Study of Spatial Organization of Traditional Shop-Houses of Old Dhaka

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To my Parents,
Samarendu Shekhar Hazra
Maya Rani Hazra

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Abstract

The evolution of Old Dhaka and its transformation is closely embedded with its rich socio-cultural tradition that makes the city historically significant. Like many other Asian cities shop-houses emerged and evolved in the pre-urban core of Old Dhaka as a distinct building typology in its spatial arrangement. In fact from the pre-Mughal period, the shop-houses are retained in between the borders of *Dholai Khal* and the River *Buriganga,* settled in different *mahallas* by various craft based hereditary trader communities. Since its beginning, Dhaka city has flourished in many folds and transformed into one of the Mega City of the world through the interplay of politics and trade, but the Old Dhaka, particularly the earliest core retained its indigenous settlement pattern with its traditional house forms due to its nonpareil social structure, rich cultural heritage and unique architectural morphology of built environment. Here the traditional shop-houses, sometimes with trivial modification by adopting the socio-economic needs, are still vibrant and vigorous in their function and activity. The spatial pattern and 'live-work' environment of these shop-houses proposes that certain social and cultural facets are interwoven within a rich cultural whole in this unique type of dwellings.

The spatial organization of the traditional shop-houses and how it relates with its socio cultural background has been revealed in this study to understand the underlying principles that formulates such a sustainable morphology which demonstrate the celebration of life for such a long period of time before the complete advent of new form and formulation. Space syntax analysis has been applied on 15 (fifteen) traditional shop-houses in Shakhari Bazar, Tanti Bazar and Panni Tola locality. The study focused on the domestic activity patterns in relation to the spatial arrangement patterns in this unique houseform.

By analyzing plans in topological terms this research established the genotype of Old Dhaka traditional shop-houses. The results also confirm that although the forms as well as the elements of the traditional shop-houses have been settled by different trade groups in different locations and altered historically over time there is no significant difference in-between the spatial configuration and space use pattern within the configuration. The finding indicates that the underlying principles of social and cultural dimensions govern the pattern of spatial configuration of Old-Dhaka shop-houses. This specifies that the common domestic spaces of Old Dhaka shop-houses actually represent the social life and cultural identity of Old Dhaka society.

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Chapter 01 INTRODUCTION

1.1 Background

Over the time Dhaka grew from a small trading town and evolved in to a Mega City through the interplay of politics and trade (Hassan, 2008) which makes the city significant in historical context. Historically Old Dhaka was divided into a number of residential communities, known as "*mahallas*" where different economic functions or activities had been developed with its physical layout (Siddiqui, Qadir, Alamgir, & Huq, 1993). An important aspect of Old Dhaka's economic life was the handicraft industries organized on household basis. In Old Dhaka these specialized craft based hereditary trader groups settled in different *mahallas* and developed a living space (Mowla Q. A., 1997) where the production house i.e. factory and the domestic activities i.e. residence combined within a single form which is referred to shop-house (Chulasai, 1985). 'Shop-houses' hold the physical manifestation of these home based economic activities. Shop-houses have become one of the most common types of dwelling in the dense urban areas of many other Asian Cities too (Bejrananda, 1998). In fact the growth and development of shop-houses was evident in Dhaka from the very beginning of the city. Though there is no local term exists to express this particular building type in Bengali (Khan F. M., 2013), from the pre-Mughal period, the shop-houses and its settlement retained (Ahsan, 1991) and sometimes with trivial modification by adopting the socio-economic needs, these traditional shop-houses still demonstrated vibrant and vigorous functions and activities due to coherence of their social structure and cultural richness. The articulation of spaces in the shop-houses, the way they separated from each other and at the same time united as a unique whole appears different from traditional houseform of the locals. Shop-houses of Old Dhaka distinguished as a significant urban built form (Ali, Khan, Imam, Khan, & Ameen, 1993). The traditional form of the shop-houses in Old Dhaka and its 'live-work' environment proposes that certain social and cultural facets are interwoven within a rich cultural whole in this unique type of dwelling, which needs to reveal, to understand the underlying principles in global context and to comprehend the compact living solution in local.

1.2 Problem Statement

Historically, the development of shop-houses was limited to the confines of the River *Buriganga* and *Dholai Khal*, the earliest urban core constituted with areas namely Lakhshmibazar, Banglabazar, Shakhari Bazar, Tanti Bazar, Panni Tola and Goalnagar etc. Traditional shop-houses of diverse trade groups eventually flourished in other quarters of the city, which plays an important role in the growth of Old Dhaka. During Mughal and British periods populace related through occupation, religion, geographical origin and caste used to live in different localities in Old Dhaka (Siddiqui, Qadir, Alamgir, & Huq, 1993). Certainly the built environment of the glorious indigenous settlements at the early stage of city formation demonstrated the incomparable social structure of the unique trade caste and their rich cultural background. With the course of time through the historic evolution process although certain localities remained

unchanged and retained the original settlement with the earliest trade inhabitants e.g. *shakaries* in Shakhari Bazar, while few other localities observed a change in its original settlement due to the shrinkage and fall of the particular trade along with its houseform, i.e. shop-houses replaced with residences, but the name of the locality still bears the evidence of the original trade e.g. Tanti Bazar and Panni Tola locality. Soon new trade developed due to the locational importance and the residences again altered into shop-houses to accommodate the emerging new industry e.g. weavers or *tantis* replaced by goldsmiths or silversmiths in Tanti Bazar area. So among the traditional buildings those found specifically in Shakhari Bazar, Tanti Bazar and Panni Tola locality, beside the original shop-houses which incorporates shops and trade activity dedicatedly at the time of its erection, an altered typology was found which were built as residential purpose and then again modified into shop-houses. Historically evolved traditional shop-house and its spatial arrangement have endured through time containing the strata of culture, traditions and politics of the region in every layer of bricks in each fold of spaces. The layering of spaces in the shop-houses, the way they separated from each other and at the same time united as a unique whole appears unique in this region. Social and cultural aspects of built form are encountered through the pattern of interaction of people within spaces i.e. social relation expresses itself through the arrangement of architectural spaces.

Meanwhile Dhaka city flourished in many folds and transformed into one of the Mega City of the world, but the Old Dhaka, particularly the earliest core retained its indigenous settlement pattern with its traditional houseforms due to its nonpareil social structure, rich cultural heritage and unique architectural morphology of built environment from its earliest settlement till now. But recently to meet the ongoing commercial demand a good number of plots in the study area have transformed into mixed use developments. The high concentrations of shops and commercial activities are thus evident in the present context of Old Dhaka which are often altering the traditional *mahalla* environment. Therefore, it is apparent that the mixed use development has influences the overall growth in areas where shop-houses were already evident. Along with the change in land use, the other functional aspects like the distribution of functions within built form and pattern of ownership of traditional shop-houses have also changed in local areas (Khan F. M., 2013).

Therefore, it is essential to explore the spatial arrangements of space organization of the traditional shop-houses, how it relates with its socio cultural context; to document the underlying principles that formulates such a sustainable morphology which demonstrate the celebration of life for such a long period of time and to understand the manifestation of intangible heritage with the relief of the existing tangible part before the complete advent of new form and formulation.

1.3 Research Questions

Considering the above issues, two governing research questions of the thesis are:

- What are the underlying principles that formulate the spatial organizational patterns of traditional shop-houses of Old Dhaka?

- What are the similarities or differences in-between the organizational patterns of traditional shop-houses among various trade groups in different localities and among traditionally varied original and altered typologies?

In order to test these two questions and to verify the existence of underlying principles of spatial organizations, syntactic values derived from space syntax model has been calculated.

According to the **space syntax** theory, spatial configuration reflects the existence of "social knowledge" (Hillier B. , 1997) and this kind of abstract knowledge can be determined by the way a culture organizes domestic space through the configuration of that space. The study investigates and elaborates upon the underlying spatial patterns of shop-houses by using space syntax. Thus, one of the main concerns of this research is to investigate the genotypes of shop-houses in terms of social and cultural consensus.

The focal point of the study is to understand the relationship between socio-cultural aspects and spatial configurations of the shop-houses of Old Dhaka. One of the unique characteristics of the selected areas is the presence of shop-houses that have evolved from indigenous culture. The whole study deals with two major aspects, spatial configuration and the uses of space. The former is defined as the relation among spaces in which all other spaces are taken into account. The later one deals with activities that take place in any given space.

The whole study consists of two primary analyses. The first involves the examination of 15 shop-houses to institute a basic formal summary of syntactic data and establishment of shop-house **genotype**. The procedure deals with integration order of spaces and space analysis in each house. The second analysis involves identifying differences among shop-houses with regard to their trades and typologies.

1.4 Objectives of the Research

(a) Objectives with specific aims:

The aim of this research is to reveal the underlying principles of spatial arrangement of shop-houses in Old Dhaka from a socio-cultural perspective.

The objective of this research is

- To reveal the spatial layout of traditional shop-houses in the context of Old Dhaka.
- To determine the morphological 'genotypes' of traditional shop-houses by analyzing the activity patterns and movement in relation to spatial arrangement patterns.

(b) Possible Outcome:

The outcome of this fundamental research which ultimately reveals the underlying principles that govern the spatial organization of shop-houses of Old Dhaka might help to enhance the knowledge base in the understanding of this basic and significant urban houseform in its local socio-cultural context.

1.5 Research Rationale

Particular research interest in shop-houses is relatively recent among the architectural community. The UNESCO conference held in 2007 marked a seminal moment in this regard and after one year later, Melaka and George Town, two historic cities enriched with shop-houses of five hundred years history, was listed as a World Heritage Site (Ahmad & al., 2008). From the micro scale detailing to the macro scale patterns of movement, traditional shop-houses in the modern city provide a perfect case study for 'contradiction adapted' and 'contradiction juxtaposed', as per the dichotomy presented by Robert Venturi (Venturi, 1966). Study of architecture like the shop-house is increasingly relevant to contemporary urban life, as many cities combat an unprecedented lack of affordability and a growing gap between live and work space.

Like many other Asian cities, Old Dhaka exhibits the presence of shop-house from the earliest period of its settlements till now. The shop-house is a particular instance of the age-old, universal mixed-use typology, with roots in the age of New Imperialism. The shop-house distinguished as a unique building type featured with narrow fronts, elongated rears and adaptation to the local climate through features like internal courtyards. This hybrid building combined commercial with residential uses, private ownership with public corridor, and colonial ornamentation with local form. Historically shop-houses dominated the city centers of the region, weaving a vibrant urban fabric.

Meanwhile the new wave of globalization surge a dramatic change to South Asian cities during the last few decades. With the acceleration of urbanization around the world, which indeed an effect of so called globalization, the physical changes of traditional cities also accelerated not only to accommodate the incoming population but also to meet the growing commercial demand (Mahmud, 2007). As a result, cities today are battling a crisis of livability. In the face of global commerce, development is in danger of losing regional specificity, history, and traditional value. Particularly in developing countries, large patches of significant human-scale vernacular

forms are being razed and removed at alarming rates. The shop-houses of Southeast Asia exemplify this trend. Such change is also evident in Old Dhaka due to the insertion of the commercial functions in the local fabrics. Therefore, the traditional settlement pattern with shop-houses that sustained well in different localities of Old Dhaka for about 400 years since pre-Mughal period till to date, is now experiencing a change in local urban fabric due to the increased growth of commercial demands.

Basically, the purpose of the study is to examine the structure of spatial organization of shop-houses that have resided from more than centuries of social and cultural integration. Knowledge about the organization of space in shop-houses in the context of Old Dhaka is merely addressed in academic research. Though few studies on shop-house have been conducted emphasizing on historical conservation, or development of shop-houses considering the socio-economic influences in macro level, there is still the need for micro level study to find out the genotype of Old Dhaka shop-house by understanding the relationship between domestic activities and spatial arrangements in this unique houseform. The thesis focus on the role of the built environment in understanding the relationship between space, social life and culture and demonstrate the relationship between space and social life that is the integral part of the social and cultural aspects of domestic architecture.

This study shall be a useful documentation for the academicians in this field. Moreover, the study may help the respective professionals to formulate effective policies and design guidelines regarding the future development in local areas of Old Dhaka with an aim to revive the livability and balance of tradition, by protecting, promoting and conserving generic components and elements of the traditional spatial organization and urban pattern.

1.6 Scope and Limitations

The extent of the study was limited to the earliest urban core of Old Dhaka which covers Shakhari Bazar, Tanti Bazar and Panni Tola locality where still a significant number of traditional shop-houses exists.

The scope of the study has been inhibited to some extent due to several limitations. Firstly, it is often difficult to collect the information regarding the earlier history, the building floor plans or even the current status of shop-houses during the field survey in the study area. As the majority of people of the study area belong to minority group and a good number of plots of the area are *Devottor* and enemy property, so local people often feel insecure and do not co-operate to provide the correct information. Besides, the local residents often do not allow studying the building floor plans and organization of spaces due to the privacy issues. After 2009 (Bangladesh Gadget, 2009) this condition becomes more sensitive when the location declared as a Heritage Site for preservation without the concern or consent of the locals or owners. This

action could mean that they would no longer legally own their ancestral properties and, as a result, would not be able to modify or tear down the decaying heritage structures in order to construct new buildings. This caused the local owners to protest against the decision and force the Government to withdraw it by 2017 (Bangladesh Gadget, 2017). Their anger still persists and the locals fell embarrassed and reluctant on any survey on the locality.

Secondly, detail floor plans of original shop-houses are required to study the spatial arrangements. But as there is no documentation on this regard except few isolated case studies in some secondary sources, by observing the building style, construction technique and materials along with the feedback from the inhabitants were the only way to reproduce the original floor plans of traditionally built shop-houses. Lastly, due to the time constraints, limited numbers of shop-houses (15) in limited areas (3) have been selected to conduct the study.

1.7 Outline of Methodology

The research has used the multi-method research methodology which has basically covered two research strategies, one is Interpretive-Historical and the other is Qualitative (Groat & Wang, 2002).

The research has followed the following steps which summarized in Table 1.1:

1.7.1 Literature review

Available relevant literature based on published articles, books, web sites and other recorded documents has been reviewed to learn the historical background and social structure of Old Dhaka and to understand the notion of shop-houses, its plan morphology and development in Southeast Asian cities. Specific literature on culture-society-houseform and spatial analysis based on the theories of space syntax has also been covered.

