



## Vertical growth and Associated Socio-Functional changes after 21<sup>st</sup> Century: A micro study of Kolkata, India

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### Abstract

Since 1950s there has been rapid urbanisation in developing and developed countries following the role models of developed countries. India is not an exception. The main focus of this paper is urbanisation in Kolkata, one of the busiest and the largest city in eastern India. The beginning of 21<sup>st</sup> century gave a new face to North Kolkata leading to its urbanisation. Phenomenal increase in the pace of urbanisation has led to a rapid growth in building multi-storeyed structures in the already saturated city. The general aim of this investigation is to analyse the spatial and temporal pattern of urban growth in Kolkata. A more focused field-based component of this study explores the nature and extent of vertical growth in a small area with an attempt to relate transformation of the urban skyline with urban functionalities. This work also focuses on the fact that how lack of opportunity of horizontal spread has driven the rapidly growing population of the urban region to concentrate on the limited amount of space available and utilize it to the fullest which is perceptibly being done by vertical growth. Since unscientific and unchecked vertical growth is also not desirable for both the mankind and the environment because of its future consequences, therefore, better, eco-friendly and scientific modes of vertical growth is also discussed in this paper.

**Keywords:** Urban ecology, Urban morphology, Vertical growth, Urbanization.

### Introduction

During the last 20 years urban social study in urban geography has developed very widely, Kolkata Municipality Corporation, Buildings department section, 2014-15<sup>1</sup>. Urban morphology and its associated building structure have also changed during this period. In the last 15 years urban vertical structure and its function have been influenced by increasing population, Census of India 2011<sup>2</sup>. North Kolkata is not an exception. Historically North Kolkata is the oldest part of the city. In the initial stage urban morphology in urban geography includes mainly two important schools which are developed by M. R. G. Conzen and G. Caniggia, Whitehand, 2007<sup>3</sup>. Urban morphology is the clear shape for urban forms of any historical cities and it's also changing for present content, Sima and Zhang<sup>4</sup>. Urban morphology is forms of urban residential structure in a city area and urban landscape makes an important role for this structure. Urban morphology mainly depends on three basic factors; migration (village to urban, refugee), changes in urban administrative scenario and urban resources. People move from villages to urban centers (Rural urban migration) and enjoy the urban lifestyle and benefits, Cheng and Selden<sup>5</sup>. Agglomeration of urban economics, industrialisation and sectorial economy attract migration, Todaro<sup>6</sup>. Change of administrative pattern increases rate of urbanisation as was in case of China in 1974-1990 that witnessed an increase of around 40% of the total urbanisation Krikby<sup>7</sup>. Land use pattern of an urban area also makes a huge impact over the vertical growth as well. Land-use

suitability and accessibility are important factors that determine the growth of urbanisation and urban morphological structure. Integration of certain essential aspects like political, social and cultural functions is also needed to complete the entire urban morphology, Friedman<sup>8</sup>. After 21<sup>st</sup> century, the functional use of new buildings has changed the social ecology of this city. Therefore the relationship between them has also changed. Urban life and the associated functional scenario are significant dynamic processes and are the main factors for urban economic progress. This environment is under the umbrella of urban environment, which is characterized by the presence of high density residential and commercial buildings, surface covered in pavement and several other urban related factors. Efficient use of land can be done by vertical growth and sustainable eco environment. Shape of urban structure is the clear picture of urban geography which provide the urban sky growth scenario. It also helps us to understand the character of a metropolitan area, city or megacity and its structure spatially. This is done by examining its components and the process of its development. This also may include the analysis of the physical forms (street pattern, buildings pattern, sometimes referred as urban grain) on different scales (micro, mesa) as well as pattern of movement, land use, buildings ownership and occupation. The analysis of specific settlement is done by using maps and their process of development and is concluded by comparing the current map of a settlement with their structure. An important part of this sub field is studying how the physical form of a city transformed over time and its composition with other cities. Vertical growth

is the sky growth and it is also depend on strong local growth. It indicates the changing pattern of the urban function. Standard of living depends on the sectorial pattern of the area .Vertical growth can lead to diversity risk; which in turn support lack of urban land to be developed .Buildings that are more than 50 years old are very much hazardous, so these buildings should be rebuilt with vertical growth in the sky. In this policy 10% floor area ratio will be allowed for all green buildings and 15% additional floor area ratio will be allowed for mass housing, hospital, Times of India, 6th August 2014, WB Govt.<sup>9</sup>.

