as the urban function of Dhaka has evolved and changed according to its political and commercial consideration. Although historical and social evolution of Dhaka has been described in the previous section, the morphological phases of development still needs to be unveil. In this section, the morphological overview has been highlighted to reveal the evolutionary changes of development over time.

Space syntax theory can be applied to reveal whether these changes are arbitrary, or whether there is any hidden logic to the pattern of growth over time. Therefore, other than historical development configurational analysis by the space syntax is explored to identify the global-local integration, connectivity and the spatial relationship between different syntactic measures in relation to the changing pattern of urban function.

Through this morphological analysis the development pattern of urban spaces as well as the importance of street network both locally and globally is identified. Moreover, syntactic values of different time period is summarised at the end of this section which help us to identify the globally important roads.

The morphological analysis is carried out at six different stages in the city's growth considering only the boundary of ward 49, by using the maps of 1952-2007 from secondary sources (Figure 5.3). The axial map of six different period is used for syntactic analysis where highest and lowest range of global integration value (R=n) is shown in different band of colour. However, the numerical and explanatory interpretations of these syntactic values are discussed in the following part.

The base maps (maps of 1952, 1973, 1987, 1995 and 2001 are collected from SOB and for 2007, images from Google Earth are used for all the Wards), from which the axial maps are prepared, are attached in Appendix A.

5.6.1 Global Integration Core

The integration core of a city is mainly formed with the highest integrated axial lines. Integration core generally concentrated in the heart of the commercial and ceremonial centre.

In the syntactic analysis of 1952 (Figure 5.3), the global integration core (the integration core of a city is mainly formed with the highest integrated axial lines) lies along the Mirpur Road and also in road 2. Moreover, the street network was not good enough at that time because the area was not developed at all.

In 1973 the area had became a planned and developed one and the number of segments (axial lines) increased. Now the integration core is Mirpur road, Satmasjid Road and Road 16. Earlier commercial activities were along only Mirpur Road and Road 2. But now the situation has changed, commercial activities spread to Satmasjid Road and Road 16.

In 1987 some new roads (Roads 7A-15A) show the second highest integration value, while the previous core remained the same. And in 1995 Mirpur Road, Satmasjid Road, Roads 7A-12A and road 16 represent the urban core. Because that time huge commercial and educational activities started in those areas.

In 2001 and 2007 it is found that the integration core lies along Mirpur Road, Satmasjid Road and Road 16, because now commercial activities are only permitted in these roads. Roads 7A-15A and Road 2 are also prominent.

It can be said that in DRA, the integration core follows mainly the commercial activities. And in case of the second highest values, it basically includes the educational, official and other purpose.
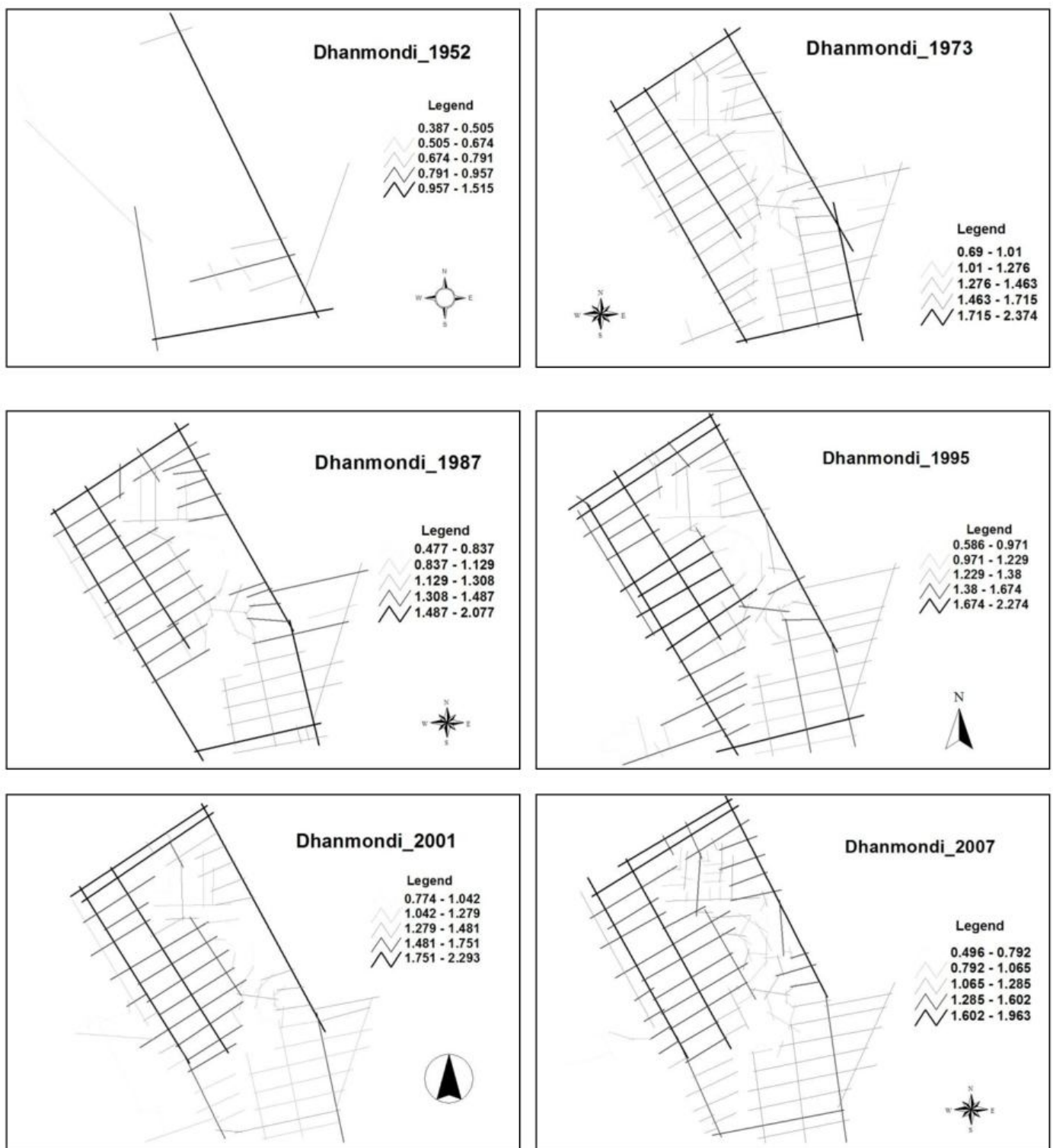
Figure 5.3: Global Integration (R=n) of Ward 49 in Different Time Periods

(Not to Scale)

5.6.2 Connectivity and Control

Connectivity (CN) of a space literally means how many spaces intersect with it. The most connected roads are Mirpur Road and Satmasjid Road, kept constant in all phases except 1952. And later the connector road, which passes through the Roads 7A-15A, becomes the highest connected road (Figure 5.4).

The lowest CN value is 6, which was in 1952 be cause at that time road network was not developed. The CN values are higher in the rest of the phases (Table 5.1). It has been observed that the maximum connected axial segments exhibit highest integration. These maximum connected roads within the global integration core help to form the core of the area. Average connectivity value is quite low (3).

Control Value (CV) is a dynamic local measure. It measures the degree to which a space controls access to its immediate neighbours taking into account the number of alternative connections that each of these neighbours has.

From this point of view, DRA shows higher CV values (Table 5.1). Also higher CV value exhibits higher CN. CV values are highest along the Mirpur Road and Satmasjid Road just like the CN values, in all phases (Figure 5.5).

5.6.3 Global (R=n) and Local (R=3) Integration Pattern

It has already been mentioned that, integration in general is a depth measure of different spatial systems; and the mean global integration (R=n) of a system exhibits a crude interpretation of the amount of hierarchy present in the system as a whole in the sense of representing average directness or indirectness of connections between spaces.

The idea of local integration (R=3) comes from the conjecture that the traditional city typically consists of a super grid for strong primary movement routes, and that those axes off these major routes are seldom more than three steps deep from a strong structural axis (Hillier, 1984). Therefore, the global integration represents the hierarchical variation of integration within the total city structure where as local integration signifies the local importance of road network.
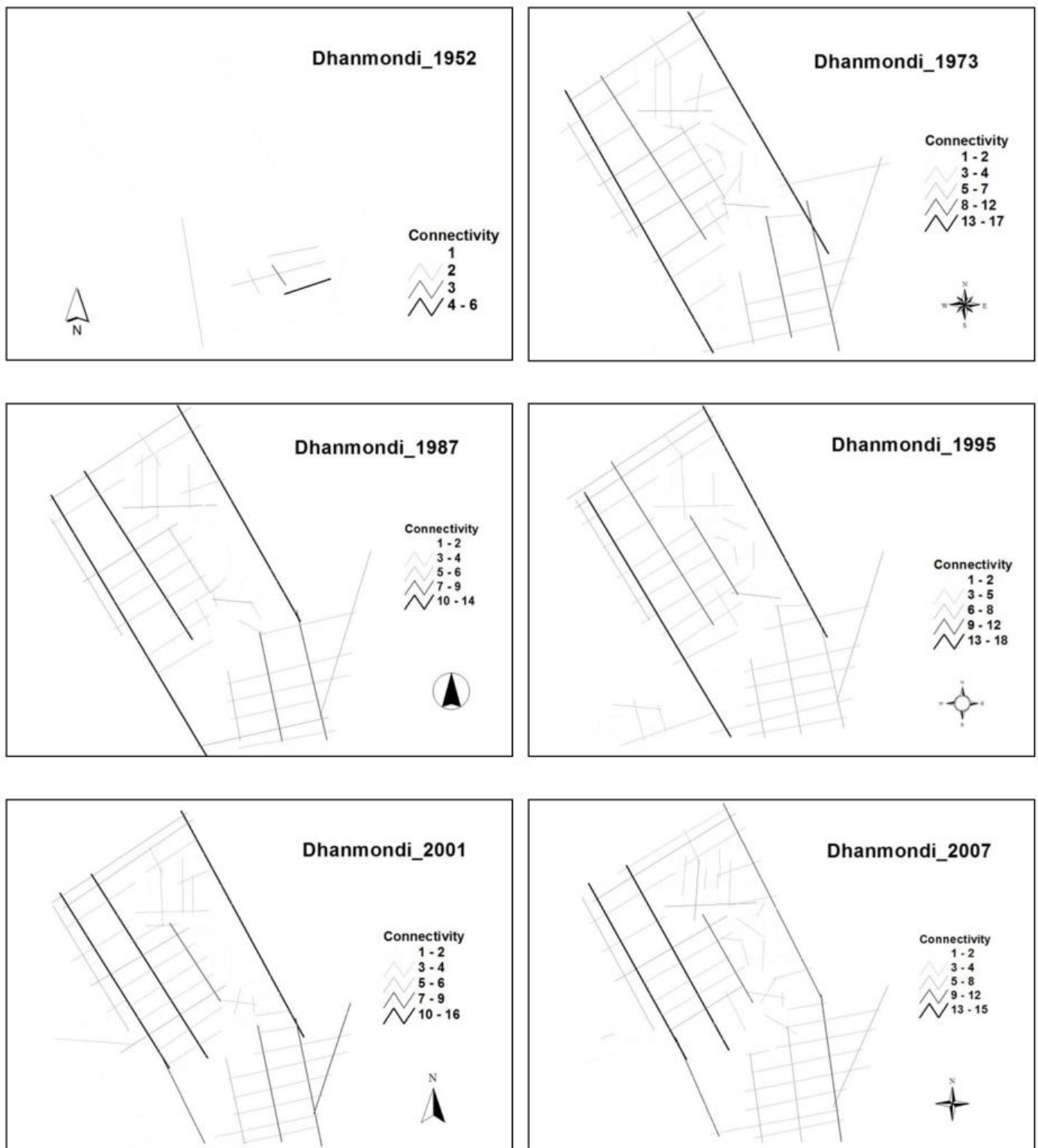
Figure 5.4: Connectivity (CN) of Ward 49 in Different Time Periods

(Not to Scale)

Table 5.1: Syntactic Measures of Ward 49 in Different Time Periods

Syntactic Measures		Time Period	1952	1973	1987	1995	2001	2007
Integration Global	R=n	Segment No.	13	87	74	97	90	123
		R=n Max	1.51547	2.37416	2.07684	2.27350	2.29344	1.96311
		R=n Min	0.38693	0.69005	0.47731	0.58616	0.77447	0.49573
		R=n Mean	0.81038	1.35824	1.27013	1.29705	1.30357	1.14951
		Std. Deviation	0.298077	0.30147	0.283886	0.32010	0.30442	0.276245
Integration Local	R=3	R=3 Max	3.66679	5.31152	4.97926	5.45669	4.96063	5.24665
		R=3 Min	0.21093	0.21093	0.21093	0.21093	0.21093	0.21093
		R=3 Mean	1.17834	2.09970	2.08378	2.14179	2.02701	1.87939
		Std. Deviation	0.84935	0.90198	0.856072	0.90200	0.897161	0.907139
Connectivity	(CN)	CN Max	6	17	14	18	16	15
		CN Min	1	1	1	1	1	1
		CN Mean	1.84615	3	3	3	3.31111	3
		Std. Deviation	1.405119	2.695646	2.54511	2.874262	2.62077	2.45449
Control	(CV)	CV Max	4.83333	7.07500	6.97778	8.25000	5.56250	8.32143
		CV Min	0.50000	0.05882	0.07692	0.05556	0.06250	0.07143
		CV Mean	1	1	1	1	1	1
		Std. Deviation	1.301707	1	1.086182	1.21668	1.005857	1.117057
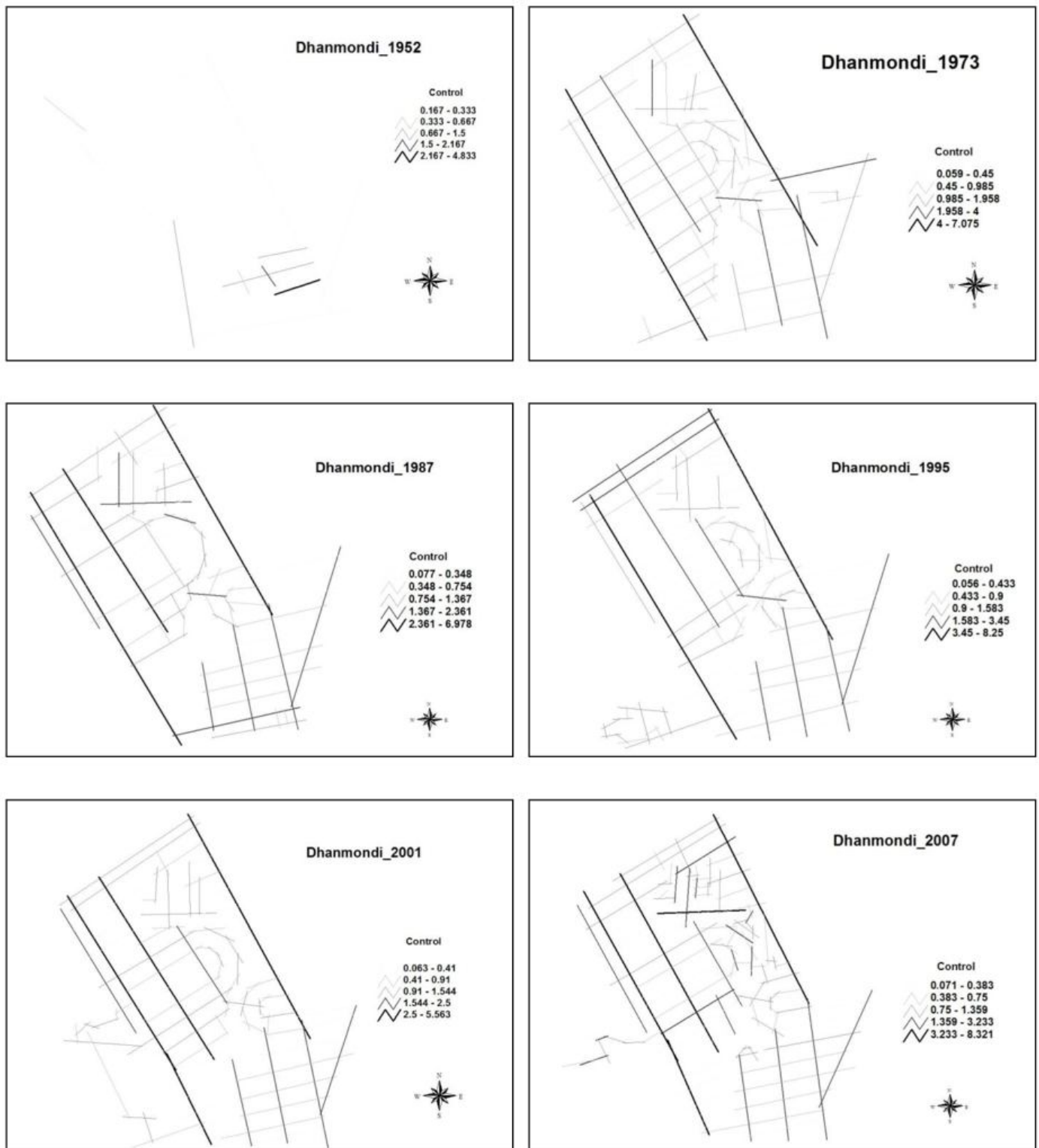
Figure 5.5: Control (CV) of Ward 49 in Different Time Periods

(Not to Scale)

Local integration values are higher than global integration. But does not vary much too much. It means local roads are getting a bit less importance in comparison to the highly integrated global streets.

As in 1952 the area was not developed enough that is why at that time the global and local integration values are lower than in the other phases.

5.6.4 Intelligibility

According to the space syntax theory, not only the local and global characteristics of urban systems are important issues, but also the interaction between them and the correspondence between the local and global configuration of space is also significant.

Intelligibility of an urban system is the degree of correlation between global and local properties of each line in the system. The stronger the correlation, the more we can infer the global position of a space from its directly observable local connections.

Correlation value of syntactic measures epitomizes the local and global relationship as well as the importance of any urban grid structure as 'part-whole' system. A globally important road may not create impact on local grid network; on the other hand locally important road can be isolated and disintegrated from the urban core of the city. This part-whole relationship of urban grid can be described more precisely by the correlation value as well as the slope of scattergram. To divulge the local and global correlation scatter gram is used as a tool to identify the representative local measures within the global structure of the city. If the average correlation value is close to 0.5, it produces a tight and linear scatter gram with comparatively greater slope. Linearity in scatters implies a good relation between local and global integration; and steeper slope across the regression line entails the most integrated line within the city (Ferdous, 2007).

After summarizing the correlation value of local and global measures in Table 5.2, the relationship between integration (global and local) with connectivity is compared. By comparing the global and local correlation value from the Table 5.2, it is assumed that the overall correlation value (both Rn-R3 and Rn-CN) is very strong and almost static

throughout the years. The scattergram (Figures 5.6 and 5.7) also implies comparatively linear and highly steep slope. It is also observable that the correlation values of Rn-R3 are higher in comparison to the correlation values of Rn-CN. And for Rn-R3, the tangent of slope values is higher than Rn-CN. Again there is a slight gradual decreasing trend in the tangent slope values.

It is observed that the global and local correlation (Rn-R3) is very high, static and the tangent of slope is also very steep. This indicates strong relationship between the two measures. Moreover the correlation is almost same in all periods. But the correlation of Rn-CN is a bit lower than Rn-R3. It states that the connectivity pattern of road network in between the global and local streets is slightly deteriorating. In connectivity analysis it is seen that the local streets are less connected than the global ones.

**Table 5.2: Correlation value of Global and Local Measures of Ward 49 in Different Time Periods**

Time Period	R of Rn-R3/ Intelligibility	Equation	R of Rn-CN/ Intelligibility	Equation
1952	0.8956	$y = 2.552x - 0.8897$ $R^2 = 0.8021$	0.7715	$y = 3.637x - 1.1012$ $R^2 = 0.5953$
1973	0.8616	$y = 2.5777x - 1.4015$ $R^2 = 0.7423$	0.6663	$y = 5.9574x - 4.8272$ $R^2 = 0.4439$
1987	0.8281	$y = 2.4972x - 1.088$ $R^2 = 0.6858$	0.6143	$y = 5.5076x - 3.6441$ $R^2 = 0.3774$
1995	0.8372	$y = 2.3591x - 0.9181$ $R^2 = 0.7009$	0.5769	$y = 5.1805x - 3.3998$ $R^2 = 0.3329$
2001	0.7903	$y = 2.3291x - 1.0092$ $R^2 = 0.6246$	0.6286	$y = 5.4117x - 3.7435$ $R^2 = 0.3952$
2007	0.8085	$y = 2.6548x - 1.1723$ $R^2 = 0.6536$	0.5775	$y = 5.1315x - 2.8905$ $R^2 = 0.3335$

[Here, R= Correlation, Rn= Global Integration, R3= Local Integration and R^2= Tangent of Slope]
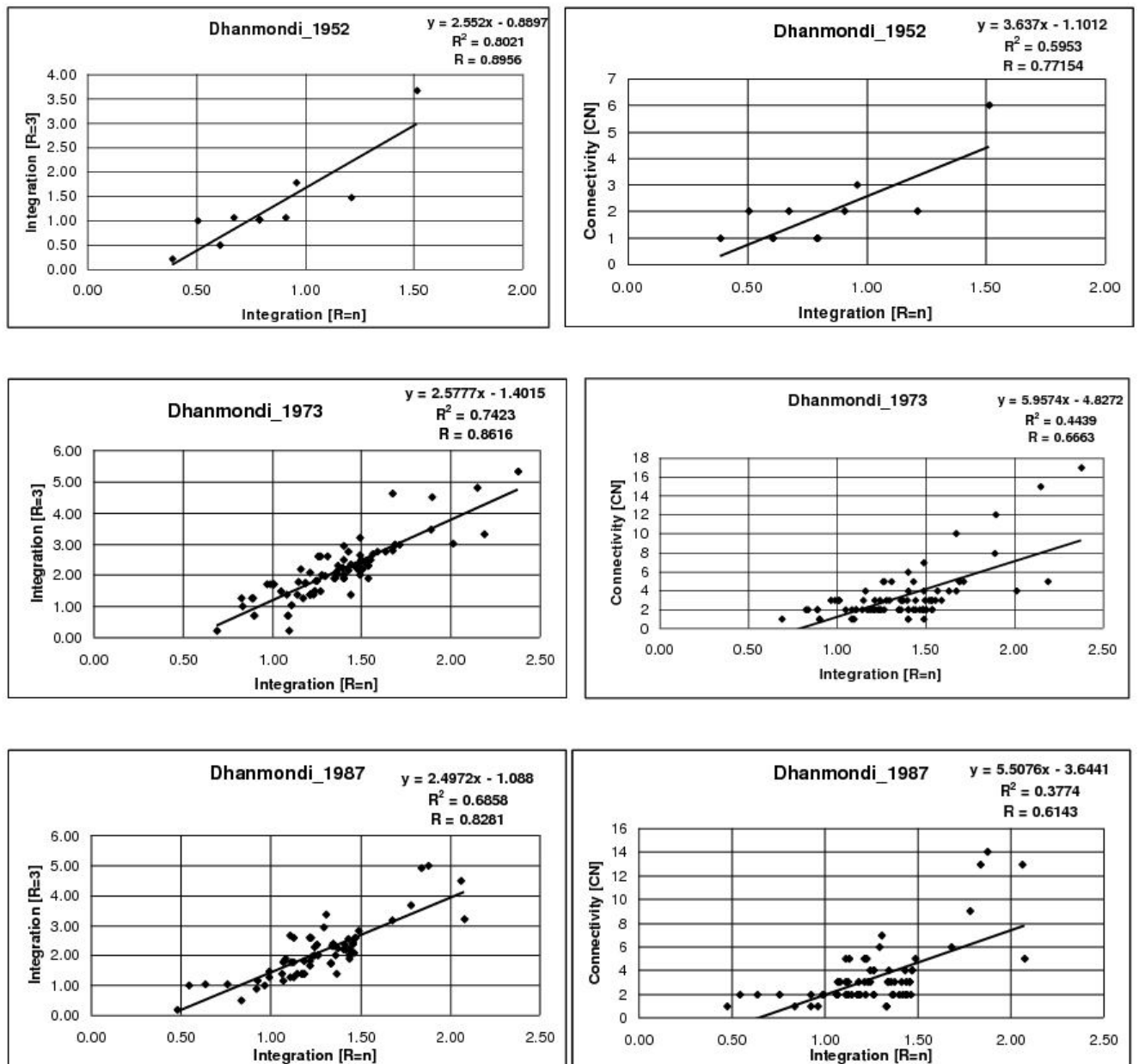
**Figure 5.6: Scatter of Correlation between Local and Global Measures
of Ward 49 in Different Time Periods**
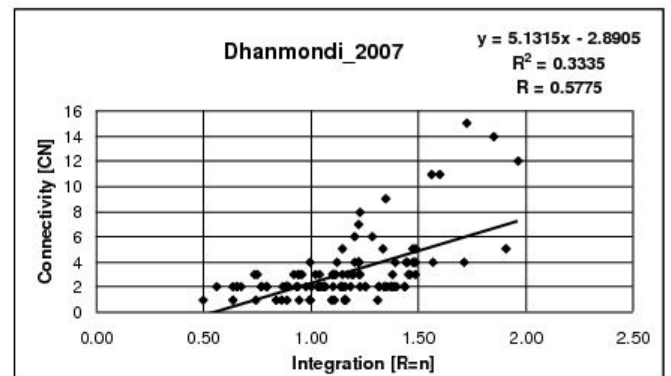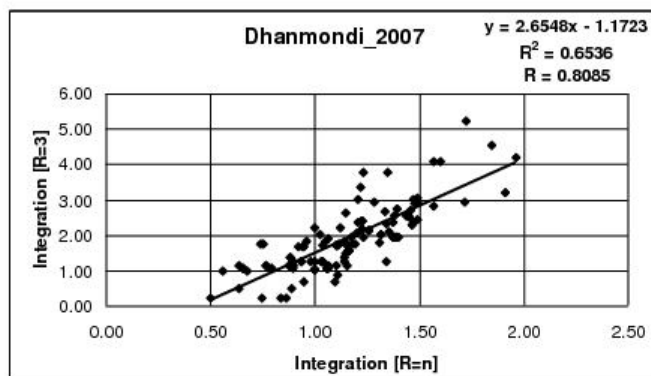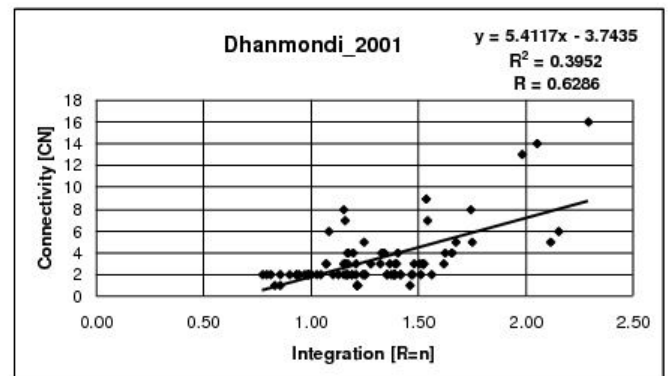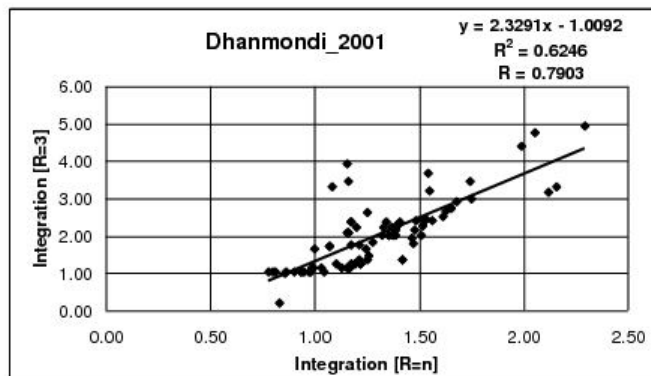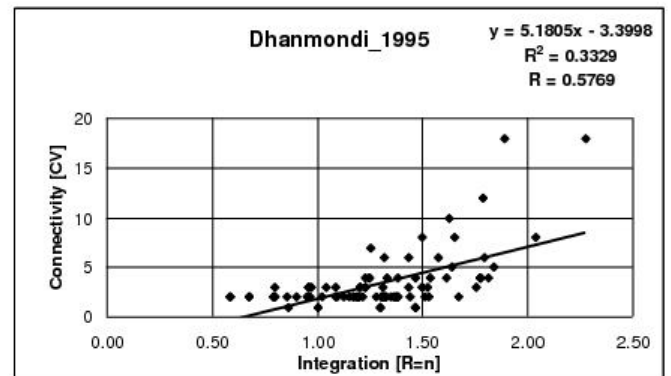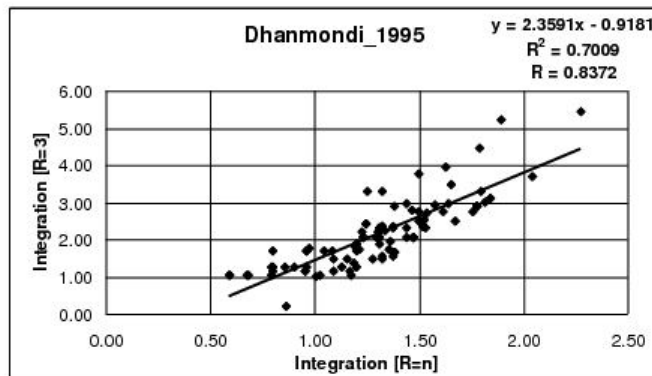
Figure 5.7: Scatter of Correlation between Local and Global Measures of Ward 49 in Different Time Periods