1.7.2 Field survey and documentation

Reconnaissance survey

To find out the present status of the functional and physical aspects of Shakhari Bazar, Tanti Bazar and Panni Tola, a reconnaissance survey has been undertaken to reveal the morphological change of the shop-houses and their evolution in the study area. An observation sheet (Appendix C) has been used for all the plots of the study area to record the general information considering the functional and physical aspects.

Table 1.1: Steps of the study

	Strategies	Tactics/Data Sources	Goal
Phase-I	Research Question Formation		Problem identification; Development of objectives.
Phase-II	Interpretive-Historical Study	Literature Review: Historical analysis from secondary sources.	Review Old-Dhaka context; Understand the notion of shop-houses and morphological aspects of South Asian and Old Dhaka shop-houses; Review space-society relationship and the urban houseform of Dhaka; Understand space syntax methodology.
		Archival documentation in city records; Verbal/visual analysis through reconnaissance survey.	Reconcile the morphology of the study area and buildings in present context.
		Physical Survey.	Documentation of floor plans.
		Questionnaire survey and on-site observation.	Understand the domestic activity pattern.
Phase-III	Qualitative Study	In-depth, open ended interviews with original residents;	Preparation of drawings and details of physical properties of each shop-house at its traditional stage.
		Analysis of representative house plans through Space syntax.	Find out the syntactic properties of shop-houses.
Phase-IV	Analysis	Distribution of RRA values; Analysis of Base Difference Factors and patterns of Justified Access Graph.	Establishing the genotype of Old Dhaka shop-houses.
		Analysis of variance on RRA values, Mean Depth, Connectivity and Control Values.	Determining the effect of various trade groups and traditionally varied typologies.
Phase-V	Findings and Conclusion		Conclusion and Recommendation

Physical survey

Various types of household data and physical design feature of shop-house have been collected during field survey. The physical features of shop house acquired from onsite measurement used for preparing detail drawings of the architectural floor plans in relation to space activity pattern. Through discussion with the household members and keen observation of construction technique and building materials, the original traditional layouts of the shop-houses were drawn for the study purpose. Available secondary sources in this regard also used in cross checking the findings. The location of both architectural features and temporary partitions created by furniture arrangement in each space, including traditional artifacts, which might hold clues as to where domestic activities were taking place, has been recorded.

Questionnaire survey and on-site observation

Socio-demographic data e.g. household information including the use of domestic spaces and building backgrounds has been collected from targeted focus group interview with unstructured questionnaire Survey (Appendix D). Discussion with household members and senior local residents has also been conducted regarding the history and development of particular shop-houses and of the locality. The domestic and trade related activity has also been observed to understand the present life style of the occupants in order to relate it with the historical time.

1.7.3 Analysis

The space syntax model has been applied as an effective tool to study social relations. This approach makes the study of intellectual disciplines such as culture and social contents of built form possible in a quantitative format by directly specifying the mutual relationships between spatial configuration, socio-cultural aspects, and human relations. (Bejrananda, 1998) It is also able to demonstrate how these relations have taken place, and how the internal spaces of shop-houses are regulated.

To find out the basic organizational pattern of spaces in layout plans from the view point of architectural morphology, space syntax theory and method has been applied for analysis of shop-house floor plans (Hillier & Hanson, 1984). The depth structures of spaces in these houses had tested with ‘Justified Graphs Analysis’ or ‘Jass’, a software for convex space analysis which is written under a GNU public license (Koch, 2004).

1.8 Structure of the Thesis

This thesis has been compiled in five chapters to achieve the answer to the research questions and objectives with an exploration of the spatial organization of traditional shop-houses of Old Dhaka.

The Chapter One gives a background of the thesis and formulates the research problems, objectives, rationale, scope and methodology to study the space configuration of traditional shop-houses.

The Chapter Two reviews the relevant literatures on the historical background of study area, notion of shop-houses, their functional and physical aspects with an objective to understand the morphology and development of shop-houses in Southeast Asian cities. Moreover, this chapter also focuses the evolution of Old Dhaka shop-houses in the study area and indicators of morphological characteristic at the level of traditional city and buildings. Then society, space and houseform are analyzed from theoretical perspective and try to understand their interrelation. Finally, the chapter explains the research outline in detail to do the spatial analysis of the traditional shop-houses of Old Dhaka and to analyze the domestic space organization through the activity pattern of regular functions.

The Chapter Three discusses the socio cultural and economic status of the study area on the basis of reconnaissance survey and elaborate description of the 15 (fifteen) traditional shop-houses of Shakhari Bazar, Tanti Bazar and Panni Tola that taken as case studies for the thesis. Formulation of the basis for the analysis also explains in this chapter.

The Chapter Four explores the spatial logic of the space organization of shop-houses of study areas of Old Dhaka where 'Space syntax' has been used as the tool for the spatial analysis.

The Chapter Five is the concluding chapter, discusses the important findings of the study and draws the conclusion by summarizing all the data regarding the spatial organization of shop-houses.

Chapter 02 LITERATURE REVIEW

2.1 Introduction

This chapter incorporates the review of relevant literature that discusses the background information and theoretical issues regarding the study of the traditional shop-houses of Old Dhaka in relation to their spatial organization. For the convenience of the discussion, this chapter has been structured into five parts.

As the thesis emphasize the study of the traditional shop-houses of Old Dhaka, the first part of this chapter tries to understand the context, to cognize the historical, social, political and economic background of the study area, its settlement pattern and morphological evolution.

The second part of the chapter discusses the notion of shop-houses, its development in Southeast Asian cities and describes their functional and physical features to reveal the general idea of shop-house. This part also focuses on the evolution of shop-house in Old Dhaka with general discussion on this traditional houseform.

The part three demonstrates society space relationship from literature focusing the spatial and social dimension and identifies the activity pattern of urban houses.

This chapter also intends to understand the urban houseform of Dhaka and its evolution in part four through review of relevant literatures and discusses on types and typologies of houseform of Dhaka in order to categorize Old-Dhaka shop-houses.

Finally, the chapter explains the space syntax methodology in detail and the process of analyzing the domestic space organization in its last part. Here examples of domestic space analysis with the use space syntax are elaborated.

2.2 The Old Dhaka Context

Dhaka is signified as a city with a history of over four hundred years. In fact Dhaka was the centre of political, cultural and social life; promoted by the Mughals (Dani, 1962). From the very beginning, the historic old part of this city has been famous for its spontaneous spatial structure and lively urban spaces. In its evolution, the urban fabric of Dhaka city as well as the indigenous geomorphic pattern of the old city with its heterogeneous character and subculture has gone through rapid alteration along with the economic and political changes (Ahsan, 1991). However, in comparison to the entire Dhaka city, this changing morphology influences a little in the physical pattern of Old Dhaka, particularly the earliest urban core, and its spatial structure remains almost homogenous over centuries. The natural endowment of its organic morphology retains the traditional features, which it has inherited from the past and is valued for its 'indigenous' urban pattern (Nilufar, 1997).

2.2.1 Historical background

Dhaka, the capital city of Bangladesh, has grown from a small Hindu trading centre to a metropolis. Its antiquity can be traced back to 7th century CE; however, according to historians, Dhaka was a defense outpost for *Sena* Dynasty (9th and 10th century CE) capital Vikrampur. Sometimes during the 14th century CE Dhaka in the present location possibly grew as a centre for artisans and craftsmen, being near the capital of Sonargaon, of which Dhaka was a commercial satellite (Mowla Q. A., 1997). Legend attached near the confluence of *Meghna*, *Dhaleswari* and *Sitalakhya* Rivers there were fifty-two marketing towns called fifty two bazaars with fifty three gullies (lanes). Sonargaon, Bangalla and Vikrampur were the important one (Brit, 1914). Banglabazar of the pre-Mughal Dhaka is perhaps the Bangalla of legend. Dhaka rose to prominence only after it became the capital of Bengal during the Mughal rule under the Muslims in 1608 CE. For a long period of its growth, Dhaka was confined within the medieval Mughal core (Fig. 2.1).

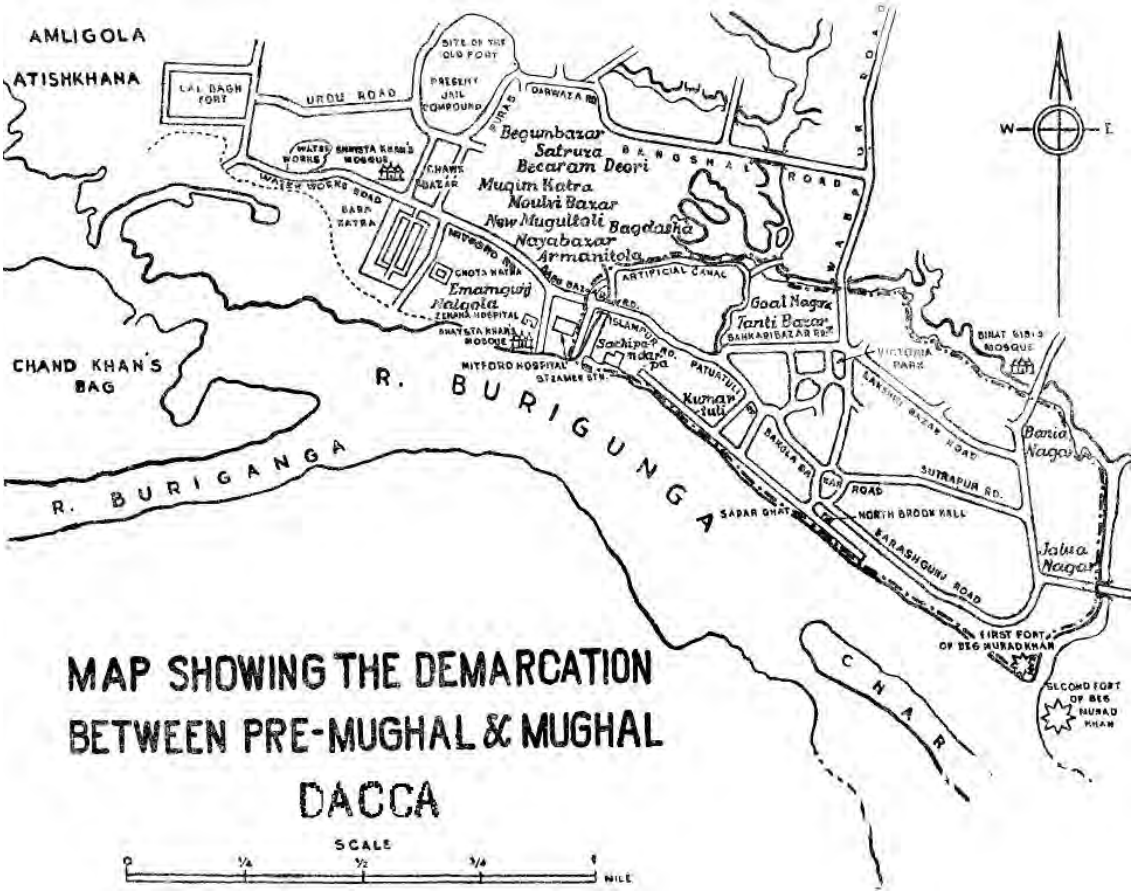


Figure 2.1 Map showing the demarcation between Pre-Mughal and Mughal Dhaka

Source: Ahmad Hasan Dani, 1962

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 different phases of development. Now Old and New Dhaka exist side by side, one

in the historic core with densely developed indigenous settlements and the other in the spontaneous settlements of recent years – the former is commonly called the 'indigenous' and the latter is labeled as 'informal' development (Siddique, 1991, p. 10). 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, pp. 20-21).

The present research has mainly concentrated on the architectural morphology of traditional shop-houses of Old Dhaka; as the morphology is not only related with the historical evolution but also with the societal aspects, next part is going to elaborate the socio-cultural background of Old Dhaka.

2.2.2 Socio-cultural background

Although now Dhaka is a Muslim dominant town, Hindus were the majority until the British period (Begum, 1991, pp. 120-126). As it mention earlier, Dhaka was developed as a small Hindu trading centre, but after the partition in 1947 the majority of Hindu migrated. Shakhari Bazar, Tanti Bazar and Panni Tola represent this pre urban Hindu core where majority people were Hindu throughout its history. Even at present Hindus are mostly concentrated particularly within this territory. This homogeneous and specific ethnic background strongly influence to develop religious and other cultural activity like *Puja, Parbon* and other rituals (Ferdous, 2007). These areas are also very famous for the life style of Hindu dominant hereditary craftsmen. The traditional trading, behavior and other cultural and religious activities of these organic spines reflect the ethnic background of this specific community.

The fundamental characteristics of the indigenous pattern are winding, intricate streets, where walls defining the boundary (Khan I. M., 1982). Historically a group of these boundaries forms the traditional neighborhoods. Neighborhood is primarily a social phenomenon arising from cohabitation in a physical area, locally known as '*mahalla*' or '*tola*' (Nilufer, 2004). In the old part of Dhaka, the *mahallas* were created with a few houses, mostly arranged along the access road, sometimes along the urban space of Bazar Street. In Shakhari Bazar, Tanti bazar and Panni Tola the Hindu craftsmen and weavers developed such local *mahallas*. The religion and socio-economic status had a deep impact on its physical character. The urban fabric of the *mahalla* has a strong spatial quality of indigenous character. It is observed from physical evidences that the settlement developed through a hierarchy of spaces and hierarchy of social relationship, which was manifested by a particular type of spaces. Here the urban fabric developed as a sequence of *Uthan*, Gully, *Mahalla*, *Morh*, *Chawk* and Bazar where common party walls, introverted shop-houses, narrow and intimate roads etc. are some of the unique elements of this unique urban fabric.

2.2.3 Political background

Over the time Dhaka ruled under the ruler-ship of various nations. After the Buddhist Kingdom of Kamrup (7th and 8th centuries CE) Dhaka was governed by the *Sena* Dynasty of Vikrampur in 9th and 10th century CE. The invasion by Bakhtiyar Khalji in late 12th century CE initiates the Muslim ruling in Bengal. Dhaka was successively ruled by the Turkish and Afghan governors descending from Delhi Sultanate (1299 to 1608 CE) before the arrival of the Mughals (Khan & Islam, 1964). The town consisted of few important market centres like Lakshmi Bazar, Bangla Bazar, Bania Nagar, Shakhari Bazar, Tanti Bazar and few localities of other artisan (Khan & Islam, 1964). Dhaka was confined between the *Dulai Khal* and the *Buriganga* River from its inception until it became the capital of Bengal during the Mughal rule in 1608 CE. Soon from a suburban town Dhaka became a metropolis.