**Study Area:** Kolkata is the 3<sup>rd</sup> largest city (Census of India, 2011) of India and capital of West Bengal. It is one of the ancient city of India. It had its significance even during the British Raj when it was the capital city at that time. Being one of the port cities in ancient times, it has always attracted people towards itself. So the population of Kolkata was always increasing even in the past and at present it has been seen that there was a drastic increase in population of the city in the last three decades. This is bringing about changes in the morphological character of the city. But however it has been seen that the concentration of population is more towards North Kolkata as is the oldest part of the city. It includes areas such as Shyambazar, Shobhabazar, Chitpur, and Cossipur along with the north sub urban areas. This study area is located between 22°35'39"N-22°36'05"N and 88°22'15"E-88°22'31"E (Figure-1). The areal extent is 326402.8703 square metres.

**Research Objectives:** (i) To analyse the change in the vertical growth of buildings in relation to its temporal scale. (ii) To

understand how the social functions are related to the vertical growth of buildings.

### Methodology

The research work is based on primary and secondary data. Primary data are collected from the field and secondary data has been collected from the Census of India, Kolkata, Kolkata Municipality Corporation (KMC) and previous literatures. Satellite data was collected from the USGS (Earth Explorer, LC8). Supervised classification was done using Arc GIS10.2.2 and Google Earth application. Before going to the field a plan of work was set in mind, because field work was to be done within a short period. New buildings were only considered in the data collection process. We had taken into account the number of new buildings, age of the new buildings, functional changes of the new buildings, drainage system, number of floor in new buildings etc. The location of the new buildings locations were taken by hand GPS. Analysis of all the primary data was done by the application of software like Arc GIS10.2.2 and IBM SPSS 22. The final results depend on some specific technique and equation like FSI equation. Location of different places was done by GPS data and Google Earth application. In the primary stage GPS data like Latitudes, Longitudes and Elevations were converted into CSV file and were exported into on Google Earth. Then the positions of the new buildings were marked and saved as KML file. This KML file was imported in Arc GIS10.2.2 software and the final map was prepared. The programs used in this work are Microsoft Word document and Microsoft Excel.