5.6.5 Summary of Syntactic Analysis of Ward 49

The syntactic analysis of Ward 49 (DRA) is summarized below:

a) The integration core lies in the commercial zone like Satmasjid Road and Mirpur Road.

b) The segment numbers are almost unchanged except year 1952.

c) Global roads are more integrated/ accessible while local roads are much more segregated/ inaccessible.

d) Global roads have high connectivity and control values than the local ones.

e) Locally important roads get less importance to the local inhabitants irrespective to the global measures.

f) The global and local correlation (Rn-R3 and Rn-CN) is high, steady and the tangent of slope is also very steep.

Being a planned residential area, the syntactic measures are showing quite unchanged and high values in all phases. Only in case of 1952, some abrupt values are found because in that time period the area was not developed rather it was almost open field. Higher values indicate that the street network is highly connective among each other.

[Some other maps, related to morphological change of each Ward, are attached in Appendix B and Appendix C]

Chapter 06
Ward 72: A Detailed Morphological Analysis

Ward 72 is located in old Dhaka. It is in one of oldest historical core of Dhaka City. This area exists from the Pre-Mughal period. The town consists of a few market centers like Shankhari Bazar, Tanti Bazar, and a few localities of other craftsmen and businessmen that were also existed in the Pre-Mughal period.

6.1 Old Dhaka as Indigenous Settlement

The city of Dhaka expanded in different historical stages and experienced indigenous, formal and informal development. Within the spatial pattern of Dhaka, Old and New Dhaka has experienced two different phases of development and outside the boundary of densely developed indigenous Old Dhaka, the rest of the development is known as New Dhaka. Hence, among the spatial structures in Dhaka it has been observed that there are two distinct phase; Old Dhaka and New Dhaka exist side by side- one in the historic core and the other in the extemporaneous settlements of recent years - the former is commonly called the 'indigenous' and the latter is labelled as 'informal' development.

It has been claimed that the organic cities reflect, the community spirit; and the founders and builders of these cities may not have drawn their plans as we would draw them, but they seem to have had a clear conception about the city they wanted, its arrangement and the relation of its constituent parts to each other and to the whole. Consequently, the argument can be put forward that both in historic and contemporary part of a city, naturally grown areas are the reflection of people's own way of building their city at that particular period of time. Therefore, Dhaka can be generally termed as 'Architecture of a city without an architect' thus an organic city par excellence (Nilufar, 1997: 20-21).

Behind the chronological development of Dhaka city, the urban fabric of Old Dhaka preserves its indigenous morphological pattern. Therefore, the organic localities in old city are distinctive geographical areas having homogenous morphological character.

The present research is mainly concentrated on the morphology of Dhaka. However, the morphology is not only related with the historical evolution but also with the societal aspects. Historically Dhaka was the provincial capital of Bengal under the central state of India. Although in Bengal the majority Muslims were Hindu converts they were inevitably influenced by the Hindu majority.

Photograph 6.1: A Sketch of Old Dhaka

Moreover, the population density in the areas of Old Dhaka was higher than the city averages and at present still highest. The population density of urban areas in Bangladesh is 15 to 18.75 PPA (Persons per Acre) and that of Dhaka City Corporation is 109 PPA. In Sutrapur Thana (Farashganj area) it is 282 PPA and in Kotwali Thana (Shankhari Bazaar) it is 408 PPA (BBS, 1991 and Ferdous, 2007).

The probable reason is, as that time the main city centre and settlement was developed along the riverside of Buriganga. Fairly large size families live near the central part of the city, whereas smaller families and single persons are found in the suburb areas or near work places of the city. In addition, the spatial segregation of religious groups of Dhaka is dominant among the Hindu population who are mainly found near the Pre-Mughal Hindu core (Shankhari Bazar, Tanti Bazaar).

According to the above discussion, it is clearly comprehend that other than history, societal structure also played a vital role for developing indigenous old Dhaka city. In spite of this, intermingles of heterogeneous class and caste system also reflected in the morphological pattern of Old Dhaka and this intermixing character of old city accelerated to create the order of organic urban spaces. This heterogeneous community in Old Dhaka has been developed as people of different caste and ethnic background mixed in some parts of Old Dhaka where as the spatial structure was divided according to the occupational groups of society.

6.2 Study Area Profile

Ward 72 is located in Kotwali Thana. Kotwali Thana Area is considered as old Dhaka. Many administrative establishments including Dhaka City Corporation, Police Head Quarters, Bangladesh Fire Service, Lawyer Court and Judge Court are located surrounding this ward.

6.2.1 Location

Dhaka Kotwali is located at 23.7056° N 90.3250° E . It has 31992 units of house hold and total area 2.07 km² (URL: 12). This thana is bounded by Ramna and Motijheel thanas on the north, Buriganga river and Keraniganj upazila on the south, Sutrapur thana on the east, Lalbagh thana on the west (Figure 6.1). It consists of six wards and 97 mohallas (Marufuzzaman, n.d.).

The total area of Ward 72 is 51 acres. It is located (Figure 6.2) on the north-east of Sadar ghat, bounded by English Road and Babu Bazar on the north (ward 71), Bongshal Bazar and Islampur Road on the south (ward 73), Nawabpur Road and Bahadur Shah Park on the east (ward 78) and Bongshal and Armanitola Church on the west (ward 68). It consists of 16 mohollas and 5408 households (Marufuzzaman, n.d.).

6.2.2 Road Pattern

The pattern that exists in the old city is meandering and intricate street network where walls defining the houses. Its organic character is particularly distinctive owing to the density of its built-up areas in comparison to the looseness of the later developments. The narrow streets in the historic part are continuously labyrinthine and out, and are convoluted to an extreme degree in some places. The cu-de-sacs sometimes cut deep inside the urban block presenting a series of sharp turns (local roads). However, a few long lines pass through residential areas, which give rise to another type of urban pattern, e.g. Shankhari Bazar Road, Tanti Bazaar Road. These are mainly the commercial interfaces of the city; such areas have no lanes and by lanes as the access are from single bazaar streets. The streets are defined by closely spaced buildings in contrast to the former pattern where buildings are loosely spaced.
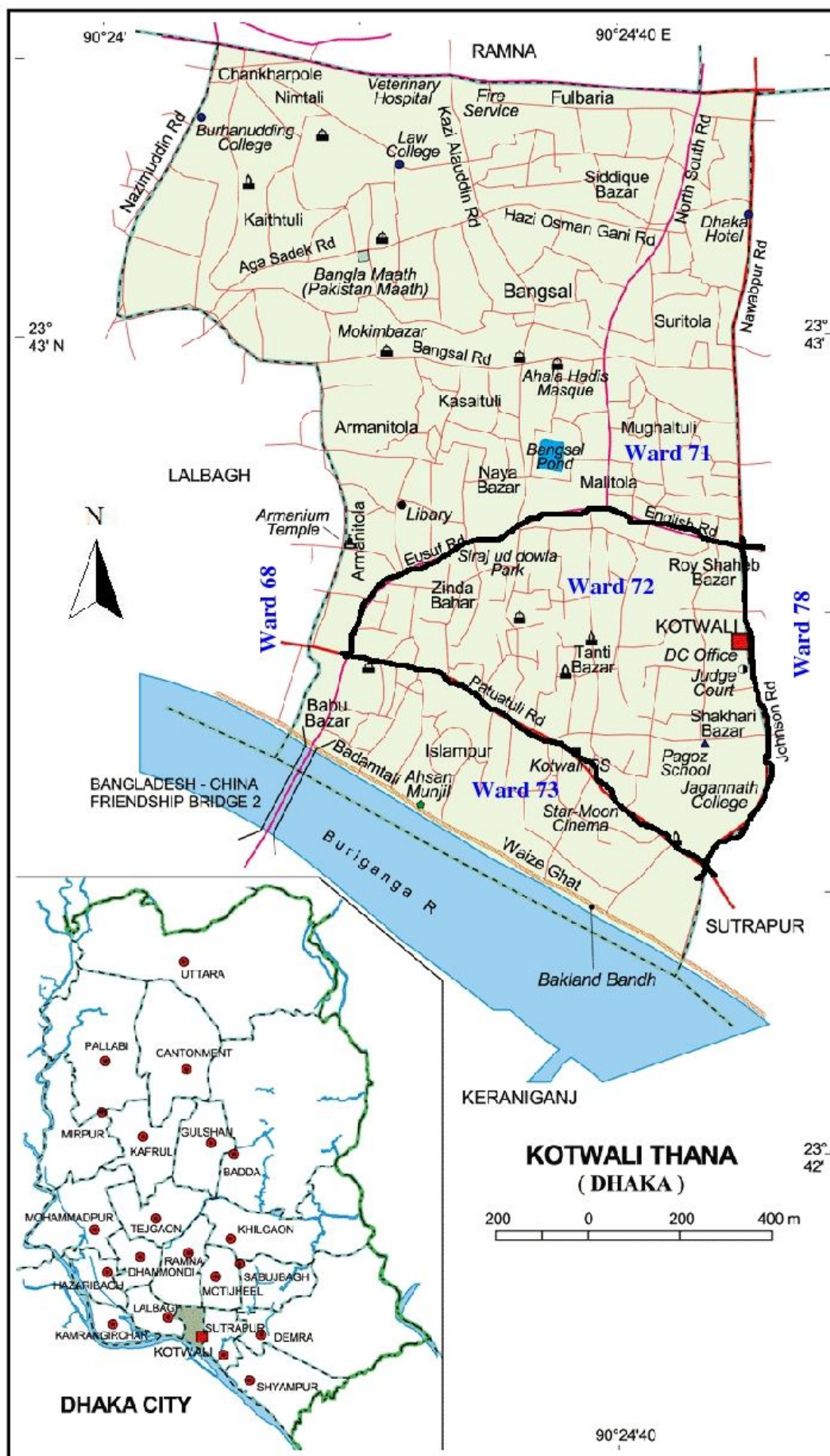
Figure 6.1: Map of Kotwali Thana

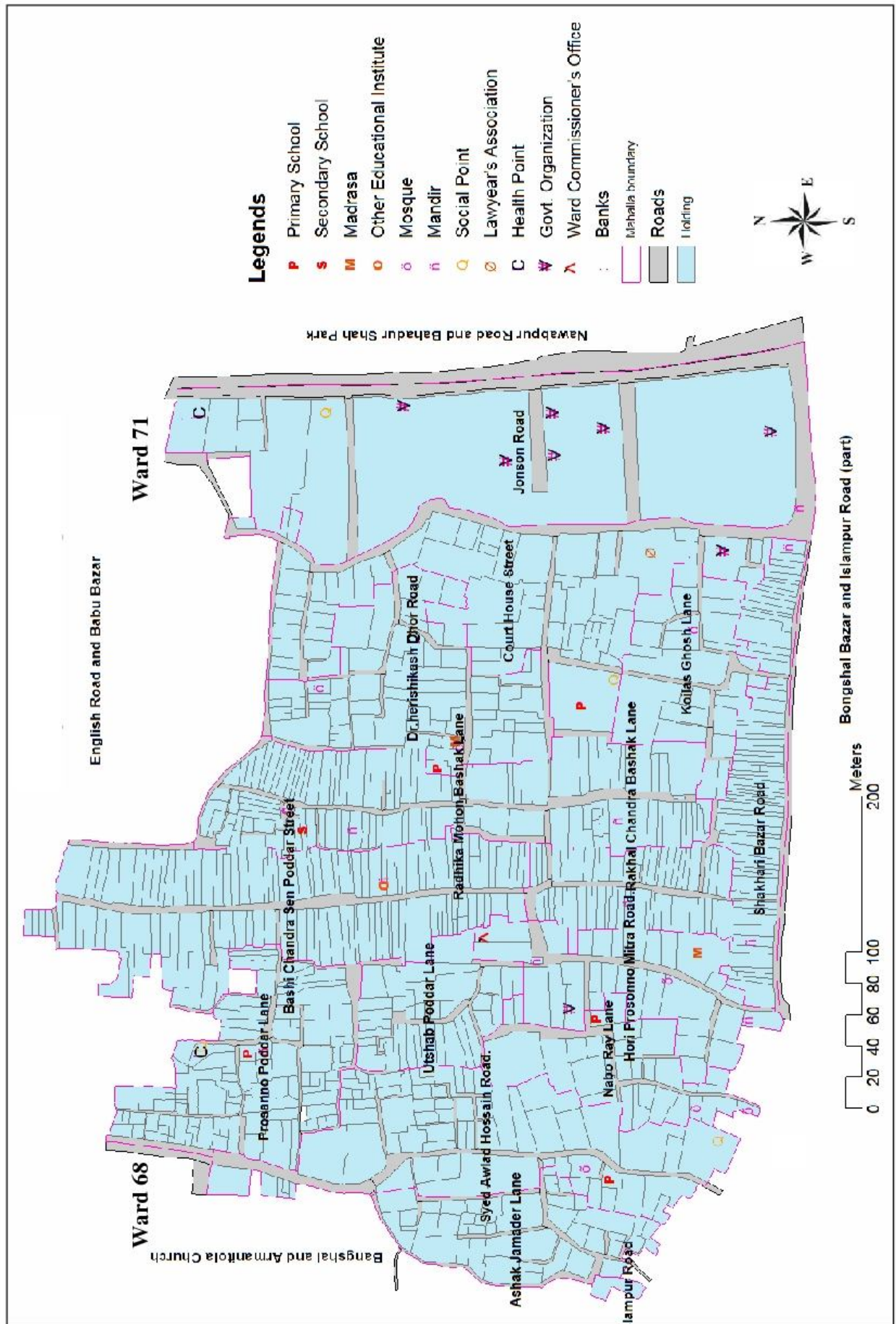Source: http://www.bangladesh.gov.bd/maps/images/dhaka/DhakaKotwaliT.gif

Figure 6.2: Map of Ward 72

Source: DCC, 2006

6.2.3 Religious State

People of Hindu caste are relatively dominant here compared to other communities. But many Muslims also live here. Population density of this area is very high. Hindu or Muslim whoever it is, residents of this area are very religious in their customs and manner. Different types of rituals add more color to the traditional living style of these people.

6.2.4 Land Use Pattern

This is a very old part of Dhaka city. Here urbanization began a long time ago. Infact 100% land of this ward has been urbanized. Almost all the area is built-up and vacant land is very difficult to be found. Mixed use of land is an important character of this area. In most cases the ground floor of the building is used as shops or other economic activity and the upper floors are used for residential purpose. This kind of mixed use buildings are mainly found mostly in Shakhari bazar, Tanti bazar, Nabaroy Lane, Radhika Mohan Bashak Lane and Ussab Poddar lane areas.

6.2.5 Physical Characteristics

In is the oldest part of Dhaka city, the buildings are also very old. The buildings are so old that the boisterous Shakhari bazaar of Old Dhaka poses as a death trap, with its old disintegrating buildings on the verge of collapse. But new buildings are growing in the area side by side or between two old buildings. Many multi-storied markets have already made their way between the old dilapidated buildings. The buildings are very congested and there is no gap between two adjacent buildings especially in Shakhari bazar. But the new buildings leave some space but that is not enough according to the set-back rules of RAJUK. Infact the practice of following set-back rules for buildings are totally absent in this area.

All sorts of utility services are present in this area that includes electricity, water, gas, sewerage and telephone. But many of the connection of these utility services are not legal and that is why they are faulty. Especially the electricity connections are hanging in such a way that it is difficult to track down any individual line.
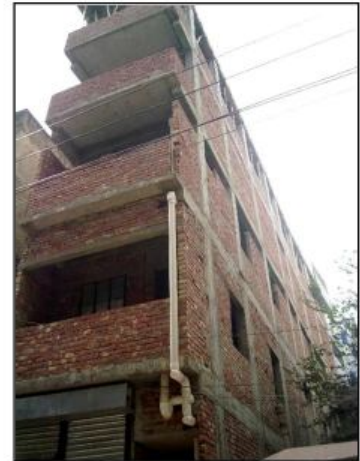
According to the construction period of buildings, three categories of buildings have been found here (Photograph 6.2). Old buildings (mostly 2-3 storied), newly constructed buildings over old buildings (mostly 4-5 storied) and new buildings (mostly 5-7 storied).

| 1. Old buildings | 2. Newly constructed buildings over old buildings | 3. New buildings |

Photograph 6.2: Building Categories of Ward 72

Temples are very prominent feature in this area. There are many focal temples along with numerous small ones. Besides, maximum houses have temples on topmost floors.

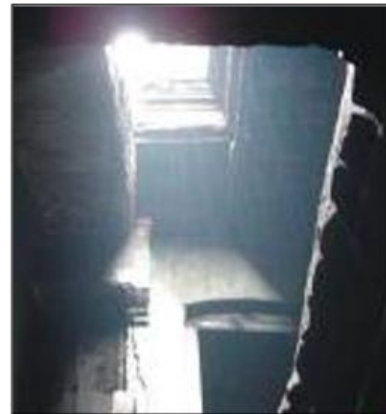Roof top Temple   Public Temple

Photograph 6.3: Temples

The prominent architectural features are narrow and long corridor, high ceiling, raised stair, high plinth, light-well, niche / alcoves, triple arch, overlooking balconies with decorated parapets in the street front, arches over doors and windows.

Triple Arch

Stairs

Light well

Overlooking Balcony

Alcove

Photograph 6.4: Architectural Features of Ward 72

6.2.6 Unique Features

Two mohollas of ward 72 are so old and traditional that they require more description. These are Tanti bazar and Shakhari bazar, the two oldest market places of Dhaka City.

6.2.6.1 Tanti Bazar

Much history cannot be known about Tanti bazar. All it is known that once upon a time wavers used to live in this locality in great numbers. That is why it is called Tanti Bazar. Many believe that this bazar was established during the Pre-Mughal period (Mamun, 1993).

6.2.6.2 Shakhari Bazar

The moholla belongs to the Shakhari Community, who borrowed their name from Shakha, a richly decorated bangle crafted from slices of Shankha or conch-shells. Shakha is the symbol that indicates that a Hindu woman is married. As one of the most densely populated areas in the world Shakhari Bazar also has the largest concentration of the Hindus in Dhaka. At present there are about 10,000 people living in Shakhari Bazar and that within an area of 4.6 acres of land makes it one of the highest density areas of the world (Islam and Zaman, 2006).

Shakhari Bazar has a distinct urban fabric. The narrow street of Shakhari Bazar is unique in the sense that the buildings on both sides of the road represent architectural and cultural heritage (Figure 6.3). It is a 600 ft long narrow street lined by thin slices of brick buildings (150) 200-300 years old. These buildings are 10-12 ft in width and 70-100ft in length going up to 2-4 storeys.

Apart from Shakha a number of other traditional crafts are widely seen in the mohalla, to name a few are, musical instruments, paper crafts, Shola-pith or crafts using jute straw and Styrofoam sheet, Clay Statues for puja or other religious purpose, stone craft etc. In recent times there has been a remarkable rise in the goldsmith shops in Shakhari Bazar. Shakhari Bazar is the manifestation of the irrational policies, lack of adequate development control rules and distorted legal framework, all of which have left their indelible mark on this precious little moholla that shares a long history of more than 400 years with Dhaka city itself.
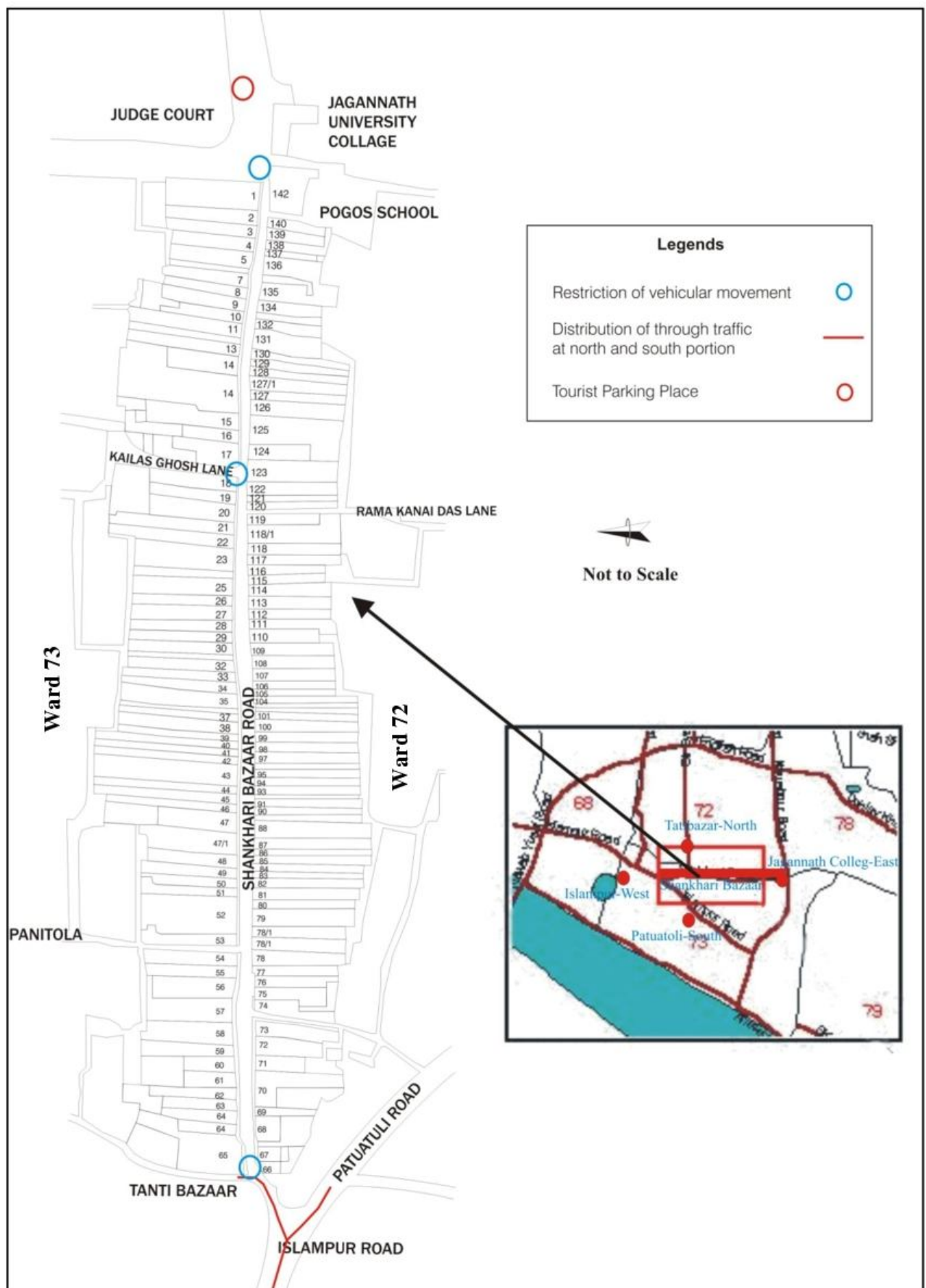
Figure 6.3: Street Network of Shakhari Bazar

Source: Architecture Library, BUET

6.2.7 Local People's Perception

➢ **Respondent 01**
   Name: Dilip Biswas
   Age: 50 years

I was born here. In that time most of the houses were 2-3 storied. Buildings were constructed mostly with lime. The road pattern at present is unchanged. Now-a-day's high-rise buildings are constructed. In some old buildings new floors are added. The opportunities for new business are gradually increasing. The number of businessmen in this area is increased from 150 to 700. The Dholai-khal Road was a canal in the past. This road was constructed after liberation war by the time of 1978-79. There is no open space and playing field in Old Dhaka from the past. The plots size of this area is same as the past.