In 1707, Mughal period fall after the death of Mughal emperor Aurangazib and Dhaka had experienced sixty years period of political instability. In 1715-16, Dhaka lost its status as a provincial capital when it was shifted to Murshidabad (Siddiqui, 2010, p. 2). During this period, 'East India Company' gained political domination and took over the control of Dhaka city in 1764 (Khan & Atiquallah, 1965) before the direct control of British Raj in 1858. From 1700 to 1859, within 150 years the population and the area of Dhaka city was decreased 94% and 97% correspondingly (D'Oyly, 1814). In 1824, English Bishop Haber visited Dhaka and described the ruined, devastated and desolation state of Old Dhaka in that period (Heber, 1830). The trade and commerce reduced tremendously whereas the mosques, palaces, fortress and churches all were ruined. In 1853 Trevelyan testified “Dacca, the Manchester of India, has fallen from a very flourishing town to a very poor and small town” (Trevelyan, 1853). The jungles of the Rennell’s map, prepared in 1859 are the most accurate depiction of this age, which is the first detailed cartographic document available to investigate Dhaka's past, indicate a decline in the population and a subsequent contraction in the urban area, which seems to have been due to the political and commercial depressions.

Consequently two hundred years of British rule ended after the partition in 1947, Dhaka became the legislative capital of Pakistan and after the independence of Bangladesh in 1971, Dhaka continued as the capital of new state. Although the new Dhaka had a phenomenal growth, the spatial structure of Old Dhaka remains static and exhibits consistency within the total structure. However, as the present thesis mainly concentrated on Old Dhaka, it is generally observed that throughout the history the Bazar Street remained as the most integrated part for the old city over four hundred years.

2.2.4 Socio-economic background

Bangladesh is a true riverine country, where most of its land is formed from silt deposits from the Bay of Bengal (Hofer, 2006). The Ganges and Brahmaputra River crisscrossing the topography of this region with the network of many branches, giving Dhaka the advantage of possessing one of the most advanced cross-country communication systems (Fig. 2.2). It connected with various other rivers, such as Buriganga and Meghna, as well as many minor rivers and rivulets, making it a suitable junction for various water transportations and trade. In 1765, James Rennell observed, 'The Kingdom of Bengal, particularly the Eastern part, is naturally the most convenient for trade within itself of any country in the world' (Ahmed S. U., 1986, p. 10). This strategic geographical location convinced Islan Khan, the Mughal Subahdar of Bengal, to shift his capital from Rajmahal to Dhaka which he renamed as Jahangirnagar after the Mughal Emperor Jahangir.

Since the Mughal reign Dhaka has been both a centre of trade and commerce (Ahmed S. U., 1986, p. 90). Meanwhile Dhaka grew beyond the limit of the *Dulai Khal* towards north and west during Mughal period. Different types of specialized industries of crafts are flourished in different localities (Khan & Islam, 1964). In addition, the older part of the city also gained in importance by the establishment of European factories in the vicinity of Babu Bazar and Bangla Bazar (Ahsan, 1991, p. 398).

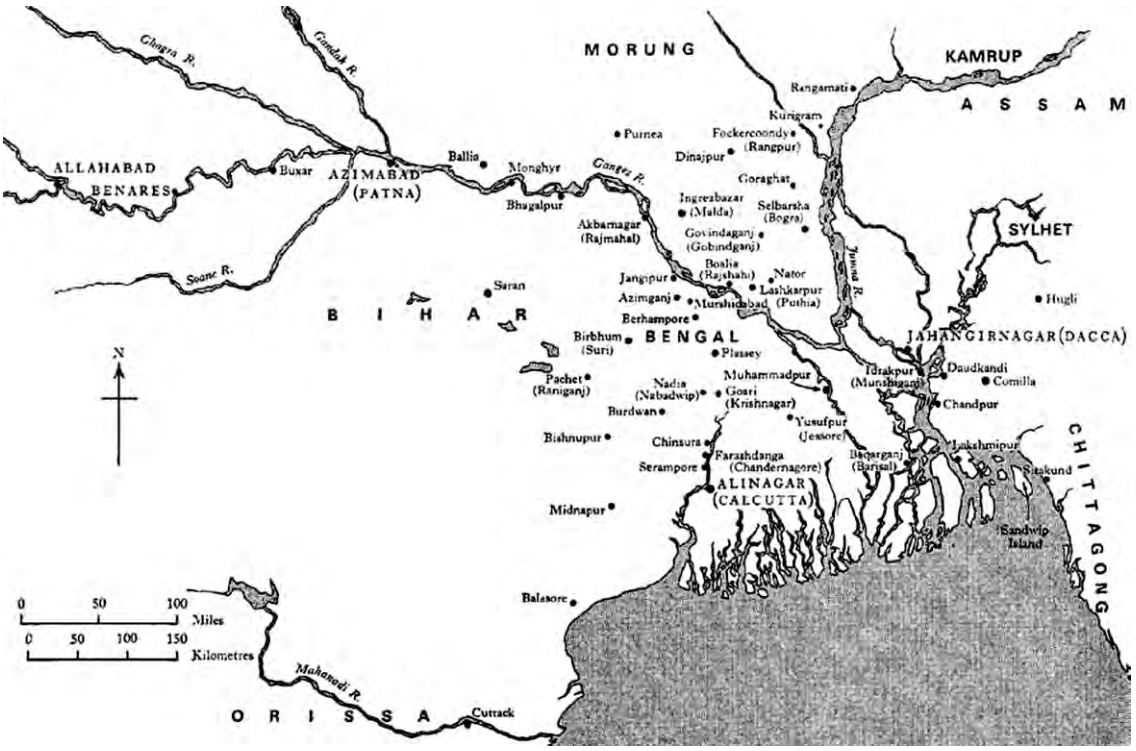


Figure 2.2 Map of combined India showing the water routes with Dhaka in the central water path system between the East and the West

Source: Spruner, Karl von, Spruner-Menke Atlas Antiquus, (Gotha: Justus Perthes), 1865

In the early 1700s, Dhaka reached its peak, and was recognized as the queen of cities in India by various foreign travellers and scholars. Shakhari Bazar, Tanti Bazar, Islampur Road and several such streets of Dhaka had transformed into a dense urban scape for various craftsmen, merchants and government authorities. This dense population gave rise to multi-storied storefronts and private houses being built out of entirely clay and limestone bricks (Husain, 2007, p. 442). The buildings ranged from one storey to four storeys high, depending on the number of occupants, the storefront and the storage requirements of the craft or trade (Asher, 1992, p. 42). Most of the buildings acted as a multi-use structure for both professional and domestic use, and most of the ground floor was dedicated to various crafts stores, trading areas or other commercial storefronts (Fig. 2.3 and Fig. 2.4).

Figure 2.3 Photograph from 1860 of shakharis, members of the Hindu Sudra caste of shell-cutters, on Shakhari Bazar

Source:
http://www.bl.uk/onlinegallery/onlineex/apac/

Figure 2.4 Two weavers at work at a loom in an open-sided mud-walled house taken in the early 1860s

Source:
http://www.bl.uk/onlinegallery/onlineex/apac/

With the introduction of European trading companies, Dhaka reached a new dimension in export and trading and the inhabitants continued to enjoy great luxuries. This prosperous time ended in 1765 (Karim A. K., 1980, p. 22) when The East India Company took over the civil administration and imposed excessive custom and town duties which led to the departure of many foreign and local merchants from the city (Ahmed S. U., 1986, p. 90). Therefore, Bengal society fell into a state of decay; both physically and economically (Smita, 2015). By 1828, the local artisans also had to fight against the large influx of British machine-made cotton goods, brought about by the Industrial Revolution in England (Ahmed S. U., 1986, p. 95).

In the mid-19th century, Dhaka started to emerge from the shadows of its post-Mughal decline to become the second city of Bengal under the British Empire when the British realized the importance of Bengal in the economic life of India. Though the city limits did not alter much, the internal urban structure underwent vast changes. Medieval Dhaka was finally in the process of transforming into a modern city with paved roads, open parks and spaces, street lights, and

piped water-supply. This expansion of Dhaka invited more migrants, including the craftsmen, traders and manufacturers, from various parts of India and neighbouring countries to make Dhaka their home (Karim A. K., 1980, p. 87). The city dwellers flourished and their lavish lifestyle reflected on their homes. Multi-storied buildings replaced some of the one-storey structures, using modern methods of construction. This new wealth also gave them the freedom to replicate architectural elements of luxurious bungalows and palaces. In general, ornamentation of facades was copied from historic and grand structures of the region (Husain, 2007, p. 341).

So, in the process of economic progress Dhaka transformed into a modern, forward-thinking metropolis where new forms of trade, commerce and manufacturers had laid the foundations for renewed economic life (Siddiqui, 2010, p. 6).

2.3 Notion of Shop-houses

2.3.1 Shop-house: a world view

The shop-house is an archetypal urban vernacular houseform which is a significant houseform in Southeast Asia. It derives from traditional Asian house architecture, yet displays strong European colonial influences in its appearance. This mixed use building form characterizes the historical centres of most towns and cities in the region (Chua & Edwards, 1992). Historically, shop-houses built on elongated plot with narrow street frontage. This type of 'burgage plots' were common in many trading towns ensuring a commercial interface to a large number of traders within a limited area. In the shop-houses, shops are placed along the street (Ismail & Shamsuddin, 2005, p. 3) to take the advantage of the street front for business purposes. Shop-houses are generally found grouped together in long terraces, separated from each other by masonry walls. Facade ornamentation is varied and draws inspiration from both the eastern and western traditions.

Wakita and Shiraishi have defined shop-houses as the buildings that have shops, workshops or other trading accommodation on the ground floor and living quarters on the upper floors (Wakita & Shiraishi, 2010). The shop-house was developed in Southeast Asian countries like China, Malaysia, Thailand, Singapore, Cambodia, Vietnam, Indonesia etc. (Fig. 2.5-2.7) by the early 19th century (Ismail & Shamsuddin, 2005, p. 3). The shop-houses of traditional morphology were developed to provide an opportunity to live, work and recreation in the same place, thus offers a good solution during the periods of urban transportation and economic crisis (Chulasai, 1985, p. 30).

Shop-houses are also found in other regions of the world including Europe, North and South America and Caribbean Islands (Lennard & Lennard, 2004).

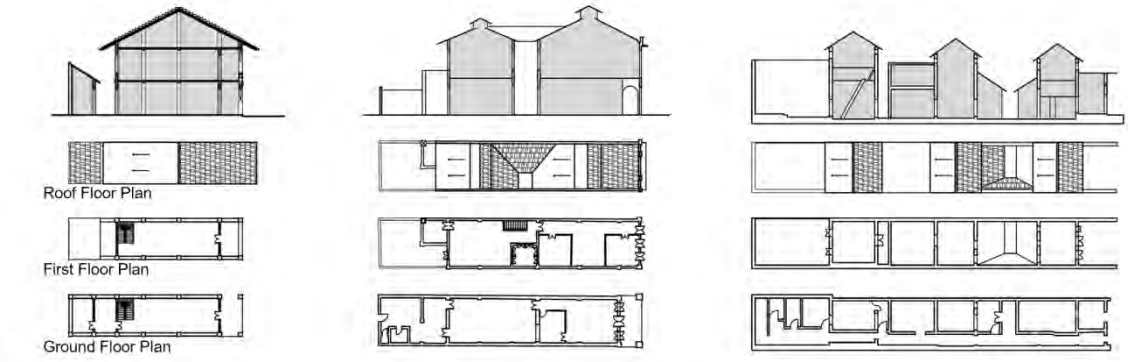


Figure 2.5 Different configuration of shop-houses. (A) Cambodia, (B) Malaysia, (C) Vietnam

Source: Sokly Yam and Seo Ryeung Ju, 2016

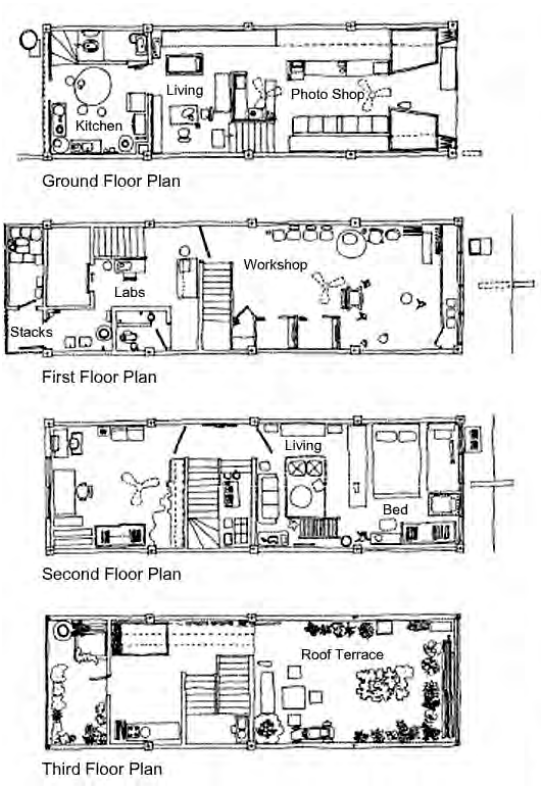


Figure 2.6 A typical shop-house in a Chinese neighborhood in Bangkok

Source: Chulasai, 1985, p. 25

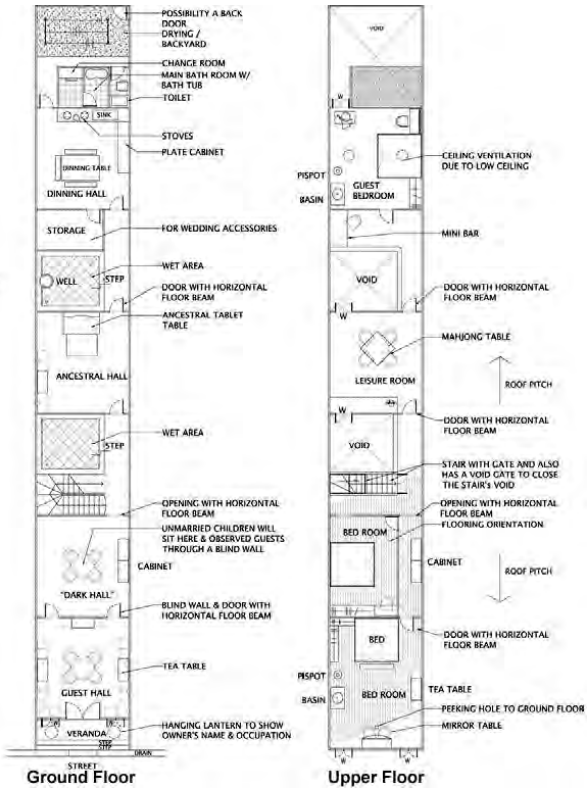


Figure 2.7 Peranakan shop-house in Malacca, Malaysia

Source: Khan, 2013, p. 18

2.3.2 Shop-houses in the context of Southeast Asian cities

Shop-houses are one of the most popular building types of Southeast Asia. The discussion of shop-houses in this part concentrates on the Southeast Asian cities.