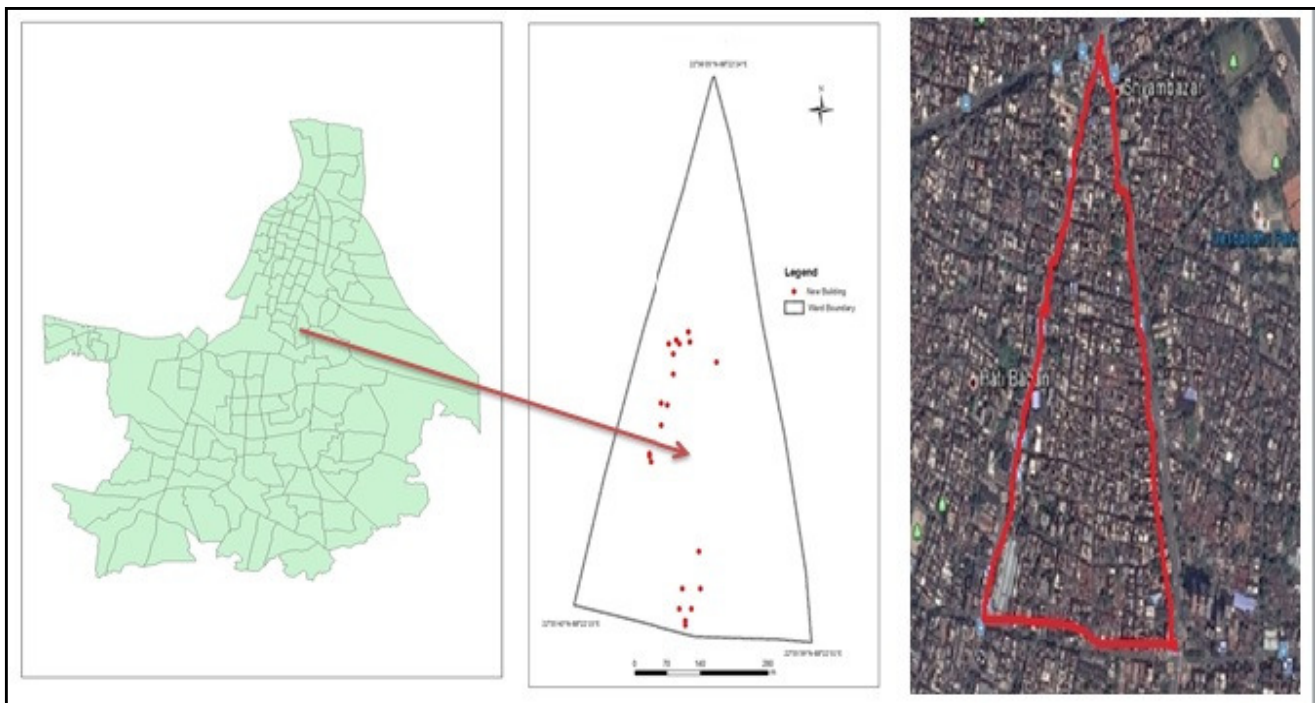


Figure-1  
Study area of ward 11 of Kolkata Municipality, Kolkata, West Bengal

### Result and Discussion

The two main aspects of a society that are looked upon are social and economic patterns. There has been a drastic change in total population, sex ratio, child population literacy rate of Kolkata, so obviously North Kolkata was not left out. Most importantly the total population took a steady leap from 12,000 in 18<sup>th</sup> century to 1 Lakh in 19<sup>th</sup> century, 1850 saw 6,33,000 and 20<sup>th</sup> century held 8,48,000 people. In 1950, there were 25,49,000 inhabitants and census 2011 showed 44,96,694 city dwellers. Such a significant change in population structure

appears to be the basic reason of this study being undertaken (Figure-2).

The demographic scenario of Kolkata has changed due to socio-economic facilities, but infant population and sex ratio is increasing at slower rate (Figure-3-5). Each of those demographic changes directly influences the total structure of the society. This dynamic increase of total population indicates the changes of social structure. Male-female ratio is also another socio-economic indicator. The census of 1991, 2001 and 2011 totally indicates this changing structure.