➢ **Respondent 02**
   Name: Indreshhor Dutt
   Age: 52 years

I have been living here from my childhood. Road condition was very poor in the past. But from in the period of Ayub Khan the roads were pitched. Most of the houses were then two storied. There is no vacant land in this area from that time. At present the road pattern is as like as the past but the condition of buildings is gradually changing. New and modern building construction takes place by the side of old and vulnerable buildings.

➢ **Respondent 03**
   Name: Mrs. Lina Akhter
   Age: 42 years

The change of this area is not so mentionable for the last 20-30 years. The road width is same as before. There is not that much of vacant land from the past. The area is not grown up as a planned residential or commercial area. Different types of businessmen lived in this area. The area is famous for its shakhari products. Besides these there are many small industries in this area. People of this area are mainly involved in business.

Most of the buildings of this area are very old. They are not that much repaired ever since these were constructed. The utility condition of this area is not so well. The major problem is water and dumping garbage.

➢ **Respondent 04**
   Name: Md. Rahmat Bari
   Age: 53 years

People of this area are mainly involved in different kinds of small business. Buildings are very old. Some new buildings are being constructed for commercial purpose. The area is famous for different types of wholesale market of mechanical parts and shakhari products. Dhaka was once renowned for the art of making bangles and other kinds of ornamental adornments from conch shells. Originally centered in Shakhari Bazar in this area, the area had been home to these artisans for centuries. Most of the shakhari makers are Hindu in religion. Open space are not that much available in this area. Roads are very narrow and some houses are very much prone to hazard.

➢ **Respondent 05**
   Name: Hashem Sufi
   Age: 48 years

The origin of my family is mainly from India. I and my wife make shakhari products. Our shakhari shop is one of the oldest shops of this area. It was started by my father. Shakhari products are now not that much popular but it still has a very high value for Hindu religion still now. Many temples stand on the narrow streets of this area. Over the years it has become the most popular centre for Hindu religious festivities. The area has the largest concentration of the Hindus in Dhaka. The place and way of life of the Shakharis is now a tourist attraction. The narrow slender buildings of this area built about 200 years ago, are too old and dilapidated to live in. A number of these structures collapsed in 2004 killing 19 lives.

The road width and plot size of this area is unchanged for years. Although the building height is increasing but the construction seems to be very risky. Actually for years, this area is remained unchanged in the context of road pattern, plot size and open space; only the building height has increased.
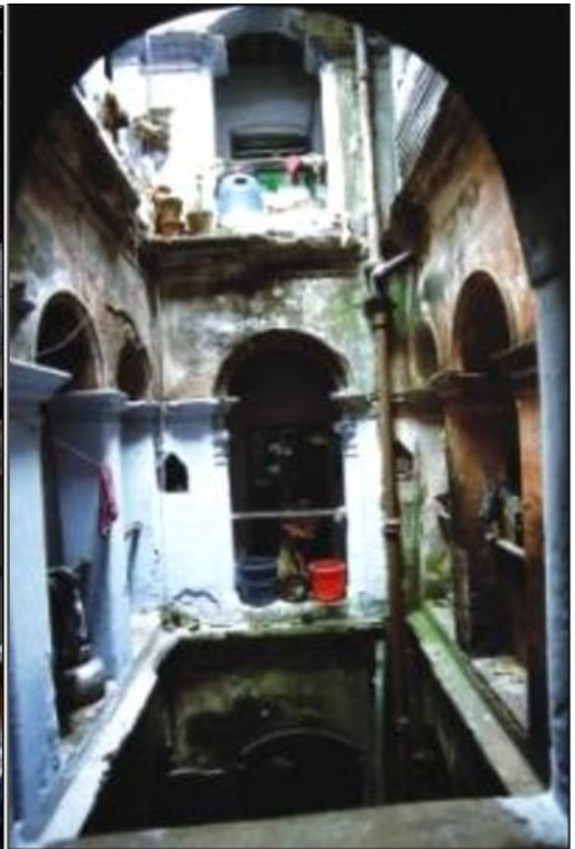
Photograph 6.5: Urban Environment of Ward 72

Photograph 6.6: Urban Environment of Ward 72

6.3 Syntactic Analysis of Ward 72

6.3.1 Global Integration Core

In 1952 the core follows Islampur Road and Johnson Road (Figure 6.4). In 1973 it followed Shakhari Bazar Road, English (Inglis) Road and Kotwali Road. In 1987 and 1995 the core lied on English Road, Johnson Road and Shakhari Bazar Road. In 2001 it follows Shakhari Bazar, some part of Islampur Road and Kotwali Road. In 2007 the core is in Shakhari Bazar Road, English Road, Johnson Road and Kotwali Road.

Shakhari Bazar Road is full of commercial activities, like Islampur Road and English Road. There is DC office, Judge Court and other important public institutions beside Johnson Road. Kotwali Road links the ward from one end to other.

6.3.2 Connectivity and Control

In 1952 Islampur and Jonson roads are most connective. Most connective roads are, in 1973 English Road, Shakhari Bazar Road and Kotwali Road, in 1987 and 1995 some local roads and in 2001 Islampur, Shakhari Bazar Road and Kotwali Road and in 2007 Johnson, Shakhari Bazar Road and Kotwali Road, are dominant (Figure 6.5).

Moreover, the average connectivity throughout the years varied from 2-4 (Table 6.1) which is very low. Control values were also very low.

6.3.3 Global (R=n) and Local (R=3) Integration Pattern

The global and local integration remain almost constant and balanced in all phases (Table 6.1). It indicates that the locally important roads always get importance to the local inhabitants irrespective of the global measures.

6.3.4 Intelligibility

It is found that the correlation values are very high in the past years and gradually it is decreasing (Table 6.2). Moreover, the tangent of slope is also lowering down (Figures 6.6 and 6.7).
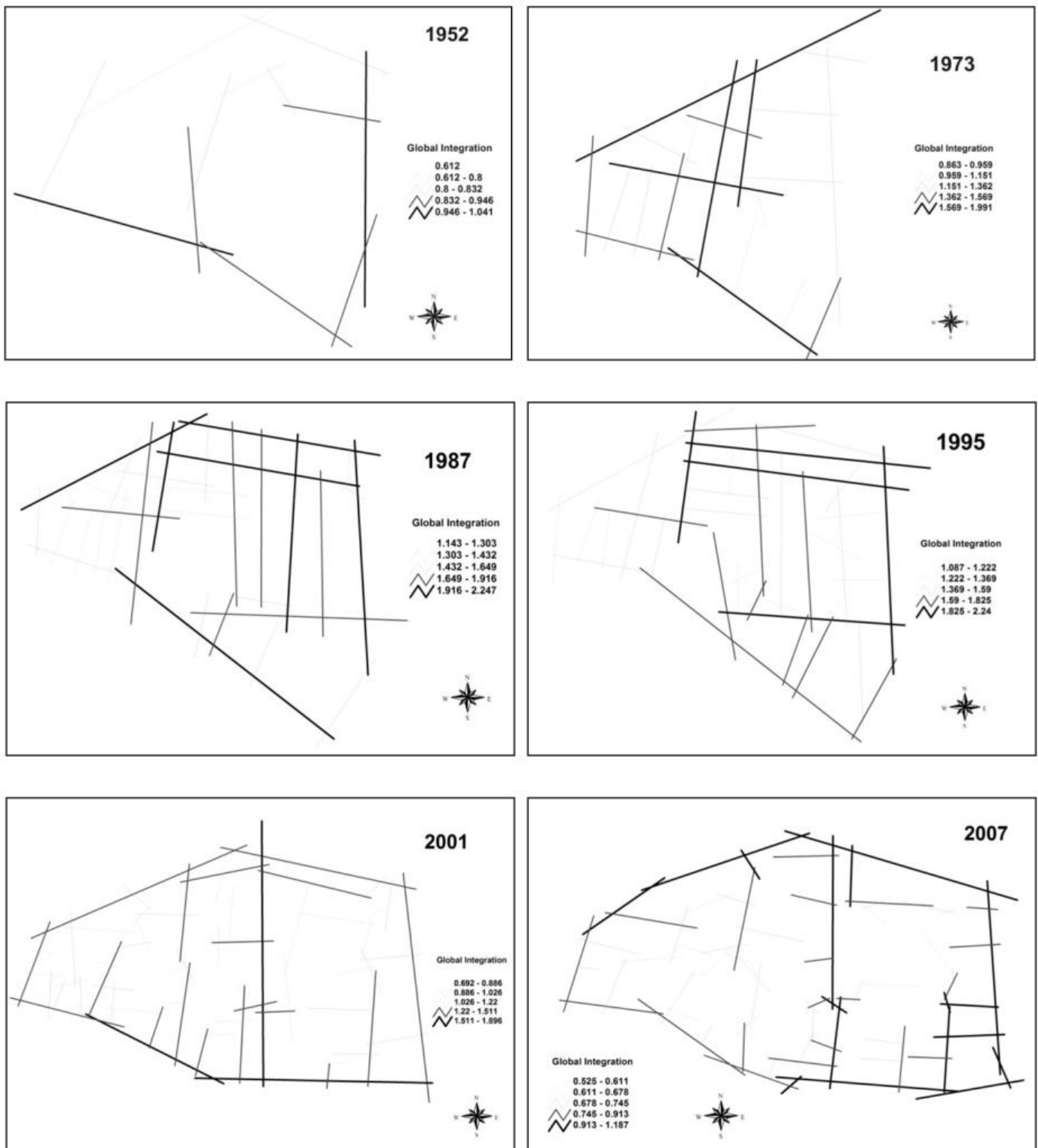
Figure 6.4: Global Integration (R=n) of Ward 72 in Different Time Periods

(Not to Scale)

This suggests that changes in the urban grid in recent times have been particularly detrimental. Actually throughout the years the population density and building height of this area is increasing without following any prior to planning. This means locally important roads are being isolated and disintegrated from the urban core.

Again the local global connectivity (Rn-CN) is comparative low that exemplifies the less connected linearity of this area. However, the local global integration (Rn-R3) is moderately higher and this proves both global and local importance of Ward 72 even at present.

6.3.5 Summary of Syntactic Analysis of Ward 72

a) The integration core lies generally along Shakhari Bazar Road, English Road, Jonson Road and Kotwali Road.

b) The numbers of segments are increasing throughout the years.

c) The global and local integration remains almost constant and balanced in all phases.

d) Shakhari Bazar and Kotwali roads show the highest connectivity and control values throughout the years.

e) Although the correlation values are very high in the past years, but gradually it is decreasing.

Therefore, it is believed that to unveil the underlying morphological order of an organic form like Ward 72, it is necessary to understand the notion of the users, i.e. how they understand its structure and how they arrange themselves on the ground. The syntactic quantitative measures like integration, connectivity and correlation strengthen the qualitative value of hidden geomorphic order of the organic city.

From this morphological analysis, it has been observed that the physical and configurational characteristics of Ward 72 (Old Dhaka) still represent the past. Therefore studying the consistency in spatial pattern helps to understand the past character as well as give direction to the future.
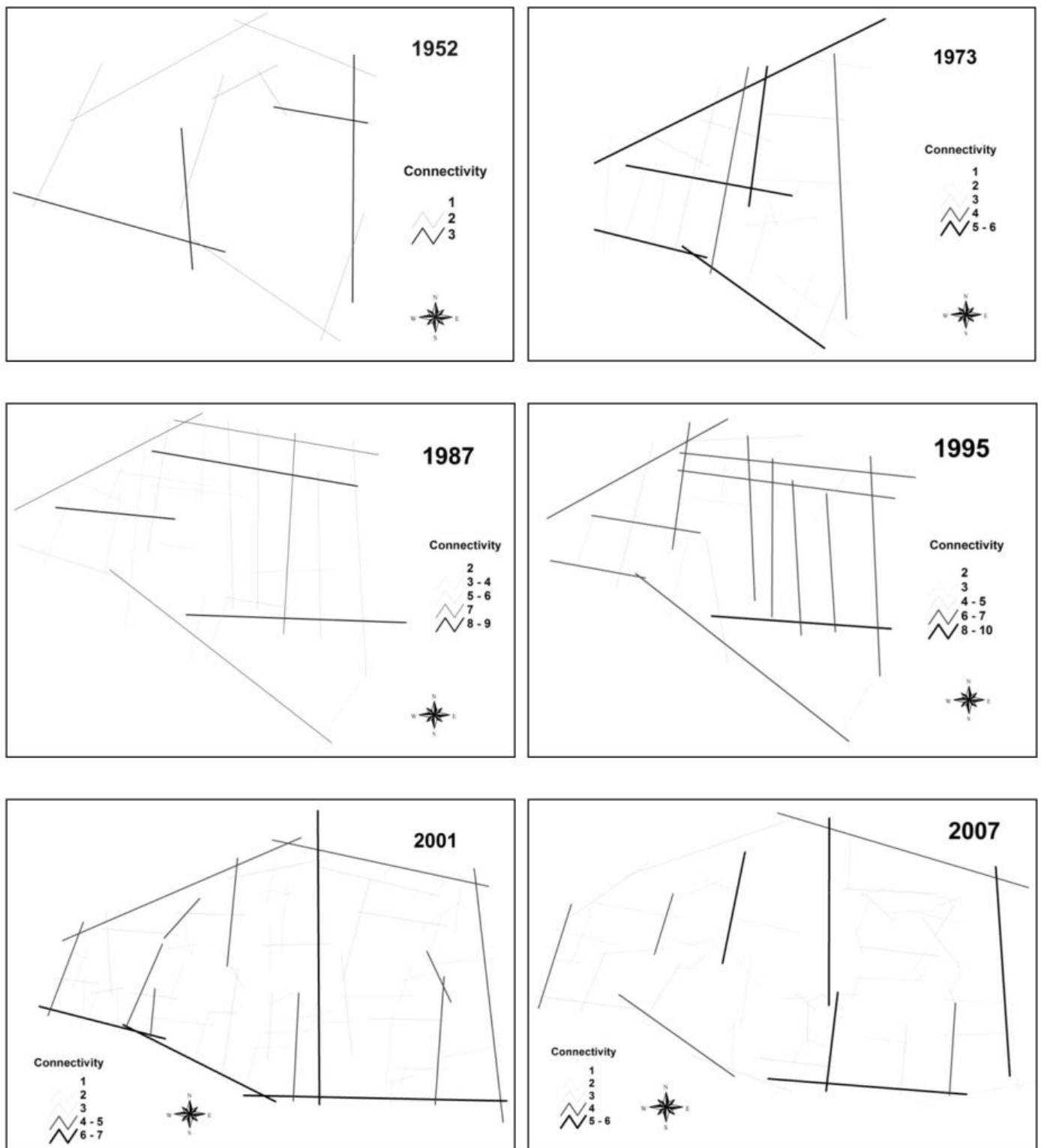
Figure 6.5: Connectivity (CN) of Ward 72 in Different Time Periods

(Not to Scale)

Table 6.1: Syntactic Measures of Ward 72 in Different Time Periods

| Syntactic Measures		Time Period	1952	1973	1987	1995	2001	2007
Integration Global	R=n	Segment No.	14	24	44	48	79	87
		R=n Max	1.04056	1.99126	2.24658	2.23986	1.89582	1.18708
		R=n Min	0.61209	0.86288	1.14300	1.08699	0.69219	0.52474
		R=n Mean	0.85856	1	1.56202	1	1.08188	0.76714
		Std. Deviation	0.13237	0.322791	0	0.286535	0.24725	0.151016
Integration Local	R=3	R=3 Max	1.72399	2.94228	3.69806	3.88328	3.21437	3.03094
		R=3 Min	0.50003	0.50003	1.27373	1.16346	0.21093	0.21093
		R=3 Mean	1.20982	1.85331	2	2.20811	1.53693	1.40145
		Std. Deviation	0.399402	0.622029	0.662437	0.675299	1	0.572503
Connectivity	(CN)	CN Max	3	6	9	10	7	6
		CN Min	1	1	2	2	1	1
		CN Mean	2	3	4	3.62500	2.60759	2.34483
		Std. Deviation	0.662994	1.411649	2.108575	2.149963	1.295136	1.076467
Control	(CV)	CV Max	1.83333	2.28333	2.83333	3.55952	2.36667	3.75000
		CV Min	0.33333	0.33333	0.25397	0.24286	0.25000	0.16667
		CV Mean	1	1	1	1	1	1
		Std. Deviation	0.452911	0.600522	1	0.858611	0.528829	0.660382

Table 6.2: Correlation value of Global and Local Measures of Ward 72 in Different Time Periods

Time Period	R of Rn-R3/ Intelligibility	Equation	R of Rn-CN/ Intelligibility	Equation
1952	0.926891	$y = 2.7967x - 1.1913$ $R^2 = 0.8591$	0.904338	$y = 4.5295x - 1.746$ $R^2 = 0.8178$
1973	0.933863	$y = 1.7996x - 0.6459$ $R^2 = 0.8721$	0.857795	$y = 3.7514x - 2.1265$ $R^2 = 0.7358$
1987	0.909904	$y = 2.0102x - 0.8549$ $R^2 = 0.8279$	0.853305	$y = 6.0005x - 5.5092$ $R^2 = 0.7281$
1995	0.837952	$y = 1.9749x - 0.7281$ $R^2 = 0.7022$	0.764556	$y = 5.7367x - 4.9044$ $R^2 = 0.5845$
2001	0.870061	$y = 2.3976x - 1.057$ $R^2 = 0.757$	0.813903	$y = 4.2633x - 2.0048$ $R^2 = 0.6624$
2007	0.628307	$y = 2.3819x - 0.4258$ $R^2 = 0.3948$	0.493269	$y = 3.5161x - 0.3525$ $R^2 = 0.2433$

[Here, R= Correlation, Rn= Global Integration, R3= Local Integration and R^2= Tangent of Slope]
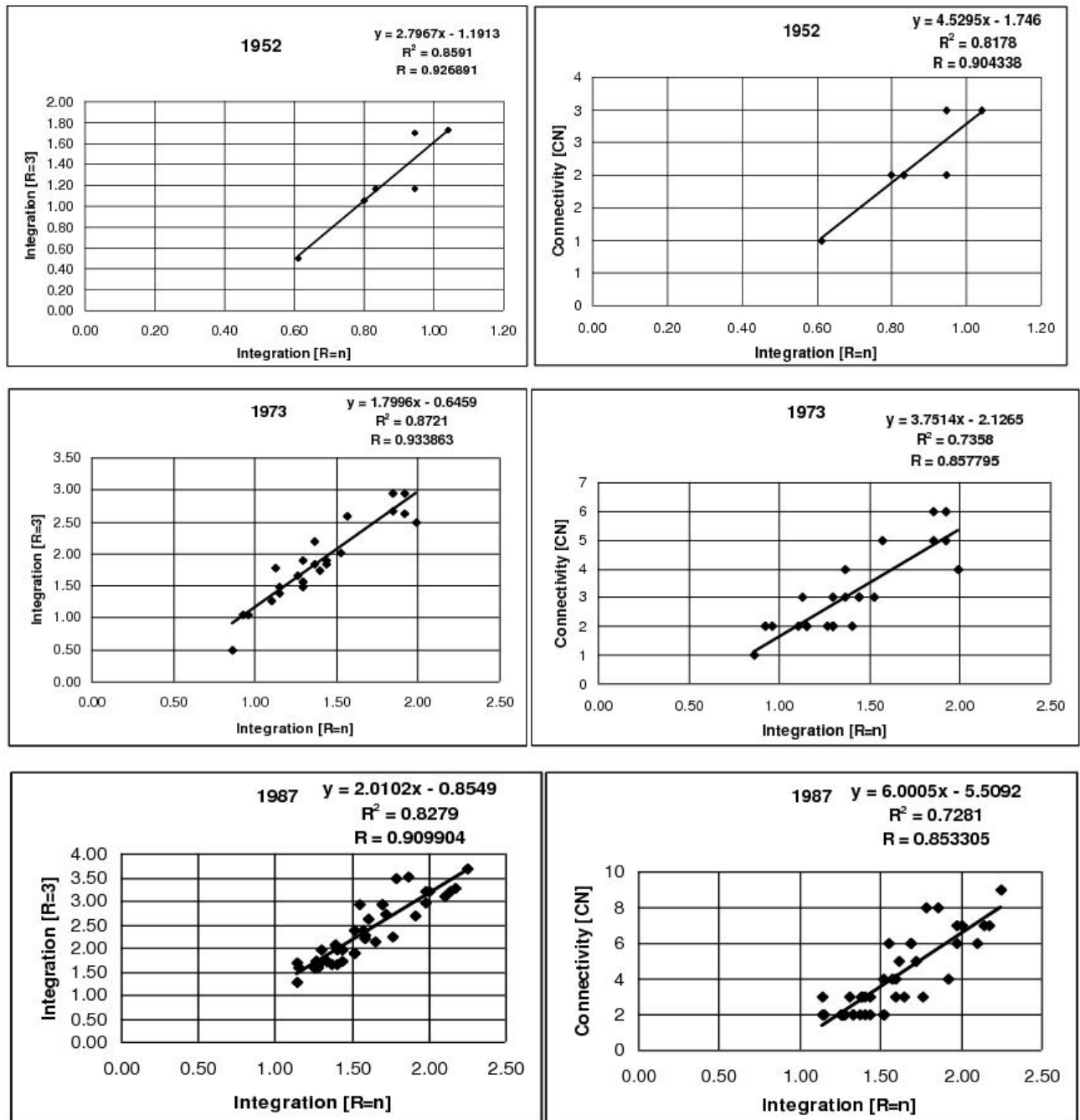
Figure 6.6: Scatter of Correlation between Local and Global Measures of Ward 72 in Different Time Periods
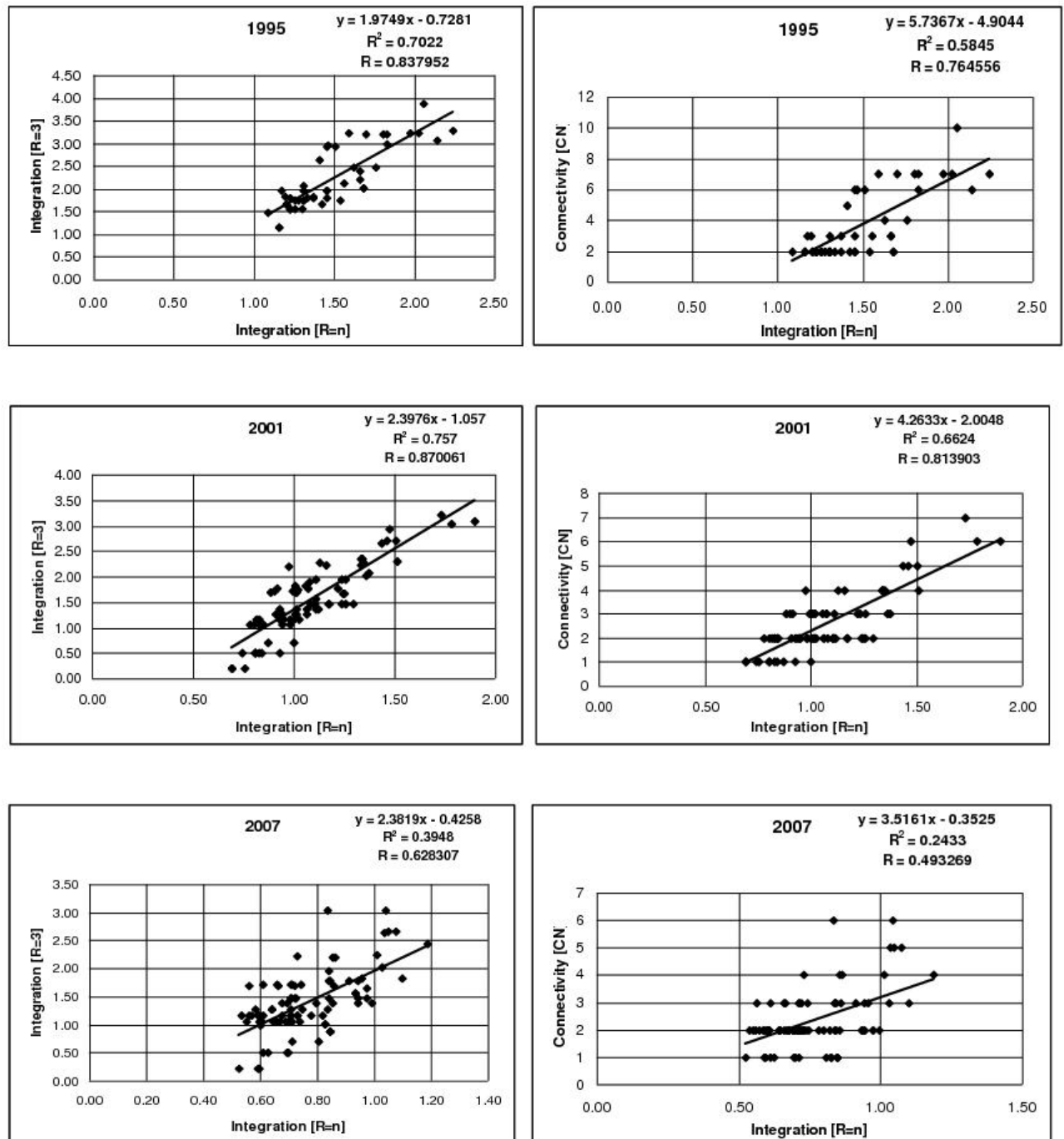
Figure 6.7: Scatter of Correlation between Local and Global Measures of Ward 72 in Different Time Periods

Chapter 07

Ward 18 and 19: A Detailed Morphological Analysis

Every city has its posh residential areas. Away from the bustling city, quiet and serene, these are where the well-off dwell, and where others drive by, dreaming of buying a house there someday. Once upon a time, Dhaka too could boast of elegant, quiet residential areas where cosy or majestic houses with fragrant flower gardens lined the tranquil lanes adorned with billowing trees.