The position of the shop and residential space depend on the number of floors of the shop-houses. In case of a single storey shop-house, residential spaces are located beyond the shop; while in case of multistoried shop-houses; residential spaces are typically located above the shops (IAT Editorial, 2007, p. 3). Usually the building is not free standing; rather, it is connected to other shop-houses on both of its sides, which create a shop-house block along the street. A shop-house often contains a shop with separate or detached residential spaces. The structure along the street contains a semi-public function usually a shop (IAT Editorial, 2007, p. 3). The ground floor of the shop-houses is generally used for commercial purposes such as light industry or warehouses, for unloading various goods, sundry shops etc (Panin & Jiratasnakukl, 2002, p. 28). Examples of different types of shops of shop-houses are jewellery, spices, religious paraphernalia, clothing apparel, personal items, medicinal herbs, hardware shops, tailors, goldsmiths, watch smiths, bakeries, barbers, butchers etc (Mui, Badarulzaman, & Ahmad, 2003, p. 2). The shops may be retail or wholesale in nature (Lee, 1996, p. 399).

On the other hand, the residential spaces at the upper floors are meant to accommodate one or more families, or serve as a dormitory for single workers (IAT Editorial, 2007, p. 3). Popular belief holds that shop-houses of the Southeast Asian cities were initially occupied by single families, with their private living areas in one space and the more public family business in another space (IAT Editorial, 2007, p. 3). Eventually, as mentioned by Phuong and Groves, it was very common in Thailand and Vietnam in the late 19th century for several families to jointly own and occupy single shop-house (Phuong & Groves, 2006, p. 125).

Moreover, from the beginning of shop-house development, owner of the building himself was the owner of the shop as well. Eventually to cover the expense of the construction, the shop-houses were rented to the public with revenues shared between the government and landowners in many Southeast Asian cities (Chulasai, 1985, p. 25). In many cases, shops are also run by new entrepreneurs living elsewhere (Up, 1994, p. 11). Not only the shops but different units of residences are also being rented. In China and Malaysia many rooms of the shop-houses were rented to other families for extra income generation (Up, 1994, p. 8). However, it is also possible that the residential and commercial spaces were used by unrelated persons or groups, who may be tenants or resident owners (IAT Editorial, 2007, p. 3). It is also observed in Bangkok that the owner rented the upper floors or all of the floors and lived elsewhere (Olson, 2011, p. 2).

The morphology of traditional shop-houses has been changing for last few decades because of the social and economic development of Southeast Asian cities (Chulasai, 1985, p. 25). Traditional shop-houses are low rise, single or two storied buildings. During the late 19th century, landowners started to build taller shop-houses to meet the increased need in housing due to the increase in population density in Southeast Asian cities (Zubir & Sulaiman, 2004, p. 14). Along with the changes in the building level, different variants of shop-houses have also emerged during early 20th century. For example 'chophouse' is a variant of shop-house which holds a large density of residents in the building. However, the design of chophouse is similar to the shop-houses (IAT Editorial, 2007, p. 7). Moreover, the term 'shopoffice' is used to refer to a variant of shop-house but it is occupied in full for commercial use on both the ground floor and floors above. A shopoffice may also adopt dual commercial-residential use (IAT Editorial, 2007, p. 7). Transformation of shop-houses in different periods took place due to the changing needs of people and aspirations, some with priorities. Family requirements, tenure type and security also vary over the time accordingly (Mai & Rahman, 2010, p. 2).

2.3.3 Organization of spaces in Southeast Asian shop-houses

Shop-houses generally have oblong and linear plots with narrow street frontages, but may extend backwards to long depths, in some cases extending all the way to the rear street. The reason for the narrow width of the buildings is also related to taxes, i.e. the idea that buildings were historically taxed according to street frontage rather than the total area of the plot, thereby creating an economic motivation to build narrow and deeply (IAT Editorial, 2007, p. 4). Based on the organization of spaces, traditional Southeast Asian shop-houses can be classified into two types. They are shop-house with courtyards and shop-house without courtyard.

In case of shop-houses with single or multiple courtyards, the commercial spaces i.e. the shops with workshops are located at the front portion of the building along the street. Generally the semi-private spaces are arranged in the next stage and sequentially the private residential spaces and services are located at the last stage. Most of the male dominated professional activities are performed around the first courtyard like manufacturing, sorting and storing of products. The other courtyards or backyards at the rear are used for female dominated household activities (Imamuddin, Hasan, & Alam, 1989, p. 47). In case of bigger shop-houses, courtyards are surrounded by the porches and balconies which separate the private family quarters from the front public area (Ismail, 2005, p. 24). Entry to the inner part of the building is usually kept through the shops or a corridor placed at one side or middle of the plot. The courtyards of the traditional shop-houses are generally designed to provide daylight in the internal spaces of the narrow and deep plan of the shop-houses. It also provides natural ventilation and sometimes gives shade depending on the orientation of the sun (Ahmad & Rasdi, 2000, p. 26).

On the contrary, in case of shop-houses having no courtyard, the arrangement and sequence of spaces are more or less similar to the shop-houses with courtyards. In shop-houses without courtyards, the shops are located near the street, in the next stage placed the semi-private spaces, private living spaces and services are generally located at the rear of the plot. Each room is arranged within two parallel party walls. In some cases, in order to provide light in every space, narrow light and air wells are located in different spaces of the building. In this type, entry to the inner part of the building is usually done through the shops.

Moreover, depending on the organization of different spaces, types of shop-houses may be single storied or multi-storied. In case of single storey shop-houses, it is evident that the floor area can be divided into three segments: commercial space adjacent to the street, residential part in the middle and service part at the rear (Imamuddin, Hasan, & Alam, 1989, p. 47). Moreover, in multi storied shop-houses, the commercial space with workshop are located in the ground floor beside the street, semi-private areas and services are located at the rear portion in the ground floor and generally the private residential spaces are located in upper floors.

In some cases, the types of shop-houses discussed above, have the feature of covered walkway or veranda-way in front of the shops beside the road, which is a distinctive character of the shop-houses of Southeast Asian cities. This kind of walkway is known as '*Kaki lima'* or 'five-foot way' which is at least five feet in width. The main reason of creating a five feet wide covered passage in front of the shop-house is to enable pedestrians to walk and buy the products under cover, protected from the sun and rain and away from vehicular traffic (Chun, Hasan, & Noordin, 2005, p. 8). The five feet walkways are also used as a spillover space by the shopkeepers to display their products in the pedestrian part of the street (Bashri & Mai, 2008, p. 24).

2.3.4 Shop-houses in Bangladesh

There is evidence of shop-houses in different parts of Bangladesh, especially in the urban areas where the development thrived in the colonial period. The colonial urban societies were a composite of mostly self-employed professional and craftsmen. Most of the shop-houses were built by them along with the businessmen. A growing number of trading and manufacturing industries, mostly small and cottage industry flourished and developed a mixed and traditional flavoured environment everywhere during the colonial period in the old towns of the country (Khan F. A., 1999, p. 66). Since the road side land price is rapidly growing up, the traditional shop-houses are often demolished for new construction.

Table 2.1 Shop-houses and their location throughout Bangladesh

Sl. No.	City/Town	Location
1.	Dhaka	Sadarghat to Chawk Bazar, Court to Fulbaria, Sadarghat to Farashganj.
2.	Chittagong	Dewan Bazar to Chandanpura, Andar qila to Chawk Bazar, Bandal to Firingi Bazar and Sadarghat.
3.	Sylhet	Bandar Bazar
4.	Rajshahi	Shaheb Bazar, Rani Bazar
5.	Natore	Nicha Bazar, Ucha Bazar, Nimtala, Kaporia Patti.
6.	Bogra	Satmatha, Nazrul Islam Sarani, Gala Pati, Temple Street, Chandai Bazar.
7.	Jessore	Daratanar Mour to Chowrasta
8.	Khulna	Dak Banglar Mour to upper Jessore Road, Cemetery Road
9.	Comilla	Rajgonj to Chawk Bazar, Rajgonj to Mughal Toly, Monohorpur, Kandirpar.
10.	Brahmanbaria	Jagat Bazar, Mahadevpatti, Chati Patti.
11.	Chandpur	Puranbazar.
12.	Dinajpur	Munshipara, Nimtala, Maldah Patti, Bashunia Patti, Churipatti, Garu Hatta Bara Bandar, Kali Tala.
13.	Rangpur	Station Road

Source: Khan F. A., 1999, pp. 66-67

2.3.5 Old Dhaka shop-houses

2.3.5.1 Development of shop-houses in Old Dhaka

The growth of shop-houses is evident in different areas of Old Dhaka in different historical periods of its development. This part therefore deals with the history of development of shop-houses in different areas of Old Dhaka particularly around the study area which was the pre urban core of the historic city.

The origin of shop-houses in Old Dhaka can be traced back since pre-Mughal period (Ahsan, 1991, p. 397). According to the literatures during the Pre-Mughal Muslim rules Dhaka was noted for its trade and commerce based on handicraft industries. The traders settled in Lakshmibazar and Banglabazar, craftsmen in Shakhari Bazar and Tanti Bazar and businessmen in Patuatuli, Sutrapur, Kamarnagar, Goalnagar etc. areas in and around the commercial core around 1456 where the shop-houses were evident (Dani, 1962, p. 7), (Khatun, 1991, p. 636). It is known that the spatial pattern and urban fabric of Old Dhaka is particularly distinctive with its street network and densely buildup areas with indigenous settlements (Nilufar, 2010).

In Mughal period Dhaka was both a centre of trade and commerce and an important manufacturing town (Ahmed S. U., 1986, p. 11). At this period the growth of the city extended towards north western and south eastern part of the city (Mohsin, 1991, p. 65). The development of shop-houses was seen in Banianagar, Kumartuli, Jaluanagar, Juginagar, Kagazitola, Churihatta, Sanchibandar, Kasaituli, Kayathtoli, Mughaltuli, Chawk Bazar and Nawabpur etc. areas (Mohsin, 1991, p. 65). The position of the city as a manufacturing centre is apparent from the names of different localities or *mahallas* specialized in different types of industries in Mughal period. Handicraft localities like Shakhari Bazar (shell cutters' locality), Tanti Bazar (weavers' locality), Patuatuli (jute-silk weavers' locality), Sutrapur (carpenters' locality), Banianagar (traders' locality, particularly of gold and silversmiths), Kumartuli (potters' locality), Juginagar (weavers' locality), localities of Kamarnagar (blacksmiths' area), Goalnagar (milkmen area), Jaluanagar (fishermen area), Kagazitola (paper makers' area) and market areas like Churihatta (bangles market), Sanchibandar (betel-leaf market), Kasaituli (butchers' market), Kayathtoli (kayastas area), Mughaltuli (Mughal area) etc. areas are the examples of such localities (Mohsin, 1991, p. 65).

With the fall of Mughal Empire, a sharp decline in trade was observed in Pre-Colonial period when British Company took over the civil administration of the country. Again in British-Colonial period during mid-19th century, the shop-houses flourished towards north and west in Islampur, Urdu Road, Bongaon, and Amligola areas (Ahmed S. , 1986, pp. 92, 115), (Hassan, 2008, p. 269).

In Pakistan period Dhaka to fulfill the need of a large population, after the partition in 1947, new commercial activities and industries expanded in different areas. During this period about 50% of the shop owners in Chawk, Patuatuli, and Banglabazar lived with their shops (Ahsan, 1991, p. 402). After the independence of 1971, Dhaka was established as the capital of Bangladesh and in every sphere of trade and commerce; Dhaka began to receive far greater attention. During this period, commercial activities have boomed in an unplanned manner along the main roads in both residential and non-residential areas of Old Dhaka. Thus it has been observed that Old Dhaka faced a transformation in its history with increasing growth of mixed use developments among which shop-houses were prominent. The existence of shop-houses still continued in these areas because of their locational importance as market centre of the old city.

2.3.5.2 Traditional shop-houses of Old Dhaka

The early settlement of the urban houses was of mud, topped with thatch in most areas of Old Dhaka, shop-houses were also of similar category (Fig. 2.8) in its early period. With the course of time these temporary shop-houses replaced with permanent buildings with the evolution of socio-economic status of the trades.