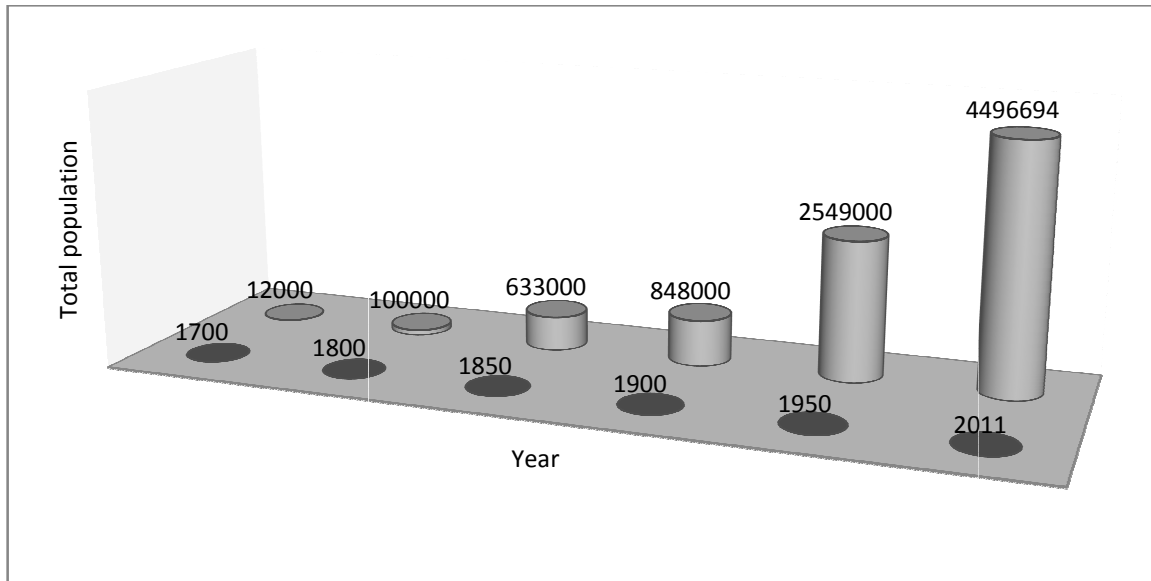


Figure-2  
Population scenario of Kolkata during last 300 years

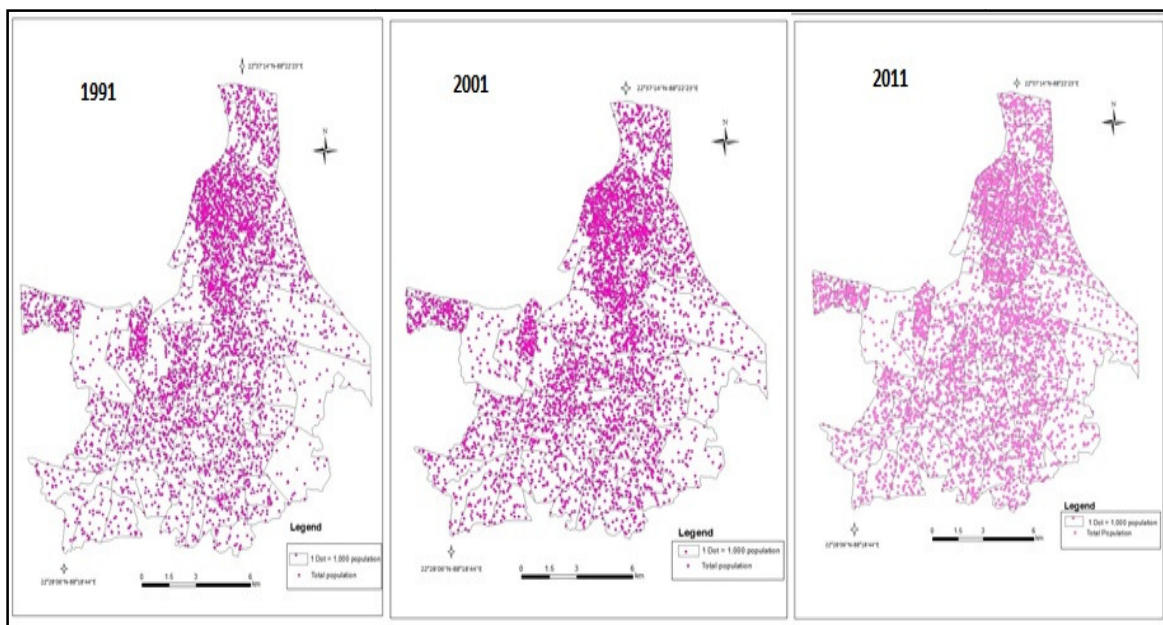


Figure-3  
Total population of Kolkata during last 20 years



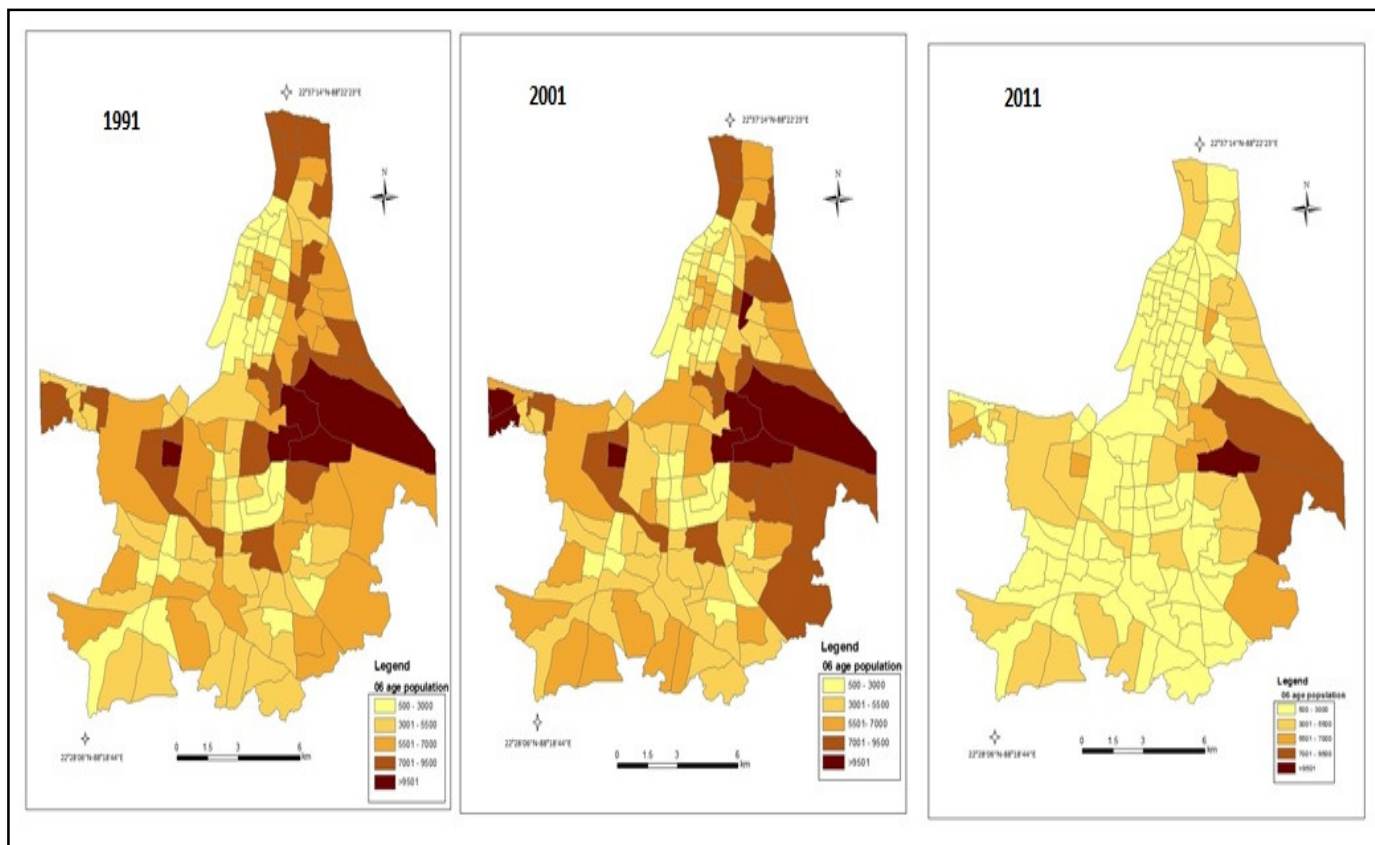


Figure-4  
06-Age population of Kolkata during last 20 years

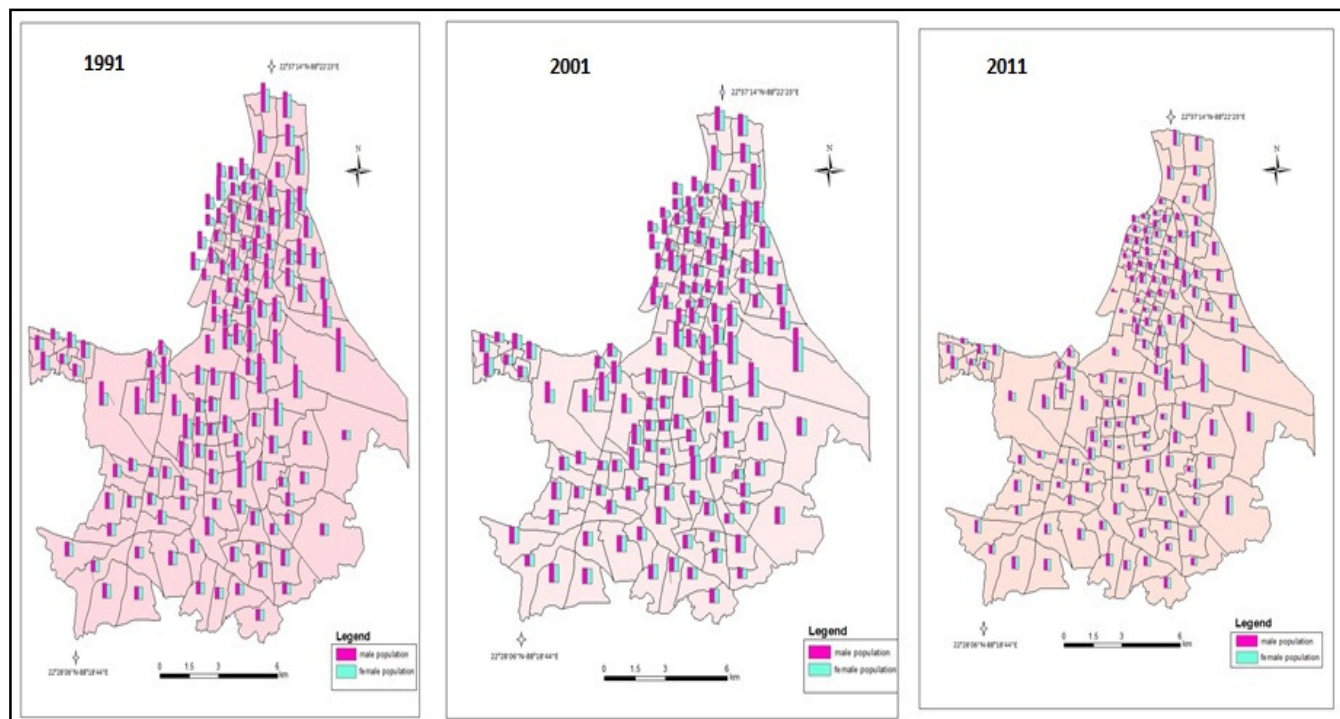


Figure-5  
Sex-Ratio of Kolkata during last 20 years

The above diagram gives a clear idea of the changes in the population structure of Kolkata which shows a steady increase. Increasing population leads to changes in the shape of city boundaries and its area. As we stepped into the 21<sup>st</sup> century, we do not observe increase in the city area. Vertical increment of the city leads to the adjustment of residing population. The supervised classification (accuracy assessment 1991 is 89.40%, 2006 is 92.80% and 2014 is 86.20%) shows different land use and land cover pattern but the result indicates that the overall urban build-up is the same. This points out to the fact that, to accommodate the increasing population vertical sky growth is taking place (Figure-6). Population is rapidly increasing but the urban area has remained constant. This indicates the significance of vertical urbanisation. There is a rate of urbanisation is very rapid in north Kolkata so h vertical growth seems to be the only solution to this problem because the increase of the population need to be accommodated in the available area. After 2000, the data shows the vertical growth of buildings increases rapidly. Although the area of Kolkata is limited but the huge residential problem due to rapid increase of population is balanced by the vertical growth of buildings.