That certainly is a far cry from residential neighbourhoods of today's Dhaka. Its so-called "posh", residential areas have and continue to become anything but that. Gulshan, Banani and Baridhara -- places where half the city travels to every morning, to work in offices, banks and restaurants, shops and garment factories.

Quaint independent houses have been turned to high rise apartment buildings, sacrificing the beautiful gardens. Lanes are now thoroughfares where cars honk rudely and create traffic jams. Roads are pot-holed, muddy and smell of rotting garbage left in heaps in corners. Avenues of elegance have been turned into lines of commercial establishments from banks to schools to clinics. So what happened to the best neighbourhoods of Dhaka?

7.1 Study Area Profile

Gulshan, Banani and Baridhara (Ward 18 and 19) are commercial cum residential areas, originally meant for offices and embassies of diplomatic missions, as well as posh residences. These areas have seen an upsurge, since mid-1990s, in the number of high-rise buildings, posh restaurants, lavish residential areas, modern markets and ice-cream parlors which are open past midnight.

7.1.1 Location

The Gulshan thana comprises an area of 53.59 km², consisting of three wards (18, 19 and 20), 37 mouzas and 20 villages, including Gulshan Model Town, consisting of Gulshan circle 1 and circle 2, Banani Model Town, Baridhara Diplomatic Zone, and Mohakhali. This thana is bounded by cantonment and Badda thanas on the north,

Tejgaon and Khilgaon thanas on the south, Badda thana on the east, Kafrul thana on the west (Figure 7.1). Gulshan thana was established in 1972. 50% of the area is residential, 20% commercial, and 12% is diplomatic area. 18% land in Gulshan consists of other areas, including slums, of which the biggest is the Karail slum. Apart from the urban areas, the 37 mouzas of Gulshan Thana also contain 20 villages. [URL: 14]

Ward 18 comprises of Baridhara Residential Area, Shahzadpur and Kalachadpur areas (Figure 7.2) and Ward 19 represents Gulshan and Banani Model Towns (Figure 7.3).

7.1.2 History

Gulshan was founded as a planned model town in 1961 with its own pourashabha (Municipal Corporation), while the neighboring Banani Model Town was founded in 1964. Gulshan pourashabha was abolished in 1982. RAJUK completed the project 'Baridhara Residential Model Town' in 1990.

These areas were originally built with the purpose of being solely residential, however, over the years many commercial buildings have been set up. The celebrated scenic view of the area, dominated by the Gulshan Lake, is deteriorating. The reason often stated is a lack of urban planning.

Baridhara is also known as "diplomatic area", since some high-commissions and embassies are located here. It is a zone designated for diplomats, high ranking civil and military officials, and politicians in Dhaka.

The independent houses of early 1970s that stood far from each other in Gulshan area have vanished because of the commercial boom; to the point of old residents' claiming it is not a residential area anymore. The traffic jams due to a lack of parking space and increased traffic activity for private schools and local clubs are have added to the problems, as well as a vanishing lake, flooded streets and growing slums. The increasing crowd of English-medium schools along roads is a particular area of concern. The Banani and Baridhara areas face further problems in the form of private university and shopping complex crowds, as well as rundown roads that has a lack of street lights.
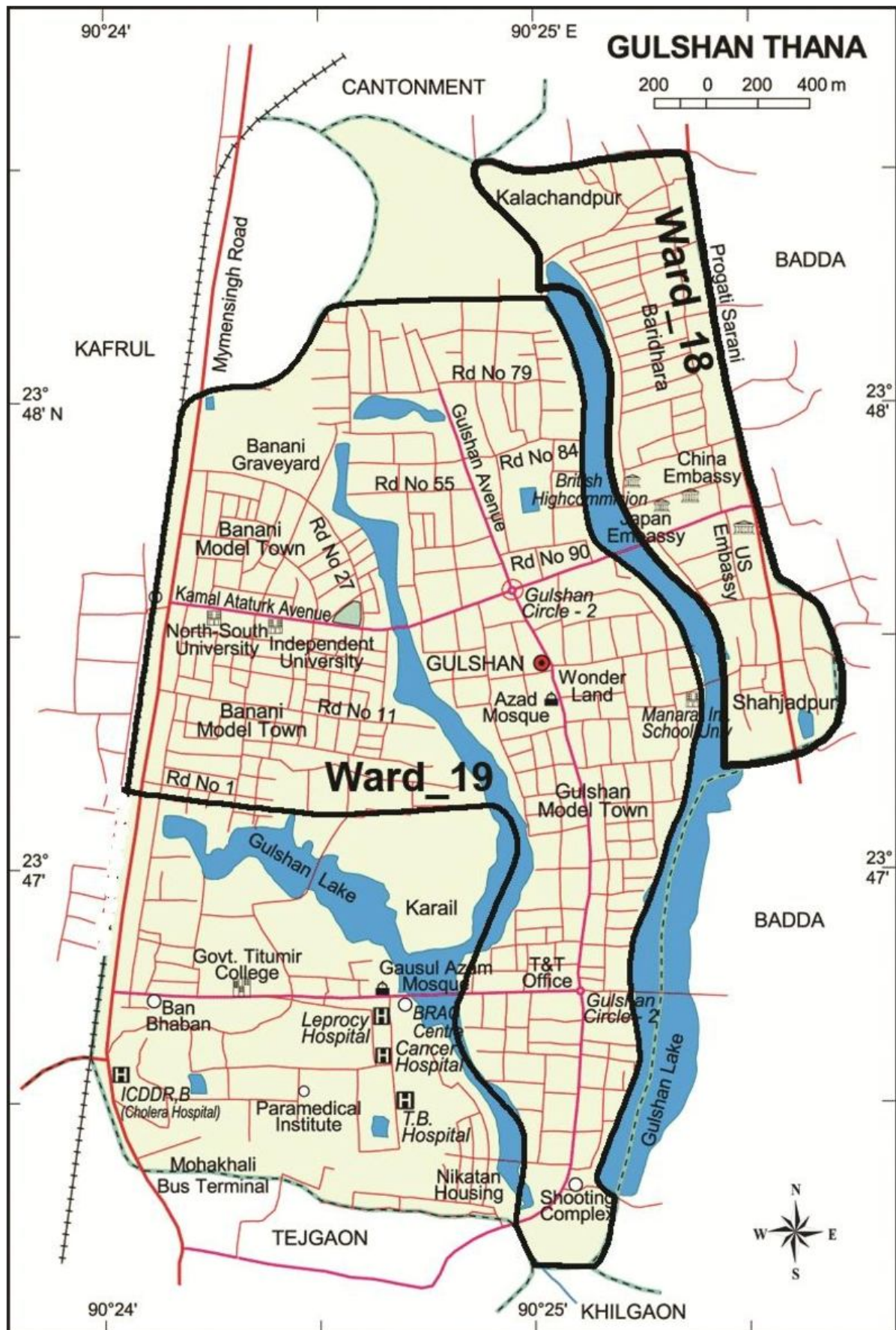
Figure 7.1: Map of Gulshan Thana

Source: http://search.com.bd/banglapedia/Maps/MG_0221.GIF

Ward 17

Ward 18

Kalachadpur

Baridhara

Ward 19

Shahzadpur

Water Body
Ward Boundary
Road
Park.shp
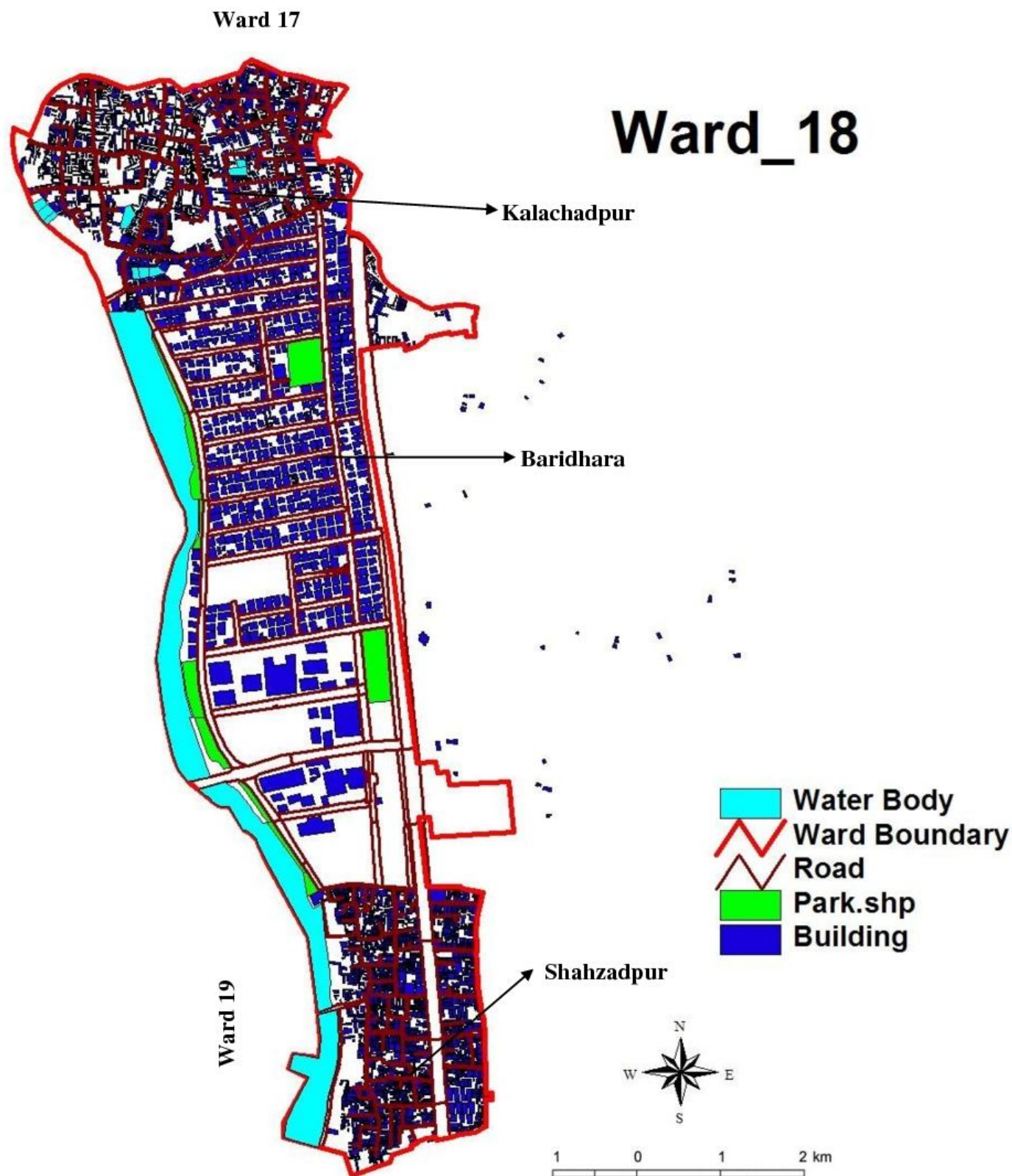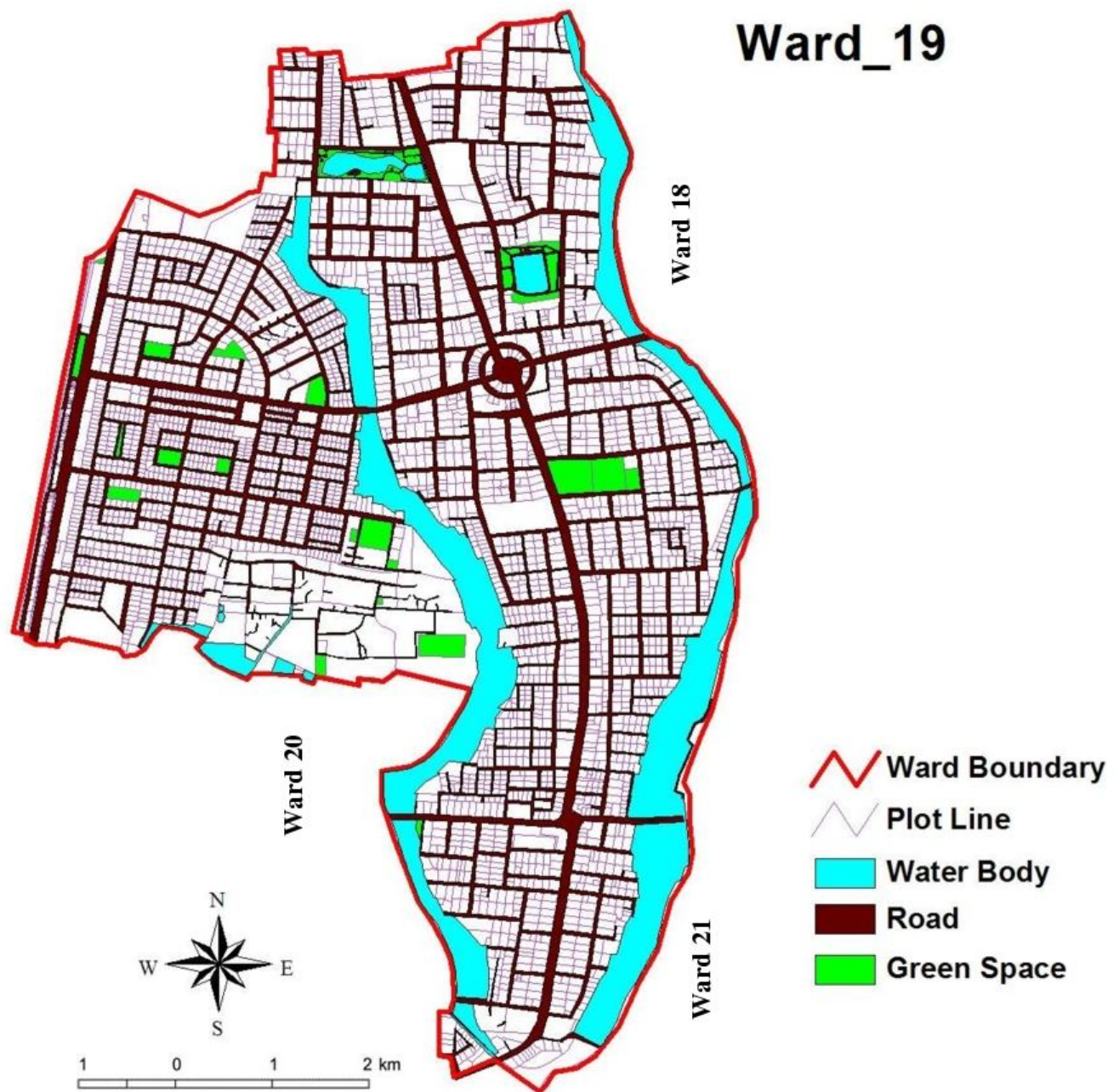Building

N
W E
S

1   0   1   2 km

Figure 7.2: Map of Ward 18

Source: DCC, 2006

Figure 7.3: Map of Ward 19

Source: DCC, 2006

7.1.3 Important Features

Most foreign diplomatic missions in Bangladesh area are located in Gulshan or Baridhara Diplomatic Zone. Thoroughfares in the area are beautified by major cell phone companies of Bangladesh. The area features a number of mosques, churches and Christian missions, including that of the Missionaries of Charity.

Many local and multinational companies have their local headquarters located in Gulshan, including Grameenphone, Banglalink, Standard Chartered Bank, Reckitt Benckiser, Siemens, Nokia, Sony Ericsson, Coca Cola and Pepsi.

There are many markets, bazaars and shopping centres in Gulshan. Most notable are Gulshan Shopping Centre, Navana Shopping Centre, Banani Bazar, DCC Market I, and DCC Market II. There also are mega-stores such as Nandan, Agora, Aarong, Shopper's World, Pink City shopping mall and the ABC Shopping Complex. A plethora of food, bank and fashion outlets are located all over the area.

The area hosts a number of elite private clubs. While the Gulshan Club and International Club have their own policies, most of the rest are sponsored by the various diplomatic missions. These include the American Recreation Association (American Club), the Canadian Club, the Dutch Club etc.

It also features Wonder Land, a children's theme park. There is a 250 room five star hotel, Westin, located at circle 1. There are many private universities and hospitals and clinics in these two Wards.

Below some photographs of these two wards (Ward 18 and 19) are given.
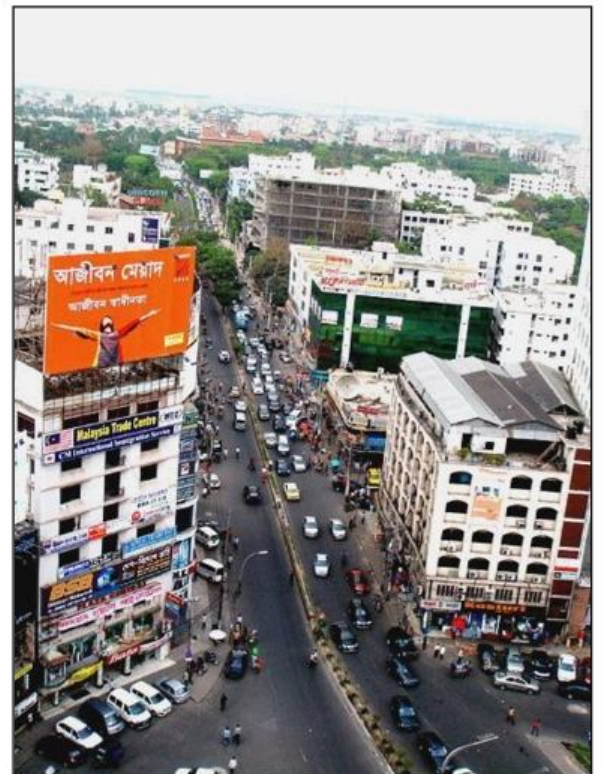
Photograph 7.1: Urban Environment of Gulshan, Banani and Baridhara

Photograph 7.2: Urban Environment of Gulshan, Banani and Baridhara

Photograph 7.3: Urban Environment of Gulshan, Banani and Baridhara

Photograph 7.4: Urban Environment of Gulshan, Banani and Baridhara

Photograph 7.5: Biswa Road and Urban Environment of Shahzadpur and Kalachadpur

Guesthouses have sprung up in many parts of both Gulshan and Banani. These, along with the big markets, rent out their lucrative ground floors as reception areas and shops, having no regard for parking spaces to ease the traffic.

Even in the early '80s, Gulshan was a picture of a perfect residential area with independent homes, lakes, and only a few corner shops. Today, people sometimes forget that it is a Residential Area even those who live here. "It's a commercial area," insists Rayan Ahmed. Offices and shops, schools and hospitals - it is anything but residential.

According to him, the rules are not strict enough and the traffic is no better. The biggest tragedy of Gulshan is its disappearing lakes. Even in the '80s, there were lakes all around Gulshan and lake view houses were the most envied of locations. But over the years the lakes have been filled in with high rises indiscriminately encroaching the water bodies.

Another common Gulshan scenario, especially during the rainy season, is the flooded roads. Rush hour traffic, besides school closing times, includes the lunch hours of garment workers employed in large factory buildings throughout the area. So much for the "diplomatic zone"!

➢ **Respondent 03**
Name: Imran H. Khan
Age: 47 years

Gulshan, once known to be a posh residential area, with mostly foreign and diplomatic residents and embassies, has transformed into an ugly concrete jungle and a commuter's worst nightmare.

When it comes to 'class', Gulshan 'was' one locality that had it all. I put it in past tense as the word class finds no place in the present Gulshan scenario anymore. Known as the posh neighbourhood of the city, Gulshan has rapidly been invaded by indiscriminate construction of high-rises and germination of commercial organisations. Urbanisation seems to be the epidemic that is plaguing our beloved

city. The sophisticated fairy-tale houses and quiet alleys have been replaced by traffic infested roads choking with open garbage dumps somewhere.

If we turn back the time, we will see that Gulshan (and Baridhara for that matter), was supposed to be used for offices and embassies of diplomatic missions. As most of the peaceful residential areas, these places too have been sacrificed to make way for banks, clinics, schools and too many other commercial concerns. Pretty soon, it will all become a concrete jungle.

Greek Houses may fit perfectly into the common scenario in Greece but when a colossal structure representing a mansion from Greece is replicated in Dhaka, the result could be quite an eye-sore. Where there were once houses with lawns and lush greenery, there is now concrete grey and drab looking apartment complexes. All the previous plans and dreams for Gulshan are now in the past, only to be looked back with nostalgia.

The Water and Sewerage Authority (WASA) must have been on vacation while the floor plans for the drainage system of Gulshan 2 were being made because each and every year, right about the monsoon time, this place is heavily hit with a torrent of rainfall creating miniature floods. It is one thing to have a poetic affiliation with rain but quite another to have the vilest of raw sewage floating around your ankles and to be forced to withstand the smell of long decomposed feces. Nonetheless, the water usually disappears within an hour or two, leaving behind thick sticky mud pies on the road.

As most of the houses of Gulshan 2 have pretty high foundations, the roads in between the houses end up as basins for all the excess water. This water has no place to go because the authorities were a little short on pipes that may lead the water out. We are only humans after all, susceptible to making mistakes and then unwittingly repeat them.

The government has been quite ingenious in their intentions to reduce traffic in these areas by not allowing rickshaws in certain roads at certain time slots. What they failed to recognise is that a Pajero V8 or a Lexus Jeep for that matter is much larger in size

and is usually driven by some maniac who might fail when it came to even driving the rickshaw. Also falling under this category are Cab drivers. Driving with the 'I'm the king of the World' motto, these lunatics usually enjoy the traffic and the bad road conditions and sometimes can be seen having their own 'Formula 1' race.

Even though the developers try hard to make their brick and sand piles by the road merge with the scenery, we have been blessed with the magic of sight that simply tells us that everything about the modern Gulshan scenario is wrong. It won't be long before we lose Gulshan to the grips of this urbanisation epidemic, which is always out to wreck havoc with our peaceful existence.

> **Respondent 04**
> **Name:** Md. Shafiqul Islam
> **Age:** 43 years

According to the speech of Md. Shafiqul Islam, in the 1966-67 there was hardly found more than two-storied building in the Gulshan and its surrounding area. Most of the buildings were one or two storied. Only two or three buildings were two-storied which were owned by the MP's (Member of the Parliament). There were total 5-6 houses in every road. Most of the land was barren and unused. The open unused land was looked like a large barren field. Different types of trees, plants and shrubs were found all of the area. Slums dwellers used to live here. The other side of this area named Badda was totally unused and open/wet land. People and children did not play in the open field. This area was full of jungle and different types of plants. But the street pattern was same as like as now, but the roads were low and narrow. The height of the roads increased in the next time, which was done by filling of sand.

Previously this area was named as 'Bhola Mouza', as people from Bhola (a district of Bangladesh) used to live here a lot. Still there is a mosque in Gulshan-1 named as 'Old Bhola Jam-e-Mosque'. When the government acquired this area, those people were shifted to nearest South Badda area.

Rajuk handed over the park, now Wonderland Park, to DCC for maintenance as Children Park in 1995. But the DCC allotted this park to M/S Via Media Business services which it converted into a commercial amusement park, causing lot of

problems for the residents of Gulshan area. The residents of Gulshan expect that this amusement park running on commercial basis should be evicted from the area and developed into a beautiful children park.

➢ **Respondent 05**
   Name: Md. Abu Taher
   Age: 47 years

He was born in the T &T (Telegraph and Telephone) Colony near Banani/Karail. According to him in the time of his childhood most of this area was full of jungle. Foxes used to bark from the evening. People normally did not go out from the house after the evening because of fear. There was only 14-15 houses were here and all of the houses were made by mud/ tin shed. T&T was the owner of land of the area of Colony.

The requisition of the area was done 50-60 years ago from now. There were no slums in that time. The slums were built during the period of President Hussain Muhammad Ershad. During acquisition of the area T&T sold some land to PWD. The roads were kutcha in that time. . The roads began to carpeting or pucca (Structure of permanent building materials) later. The condition of Banani area was worse than Karail. In Banani area the value of land was only taka 3-5 thousands per katha.