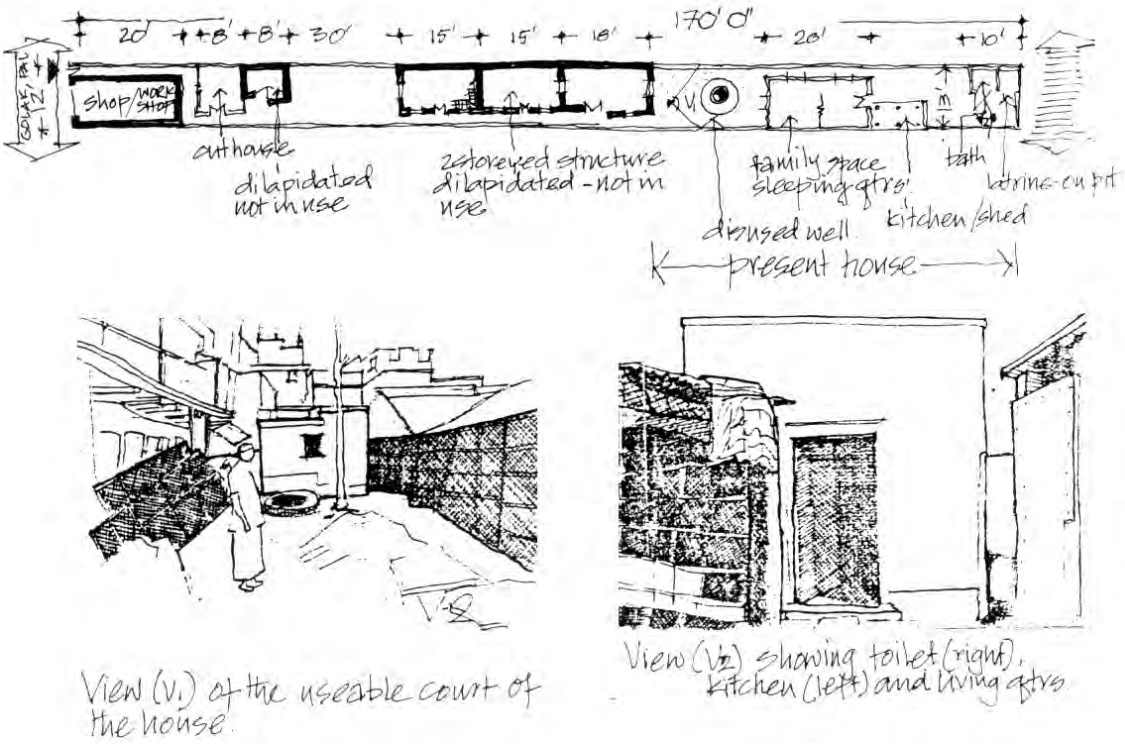


Figure 2.8 Shop-houses in the oldest pattern at 38 Golak Pal Lane, Dhaka.

Source: Khan I. M., 1985, p. 7.8

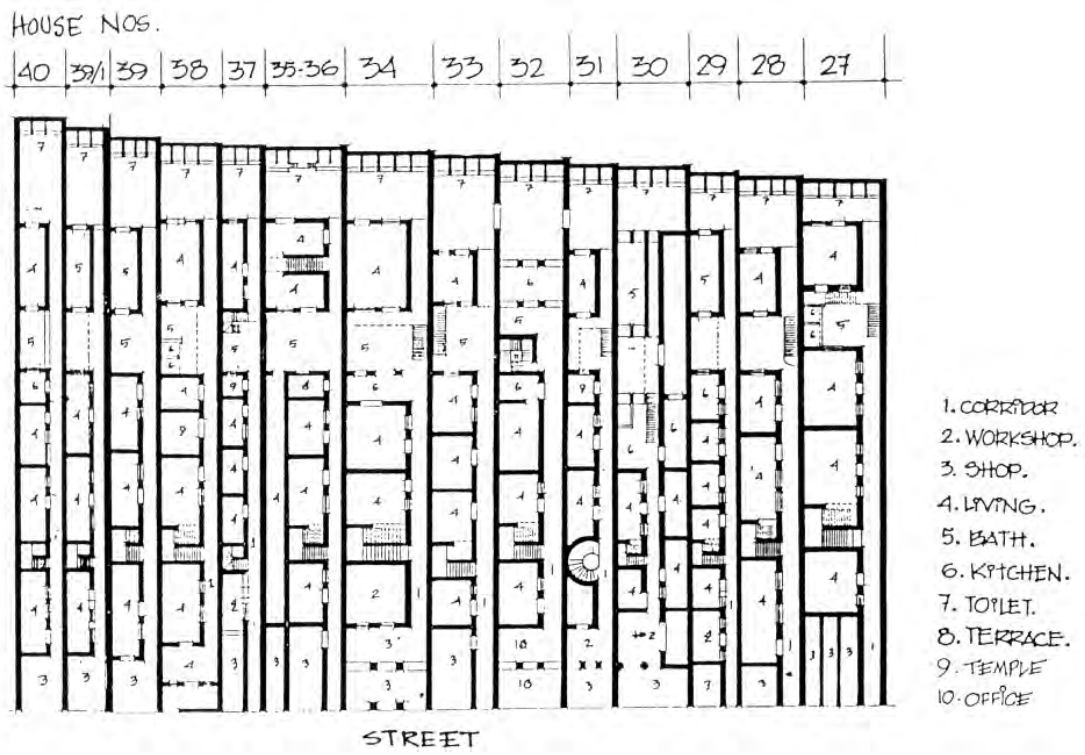


Figure 2.9 Plan showing the general layout pattern of Shakhari Bazar shop-houses.

Source: Imamuddin, Hasan, & Alam, 1989, p. 123

From the spatial structure of Old Dhaka during pre-Mughal period it is found that the streets were narrow and an organic pattern dominated the spatial organization of the city during this period. Though, a few long lines running both in north-south and east-west direction can be seen passed through the residential areas. For example Shakhari Bazar and Goalnagar in east-west direction; Tanti Bazar and its extension Panni Tola in north-south direction are those long streets which gave rise to distinct settlement pattern in comparison to other areas. These were mainly the single commercial streets which had no lanes and by lanes (Nilufar, 1997, p. 119). The same occupational groups used to live in clusters in different *mahallas* and in most cases the same house was used for the factory as well as the residence i.e. the shop-house. The houses were closely built and adjacent to one another. All the buildings were arranged on both side of a narrow road. The attached adjacent buildings formed a continuous façade towards the street. The linear site had access road on the front and canal or service lane at the rear part. This pattern took shape in the pre-colonial period when indigenous city was dependent on natural and man-made water bodies for drinking water, waste disposal, transport and communication (Khan I. M., 1982). Therefore, plot subdivision had to take into account of the street (formal access) and the service (back) progressively creating the pattern (Rahman, 1996, p. 81). But role of trade and the commercial value of the plot requiring a road frontage for each plot played a more predominant role in forming the pattern. This type was occupied mostly by businessmen, craftsmen or people from particular occupational group. Most of them desired road frontage for economic reasons, and consequent plot divisions gave rise to the particular narrow-deep form. All other *mahallas* in Old Dhaka participated in vigorous rebuilding, except Shakhari Bazar-Tanti Bazar area due to specific socio-economic and political reasons (Khan I. M., 1985). Emergence of specialized craft, settlement of ethnic Hindu community and partition in 1947 were few of the main reasons.

During Mughal rule the craftsmen received official patronage and they were allotted free land between pre-Mughal and Mughal core i.e., in Shakhari Bazar and surrounding areas like Tanti Bazar, Goalnagar etc. for their survival. During this period, they used to reside in a unique building type, the two storied shop-houses (Hassan, 2008, p. 267). Each family had a shop with a small frontage to the narrow street (Fig. 2.9). Each shop was used for both manufacturing and marketing of items. The living quarters were either the shops themselves or areas immediately behind the shops (Imamuddin, Hasan, & Alam, 1989, p. 42). For more accommodation, eventually the shop-houses were added two, three or four stories upwards. Historically in the context of Dhaka, existence of walk-up shop-houses can be found from the account of Taylor in 1840 (Khan I. M., 1982, p. 2). He described many houses of Old Dhaka to be one to four storied high (Rashid, 2000). Therefore, the old city developed freely with shop-houses. It had a typical land use pattern: a strip of land along the main roads generally used for commercial purposes and the inner areas used for manufacturing and residential activities (Siddiqui, Qadir, Alamgir, & Huq, 1993, p. 10).

2.4 Society and Space

Many theoretical approaches have tried to answer the question of how built form expresses and represents cultural aspects. What is the relationship between space, society, and culture? Before we can elaborate on the relation between space and social contents of built form, we should understand how society, culture, and space are related, and why the study of its relation with regard to the built environment is needed. It is obvious that family and social structure have been transformed by the changes in physical form in housing and settlement. Any changes in the former have directly influenced and affected the form of the latter.

This study places a focus on the role of the built environment in understanding the relationship between space, social life and culture. The question is how domestic spaces are interpreted in such frameworks. In addition, the concern of the distribution of activities within spaces, the arrangement of objects and furnishing, and the interface among inhabitants and visitors are included in the processes of analysis. Society exhibits the predominant role in the formation of settlement, also retains the preponderance in the arrangement of space. In fact, the formulation of space and its physical manipulation is a derivative of social demand (Haque, 1997). Society can be defined as a group of people occupying a specific locality who are dependent on each other for survival and who share a common culture (Haviland, 1970). The abstract idea of "culture" is always disclosed in space uses regardless of the temporary changes in architectural styles. The word *culture,* from the Latin root *co*/*ere* (to inhabit, to cultivate, or to honour), generally refers to patterns of human activity and the symbolic structures that give such activity significance. According to Rapoport the organisation of space, time, meaning and communication are systematically linked to culture (Rapoport A. , 1977).

2.4.1 Domestic space organization

In this part, several studies on the topic of spatial organization and its relation to socio-cultural contents are discussed. The review emphasizes the notion that the built environment is the reflection of social and cultural order of a certain society and that the uses of spaces are the socio-cultural components of a society. The emphasis is on the importance of studying the activity system and domestic spatial uses.

Hillier and Hanson argue that the social relation among people can be explained in terms of relations between inhabitant and visitor. The former is a person who has control over the entrance and access to spaces while the latter refers to a person who temporarily occupies space and has no control over entrance or access to space. Hillier suggests that there is a fundamental relationship between inhabitant and visitor in the sense that the inhabitant usually occupies the deeper and non-distributed parts of a building and interacts with visitor in the shallower and distributed parts of the building that form the circulation network (Hillier &

Hanson, 1984, p. 184). The relationship among inhabitants and between inhabitant and visitor is considered to be a social relation that acts as the generator of spatial patterning. These studies tentatively suggest that social content in built form is one way in which the ideational concept of culture expresses itself. It is this kind of cultural expression, social relation and activity system, in association with spatial pattern that this study mostly concerns.

Rapoport tried to establish cultural factors as primary factors keeping the others (choice of material, economic, climatic, etc.) as modifying factors. According to him family, position of women, privacy and social intercourse are primary factors that influence the houseform (Rapoport A. , 1969). Rapoport makes another type of suggestion in his article “System of activities and system of settings”, by suggesting how “*culture*” can be related to the built environment. He notes that ‘culture’ and ‘built form’ are different in scale and culture is a vast domain where built form is a subset (Rapoport A. , 1990).

He suggests a sequence where ‘culture’ the highest level of abstraction, is gradually linked to lower level components to arrive at activities at the end. Through this process, the concept of culture is dismantled and becomes more concrete and manageable.

In Rapoport’s study, the use of space is examined in terms of the relationship between architecture and activity. An activity system is a form of cultural and social expression of each society. It occurs in two types of space setting: fixed-feature elements (architectural space and partitioning) and semi-fixed-feature elements (furniture and interior arrangement). The organization of both elements influences activities and reflects the meaning of socio-cultural activity (Rapoport A. , 1990). Rapoport suggests that the physical elements within space, such as walls or partitions, function as physical cues that express the structure of spatial organization. He concludes that built form is the representation of the use of space, which in turn is the direct expression of culture.

2.4.2 Domestic space and activity system

Rapoport proposes that we cannot study the relation between activities and built form unless we consider activities as the system (Rapoport A. , 1990). His study not only suggests the significance of activity systems and the system of settings as a whole, but also indicates that the physical elements within space such as walls or partitions function as physical cues that express the structure of spatial organization. He also argues that culture is influenced by social variables which he calls the "social expression of culture."

Several studies have indicated the need to study domestic spatial systems and agreed that an activity system is one form of cultural and social expression of each society. Hillier insists that space is significant in the sense that the way it is organized and structured has strong influences on how built environments function and affect the communities (Hillier & Penn, 1993, p. 71). He has been strongly influenced by Levi-Strauss's idea that there is an obvious relationship between social structure and spatial structure of built form and settlement (Hillier B. , 1997, p. 190). This means that spatial configuration is the reflection of social organization. Hillier suggests that architectural space should be studied on the basis of "social contents of spatial patterning" as well as the "spatial content of social patterning."

Therefore, in the realm of the architectural spatial system, we should investigate how spatial pattern can be interpreted in terms of social meaning. It is in this sense that space syntax methodology is used as the quantitative approach in examining the relationship between society, culture, and spatial pattern, in particular as it applies to the research methodology selected for this study into shop-houses of Old Dhaka.

Social and cultural orders exist and express themselves through the form of built environment. Although the notion of "culture" is abstract, it can be expressed in the more practical terms of social relations and activity systems. Differences in space usage are attributed to cultural influence as well as the social structure of a people.

Consequently, the change in social structure may cause people to compromise their behavior and consequently in the spatial patterns of their houses. This is why some scholars consider human behavior to be cultural expression. Because activity and space usage are considered as cultural entities, we can study the influence that activities have on the arrangement of spaces as the account of cultural aspects of spatial system. It has been suggested that by studying the activity system and the way it governs the organization of space, one can better understand the relation between culture, social orders, and built form.

This part has pointed to the importance of cultural order and some aspects of social life in built environments. The main interest of this study is to focus on the spatial system and social relations within dwellings. While there is no absolute method regarding the best approach to the study of architectural space, this research has been used the space syntax model to investigate the relation between spatial configuration of shop-houses and aspects of the social lives of their inhabitants.

2.4.3 Activity pattern in urban houses of Dhaka

House hold activities are different in urban areas from that of rural areas. Initially urban houses were glorified versions of rural homesteads where traditional living patterns could be

duplicated. The spaces in the rural homestead can be classified as enclosed (habitable room, corridor), semi enclosed (verandah, terrace) and open (court) spaces (Mallick, 1987).

Based on the works of the researchers (Imamuddin A. , 1982), (Khan F. A., 1999), (Rashid, 2000), (Shabin, 1997) the household activities in the urban houses can be classified into two groups:

- Family activities-such as working, sleeping, cooking, washing, bathing, eating, etc.
- Formal activities-such as socializing, receiving guests, which include participation in the community.

Table 2.2 Major household activities and their locations in traditional rural-urban houses.