**Vertical growth and associated functional change of KMC ward 11:** Socio-functional scenario of plain region to mountain region is very different, Dhali M.K.<sup>10</sup>. Since the year 2000, the population has increased in number but that did not allow the inhabitation area to increase due to various reasons. The urban buildings show a complete design of city morphology and its ecology gives a new analytical window for urban planning. Settlement size and historical background of any mega city shows increasing times of changing urban morphology. North Kolkata is typically oldest part of Kolkata mega city and south Kolkata is respectively new. So urban morphology is rapidly changing in south Kolkata but its spread growth is more important than vertical growth. North Kolkata is mostly significant for sky growth because it is older part of Kolkata. From the primary survey of 2000, 2006 and 2009 the government came up with new rules and policies due to the increase in number of new buildings in these years. These policies were implemented effectively (Figure-7).

The buffer zones have been created on the basis of degree of concentration of new buildings at a particular place. It shows how the urban population growth has led to the rise of new multi-storeyed buildings and influenced the surrounding places. Here the buffering zones indicate the allocation of 4 or 3 storeyed buildings mostly. As most of the land in this urban region has already been utilised, therefore vertical growth is taking place. This concentration may have occurred due to availability of space in the past or perhaps government policies offering low price of land. The brand new buildings that were built up from the base were very few, such as 21.7%. Most were rebuilt by smashing down old weak buildings which contributes 78.3%. This present situation indicates the availability of constant space. Floor space index is essential for this purpose.

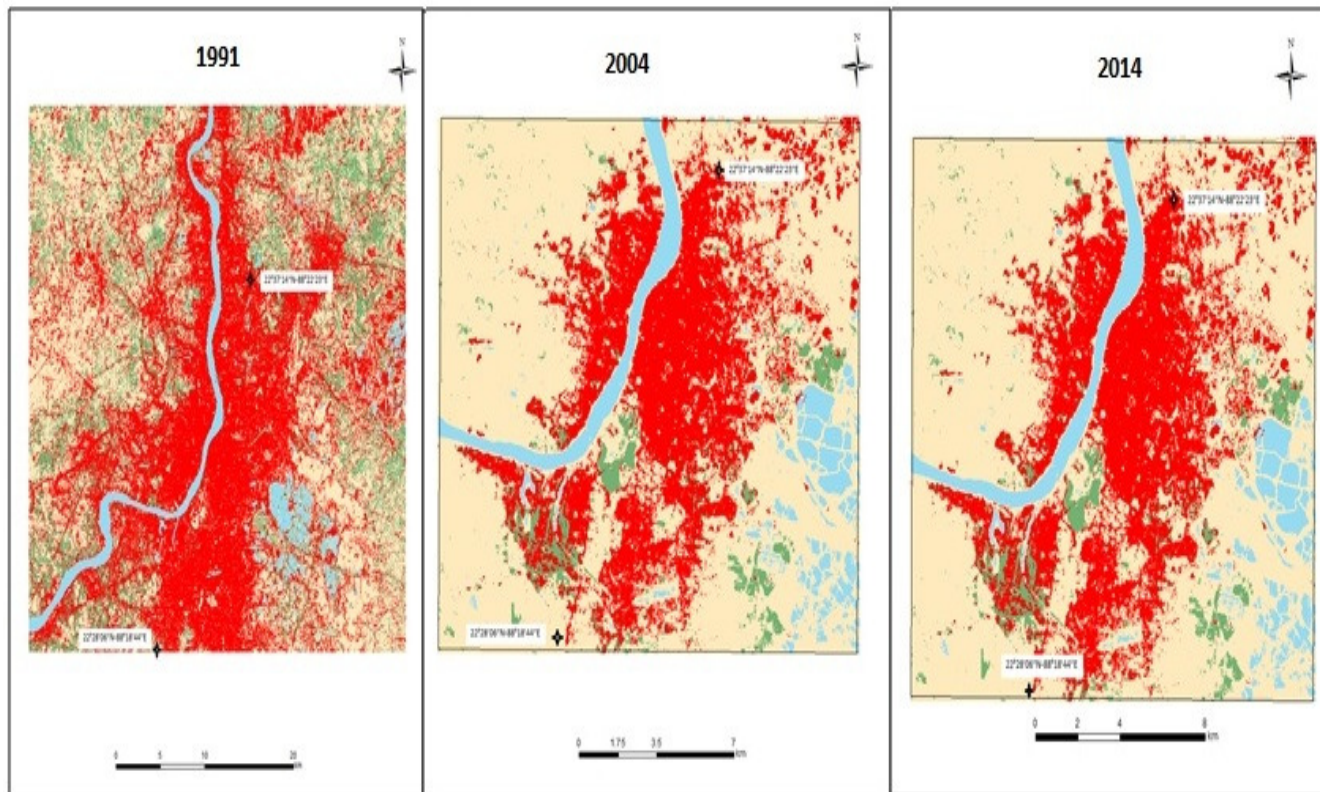
Floor space index<sup>11</sup> is the ratio between original gross floor area and build up space area.