The present Gulshan Lake was wider and bigger in the past. Most of the land was wet in rainy season. There was many wet and low land in the past. Rapid development started during 1990's. Many original owners of the land sold their land and left the area of Banani and Gulshan forever.

There was no brick made building in Gulshan area. All of the houses were kutcha or semi-pucca (Structure of semi-permanent building materials). Roads were kutcha. Huge jack-fruit and paddy grew here. There was no house in Banani that time. The areas of Gulshan, Baridhara even Dhanmondi were paddy fields. Gulshan and Banani developed fast comparatively than Badda. In the past though the land price was low, people did not show much interest in buying land because the area was full of jungle, plants and wetland.

7.2.2 Ward 18 (Baridhara, Shahzadpur and Kalachadpur)

➤ **Respondent 01**

Name: Dr. Syed Rarun-ur-Rashid

Age: 50 years

The past glory of Gulshan-Banani-Baridhara as clean, green and secured living places for the city elites has lost of model residential areas due to unbridled commercial invasion.

Construction of high-rise buildings by the influential people evading the Rajuk's master plan and shortage of sewerage system, supply of gas, fresh water poor, communication infrastructures, power and electricity supply and heavy traffic congestion as well as noise pollution have turned the posh areas into ordinary ones.

Originally, when the Dhaka Improvement Trust (DIT) started systematic urbanisation of the city, it was assumed that two-families, each comprising six members would live on a one bigha plot in the residential areas developed in Gulshan, Banani and Baridhara area with one family in the ground floor and the other on the first floor. The water supply and sewerage system was accordingly designed. Now perhaps 30 families are living in the 'high-rise' buildings on 5-7 katha plots. The natural drainage outlets consisting of khals and jheels (Canals) have already disappeared from the urban scenario.

The water in all parts of the Gulshan-Banani-Baridhara Lake has become very stinky due to severe pollution occurring under the very nose of the authorities. Sewage and waste from the residential areas of Badda, Shahzadpur, Baridhara, Gulshan and Banani are being discharged into the lake for years. Factors such as sedimentation and toxic contamination have already damaged the essential features of the lake, said the environmentalists. Rainwater during the monsoon washes away all the garbage and toxic material into the lake, causing death to a large number of fishes every year.

➢ **Respondent 02**
   Name: Md. Abul Kalam
   Age: 45 years

Baridhara, diplomatic zone and posh residential area in the city, is gradually losing its character. Commercial and illegal structures are being built everywhere in the area by violating the building code of RAJUK.

Once, Baridhara was restricted for the general people. Only diplomatic corps, different high commissioners and ambassadors could dwell there, while some other defense personals and some private landowners are allowed to dwell there.

Some of the open spaces earmarked for play grounds and educational institutions have been occupied by influential people, claiming to have valid authorization from the concerned quarters. High-rise buildings have already cropped up in those vacant lands.

At beginning of 90th decade, situation began to change. Different commercial organisations, educational institutions, beauty parlours, cafes, guesthouses have been built up in the area while sometimes without taking any permission from the RAJUK.

➢ **Respondent 03**
   Name: Mesbah Rahman
   Age: 48 years

Mesbah Rahman, a retired army person, said, "The area is losing all its residential character day by day. When we made our house in the area, there were a very few buildings in the area. But many commercial settlements are now being built all around the area without taking any permission from the authority."

The concerned authority has not taken any legal action against them. The commercial structures are mushrooming in the area. A RAJUK official said they are trying either

to withdraw permission or demolish the illegal structures from the area, but the local people are not responding actively to the matter.

According to the Building Construction Act RAJUK, it is clearly stated that to build up any hotel for commercial or residential-cum-commercial purposes, the hotel must be placed on a specific place. The site of the hotel should be covered at least its two-third portion and its back and both sides should be kept open at least 2.50 meters and 1.25 meters respectively. But in reality, the scenario is totally different. None of the hotels, guesthouses and parlours did follow the RAJUK during its construction.

At the end of the Dutabash Road, hotel Royal Garden is situated where residences of the British High Commissioner and Chinese and Japanese ambassadors' residences are located at the same lane. These types of structures and activities are not only creating panic for the local residents and foreigners but also hampering security measures.

> **Respondent 04**
  Name: Mohsin Ahmed
  Age: 38 years

At the north of Baridhara, some educational institutions and coaching centres are located. Other commercial activities are also situated there such as modern dance learning institutions, boutique shops, herbal treatment houses and tailoring shops.

We are trying to stop any kind of commercial use of land in the area. But some owners are showing keen interest to set up departmental shops, saloons and residential hotels there, while local residents do not protest this openly for unknown reason.

Lake parts of Baridhara are also being encroached by the grabbers. At night, the grabbers are encroaching into the lands of the lake portion. For this reason, Baridhara Lake is also narrowing by its size and shape. While walking through the Baridhara Lake, construction labourers were found participating in renovation works there. The lake had been declared abandoned in 1997. But its renovation and development works are going on till now.

Four spots were earmarked for residential areas to be utilized as children parks, are occupied by the influential people for uses in different forms for their personal benefit in connivance with the concerned officials of Rajuk and DCC for monetary gains.

> ➢ **Respondent 05**
> **Name:** Md. Abdul Hamid
> **Age:** 60 years

20 years ago this area and its surrounding was much worse than a village, the whole area was under water or crop field and houses were kutcha (Structure of temporary building materials). The present Biswa Road/Pragati Soroni was also crop field and vegetables were planted. The value of land was very low. Later the government acquired the land of Biswa Road. The Biswa Road was filled up with mud 30 years ago from now and was leveled in 1985-86.

Mainly Shahzadpur and Kalachadpur areas started to expand gradually after liberation. That time roads were very narrow. Houses were made by fence and mud. In Pakistan Period most of the land was vacant; there were no few plots for houses. Roads were kutcha and flood occurred in the rainy season normally. People who had their own land in Gulshan Area shifted here by selling their land. Land was divided into many small plots like 3-5 katha. After 1971 roads were paved/ pitched and developed. 10-15 years ago sewerage lines had been channeled in this area and the water supply system and other utility services had been developed.

Then in late 80's Baridhara Area was planned by RAJUK and now it is the most aristocrat high class residential area in Dhaka. But only before 20 years ago this area was under water. After Baridhara; Kalachadpur area started to develop in full swing. But both Shahzadpur and Kalachadpur are now extremely unplanned and the neighbours area suffering from proper utility services and so on. Just beside these Baridhara area is located, but these two areas seem to be almost slum. Even today the roads are very narrow and broken here and there. But the concerned authority is not taking any steps.

7.3 Syntactic Analysis of Ward 19

Gulshan was founded as a planned model town in 1961, while the neighbouring Banani Model Town was founded in 1964. This is why the syntactic analysis of Ward 19 has been started from the available map of 1973.

7.3.1 Global Integration Core

In all the phases the integration core is almost unchanged for this ward (Figure 7.5). The core follows Gulshan Avenue, Kamal Ataturk Avenue, Madani Avenue, and few roads (Road 33, 35, 48, 54, 55, 64, 70, 90, 99, 103, 104 and 113 of Gulshan-2 and Road 8 and 10 of Banani) from Gulshan to Baridhara and Banani Model Town.

7.3.2 Connectivity

The most connected road in all the phases is the road (Figure 7.6) from Gulsahn-2 circle towards the Cantonment (part of Gulshan Avenue).

In 1973 the other highly connected roads were Kamal Ataturk Avenue, New Airport Road, Road 4, 7, 11 and 17 of Banani and Road 103 of Gulshan-2. In 1987 the road from Gulshan-1 circle towards Tejgaon and a part of Gulshan Avenue from Gulshan-1 to Gulshan-2 was added. In 1995, Road 8 and 10 of Banani were added. In 2001, Road 104, 106 and 111 of Gulshan-2 were added and in 2007, Road 51 of Gulshan-2 was added with the previous ones.

7.3.3 Global (R=n) and Local (R=3) Integration Pattern

The global and local integration remain almost constant and balanced in all phases (Table 7.1). It indicates that the locally important roads always get importance to the local inhabitants irrespective of the global measures.

Figure 7.4: Bird's Eye View of Gulshan Area in Late 1960's

Source: Mamun, 1993
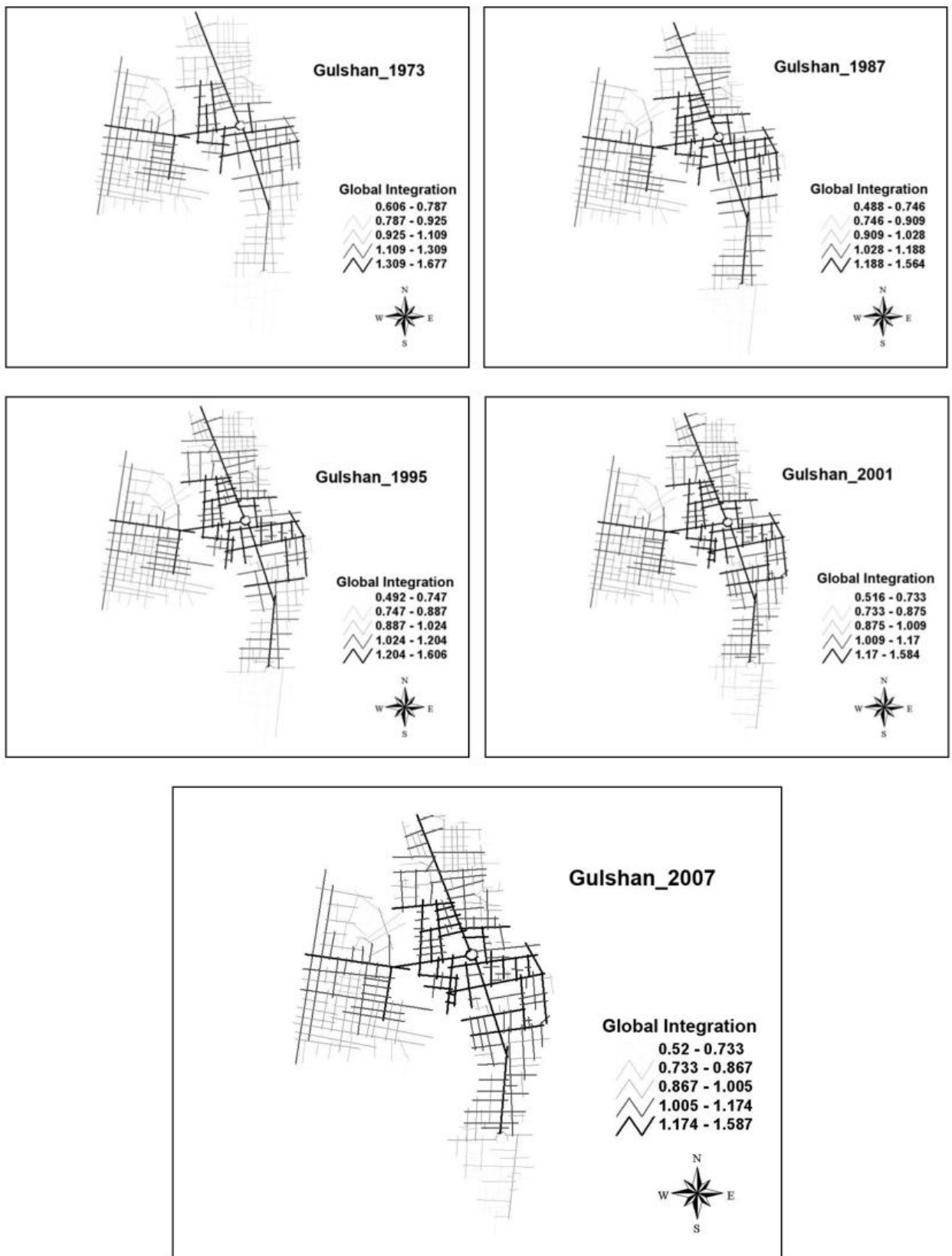
Figure 7.5: Global Integration (R=n) of Ward 19 in Different Time Periods (Not to Scale)
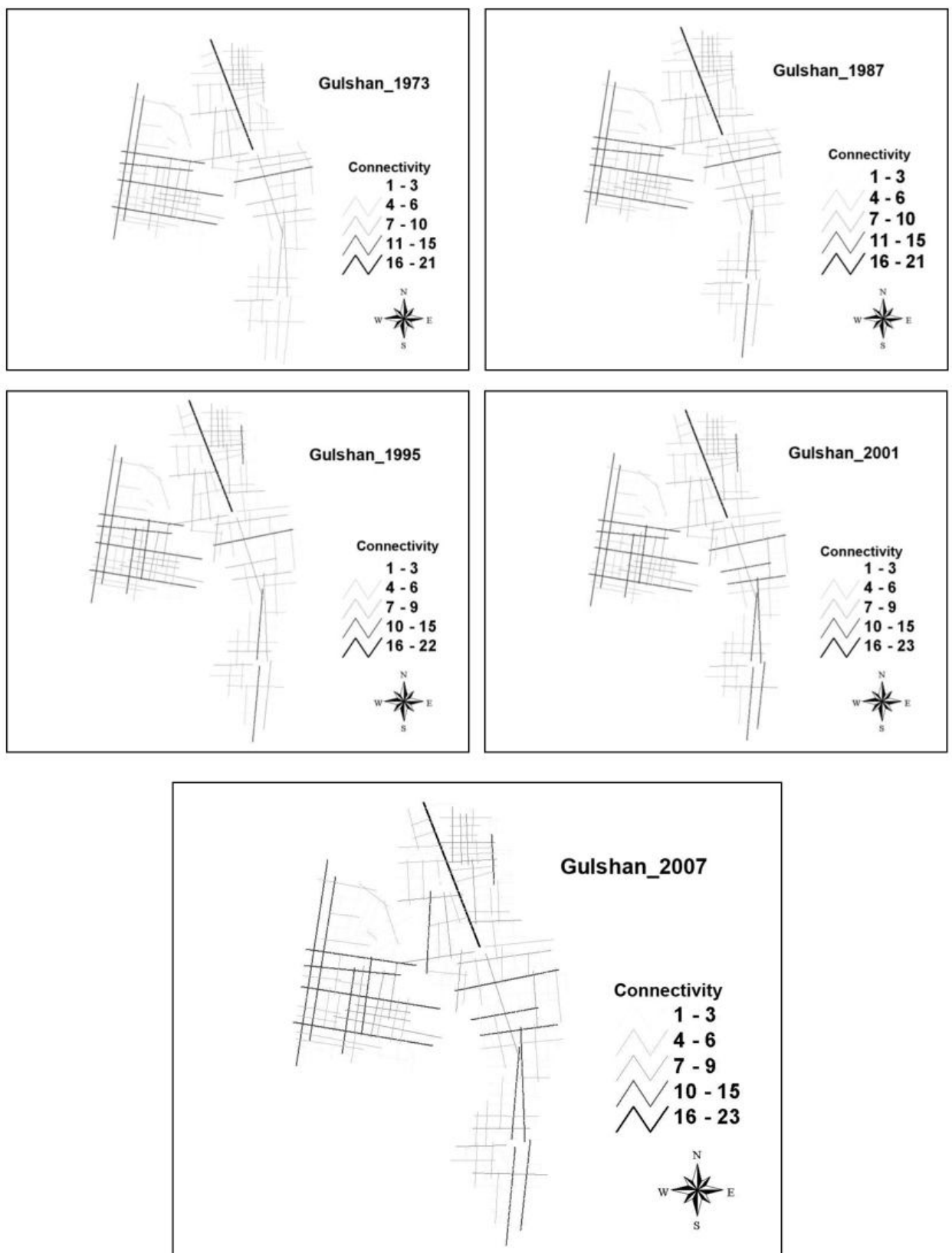
**Figure 7.6: Connectivity (CN) of Ward 19 in Different Time Periods
(Not to Scale)**

Table 7.1: Syntactic Measures of Ward 19 in Different Time Periods

Syntactic Measures		Time Period	1973	1987	1995	2001	2007
Integration Global	R=n	Segment No.	217	246	280	307	316
		R=n Max	1.67741	1.56433	1.60611	1.58368	1.58726
		R=n Min	0.60603	0.48831	0.49204	0.51589	0.52042
		R=n Mean	1.01691	0.97269	0.98003	0.96249	0.96299
		Std. Deviation	0.203706	0.197051	0.201944	0.195078	0.195516
Integration Local	R=3	R=3 Max	5.52801	5.46918	5.58466	5.69637	5.69637
		R=3 Min	0.21093	0.21093	0.21093	0.21093	0.21093
		R=3 Mean	2.34078	2.27591	2.16151	2.15832	2.13796
		Std. Deviation	0.832402	0.880432	0.934867	0.954401	0.962622
Connectivity	(CN)	CN Max	21	21	22	23	23
		CN Min	1	1	1	1	1
		CN Mean	4.15668	4	3.77857	3.70033	3.65823
		Std. Deviation	2.762742	2.812509	2.814626	2.901673	2.897776
Control	(CV)	CV Max	5.81071	5.83333	6.05238	8.30952	8.30952
		CV Min	0.12500	0.08333	0.09091	0.07143	0.07143
		CV Mean	1	1	1	1	1
		Std. Deviation	0.748989	0.824897	0.82999	0.941863	0.957755

7.3.4 Intelligibility

The correlation values are moderately high in all phases (Table 7.2). A slight decreasing trend is also followed. The tangent of slope values is almost static (Figure 7.7 and 7.8). The correlation values of Rn-CN are noticeably lower than that of Rn-R3 (average difference is 1.38).

The lowering down of correlation values indicates that the local roads are being much more segregated from the global ones and the global roads are getting more importance in comparison to the local roads.

Again the decrease of Rn-CN values indicates that the changes in urban grid are creating problems in the area. It also explains the local roads are being less connected/ inaccessible from the core gradually.

Table 7.2: Correlation value of Global and Local Measures of Ward 19 in Different Time Periods

Time Period	R of Rn-R3/ Intelligibility	Equation	R of Rn-CN/ Intelligibility	Equation
1973	0.6324	$y = 3.2528x - 1.1008$ $R^2 = 0.3999$	0.5145	$y = 6.9476x - 3.2858$ $R^2 = 0.2647$
1987	0.6448	$y = 3.2697x - 1.1436$ $R^2 = 0.4158$	0.5127	$y = 7.0548x - 3.4505$ $R^2 = 0.2629$
1995	0.6415	$y = 3.3334x - 1.1803$ $R^2 = 0.4115$	0.5087	$y = 7.4398x - 3.7375$ $R^2 = 0.2588$
2001	0.6210	$y = 3.1117x - 0.8111$ $R^2 = 0.3856$	0.4766	$y = 6.7344x - 2.6907$ $R^2 = 0.2271$
2007	0.5931	$y = 3.0133x - 0.6883$ $R^2 = 0.3518$	0.4494	$y = 6.5249x - 2.4231$ $R^2 = 0.2020$

[Here, R= Correlation, Rn= Global Integration, R3= Local Integration and R^2= Tangent of Slope]
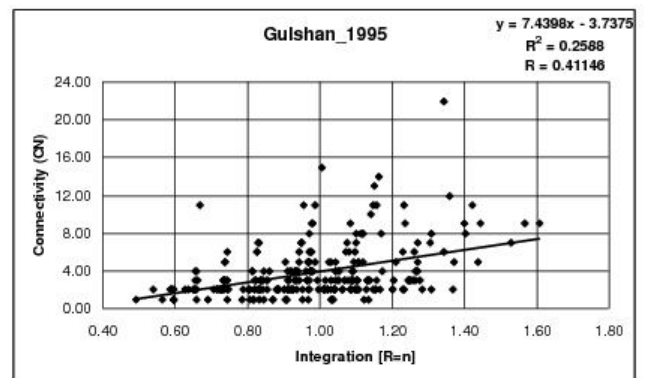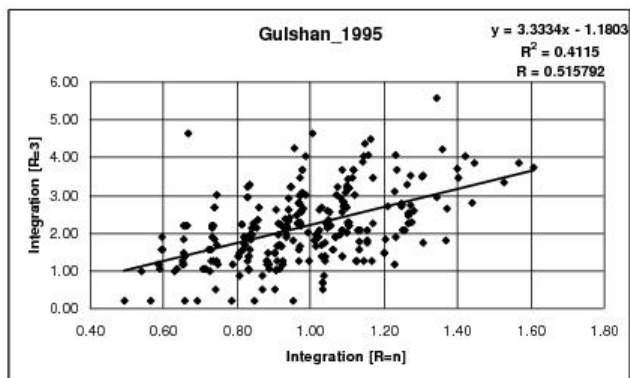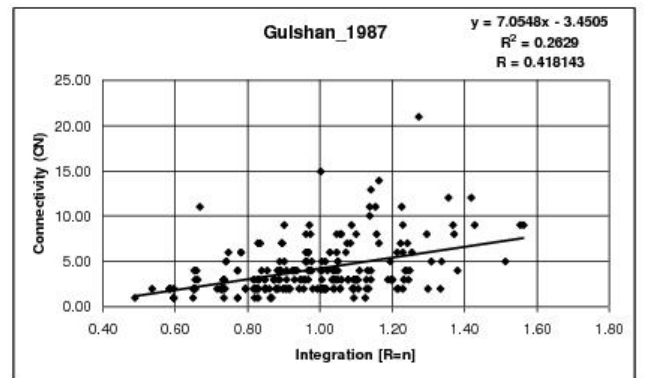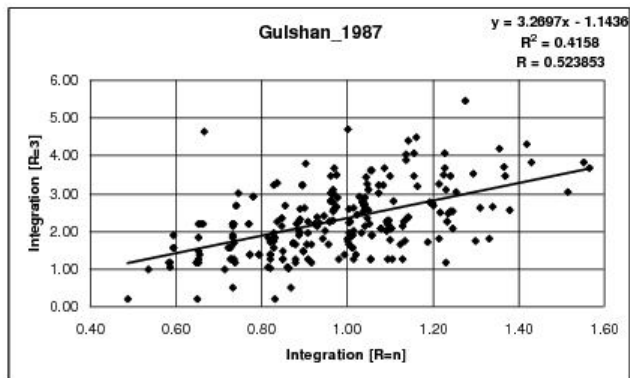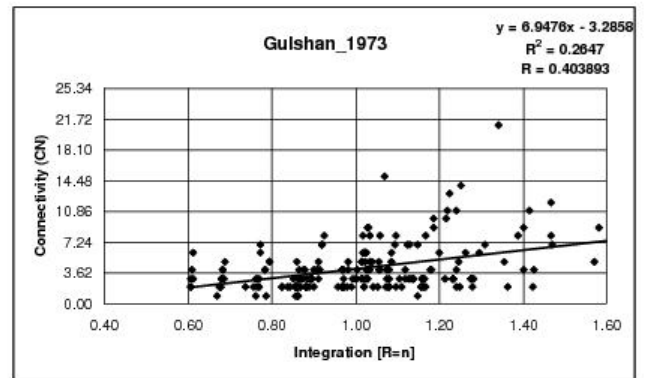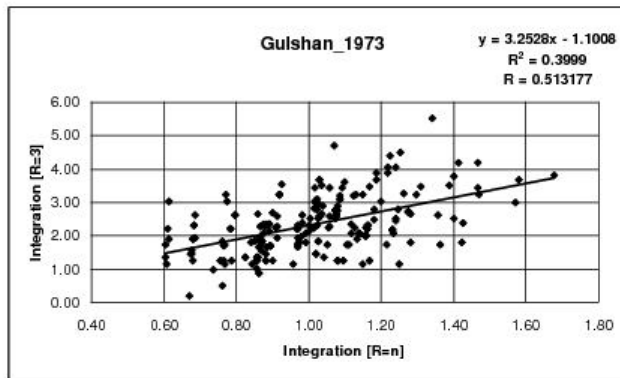
Figure 7.7: Scatter of Correlation between Local and Global Measures of Ward 19 in Different Time Periods
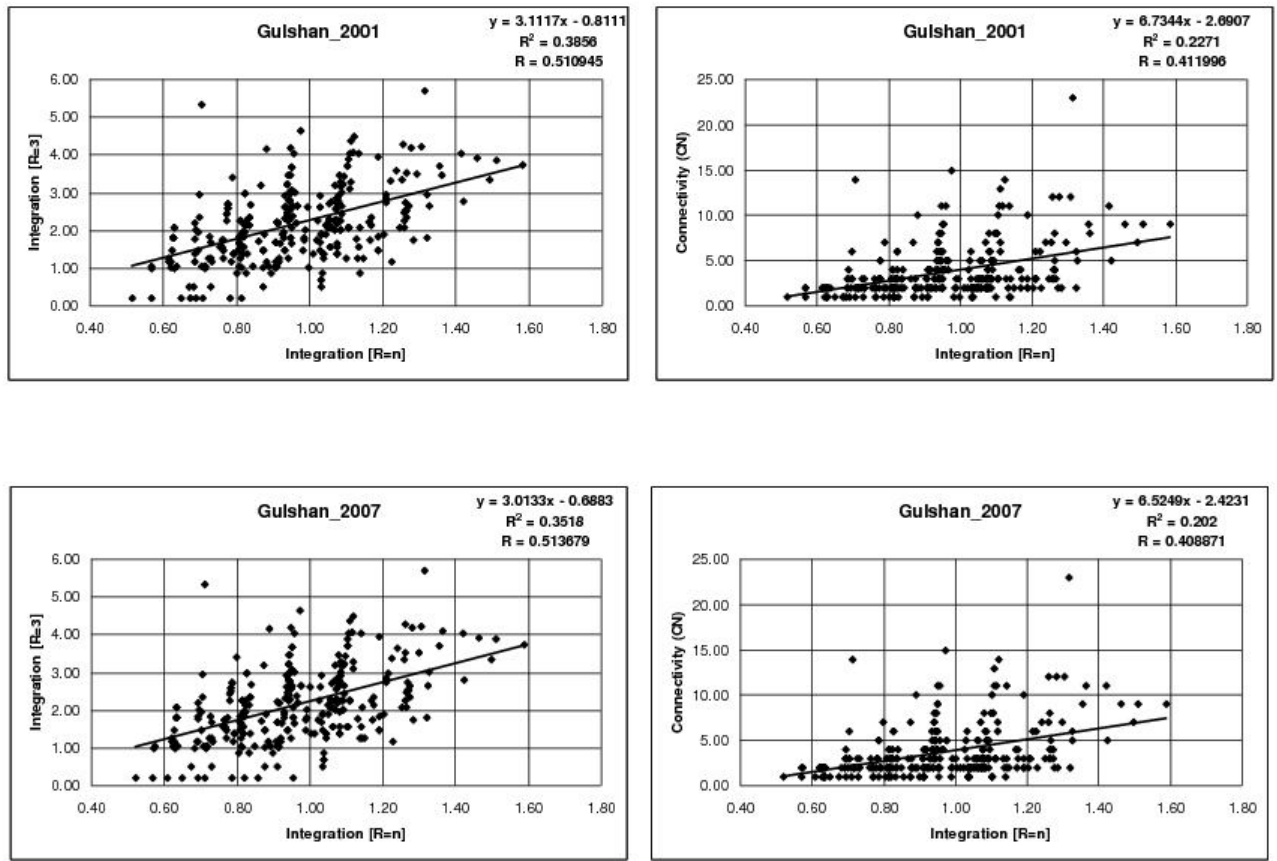
Figure 7.8: Scatter of Correlation between Local and Global Measures of Ward 19 in Different Time Periods

7.4 Syntactic Analysis of Ward 18

Baridhara Model Town, Shahzadpur and Kalachadpur- these three areas comprise of Ward 18. Among them there was no existence of Baridhara area in 1973 and 1987 (Figure 7.9). Baridhara was developed by RAJUK in 1990 as a planned residential area.