Enclosed Spaces	**Semi-enclosed Spaces**	**Open Spaces**
Sleeping		
	Work	Work
Eating	Eating	
Cooking & Food Preparation	Cooking & Food Preparation	Cooking & Food Preparation
	Washing	Washing
	Bathing	Bathing
Receiving Guest	Receiving Guest	Receiving Guest
	Leisure	Leisure
		Playing

Source: Mallick, 1987, p. 25

According to the previous studies it was seen that family activities such as working, eating, sleeping, cooking, etc. are performed in the inner part of the house while formal activities such as socializing, receiving guests, which include participation in the community are performed in the outer part of the house near to the entry. Khan (Khan F. A., 1999, p. 12), while studying the colonial architecture in Bangladesh has drawn a comparative description of the household activities in urban houses of different periods where he showed that the activity pattern transformed from rural or traditional to urban and from urban to a mixed form of local and colonial culture.

2.5 Society and Houseform

Domestic space is a direct outcome of activities associated with culturally defined norms and codes. In Bengal, both the rural and urban houses are reflective of these cultural norms. More specifically, the rural houseform is a direct interpretation of socio-cultural demands. The form can also be considered as the social unit of space. Any particular settlement pattern is evolved from the grouping of such social units. Therefore, houseforms and their grouping reveal the generation of a society. The traditional rural settlement sets the precedence of urban locality.

The 'houseform' is an expression of family demands and in physical manifestation varies widely in time, space and groups. But the seminal cultural constraints are embodied in rules of arranging space which is all pervasive and recognizable. Houses everywhere serve the same basic needs of living, cooking and eating, entertaining, bathing, sleeping, storing etc. but a glance at the architectural record reveals an astonishing variety in the ways in which these activities are accommodated in the houses of different historical periods and cultures. The important thing about a house is not that it is a list of activities or rooms but that it is a pattern of space, governed by intricate conventions about what spaces there are, how they are connected together and sequenced, which activities go together and which are separated out, how the interior is decorated, and even what kind of household objects should be in different parts of the home (Hanson J. , 1998, p. 2).

Urbanization has strongly influenced the domestic architecture. In other words, houseform in urban context is an outcome of transformed socio-cultural backgrounds and changing values adapted into the physical restrictions (Imamuddin A. , 1982, p. 2.9). The transforming life-style as a result of migration from rural to urban areas is a consequence of factors initiating changes; these are technical and infrastructural changes of the urban centres and urban facilities; change due to the occupation and livelihood of the inhabitants; changing pattern of economy etc. All these forces influence the urban socio-cultural scenario which is basically of rural origin.

The houseform consoles the socio-cultural changes in urban context with the symbolic value or images immersed in occupant's mental map.

2.5.1 History and evolution of houseform of Dhaka region

In earlier stage of urbanization, the urban centers were more of glorified villages with greater concentration of people, providing wider opportunity for socio-economic exchanges. The process of urbanization was slow and measured. Rural traditions strongly dominated the socio-cultural sphere. Hence the life-style of the rural and urban people was almost similar. As the study area is in Dhaka region, this part put emphasis on the growth and evolution of houseform of Dhaka based on the literatures.

The evolution of the urban houses of Dhaka can be traced back to 13th century CE with the pre Mughal period. Urban houses in this period were rather dense version of rural settlements (Khan I. M., 1982) and courtyards were found as an inseparable and essential element in the design and construction of urban houses in Bangladesh (Hafiz, 2011, pp. 65-86).

The cultural foundation has established the Introvert courtyard pattern in the context of Dhaka from the very beginning, which had its root in the rural pattern. The introvert courtyard type houses are common in historical house layouts (Schoenauer, 1981). In the indigenous urban houses of Dhaka the inner court served private family purposes. This Courtyard was the central space of all activities and it acted as the threshold transient semi-public space between the habitable rooms (the private territory) and the living room (the public territory).

2.5.2 Settlement pattern and houseform

The growth of Dhaka shows three distinct patterns 'indigenous pattern', 'formal pattern' and 'informal pattern' of growth in the form of the neighbourhoods (*mahallas*), this distinction also recognizes differences among the localities and social structure (Imamuddin A. , 1982, p. i.26). This paper concentrates only the traditional shop-houses developed in indigenously developed Old Dhaka.

Indigenous pattern:

Indigenous pattern is characterized by compact and densely built areas with narrow and irregular road pattern. This type discerned is mainly visible in Hindu dominated *mahallas* (e.g. Shakhari Bazar, Tanti Bazar etc.). The houses were mostly inward looking, built from the edge of the plot, attached to the adjacent building forming a continuous facade along the road. Buildings in this pattern of urban area were used for multi-functional purposes, such as living and business, by definition they are the shop-houses (Imamuddin A. , 1982, p. i.27).

Formal pattern:

The British rulers introduced the pattern which is the formal pattern of settlement. The planned new city developed in grid iron pattern during the colonial period, in contrast to the indigenous pattern and traditional informal pattern. The traditional system of mixed use areas were replaced by single use zones like residential, administrative and recreational. Detached, outward looking houses became popular primarily influenced by the colonial residential bungalows (Imamuddin A. , 1982, p. i.29).

Informal pattern:

This loosely built and ever changing category exists in both early and later period of settlement. Plot is regular but filled with intricate network of lanes and by-lanes due to the sub-division. Again being loosely built, it is perceived through the periphery walls (Khan I. M., 1982, p. 6.3).

These areas were basically developed and occupied for residential purpose. With organized service, houses were built around a courtyard (Rahman, 1996, p. 81).

2.5.3 Forces influencing the evolution of houseform of Dhaka region

From different literature it is found that various socio-political, cultural, economic and physical forces have acted in different degrees at different time on the growth of urban pattern, design and organization of the houses (Imamuddin A. , 1982, pp. 1.22-1.25).

The socio-cultural forces act over the physical forces to affect the formation of an urban house. The preponderance of rural images plays the significant role. Even under urban constraints, introduction of a courtyard is explicative of more a social demand than it's climatic or functional need. The concept of privacy has been maintained through this. The outhouse is transformed by road side living room; and the court still remains the hub of the whole arrangement maintaining the similar notion of privacy, male and female domain, front and back etc.

The urban house displays the sense of privacy and progression of space in a transformed manner. The accessibility into urban site acts as a vital phenomenon in forming the urban house. The houseform, as it is more compact due to the limitation of site exhibits the privacy within its limited boundary. Though the first generation urban houses were less affected by scarcity of urban land, the rural archetype could have been transplanted into urban archetype. In later days, the regular plot demarcation, road layout etc. due to densification forces the houseform to adjust itself also with climatic and functional considerations. The concept of front and back in rural archetype houseform was thus reshaped to form an urban archetype (Khan,1982).

Moreover, the shape of the plot guides the house form. A narrow linear site has lesser possibility of central planning around a court whereas a site with wider front can adopt the traditional set up more easily. In the first case the symbolic transformation may take place where the court can be in the form of a light well, small and narrow in size but retaining the same value object. In case of a wider plot, the court also creates an inward looking house type which meets the climatic consideration and social aspects simultaneously.

For thousands of years, religion had played a vital role in regulating the houseform. Apart from the pre-historic evidence, these religious philosophies had been forming the socio-cultural and philosophical ideals of the society that reflected in the indigenous culture and psychological attitude of the people of the urban society. Thus different aspects influence the evolution of urban houseform of Dhaka.

2.5.4 Typology of houseforms of Dhaka region

The primary houseform of the region is deep rooted in its rural counterpart. Therefore the houseform of Dhaka region can be divided into two basic types, rural houseform and urban houseform.

2.5.4.1 The rural houseform

The basic houseform is a cluster of covered shelter around a central court. The buildings are loosely spaced. The toilet, baths are not considered as the part of the proper house and kept at a distance. Most of the spaces within the physical form have multiple uses. Court is the center of most of the family functions as very few functions needed a roof (Khan I. M., 1982, p. 6.5). Privacy is specified by the distinct segregation of male/female domain. The open court is the female domain and was separated from the outer world with the cluster of rooms in all four sides. The out-house (*Bangla Ghar or Baithak Khana*) was the male domain. It locates the family within the community. It is always situated in the entrance of the house.

2.5.4.2 Early urban houseform:

The early urban houses, until the introduction of the classical order and occidental architecture by the British, were no difference from their rural counterpart in layout. The process was a gradual transformation of rural houses into a massive brick masonry structure, conceived in piece meals. The traditional shop-houses of Old Dhaka represent the early urban houseform of Dhaka city. These houses were generally multistoried. The front part of the houses acted as the shops and the rear part and the upper floors were used for living purposes. Access to the inner part of the houses was through corridors placed at the side of the house. These corridors were usually divided by a party wall to provide access to other rooms and to upper floors through stairways and ultimately terminate to service areas at the rear. Upper floors were mostly used for residential purposes. The toilets were kept out of the building and the houses developed on clearly demarcated domains. The narrow frontage and deep inside was a common character of these houses. This was probably for the dependency on the natural system for water and waste disposal and with further subdivision the houses became a narrow strip of nominal frontage (Haque, 1997, p. 29). It embodied the essential qualities needed to make an appropriate dwelling of the society prevailed that time. The dwelling stayed self-sufficient in access and service while the length allowed for the maximum separation of family domain and service area. It allowed for physical arrangement along a defined privacy gradient (Imamuddin A. , 1982). The mail domain which was the public zone of the house belonged to the frontal part of the house overlooking the adjacent street. Most of the time there was a small court in the middle part of the house which segregates the male and the female domain. The service area was situated in the rear part of the building connected to the service alley or the adjacent water body. This part was dominated by the female members of the house and remained as the private zone of the building (Haque, 1997, pp. 25-28).

2.5.5 Types of Urban houseform

The urban houseform may take a diversified character due the heterogeneous properties of urban people in their background, occupation and socio-economic situation. Urban houses in Dhaka can be divided into various types according to their functional use pattern. Such as Shop-houses, Kuthi Bari, Zamindar houses, Satellite township houses, and Professional patties etc. (Khan F. A., 1999, p. 64). This part demonstrated the types of urban houseform in order to categorize the shop-houses according to physical properties.

According to the physical properties the dwelling of Dhaka can be categorized into two broad groups, 'Introverted' and 'Extroverted' (Imamuddin A. , 1982, pp. 2.10-2.20).

2.5.5.1 Introverted houses:

Introverted houses referred to inward looking courtyard houses. It is the earliest type of urban house found in Bangladesh (Imamuddin A. , 1982). This type basically evolved from the rural houseform of Bengal, where court is the center of all major activities and functions (Fig. 2.10). In fact the traditional shop-houses are mainly of this type.

In general cases most of the introverted houses were basically, in arranging a series of rooms with transitional spaces like stair, corridors etc. The male and female domain had been separated by internal court (Khan I. M., 1982, p. 6.20). The ground floor contained services and other family activities which made it the functional part of the house, where the upper floors remained comparatively less used and were allocated for living purpose like bed rooms, family livings etc. and remained more private in respect to ground floor spaces. The living spaces are placed around the court yard. In urban houses this court came in a modified way. In pre-colonial merchant houses, the courtyard was for loading and unloading, in craftsman houses it was a spill over area of the workshop and in burghers house it was regular farmyard (Imamuddin A. , 1982).

The introverted houses of Dhaka were divided into two sub group based on the organization of court yard and its adjacent spaces. They are:

Detached type:

The detached houseform is a direct transformation of basic rural arrangement. This particular houseform is the outcome of first attempt in urban context. In rural houses, a number of single detached huts clustered around one or more courtyard. The courts may connect to each other, but the huts were never connected. This type prevails in a dominant urban houseform where there is enough space to accommodate in such a setting (Imamuddin A. , 1982). In many houses, however, the construction materials have changed keeping the form constant.

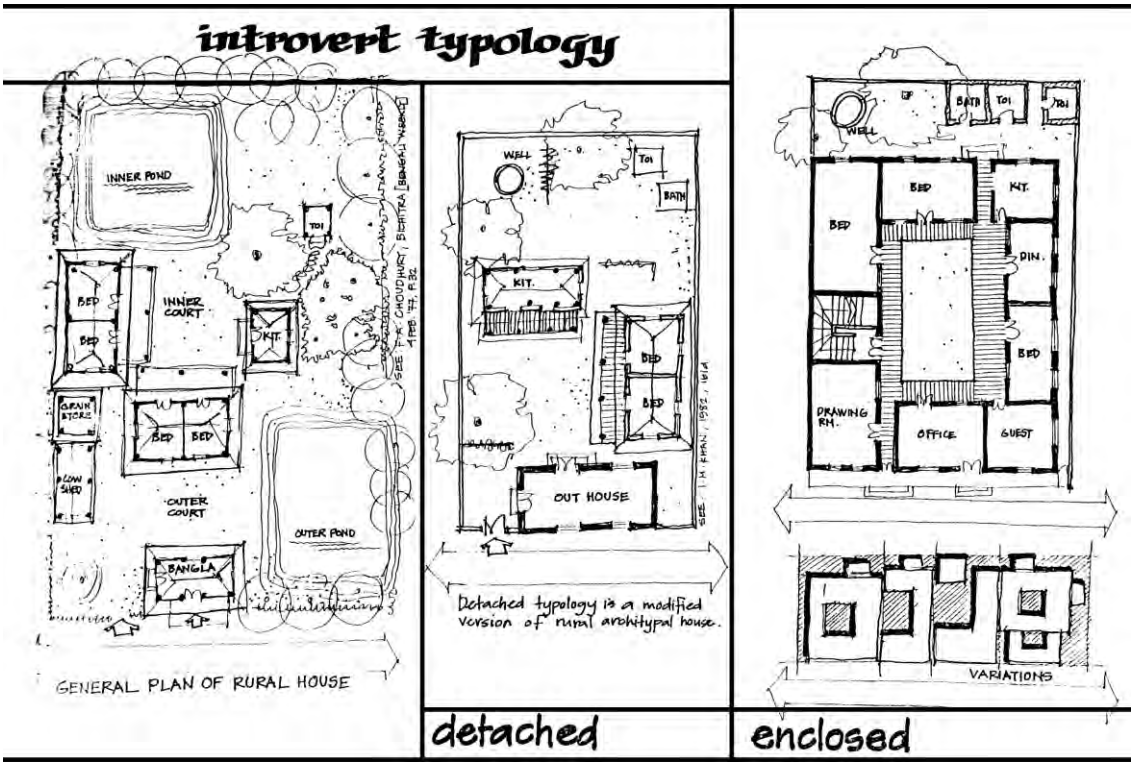


Figure 2.10 Houseform of Introvert Typology

Source: Imamuddin A. , 1982, p. 2.11

Enclosed courtyard type:

The enclosed courtyard type of houseform may refer as the most indigenous urban houseform in our country. Making the form enclosed is more an urban approach than the rural one. In fact, it coalesce the rural images with urban constraints. Physical constraints due to limitation of urban land, social and technical advancements in the city, changing concept of privacy and security with respect to high density urban living may have prompted the development of enclosed type introvert house (Imamuddin A. , 1982, p. 2.15). This type of house is usually enclosed around a central courtyard. Sometimes, this court is so small that it only acts as a light well for the multistoried linear buildings. In ground floor, rooms are arranged around the court, giving access inward. In upper floor, a continuous veranda is provided projecting the court to which rooms are open. Entry to such a house was normally through a sitting room (also named the drawing or living room), a feature synonymous with the front or formal domain of the rural compound (*Baithak Khana*). This was sometimes fronted by a verandah or court. Behind this public area, the private part of a house would surround an internal court, sometimes with a colonnaded verandah. The inner court occupied the juncture between public and private space, and served as the conceptual focus of the house. In an urban setting, such a court also created a pleasant microclimate. As in the traditional houses, the rooms had multi functions. In day time these rooms were used for working purposes and at night for sleeping purpose. This particular kind was evolved due to the demand of street frontage and scarcity of land in the urban area (Rahman & Haque, 2001). Most of the traditional shop-houses fall in this category.