$FSI = \text{original gross floor area} / \text{build up space area}$

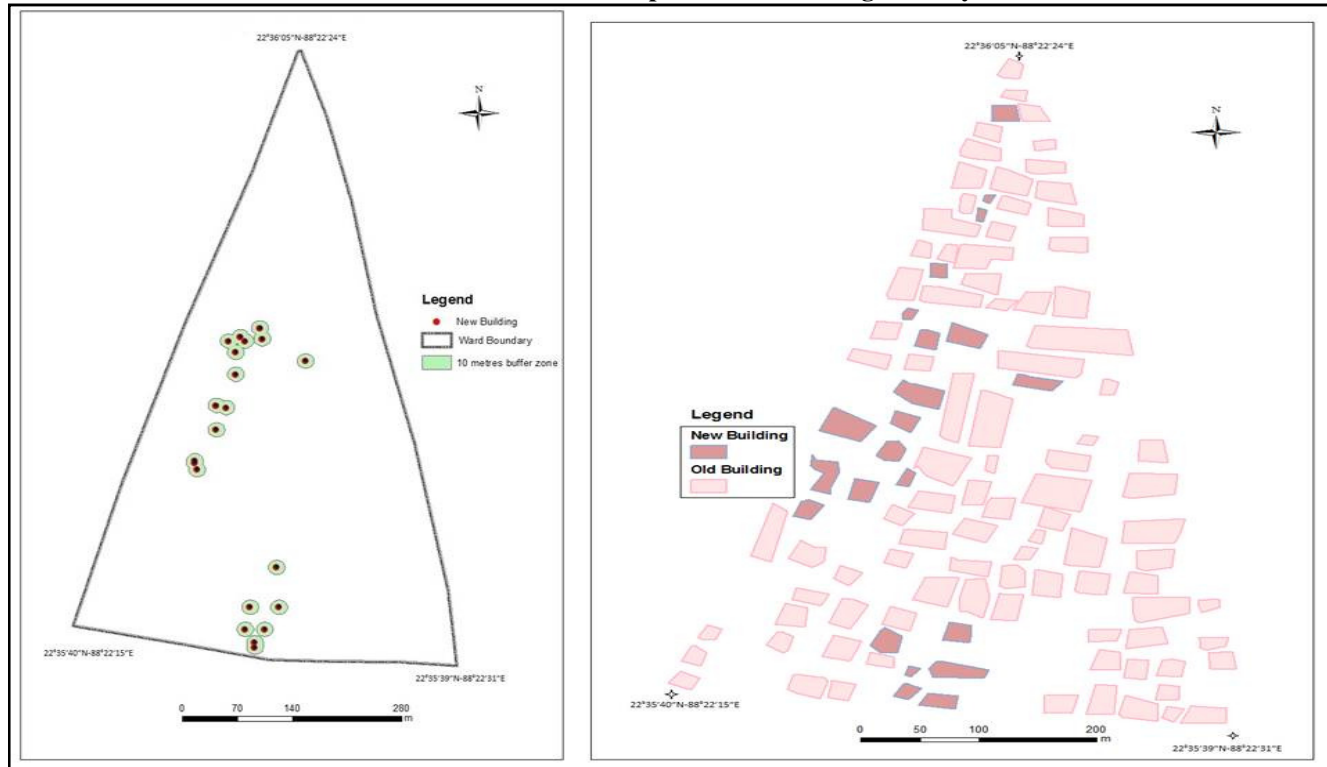
The floor space index of KMC ward 11 is 2.02 (from primary data survey). The FSI value of Kolkata for different buildings are 8-11.50 feet is 1.25, 11.25-23 feet is 1.75, 23-30 feet 2.00, 30-50 feet is 2.25, 50-66 feet is 2.50, 66-80 feet is 2.75 and above 80 feet 3.00 (from FSI Kolkata Municipality Corporation, Buildings department section). The vertical urbanisation leads to different use of buildings too. Social bonding of different social group indicates diversity of social ecology because different social groups needs social interlinks between them. Social capital, social wealth and networking are the fundamental causes for changing urban morphology. Strong social ecology is a master plan of a developed society.

A residential complex gave space and welcomed commercial shops in its ground floor leading to mixed type of buildings and the way of life style. The new form is having mixed type of buildings due to commercial demand which is clear from the pie chart as almost 50% are of those types. Water also known as 'life' is an essential need for survival. The older days gave picture of a single tube well in a family, but growth of families from the ground level lead to increase in KMC's water supply up to 78% and tube well usage reduced to 22%. The concrete layer and roads reduced infiltration of rain water and the ground water level reduced which made the KMC to grant permission for few tubewell and decreasing the availability of pumpwater. Drainage system is one of the major and most fundamental parts of urbanisation.