In 1973 and 1987, although there were settlements, several in Shahzadpur and very few in both Kalachadpur, but basically those were slums and also there were no road network (Figure 7.9). This is why the syntactic analysis of Ward 18 is considered from year 1995.
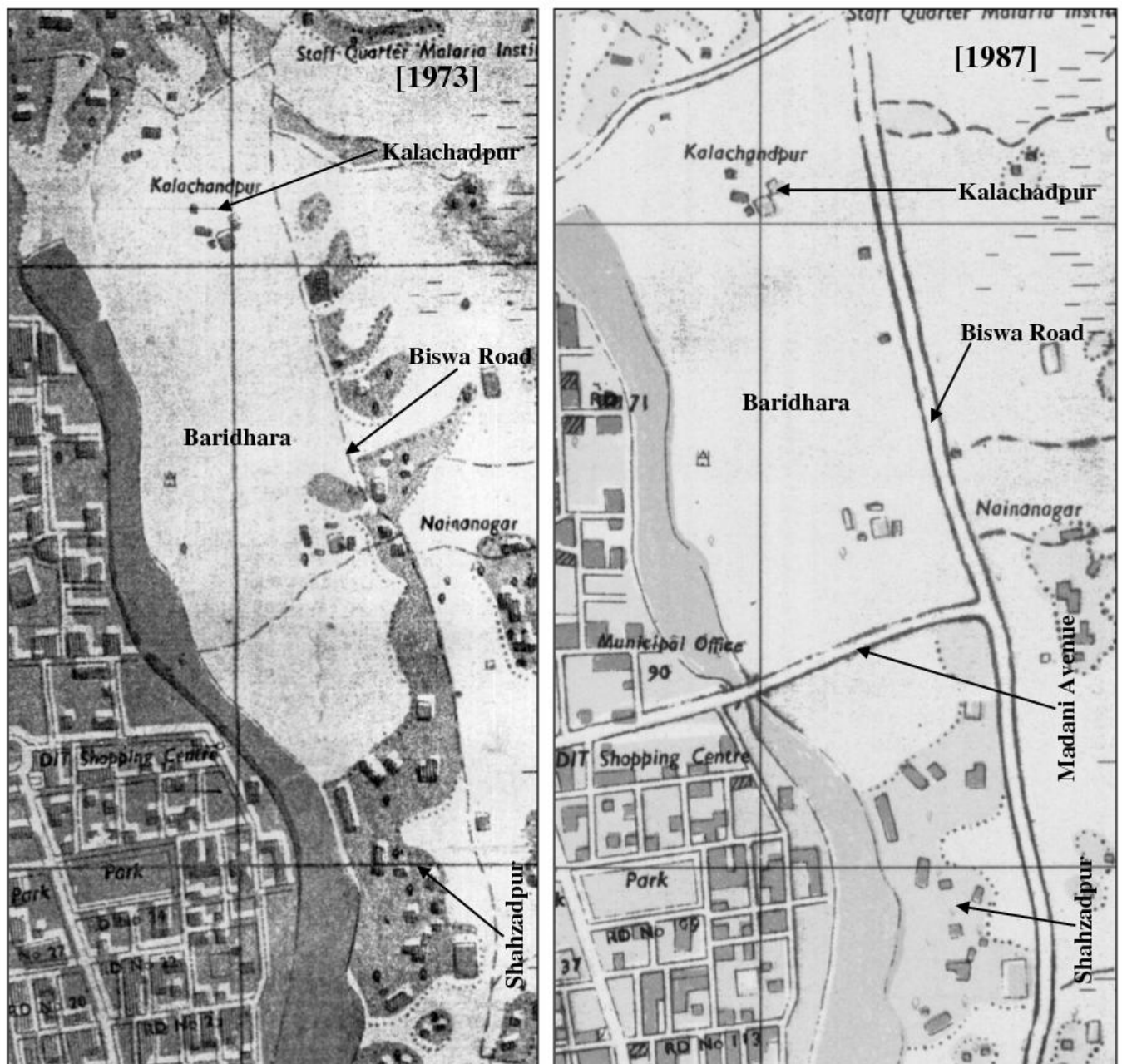
Figure 7.9: Baridhara and its Surrounding in 1973 and 1987
(Not to Scale)

Source: SOB

7.4.1 Global Integration Core

Throughout the years the integration core lies (Figure 7.10) in the Pragati Sharani/ Biswa Road, Park Road, the United Nations (UN) Road, Madani Avenue/ Baridhara Road, Dutabas (Embassy) Road and few roads of Baridhara (Road 3 and 7) and roads from Shahzadpur towards Gulshan-2 (Manarat International School Road and other roads connecting Biswa Road with Shahzadpur).

7.4.2 Connectivity

In all the three phases the most connected roads are the Biswa Road/ Pragati Sharani, Park Road and the UN Road (Figure 7.11). The average connectivity is static (3).

7.4.3 Global (R=n) and Local (R=3) Integration Pattern

The global and local integration values were almost unchanged in 1995 and 2007, but both the values have dropped down noticeably in 2007 (Table 7.3). It means the local roads have been segregated more in recent years.

7.4.4 Intelligibility

The correlation of Rn-R3 is almost unchanged throughout the years, but the correlation value of Rn-CN is very low in 2007 except year 1995 and 2001 (Table 7.4). Moreover the tangent of slope is much steeper for Rn-R3 than to Rn-CN (Figure 12 and Table 7.4).

This is may be for the recent massive development/ change in Shahzadpur and Kalachadpur areas without properly planned street-layout, which is affecting the planned residential characteristics of Baridhara area. From figure 7.10 and 7.11, it is clear that in recent times Shahzadpur area has expanded a lot with many locally connective roads. For this reason, both the local integration and correlation of Rn-CN values are showing very low in comparison to 1995 and 2001.
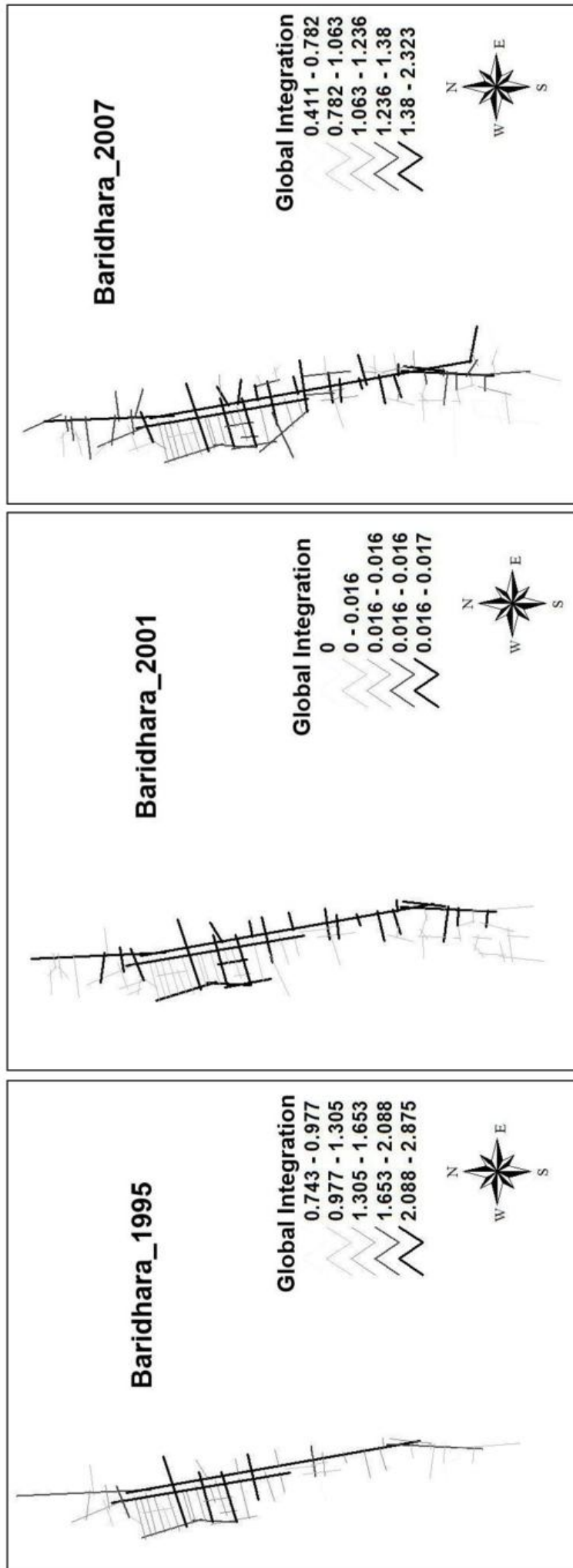
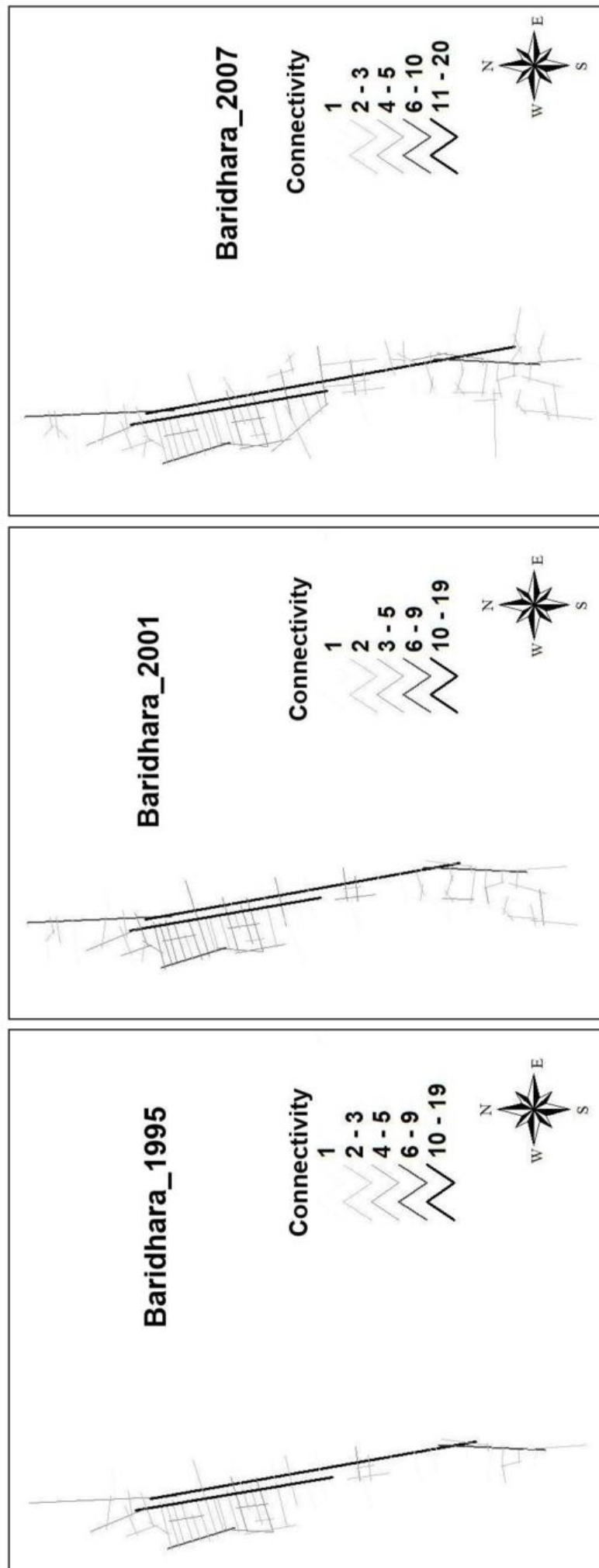**Figure 7.10: Global Integration (R=n) of Ward 18 in Different Time Periods (Not to Scale)**

Figure 7.11: Connectivity (CN) of Ward 18 in Different Time Periods (Not to Scale)

Table 7.3: Syntactic Measures of Ward 18 in Different Time Periods

Syntactic Measures	Time Period	1995	2001	2007
Integration Global R=n	Segment No.	59	64	116
	R=n Max	2.87544	3.13252	2.32346
	R=n Min	0.74309	0.90779	0.41149
	R=n Mean	1.50835	1.59059	1.18374
	Std. Deviation	0.40984	0.42213	0.33398
Integration Local R=3	R=3 Max	6.75685	6.19064	6.06299
	R=3 Min	0.50003	0.21093	0.21093
	R=3 Mean	2.18363	2.16773	1.79783
	Std. Deviation	1.03783	1.04257	1.03977
Connectivity (CN)	CN Max	19	19	20
	CN Min	1	1	1
	CN Mean	3.01695	2.96875	2.70690
	Std. Deviation	3.15404	3.27069	2.75686
Control (CV)	CV Max	9.70952	11.49167	9.74167
	CV Min	0.05263	0.05556	0.05000
	CV Mean	1.00000	1.00000	1.00000
	Std. Deviation	1.72539	1.82773	1.30540
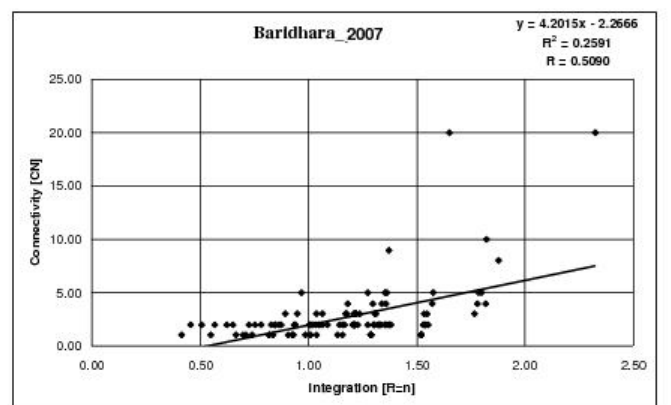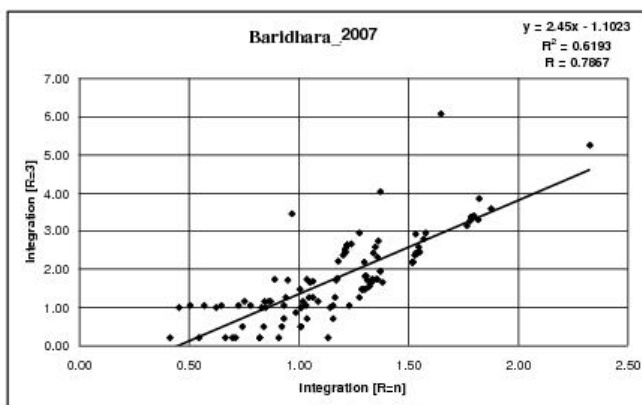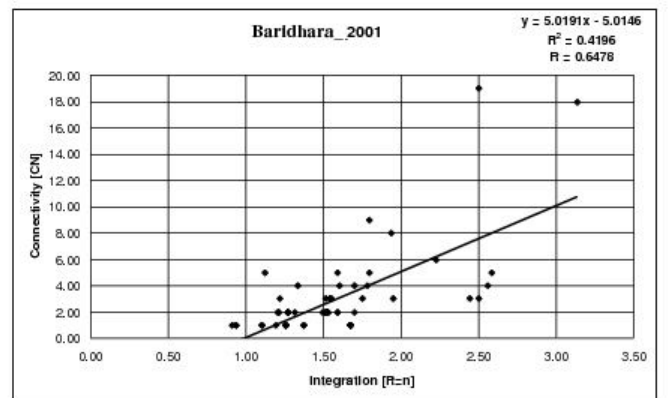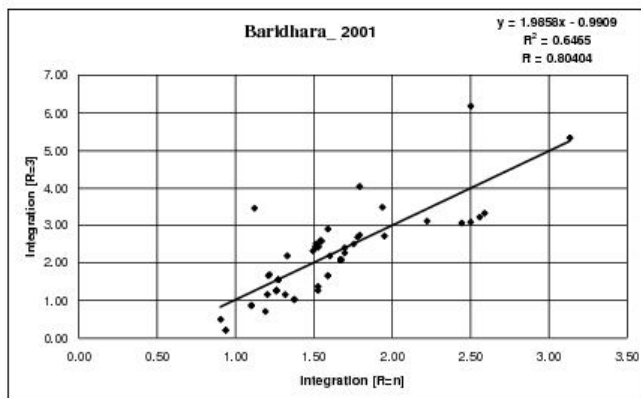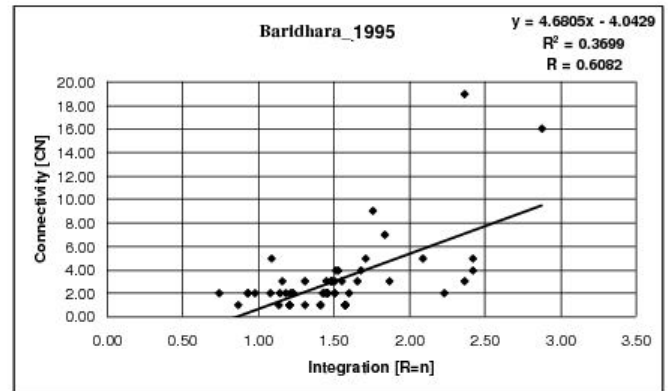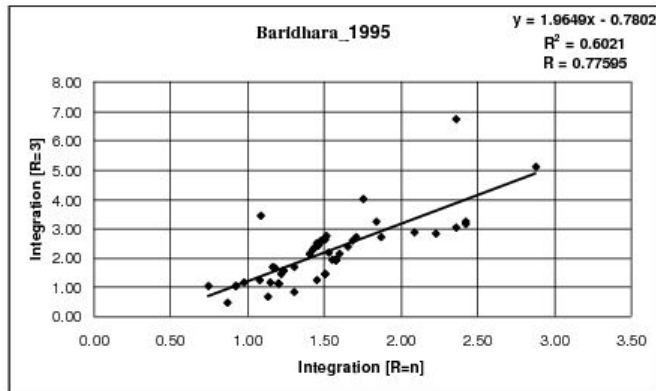
Figure 7.12: Scatter of Correlation between Local and Global Measures of Ward 18 in Different Time Periods

**Table 7.4: Intelligibility of Global and Local Measures of Ward 18
in Different Time Periods**

Time Period	R of Rn-R3/ Intelligibility	Equation	R of Rn-CN/ Intelligibility	Equation
1995	0.77595	$y = 1.9649x - 0.7802$ $R^2 = 0.6021$	0.6478	$y = 4.6805x - 4.0429$ $R^2 = 0.3699$
2001	0.80404	$y = 1.9858x - 0.9909$ $R^2 = 0.6465$	0.6478	$y = 5.0191x - 5.0146$ $R^2 = 0.4196$
2007	0.7867	$y = 2.45x - 1.1023$ $R^2 = 0.6193$	0.5090	$y = 4.2015x - 2.2666$ $R^2 = 0.2591$

**[Here, R= Correlation, Rn= Global Integration, R3= Local Integration and
R^2= Tangent of Slope]**

7.5 Summary of Syntactic Analysis of Ward 18 and 19

In summary it can be stated that-

➢ In case of Ward 19 the integration core follows Gulshan Avenue, Kamal
Ataturk Avenue and Madani Avenue. For Ward 18 the integration core lies
mainly in the Pragati Sharani/ Biswa Road, Park Road, the United Nations
(UN) Road, Madani Avenue/ Baridhara Road and Dutabas (Embassy) Road.

➢ The most connected road in all the phases of Ward 19 is the road from
Gulsahn-2 circle towards the Cantonment. For Ward 18, in all the three phases
the most connected roads are the Biswa Road/ Pragati Sharani, Park Road and
the UN Road.

➢ The global and local integration values as well as the intelligibility values of
Ward 18 are higher than that of Ward 19 in all the phases.

The interpretation on a comparative basis of the syntactic analysis, of each Ward
(18, 19, 49 and 72), is briefly described in the next chapter.

Chapter 08

Conclusion

The morphology of the historic Dhaka city is unique that had been developed spontaneously. The morphological pattern of each area has some general configurational characteristics. This study has applied the syntactic approach to reveal the morphological characteristics of Dhaka City focusing Wards 18, 19, 49 and 72.

8.1 Syntactic and Morphological Interpretation of the Wards

The syntactic values are found highest for Ward 72, then Ward 49, 18 and last upon Ward 19 chronologically. Higher values indicate that there is a strong relation of connectivity among the global and local roads. The higher the connectivity and control the higher the syntactic values. It means the street network of Old Dhaka is much more connective than the other Wards.

From the syntactic analysis, it can be found that which roads of the area are more connective or have higher control values. But it is not that much possible to find out the reasons behind it's showing higher or lower values. Normally the commercial and other business, retail or city centre activities are grown up beside the most connective roads because the highly connective roads are easily accessible by the people that attract different activities.

Higher correlation values indicate that both the global and local roads of the area are important and the control and connectivity among the roads are very high. For example, if an area shows very high correlation values (Old Dhaka), it means the overall road network of the area is highly accessible.

Sometimes it is observed that some syntactic values vary slightly; this may be of the change of connectivity pattern or control value of the roads. The change may occur due to the greater connectivity of local roads which can decrease the overall correlation values and vice-versa.

8.1.1 Nature of Integration Core

It is believed that in a spatial configuration as a consequence of the relative depth distribution (i.e. integration) the most integrated spaces in the system tend to attract certain type of land use which benefit from the presence of the people (Hiller, 1996). Thus the most integrated streets or core lines are most used by people and also lined with important global function and local shops.

In Old Dhaka (Ward 72), the integration of different phases lies mostly along the commercial interface and the integration core follows the pattern of linear Bazar Street (Shakhari Bazar). For Gulshan, Dhanmondi and Baridhara areas the core follows also the commercial hub and other major functional activities.

Gulshan-1 and 2 Circle Roads, Shankhari Bazaar, Satmasjid and Mirpur Road are famous for city scale commercial node and these roads also fall within the global integration core.

8.1.2 Street Network

It has been found out that a variation of road pattern exists in the study areas (Ward 18, 19, 49 and 72) where different levels of streets are present in general. The configurational pattern of the areas exhibits a strong and defined order where the system of **primary axial lines** contains high syntactic values. It has been traced that the city scale commercial and global functions are growing along with the key primary activities/structures.

The local areas that grow along the **secondary axes** contain the locality based social and commercial functions. These secondary roads merge with the total city structure that creates its importance both locally and globally.

Finally the **tertiary level roads** hold residential functions which constitute the segregated structure from city scale commercial area. Hence, the use of this type of space is more residential in nature and enhanced by community based neighbourhood, recreation and culture.

8.1.3 Global-Local Correlation

In some study areas, a strong global-local correlation exists like while some areas are more locally integrated. This pattern of relationship is very much influenced by the use of surrounding areas, whether residential or commercial. The correspondence between the local and global integration cores in all the study areas along with their accompanying high statistical correlation indicates that this relationship indexes the degree to which there is a natural and consistent relation exists through the structure of the grid and sub-grid between scales of interaction.

8.2 Urban Morphology and Space Syntax (A Planner's Point of View)

In recent years there has been a renewed interest, on an international scale, in the reading of urban forms, in the field of heritage as much as in the fields of urban planning and geography. This interest stems from the growing desire to conserve the "genius of place" in order to maintain the identity of a city or a village, as much as meeting the objectives of sustainable urban development based on the formal continuity of place.

In this context urban morphology makes up valuable tools in terms of characterizing urban fabrics, and the results of morphological analyses are used in the managing of transformation (regulating) and the conception of projects (architectural and urban design).

Urban morphology plays an important role in the renewal of tools for the management of heritage and urban planning for two reasons in particular.

> **Firstly**, it is part of the redefinition of the idea of time, not as the opposition of past and present, but rather as the concept of a continuous timeline. In this sense, by way of a historical reading of the process of building cities, urban morphology allows (the planners) to understand the origin of forms, to explain past transformations and to better situate those to come.