2.5.5.2 Extrovert houses:

Extrovert typology is a form adopted due to socio-cultural changes under the influence of colonial period. New life-style and values were introduced in urban living during this period. This gave rise to a new system of urban houseform i.e., extrovert type (Fig. 2.11). This form is an adoption of colonial Bungalow style. The bungalow compound complex represents a culture, life-style, and set of values and behaviours of the inhabitants which are totally different from those of either the metropolitan society or the indigenous culture in which it was located (Imamuddin A. , 1982).

Two categories also of extrovert typology are observed, composite and consolidated.

Composite type:

The pattern of composite extroverted houses has been adopted from the colonial bungalows with certain modification. It represents a free standing, outward looking courtyard less house which has detached service functions in its backyard of a large compound. The distinct zoning of class difference between the served and servant is clear in this type of houseform. In this category, zones are according to formal, informal and service activities.

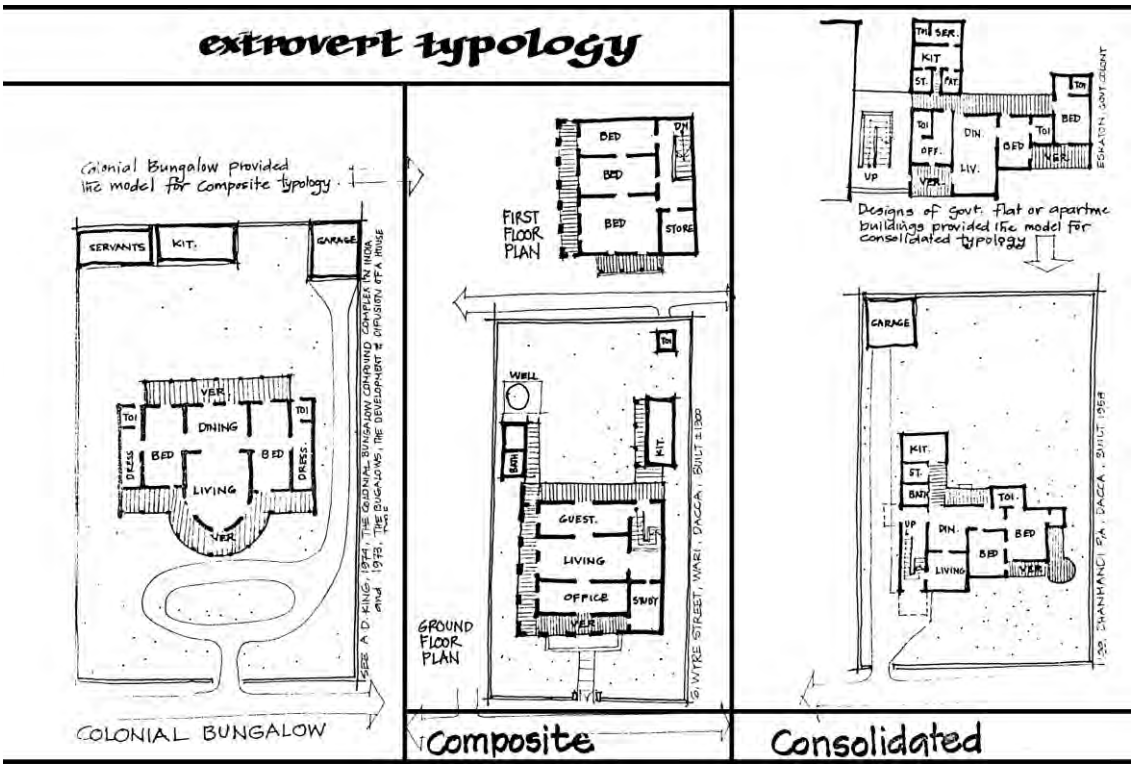


Figure 2.11 Houseform of Extrovert Typology

Source: Imamuddin A. , 1982, p. 2.16

Consolidated type:

The other type is the consolidated type, which is characterized by integration of all spaces into a single mass. This is facilitated by the Improvement of services and technology and is inspired by the novelty of mass-housing apartment, a descendent of the post-war westernized concept of living. Later in the local context, modem houses have become synonymous with consolidated house popularly known as flat type. Nevertheless, the house became separated into three distinct zones-public, private and service (Haque, 1997, pp. 35-36).

Beside these two basic types, there was another **intermingled typology** which has been popularized among the native elites in colonial period. Those are the combination of introverted and extroverted typology in Zamindar houses or the large houses of the urban elites (Reza, 2008, p. 110). In this study the traditional shop-houses won't show any match with this extrovert typologies.

2.6 The Space Syntax Methodology

Space syntax was developed by Bill Hillier, Julienne Hanson, and their colleagues at the University College of London. It is applied to the study of settlements and buildings in many disciplines. Space syntax analyzes the spatial system in terms of social rationale. It describes and analyzes the relation between space and social life that is essential to the culture of a given society.

According to Hillier and Hanson, architectural and urban forms are the manmade products that are useful in terms of "function" and "meaning" when related to social and cultural aspects (Hillier & Hanson, 1984). They argue that because of "meaning" contained in them architecture and urban forms extend cultural identity (Hillier & Hanson, 1984). Therefore, by analyzing spatial patterns one can answer questions of how social contents are embedded in spatial patterns, and how the built environment generates social relations. The development of space syntax analysis provides a new approach for studying intellectual conceptions of culture and society-space relation, and is able to describe it in quantitative terms.

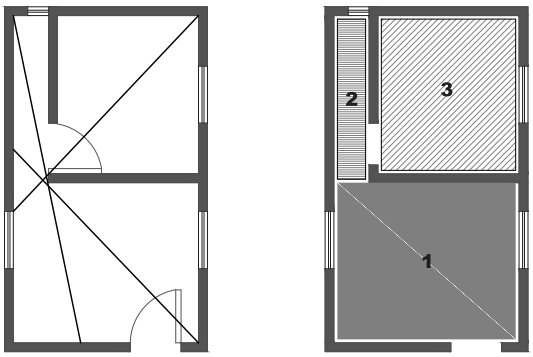
This part reviews the fundamental theory of space syntax and its application in the analysis of the internal space of buildings, as well as briefly reviewing the previous studies of space syntax on a domestic scale so that the primary assumption of the study is clarified. Because there are many technical terms involved in space syntax theory, those that are significant and related to the study are elaborated in the following in accordance with the review of the fundamental theory.

2.6.1 Fundamental concept of space syntax

In the study of settlement form, the fundamental principle of space syntax is that there is a relation between "generators of settlement forms and social forces" (Hillier & Hanson, 1984). That is to say, space and society are mutually related and described by Hillier and Hanson as the "social logic of space" and the "spatial logic of society" (Hillier & Hanson, 1984). Hillier and Hanson believe that there are mutual relationships between space and society in such a way that society organizes people in spaces and society orders space by various physical settings so that society has a definite pattern at last.

Space syntax is a set of techniques to represent, quantify, and interpret the spatial configuration in buildings and settlements (Hillier & Hanson, 1984). The aim of space syntax research is to develop the strategies to describe configured inhabited spaces in such a way that their under-lying social logic can be understood. Space syntax creates important data about how social meanings and lifestyles are expressed in spatial models. Morphological studies try to clarify the configurational properties and their meanings by mathematical and graphical analysis.

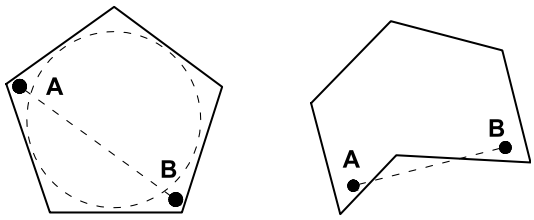
According to Hillier and Hanson, space formation is the reflection of a relation between society and space. The organization of space can be understood in terms of social interaction among people within the same or different social status such as interaction among inhabitants, inhabitants and visitors, male and female, family members, and so forth. To comprehend the organization of space, syntactic analysis emphasizes the major properties of space affecting the pattern of people's movement and the uses within spaces.



(a) (b)

Figure 2.12 Illustration of Axial Lines (a) and Convex Spaces (b).

Source: Hillier & Hanson, The Social Logic of Space, 1984, p. 98



convex space concave space

Figure 2.13 Illustration of Convex Space and Concave Space.

Source: Hillier & Hanson, The Social Logic of Space, 1984, p. 98

According to Space syntax, there are two key elements of space structure, axial lines and convex space, as shown in Figure 2.12. An **axial line** refers to the longest line of vision passing through a convex space, while a **convex space** can be defined as a space in which all points are visible to all other points. Both axiality and convexity deal with how spaces structure the movement, influence the interaction, and provide access for people within space. Based on space syntax methodology, only convex space is used to analyze the spatial configuration. The difference between a convex space and a concave space is shown in Figure 2.13. The difference is clearly shown that points in concave spaces are invisible to each other.

2.6.2 Syntactic analysis of domestic spaces

Hillier and Hanson argue that the way that people experience spaces in settlement forms differs from that experienced in the interior spaces of buildings. They suggest that by moving about a settlement one can form picture of the whole settlement. In this sense, spaces of settlement are a series of continuous spatial entities (Hillier & Hanson, 1984). On the other hand, the interior space of a building is a series of individual events. It is a system of discontinuity.

According to Hillier and Hanson, social patterns are represented by syntactic properties such as symmetry and distributedness of spaces. Symmetry and asymmetry of spaces indicate the depth of spaces and reflect social relations in terms of the permeability of spaces. They can be defined in terms of the relation between spaces and between a space and the system as a whole. The theory of space syntax emphasizes the interpretation of spatial configuration. It argues that social relation expresses itself through the arrangement of spaces. According to space syntax, the primary principle in the analysis of the internal structure of buildings is spatial configuration. **Spatial configuration** can be defined as the relation between two spaces or more that takes into account and other spaces in the system (Hillier, Hanson, & Graham, 1987). The concept of spatial configuration is illustrated in Figure 2.14.

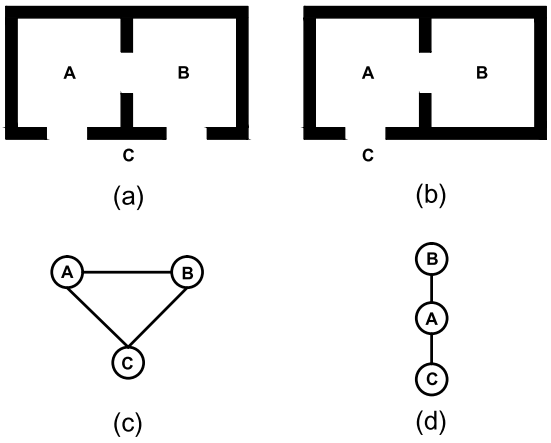


Figure 2.14 Illustration of spatial configuration, Depth and Ring properties.

Source: Bill Hillier, Space is the Machine: A Configurational Theory of Architecture, 1997, p. 34

Figure 2.14 illustrates two relations between internal spaces A and B and exterior space C. The gap between spaces will represent the "permeability" between spaces. In Figure 2.14 (a), both A and B are directly connected to C, but in Figure 2.14 (b) only A connects to C. If one wants to move from C to B, one has to pass through A first. Therefore, the relation between A, B, and C in Figure 2.14 (a) is not similar to those in Figure 2.14 (b).

In other words, the relation between A and B is changed when C is taken into account. This is the concept of spatial configuration.

We may graphically describe this kind of relation by using a **"justified access graph"** or a J-graph. A **j-graph** is one that illustrates the "depth" and "ring" properties of the whole system. **Depth** can be defined as the step or change of movement from one original space to any other space, whereas **ring** indicates the property of choice or alternative route to move from one space to another.

With a justified graph, all spaces in the system are represented by circles and the connections or accesses between spaces are represented by lines. A particular space will be selected as a root space or the original space and all other spaces will be lined up on the basis of their depth level from the root space.

Figure 2.14 (c) and (d) are justified graphs that correspond to Figure 2.14 (a) and (b) respectively. These two graphs have space C as the root space. Therefore, in Figure 2.14 (c), A and B are at depth level 1 since they can be directly accessed from C. On the other hand, in Figure 2.14 (d), B is at the depth 2 and A is at depth 1 since one has to pass through A to get to B.

Depth is used to determine integration. The **integration** value is the relative depth of a particular space to all other space. It can be calculated by using the following formula:

$$\mathbf{RA = 2(MD-1) / (}\boldsymbol{k}\mathbf{-2)}$$

when *MD* is the mean depth and *k* is the number of spaces in the building. Relative asymmetry (RA) is the measure of spatial integration. The concept of RA value can be defined as the following:

Relative asymmetry measures how deep or shallow the system is from a particular point with how deep or shallow it theoretically should be - the least depth existing when all spaces are directly connect to the original space, and the most when all spaces are arranged in a unilinear sequence away from the original space, i.e., every additional space in the system adds one more level of depth with low values indicating a space from the which the system is shallow,

that is a space which tends to integrate the system, and high values a space which tends to be segregated from the system (Hillier & Hanson, 1984, pp. 108-109).