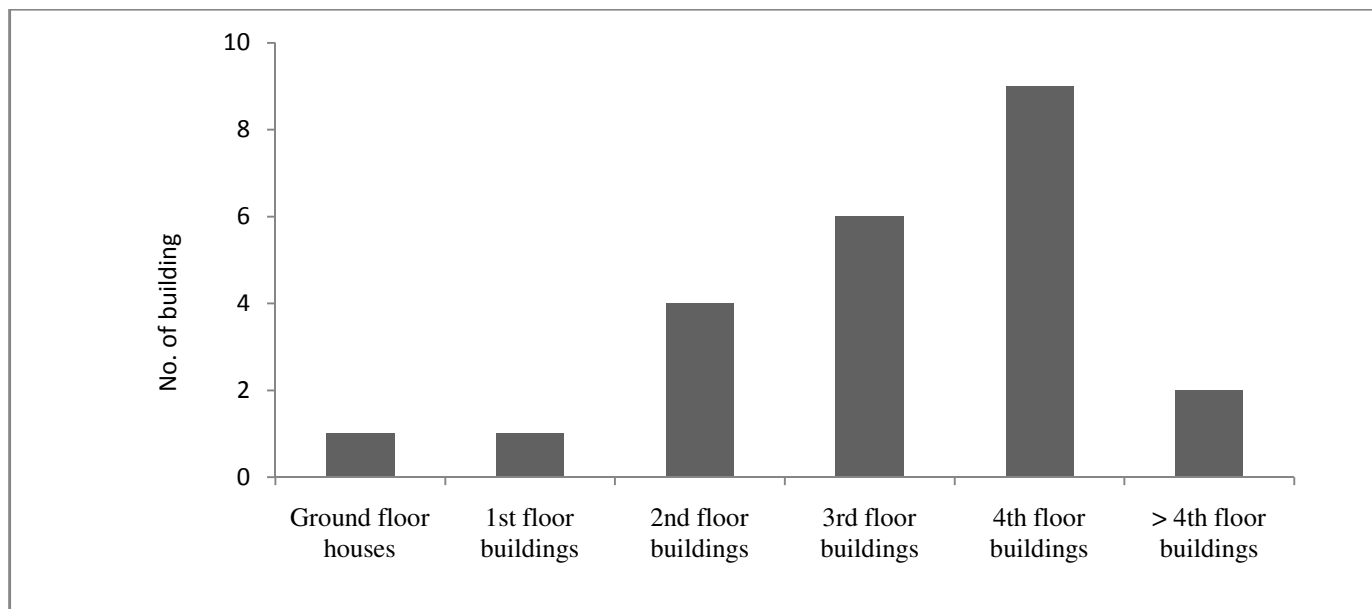
A good and well-developed urban region can be demarcated if it has a well-planned drainage system as it is also associated with health issues and to an extent security concerns. When we study the amenities offered in Kolkata metropolitancity, we observe that this urban region has quite an organised drainage system. However, in recent days, the city has seen a gradual change in this facility. Growth of urbanisation is generally followed by increase in population, and Kolkata is not an exception. According to our studies there is a change in the distribution of types of drains of the city that is 91% of the drains here are closed while the rest 9% are open drains. This shows that the sanitary system of Kolkata is of a good standard. But still, during monsoon season or after sudden rainfall, problems of water logging and stagnant water are experienced in some lower parts of the city. As we can see that the city has already reached its saturation level in terms of population growth and area of accommodation of this population, but the population is still increasing rapidly with every single day. The outer space is not much available any longer. Therefore, vertical growth is taking place at a greater extent. Earlier in the 20<sup>th</sup> century, even 3-4 storeyed buildings were rare in this city but at present those have extended to 5-6 storeyed. On the other hand very few are single or double storied (Figure-8).



**Figure-6**  
Land use and land cover map of Kolkata during last 23 years



**Figure-7**  
Buffer zones of the new building and new with old building scenario of the study area



**Figure-8**  
**Different floor scenario of new buildings**

**Conclusion**

Economic development and globalization are responsible factors for rapid change in urban morphology because in the recent times many residents choose the comfortable eco-friendly society. Peoples mainly chose upper floor house space from lower and land rent is the another factor for sky growth during last 15 years in Kolkata. Each decade sees and displays new changes in urban structure as well as urban culture. As recourses are scarce, people find ways to utilise them as much as possible to fulfil their needs and requirements. However this attitude is associated with several consequences, be it environmental or be it socio-economic. This work was on the vertical dimension of urbanisation. However this vertical growth has brought about constructional as well as sociological changes in a very short span of time. These changes has brought about changes in the way of living of people, the socio-economic structure of the society, the policies and decision making process of the administrative bodies, and has also made people more aware of their surroundings.

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