➢ **Secondly**, the frame of analysis for urban morphology allows for the different levels of intervention to intersect (territory, city, neighborhood, and building). Using this approach, morphological analysis allows (the planners) to grasp the complexity of a constructed landscape and to facilitate the integration of heritage management with the practices of urban planning.

Space syntax could provide an alternative vision and model of space for the representation of urban systems within GIS. As such, an integration of space syntax into GIS would stimulate researches oriented toward the analysis of urban systems at different levels of abstraction. GIS provides a rich set of spatial data integration, analysis and visualisation capabilities that support urban studies on the one hand. Furthermore, the principles that underline space syntax theory can extend the modelling capabilities of GIS on the other hand, particularly in terms of the diffusion of recent advances and experimentation in the analysis of urban systems. Such integration can be of value for urban planners, architects and urban managers involved in the management and planning of urban systems.

The research described in this paper introduces the principles and modelling concepts of space syntax and some of its main spatial parameters that support computational modelling and analysis of a spatial configuration for urban planning and design. It has been discussed how these concepts relate to GIS models and introduce an implementation of space syntax within a GIS platform, namely, the Axwoman prototype. The different analytical functions of Axwoman for urban morphological analysis in the context of case studies have been illustrated.

Within urban systems, a free space is explicitly represented as the centre of interest, when dealing with the displacement of human subjects within it. In fact spatial obstacles implicitly create various free spaces for human/vehicle movement. Space syntax is generally concerned with a computational representation of the free spaces in order to achieve the analysis of an urban structure. Free spaces provide a unique vision in understanding the configuration of an urban system. The influence of morphological structure on human activities can be analysed through this method using appropriate observation data on these activities.

Current results and advantages of the space syntax contribution are analysed with respect to the potential for an analysis of the morphogenesis of spatial patterns and their social implications. The space syntax method provides an efficient experimental approach to the understanding of spatial configuration.

Space syntax research has found that spatial configuration alone, represented and measured in a specific manner, explains a substantial proportion of the variance between aggregate human movement rates in different locations in both urban and building interior space. Although it seems possible to explain 'how' people move on the basis of these analyses, the question of 'why' they move this way has always seemed problematic since the analysis contains no explicit representations of either motivations or individual cognition. One possible explanation for the prediction power of the method is that the way people understand their environment and decide on movement behaviours is somehow implicitly embedded in space syntax analysis.

Space syntax analysis such as street connectivity, is only useful when testable hypotheses have been developed over years of research. For example, research has established that pedestrian movement is more impacted by the number of turns than by distance traveled. Thus, streets from which the other streets can be reached with fewer direction changes attract more people. Because they attract more people they tend to attract retail and other land uses that depend on the volumes of pedestrian traffic, and consequently, the volumes of both pedestrians and uses are multiplied. This, in a nutshell, is the theory of "natural movement" which helps to predict the likely effects of designs with regard to urban liveliness.

In this regard 'Space Syntax' **firstly** gives the emphasis on the global configuration of spatial morphology and creates urban morphological model through the technique of graph theory; **secondly**, it has proved in this study that the urban spatial configuration shapes the movement rates and the distribution of land use at the micro-urban levels, to some extent; **thirdly**, it sheds the light on the theoretical and methodological researches in urban morphology, and **further** provides a new perspective in the urban planning integrating street network/transportation and land use. This study explains the study of urban morphology through Space Syntax and provides a case study of four Wards (18, 19, 49 and 72) of Dhaka City.

8.3 Epilogue

Urban morphology approaches human settlements as generally unconscious products that emerge over long periods, through the accrual of successive generations of building activity. This leaves traces that serve to structure subsequent building activity and provide opportunities and constraints for city-building processes, such as land subdivision, infrastructure development, or building construction. Articulating and analysing the logic of these traces is the central question of urban morphology.

Time affects differently the layout of cities and the architecture of buildings. Of the many human creations, street systems are among the most resistant to change. This has been emphasized in this study by the use of a method (Space Syntax) that makes use of a model in establishing measures of space-filling, thereby facilitating the comparison of urban layouts across space and time.

Space syntax analysis is primarily concerned with using the structural organisation of space, as revealed by its analytic tools, to shed light on underlying social and cultural processes which are thought to have led to these forms. Some simulation experiments on the growth of artificial settlements make this point particularly well, but there after the main focus of space syntax studies has been the analysis of urban and built space itself, and its structure. In the urban morphogenetic tradition the emphasis is on tracing the historical evolution of urban form, through the map and other historical processes records, and on understanding and uncovering which have led to this evolution. Significantly, the concern is to understand the mutual interaction of from and process, but the tools of analysis are largely interpretative.

The interpretation of history in the light of quantitative accounts, as demonstrated in this study, will be of value to urban planners/managers and urban designers for the future planning of modern Dhaka City.

REFERENCES

(a) Published/ Unpublished Sources

Ahmed, E. (2006) "Dhaka", URL: http://dhakadailyphoto.blogspot.com, accessed on 29th November 2007.

Ahmed, S.S. (n.d.) "Dhanmondi Thana", URL: http://search.com.bd/index.html, accessed on 23rd December 2007.

Ahmed, S.U. (1991) (ed.) Dhaka Past Present Future, The Asiatic Society of Bangladesh, Dhaka.

Basak, P. (2006) "Spatio-Temporal Treads and Dimensions of Urban Form in Central Bangladesh: A GIS and Remote Sensing Analysis" unpublished master's thesis, Department of Urban and Regional Planning, Bangladesh University of Engineering and Technology (BUET), Dhaka.

Batty, M. and Longley, P. (1994) Fractal Cities, Academic Press, London, cited in Karimi (1997).

BBS (1991) Population Census 1991: Preliminary Report, Bangladesh Bureau of Statistics, Statistics Division, Ministry of Planning, Government of the people's Republic of Bangladesh (GoB), Dhaka.

BBS (1997) Urban Area Report 1991, Bangladesh Bureau of Statistics (BBS), GoB, Dhaka.

BBS (2001) Population Census 2001: Preliminary Report, Bangladesh Bureau of Statistics, Statistics Division, Ministry of Planning, Government of the people's Republic of Bangladesh (GoB), Dhaka.

Birt, B. (1906) Romance of an Eastern Capital, Smith, Elder & Co., London.

Chowdhury, A.M. (n.d.) "Dhaka", URL:http://banglapedia.org.html, accessed on 26th November 2007.

Chowdhury, S.Q. (n.d.) "Dhanmondi Lake", URL: http://a-bangladesh.com /banglapedia/HT/D_0185.html, accessed on 23rd December 2007.

Dani, A.H. (1962) Dacca: A Record of its Changing Fortunes, Asiatic Press, Dacca.

Ferdous, F. (2007) "A Morphological Analysis of Indigenous Spatial Pattern in Old Dhaka with Particular Emphasis on Cultural Spaces" unpublished master's thesis, Department of Architecture, Bangladesh University of Engineering and Technology (BUET), Dhaka.

Geddes, P. (1917) Report on Town Planning, Dacca, Bengal Secretariat Book Report, Calcutta, translated with an introduction by Abdul Mohaimen in Bengali (1990), the Dhaka City Museum, DCC, Dhaka.

Hashem, M. (2001) "Trends of Development in Dhanmondi Residential Area of Dhaka City" unpublished master's thesis, Department of Urban and Regional Planning, Bangladesh University of Engineering and Technology (BUET), Dhaka.

Hanson, J. (1989) Order and Structure in Urban Design: the plans for the rebuilding of London after the Great Fire of 1666, University College London, London.

Hiller, B. (1996) Space is the Machine: a Configurational Theory of Architecture, Cambridge University Press, Cambridge.

Hillier, B. and Hanson, J (1984) The Social Logic of Space, Cambridge University Press, Cambridge.

Hillier, B. and Penn, A. (1992) "Dense Civilizations: the shape of cities in the 21st century" Journal of Applied Energy, London **43** 41-66.

Islam, N. and Khan, F.K. (1964) "High Class Residential Areas in Dhaka City, 1608-1962", in the Oriental Geographer, Vol. 8, No. 1, pp 1-40.

Islam, S. (n.d.) "Dhanmondi", URL: http://banglapedia.search.com.bd/index.html, accessed on 23rd December 2007.

Islam, T. and Zaman, H. (2006) "Conservation of a Historic Mohalla", URL: http://www.thedailystar.net/magazine/2006/04/03/cover.htm, accessed on 27th December 2007.

Islam, Z. (2003) "High-rise Residential Development in Dhaka City: Evolution of the New Form" unpublished master's thesis, Department of Architecture, Bangladesh University of Engineering and Technology (BUET), Dhaka.

Karimi, K. (1997) "The Spatial Logic of Organic Cities in Iran and the United Kingdom" Journal of Space Syntax First International Symposium, London 1 (06) 06.1-06.3.

Kubat, A.S. (1999) "The morphological history of Istanbul" Journal of Urban Morphology 3(1) 28-41.

Mamun, M. (1989) Smritimoy Dhaka (Bengali) Pallab Publishers, Dhaka.

Mamun, M. (1993) Dhaka Smriti Bismritir Nagari (Bengali) Bangla Academy, Dhaka.

Marufuzzaman, S. (n.d.) "Kotwali Thana", URL: http://a-bangladesh.com/banglapedia/HT/K_0289.htm, accessed on 27th December 2007.

Moudon, A.Y. (1997) "Urban morphology as an emerging interdisciplinary field" Journal of Urban Morphology **1** 3-10.

Nilufar, F. (1997) "The Spatial and Social Structuring of Local Areas in Dhaka City- A Morphological Study of the Urban Grid with Reference to Neighbourhood Character within Naturally-grown Areas" unpublished doctoral thesis, Unit for Advanced Architectural Studies, The Bartlett School of Graduate Studies, University College London, University of London.

Taifoor, S.M. (1956) Glimpses of Old Dhaka, Pioneer, Dhaka.

Vance, J. E. (1977) This Scene of Man, the role and structure of the city in the geography of Western civilization, Harper's College Press, New York, cited in Karimi (1997).

(b) Universal Resource Locator (URL)/ Internet Sources

1. http://www.thedailystar.net/suppliments/2006/15thanniv/ourcities/index.htm, accessed on 27th November 2007.

2. http://en.wikipedia.org/wiki/Urban_area, accessed on 27th November 2007.

3. http://en.wikipedia.org/wiki/City, accessed on 6th December 2007.

4. http://urbanity.50megs.com/index.htm, accessed on 27th November 2007.

5. http://en.wikipedia.org/wiki/Urbanization, accessed on 27th November 2007.

6. http://en.wikipedia.org/wiki/Urban_morphology, accessed on 27th November 2007.

7. http://en.wikipedia.org/wiki/Space_syntax, accessed on 8th December 2007.

8. http://en.wikipedia.org/wiki/Dhaka, accessed on 28th November 2007.

9. http://www.dcdhaka.gov.bd/mapofdhaka.html, accessed on 28th November 2007.

10. http://en.wikipedia.org/wiki/Dhanmondi_Thana, accessed on 23rd December 2007.

11. http://www.bangladesh.gov.bd/maps/images/dhaka/DhanmondiT.gif, accessed on 23rd December 2007.

12. http://en.wikipedia.org/wiki/Dhaka_Kotwali_Thana, accessed on 27th December 2007.

13. http://www.bangladesh.gov.bd/maps/images/dhaka/DhakaKotwaliT.gif, accessed on 27th December 2007.

14. http://en.wikipedia.org/wiki/Gulshan_Thana, accessed on 28th December 2007.

15. http://search.com.bd/banglapedia/Maps/MG_0221.GIF, accessed on 28th December 2007.

Sketch Map of Dhaka (1952)

DACCA GUIDE MAP (1973)
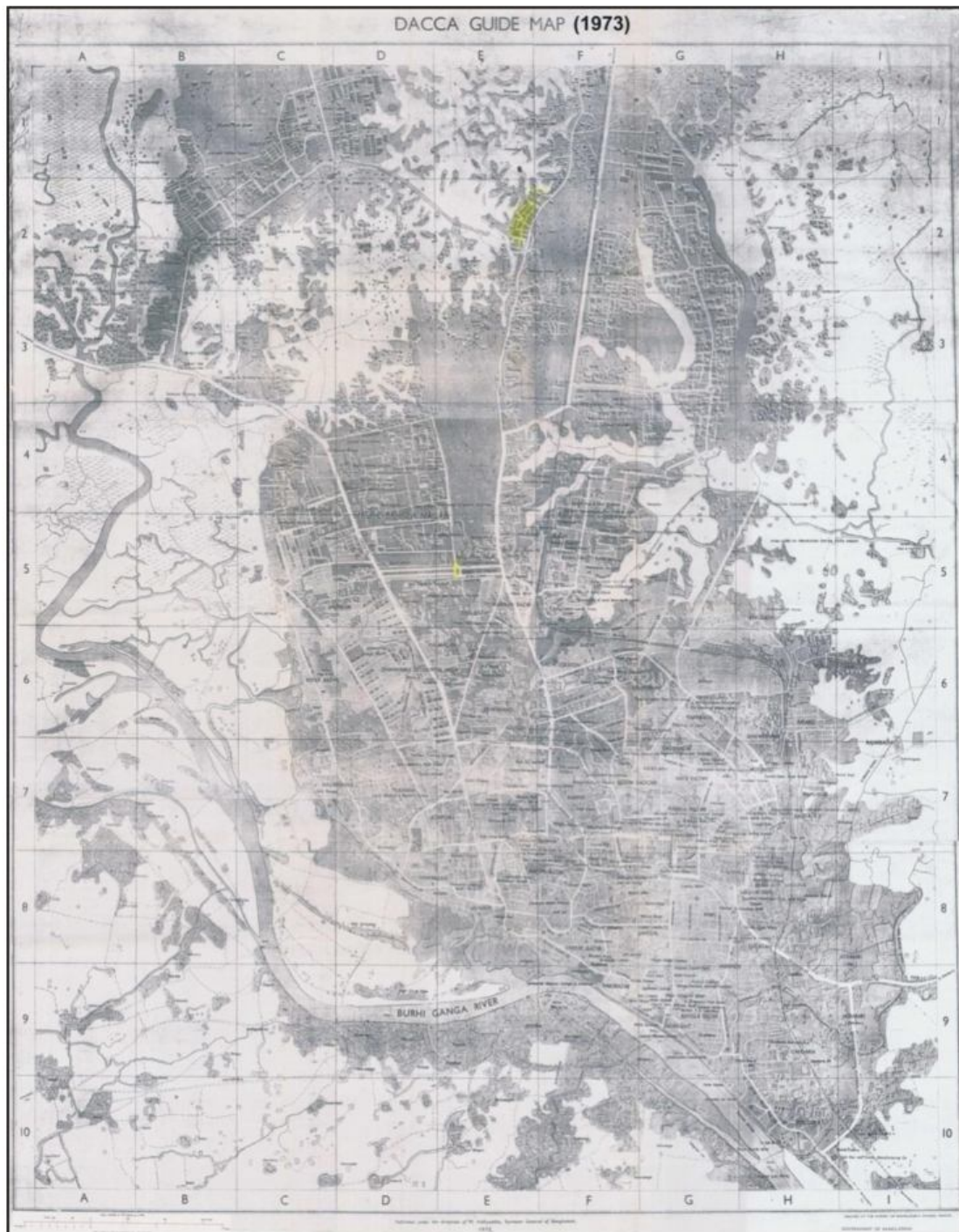
Dhaka City Guide Map (1973)
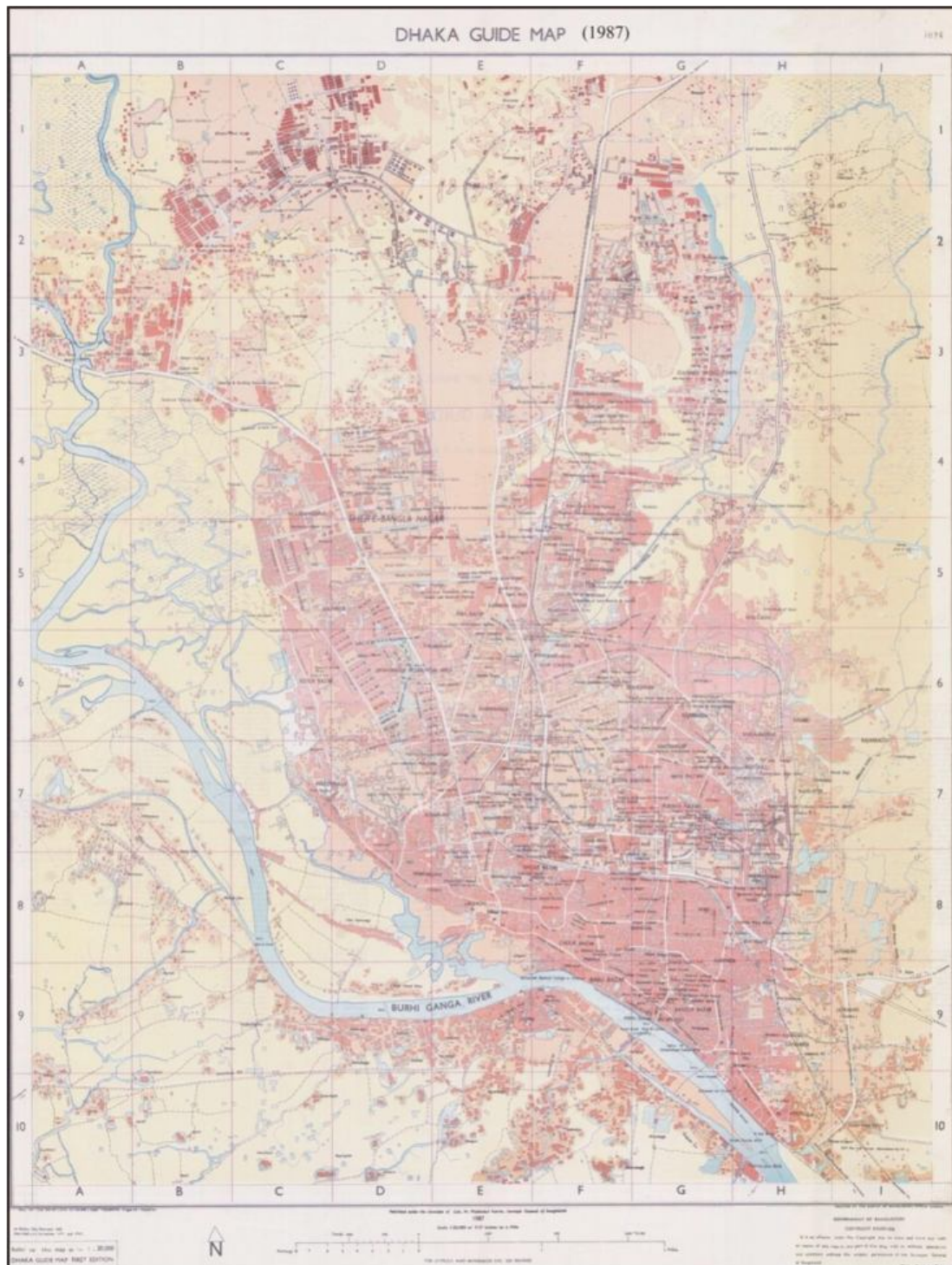
Dhaka City Guide Map (1987)
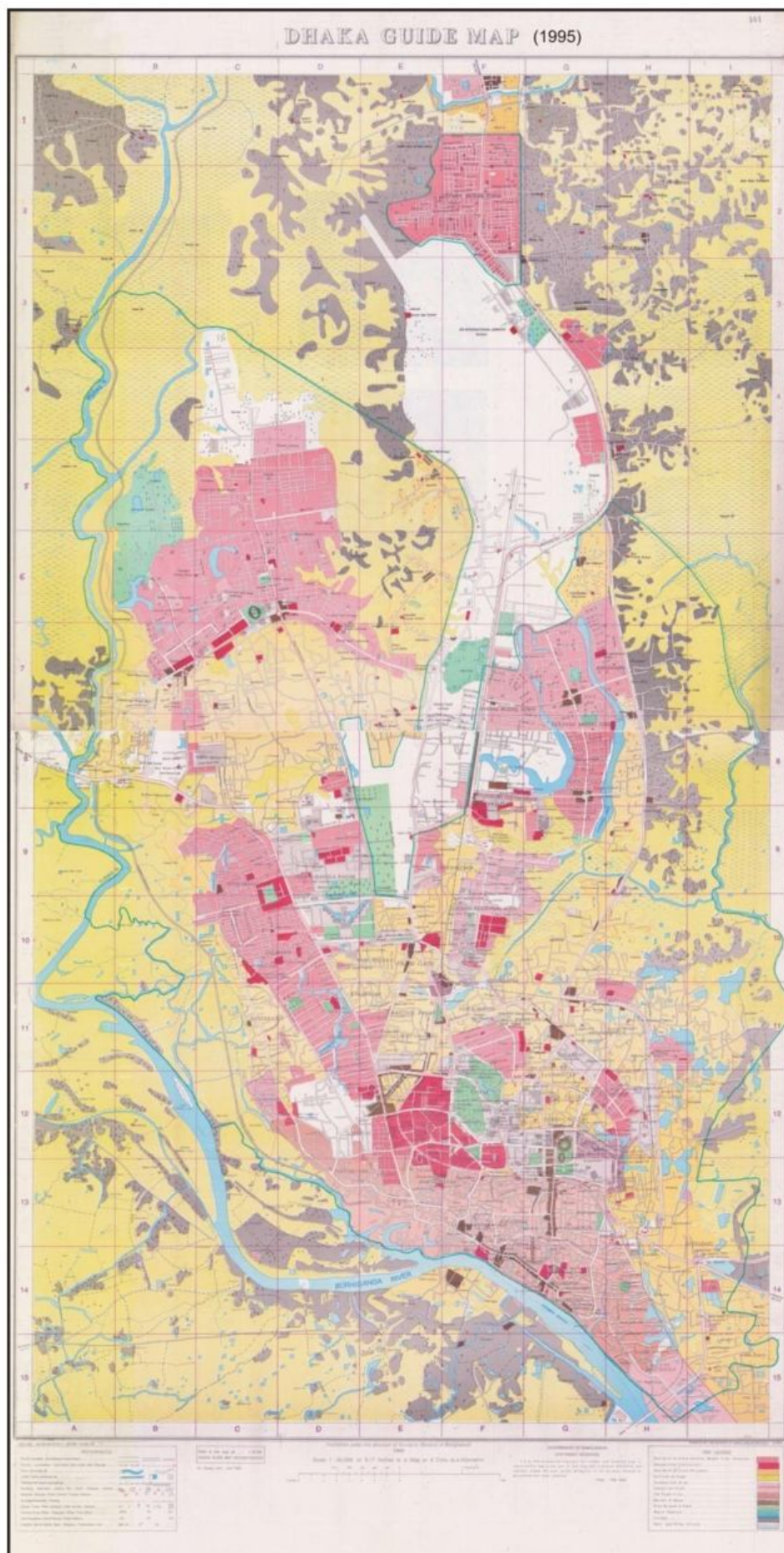
Dhaka City Guide Map (1995)

Dhaka City Guide Map (2001)

Maps of Ward 18 over the last 60 years (1947–2007)
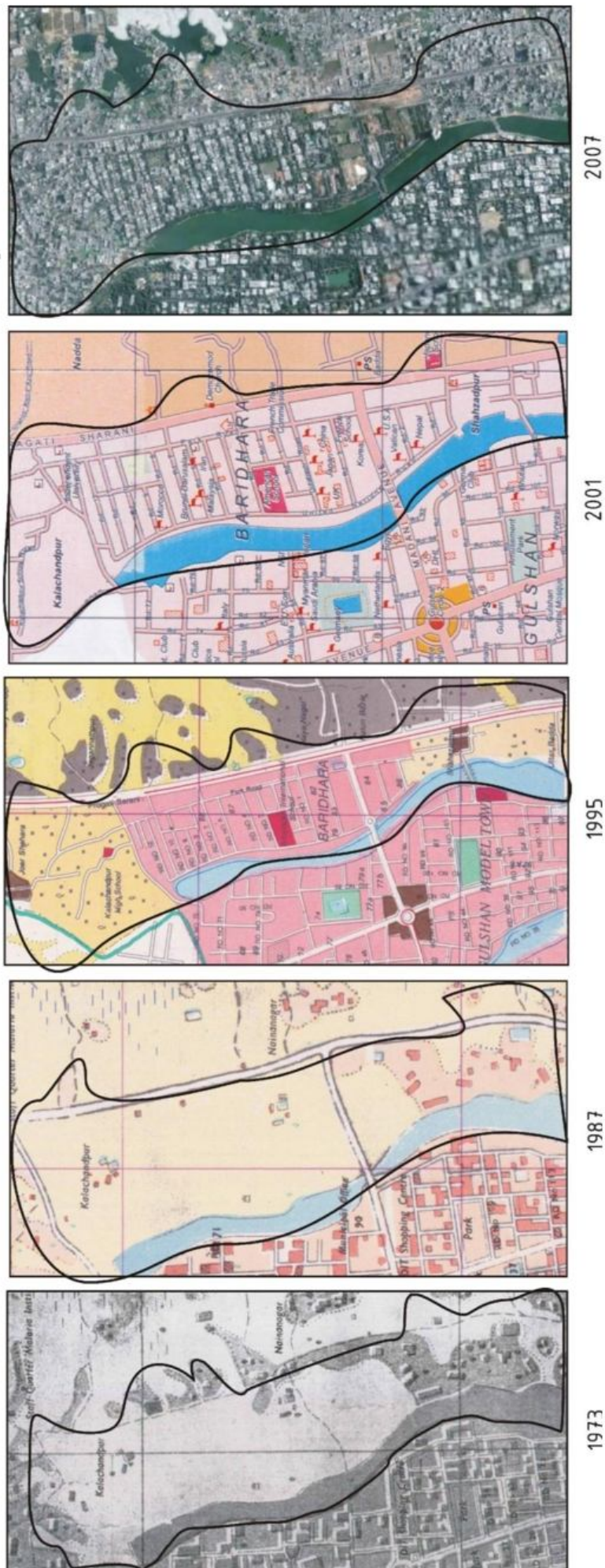
Maps of Ward 19 over the last 60 years (1947–2007)

2007
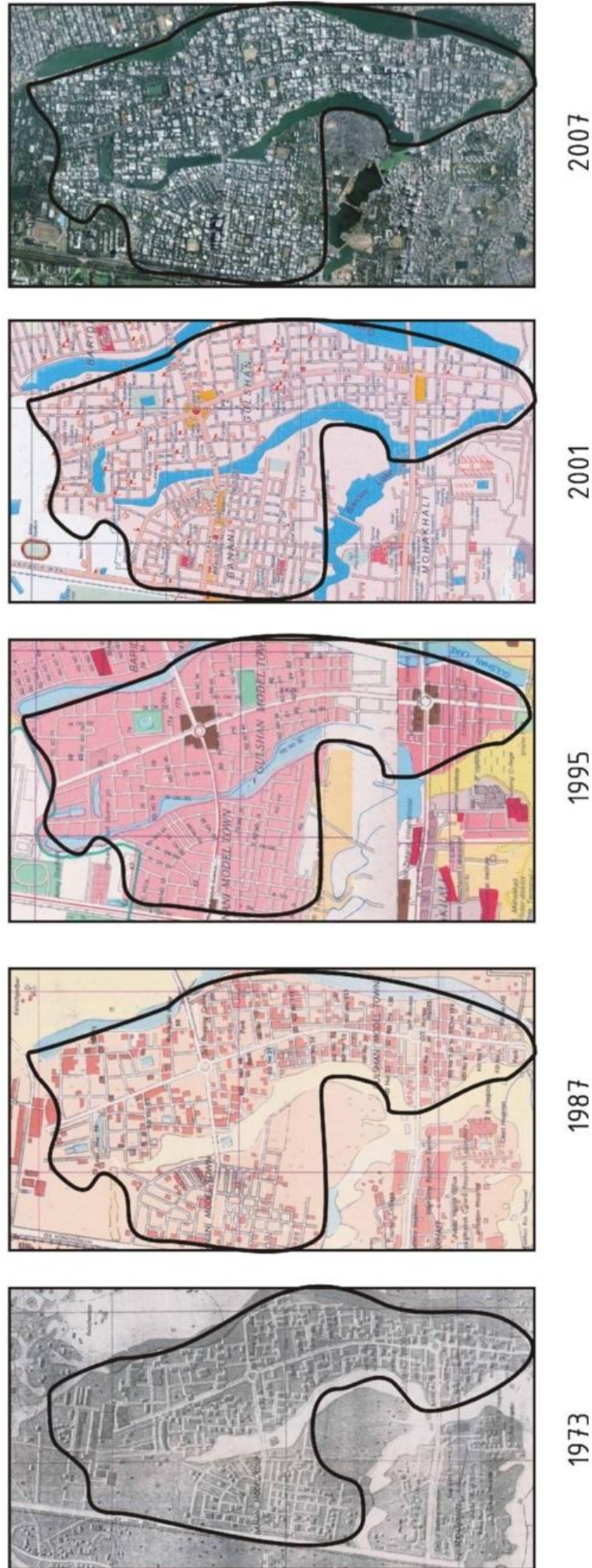
2001

1995

1987

1973

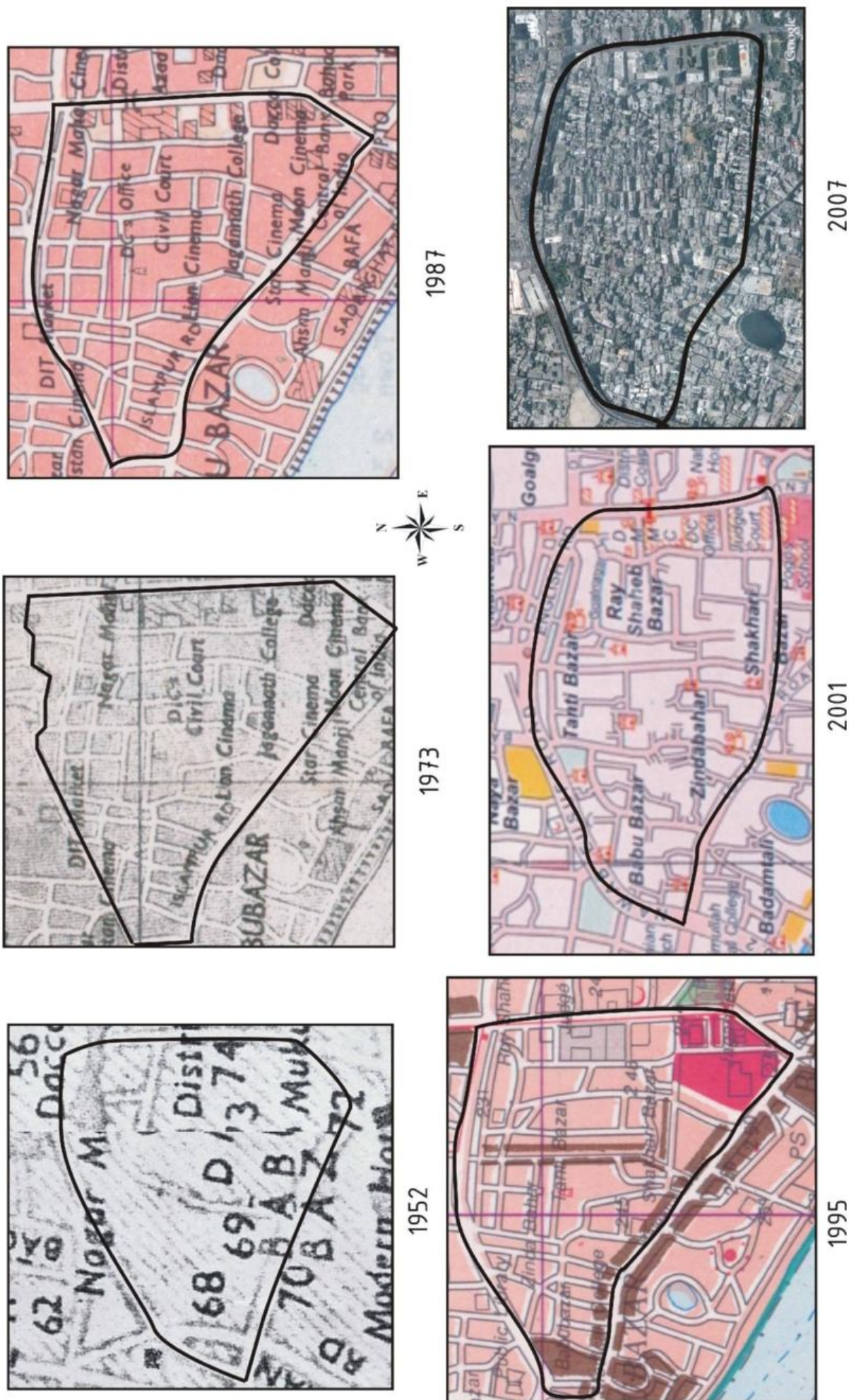# Maps of Ward 49 over the last 60 years (1947–2007)
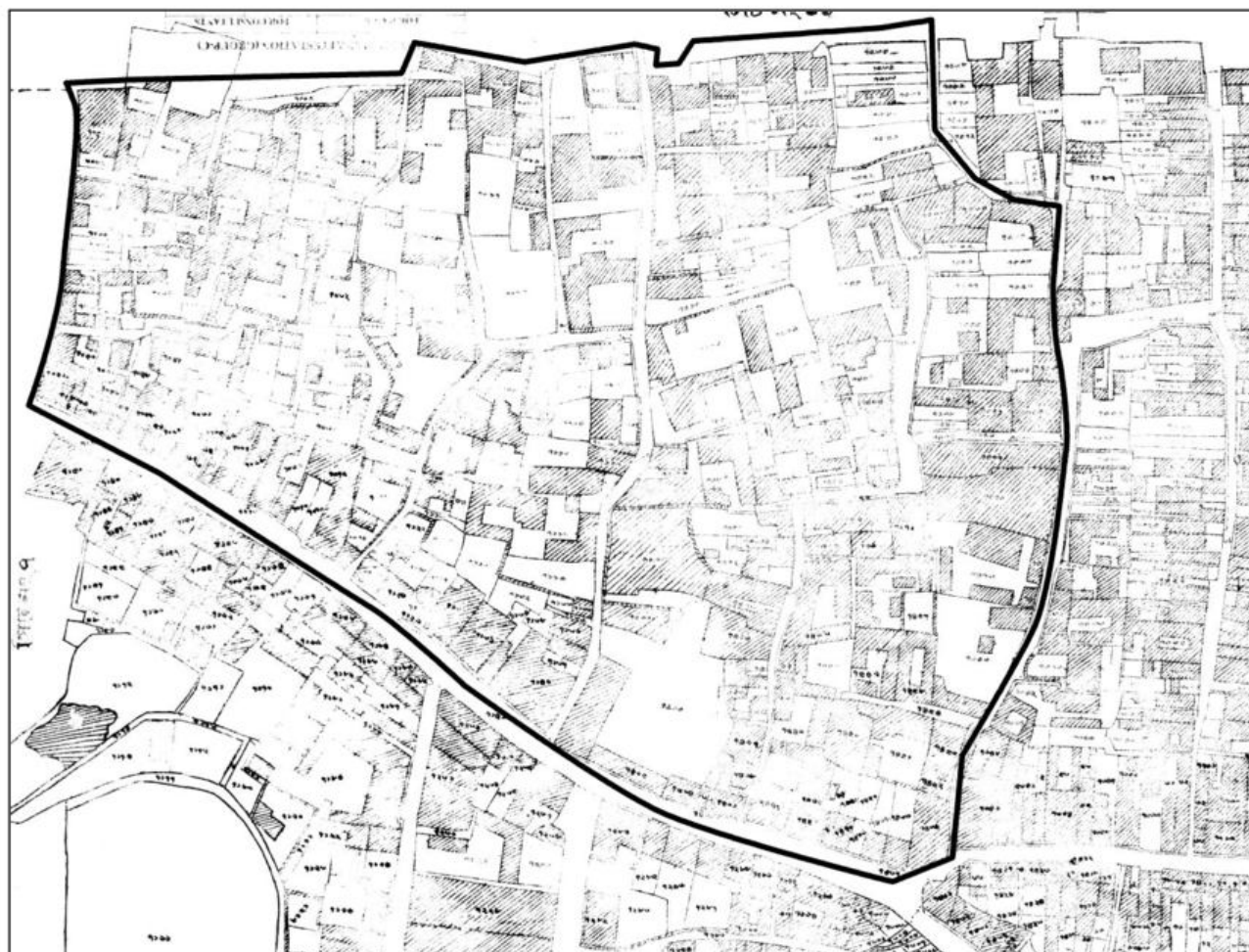

1952

1973

1987

1995

2001

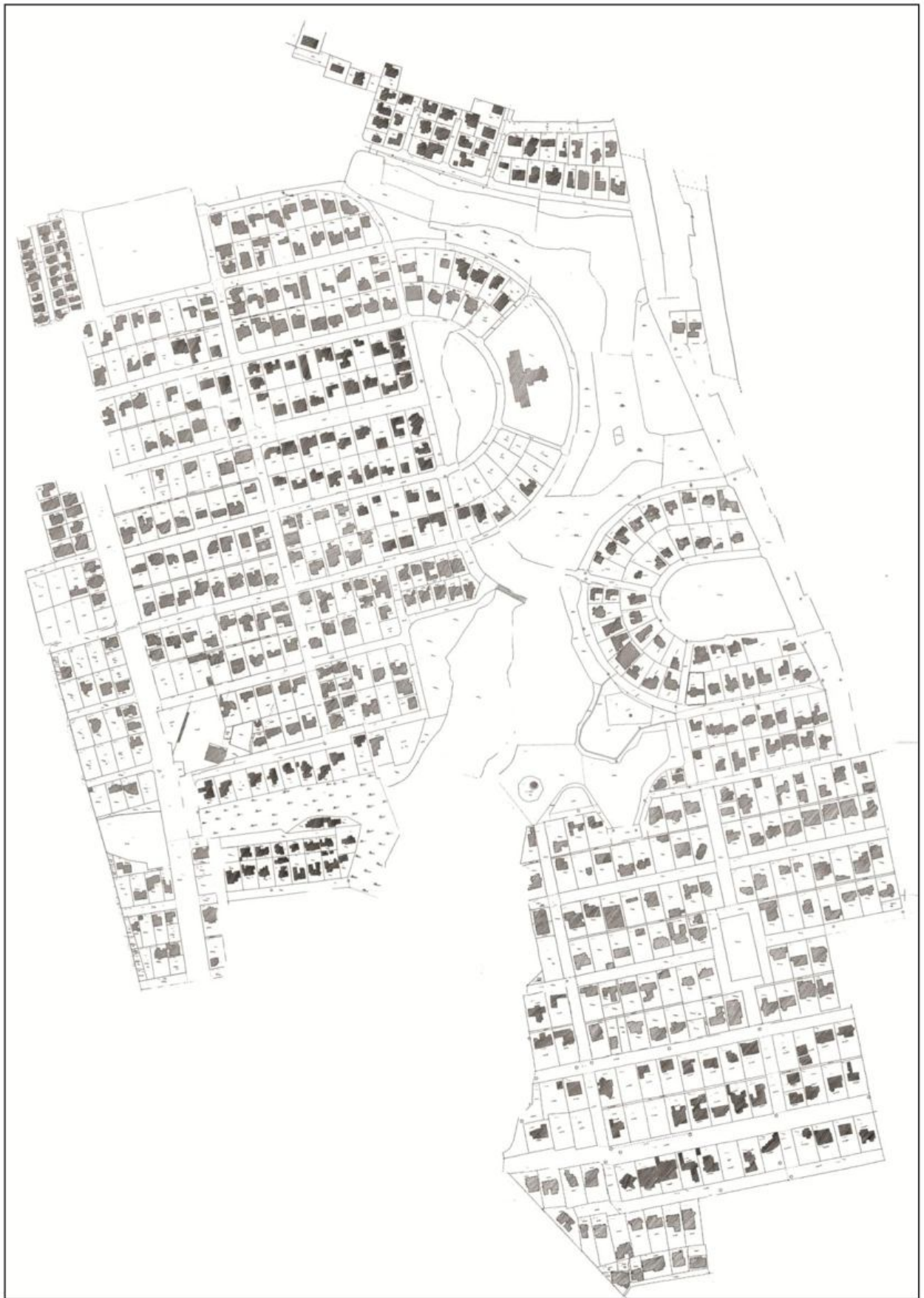2007

N E S W
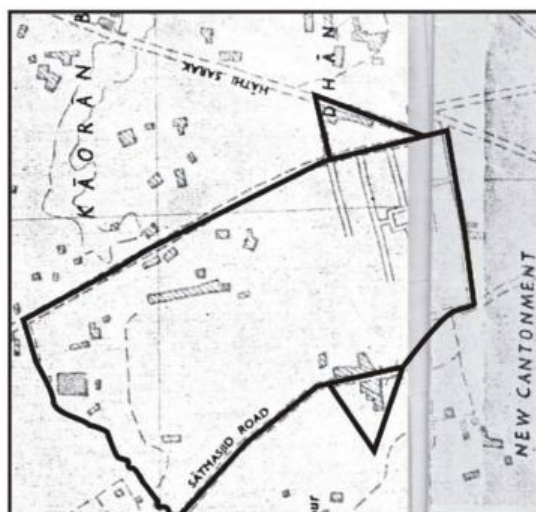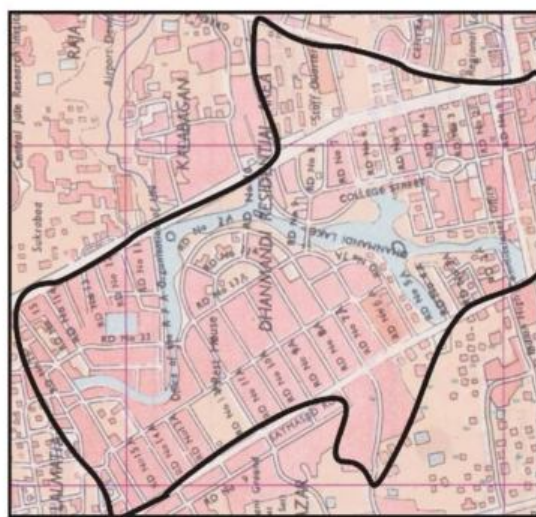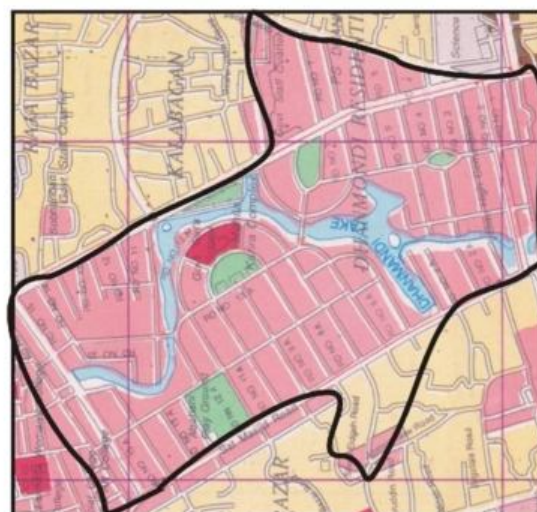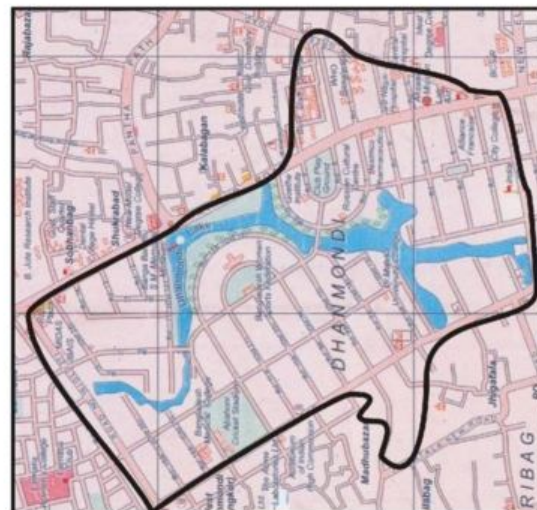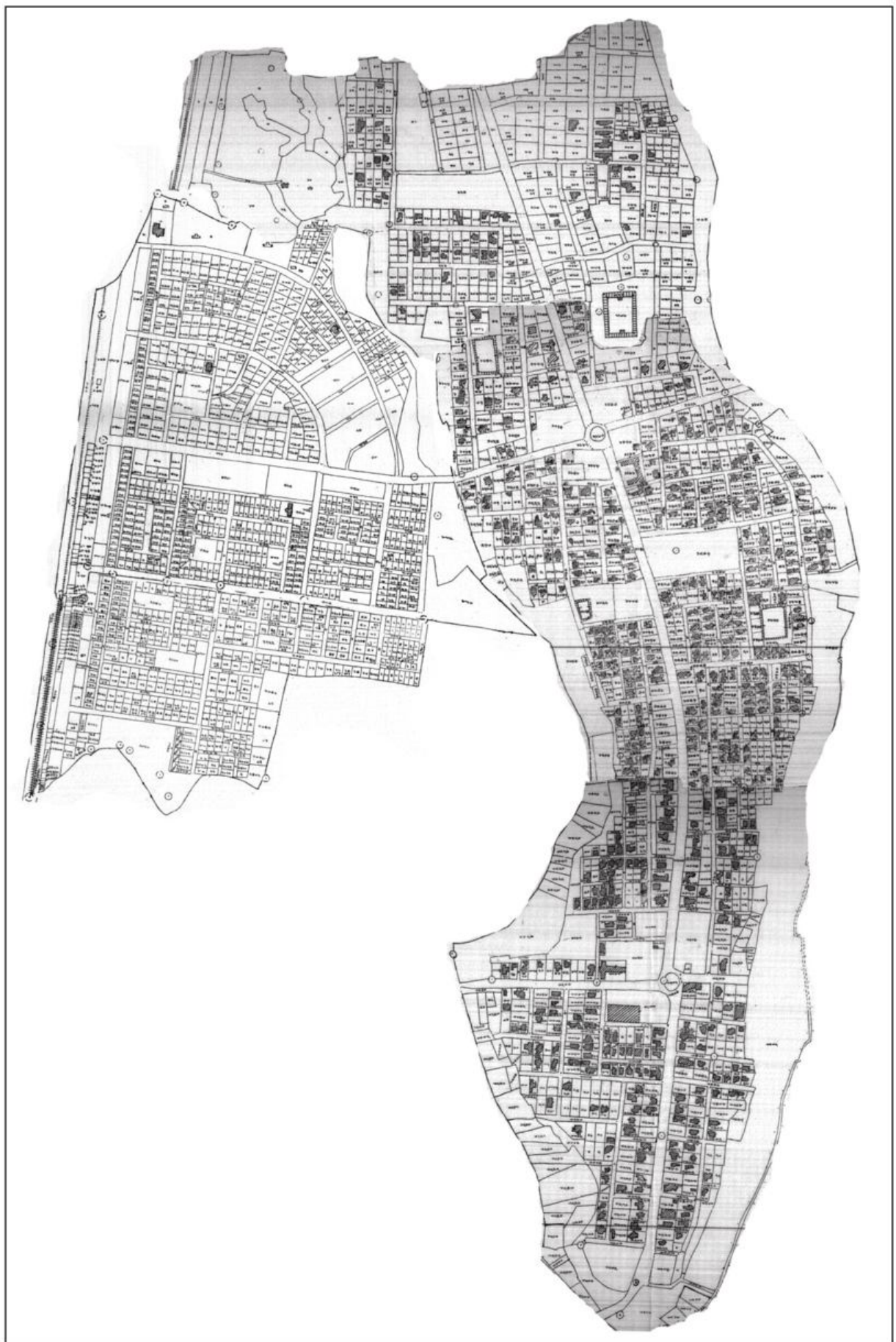
Maps of Ward 72 over the last 60 years (1947-2007)

1952

1973

1987

1995

2001

2007

Revised Survey Map (1972-85) of Ward 72 (Old Dhaka)
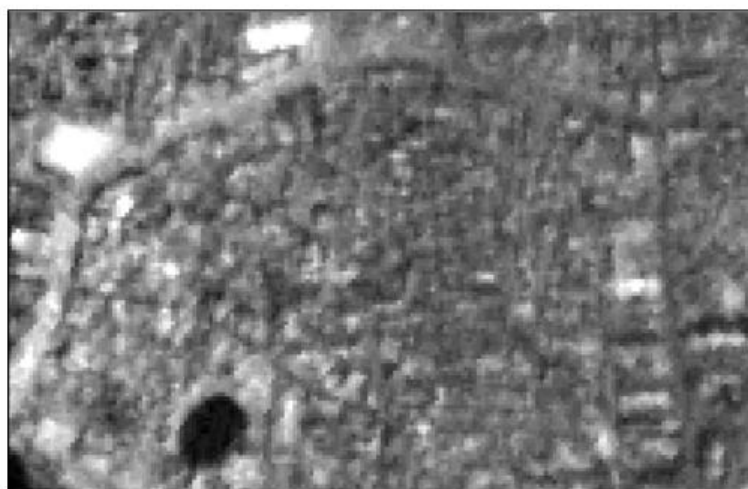
Revised Survey Map (1973-85) of Ward 49 (Dhanmondi)

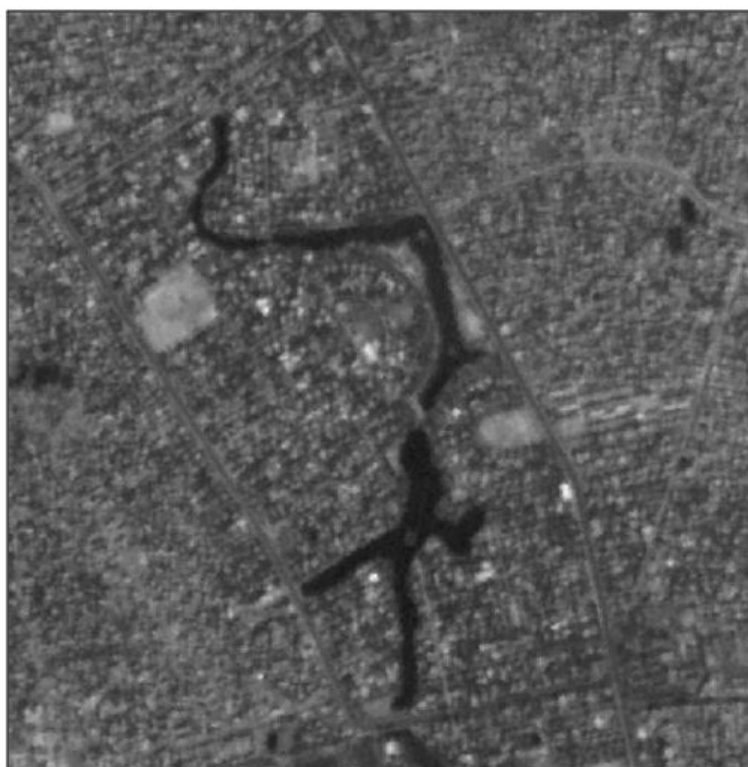**Revised Survey Map (1975-84) of Ward 19 (Gulshan and Banani)**

Ward 72

Ward 49

Ward 18 and 19

Indian Remote Sensing (IRS) Satellite Images (1996) of the Wards