If one compares systems that are different in size (i.e., having a different number of spaces), Hillier and Hanson recommend that one must adjust the RA value to control the effect of size. Thus, one has to transform the RA value to RRA or "**Real Relative Asymmetry**." The formula of RRA is:

RRA = RA / Dk

when *Dk* is the D-value for *k* spaces. D-values are given in Table 3 in 'The Social Logic of Space'.

Integration value, which can be calculated from the reverse value of RRA (1/RRA), ranges from 0, maximum integration or no depth, to 1, minimum integration. According to Hillier, integration values of each space in each system will be different, and this difference is the crucial element by which culture and social relations express themselves through space.

This type of consistency in space is denoted as "**inequality genotype"** by Hillier. Hillier states that the way in which spaces are categorized according to the ways in which culture arranges activities-what goes with what, what is separated from what, what must be adjacent and what separate, and so on-finds a repeated form. This, we saw as one of the 'deep structures' of the configuration. We called this kind of configurational repetition across a sample an "inequality genotype," since it is an abstract underlying cultural form, assuming many different physical manifestations, and expressing itself through integrational inequalities in the ways that different functions feature in the domestic-space culture (Hillier B. , 1997, p. 249).

With respect to the idea of inequality genotype, Hillier developed a measure to determine the degree of this integration value difference among any three spaces, which is called the **relative difference factor (DF)**:

$$\mathbf{DF = (H\text{-}ln2)/(ln3\text{-}ln2)}$$

$$\text{when } H = -\sum\left[\frac{a}{t}\ln\left(\frac{a}{t}\right)\right] + \left[\frac{b}{t}\ln\left(\frac{b}{t}\right)\right] + \left[\frac{c}{t}\ln\left(\frac{c}{t}\right)\right],$$

a=minimum, b=mean, c=maximum, t=a+b+c.

Hillier and his colleagues developed this measure by adopting the Shannon's H-measure for transition probabilities (Hillier, Hanson, & Graham, 1987, p. 365). Difference factor values vary from 0 to 1. The closer the value to 1, the weaker the degree of difference, thus a complex with a lower difference factor has much a stronger degree of differentiation among the integration values of different spaces.

A justified graph is always displayed in either a "tree" or "ring" form. For example, Figure 2.14 (c) is a ring-like j-graph while 2.14 (d) is a tree-like j-graph. The property of the ring shows the

presence of alternative routes from one space to another. Justified graphs that are tree-like have only one route from one space to any other space. Any system that has more than one route, its j-graph is always presented in a ring form. These two properties, ‘depth’ and ‘ring’ are underlying principles that we need in the analysis of domestic space. The "ring" form indicates the presence of an alternative route. **Space link ratio (SLR)** is the numerical value expressed if the system has a tree like graph or ring graph. SLR can be calculated by using the following formula:

SLR = (number of link + 1) / number of spaces

The system that has SLR value of 1 has a tree-like graph while a value greater than 1 indicates the existence of a ring graph.

With this information, the permeability structure of space can be defined. The properties of depth and ringiness are used to measure the integration and control of space. The properties of ring can also be described in terms of distributedness and nondistributedness. Two spaces are **distributed** when there is more than one route from one space to another and **nondistributed** when there is only one route between them. The distributed relation forms a "ring" of spaces. We may use the distributed and nondistributed dimensions of space as parameters to measure the permeability structure of spaces and of the system as a whole. Ring property reflects the spatial relation in terms of the locus of control. The present study will focus on these initial properties to analyze the spatial organization of shop-houses.

Other values that are used in analysis are the control and connectivity values. For each space having *n* neighboring spaces, it gives 1/n to each of its neighbors. The sum of each receiving neighboring space is the **control value** of that space. For example, from Figure 2.12 (b), spaces number 1 and 3 have only one neighbor, space number 2; thus they give a value of 1 to space number 2. Therefore, space number 2 has a control value of 2. Space number 2 has two neighbors, space number 1 and 3; thus it gives 0.5 to each of them. Therefore, space number 1 and 3 have a control value of 0.5 each. High control values indicate strong control.

Connectivity of a space is the numbers of convex spaces that connect that particular space. From Figure 2.12, spaces number 1, 2, and 3 have a connectivity of 1, 2, and 1.

2.6.3 Use of space syntax in houseform analysis

Space syntax model have been applied by many researchers to describe the effect of social structure and cultural order on both human settlements and individual building. In the study of internal spaces of houseform, according to space syntax theory, it can be assumed that if the pattern of integration values of a series of spaces repeats across the samples, then it can be said that the cultural pattern has been revealed.

In the early days of space syntax development Hillier and his colleagues used its techniques to explore the issues of spatial type in 17 rural dwellings in different regions of France (Hillier, Hanson, & Graham, 1987, pp. 363-385). By using the concept of inequality genotype and key elements such as different factors, space-link ratio, and other syntactic attributes, they established two distinct genotypical characteristics for these French rural dwellings. One is characterized by high emphasis on living space (i.e., *salle commune*) and the other on transition space. The former is distinguished by a strong difference among living spaces by having a *salle commune* as a controlling space that one has to pass through to move from one space to another. The latter is distinguished by a central transition space which controls the relations among internal spaces as well as the exterior space. Hillier concludes that, "the differences between the two genotypes express some difference in the forms of social solidarities."

Lya Dewi Anggraini investigates on shop houses built by Chinese & Javanese in Yogyakarta, Indonesia, the analysis focuses on the distinct spatial arrangement (Anggraini, 2011). Despite of the building shape and the house plan or floor area, there were some similarities between two cases in some extent that was its functional room. However, there was quite distinct characteristic which was in overall Javanese shop house was more open, having higher degree of connectivity, and tending to be clustered whereas Chinese shop house tended to be linear and closed in its spatial arrangement. Javanese shop house had outward orientation indicated by the higher number of rooms with access to the outside whereas Chinese shop house tended to be inwardly orientated. Chinese shop house buildings in the area observed that were built during the colonialism period by the Dutch and resembling those in their origin, later they underwent some transformation because of the influences or forces received from locals (Javanese) and others such as colonial government. This paper concluded that even though there had been some fundamental changes on the space arrangement in order to adjust with the block division system developed by the colonial authorities, inwardly there has been continuity to some extent. This what made it different from local architecture (Javanese).

In order to examine the change of spatial configuration from traditional to popular houses, the sample of 41 vernacular houses, selected from several construction dates, is analyzed in this study by Nopadon Thungsakul (Thungsakul, 2001). The findings indicate that the change of physical features influences the configurational properties of the houses. The alterations of spatial arrangements from different sources of design reveal the change of spatial patterns among vernacular houses.

These previous studies of Space syntax show the possibility for exploring the cultural order in artifacts. Findings from these studies indicate that social relations express themselves through

a configuration of spaces. From previous research, the consistency of differences in integration among spaces suggests the presence of spatial syntax constitution.

2.7 Summery

As this thesis tries to understand the underlying principles of the traditional shop-houses of Old Dhaka, it is very essential to explore its context first to understand the underlying principles of the spatial organization. The historical, socio-cultural, political and economic background of Old Dhaka is drawn from the references.

Next the basic notions of the shop-houses and its morphological aspects in Southeast Asian cities have been perceived from different secondary sources along with this the development of shop-houses in different periods in Old Dhaka and its evolution is also discussed.

It is known from the study that shop-house is a common building type of Southeast Asian cities which contains both residences and commerce into a single building unit in a single plot. Shop-houses also developed as a common building type in Old Dhaka since pre-Mughal period.

Space syntax enables one to understand the relationship between people and building by establishing the formal spatial properties of building. Based on the theory of space syntax, the primary objective is to search for the spatial pattern and consistency of differences among spaces across a sample i.e. inequality genotype. Hillier and his colleagues developed a comparative model of for analyzing the internal structure of buildings.

The spatial system can be analyzed in terms of inequality spatial genotype. With this latter concept one can analyze the underlying orders of spatial systems within a building, and can identify which spaces, in regard to the others, structure and configure the system.

To the extent that the theory of space syntax is applied, this study is built basically on the assumption that a certain group of activities is likely to correspond with a certain range of integration values. This research explores the difference among shop-houses across resident groups, physically altered and original typologies and assures that the inequality pattern of functions in shop-houses indicates the expression of social and cultural order of a certain society.

Chapter 03 CASE STUDIES

3.1 Introduction

In order to identify the prevailing order of the spatial pattern of the traditional shop-houses of Old Dhaka 15 (fifteen) shop-houses from 3 (three) different localities were analyzed in their spatial and syntactic properties with the space syntax methodology. This chapter elaborates the methodology followed in conducting the case studies with the discussion of the findings.

The first part of this chapter discusses the context of each study area with their historical background.

The second part demonstrates the findings of the reconnaissance survey, the functional and physical aspects of the study area as well as the traditional shop-houses of the study area.

The part three elaborates processing of samples for the space syntax analysis.

Finally in its last part the chapter describes the physical and syntactic properties of each case study shop-houses and summarizes the findings in area basis.

3.2 Selection of the Study Area

Three areas of Old Dhaka i.e. Shakhari Bazar, Tanti Bazar and Panni Tola has been selected for the study based on the following criteria:

- Areas having similar historical background;
- Areas having sufficient number of traditional shop-houses.

To study the spatial configurations and genotypes of the shop-house of Old Dhaka, shop-houses inhabited by different traders from locations across the region must be studied. However, it is not possible to accomplish this goal under the limited conditions of dissertation research. This study is an initial attempt to identify and publish fundamental information that can form the basis of future studies. Study areas were carefully selected where traditional shop-houses still retain their original form and function with less modification or at least the evidence of the structure can proof their age. In response to the purpose of the study, three historically significant areas were selected for study according to the criteria that the area has sufficient number of traditional shop-houses available for study and areas having similar historical background (Fig. 3.1). The three areas previously identified meet all these criteria. Some buildings in these areas have already been studied over many years, but there is little indication that the internal spatial patterns of these buildings have been scientifically investigated. This study will remedy such a deficiency. Findings will provide more explicit information for future study.

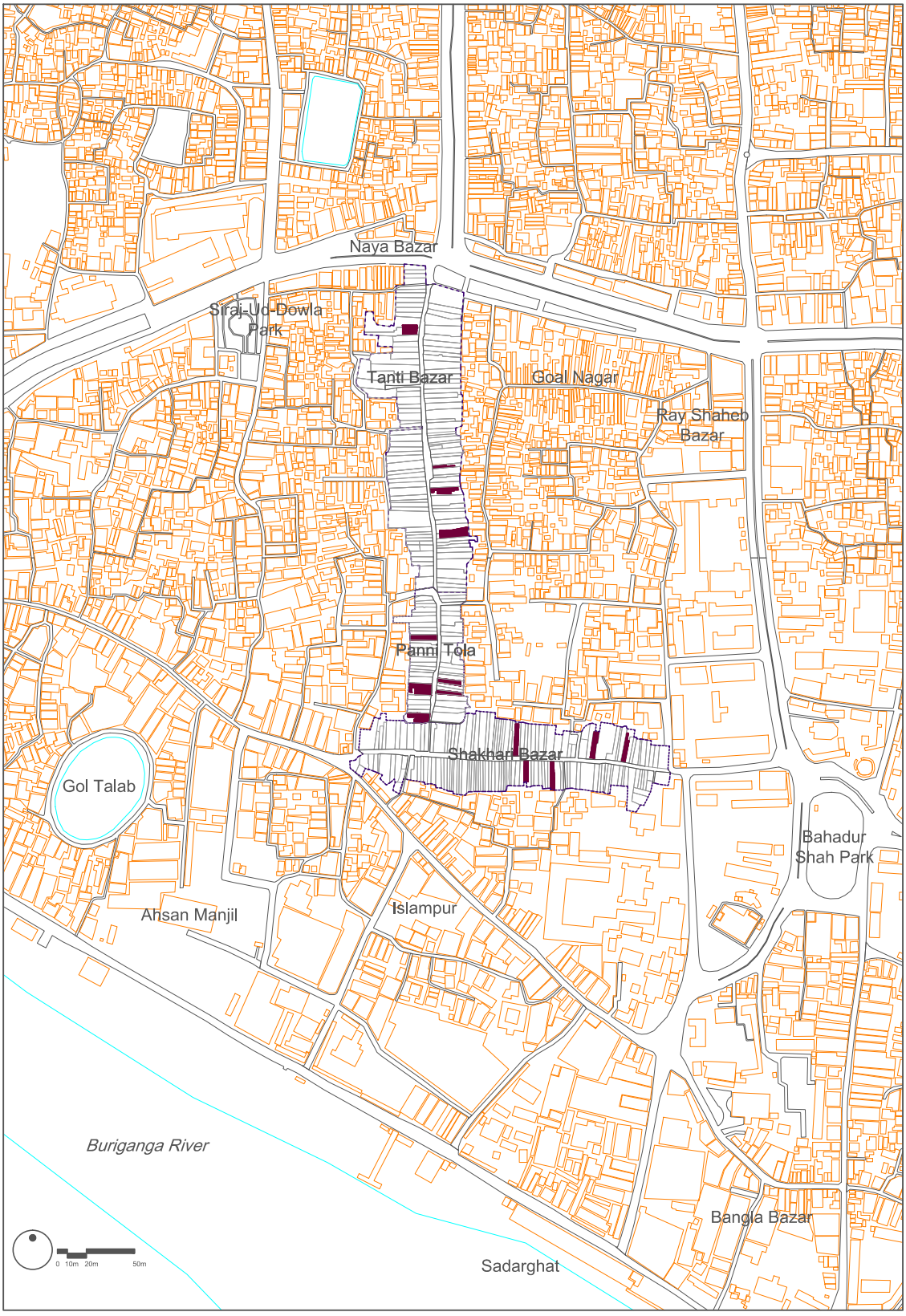


Figure 3.1 Map of survey area showing Shakhari Bazar, Tanti Bazar and Panni Tola

Source: Detailed Area Map (DAP) prepared by RAJUK, 2015

3.2.1 Shakhari Bazar

Shankha, a decorated bangle, is crafted from conch shells by specialized artisans known as *Shakhari* who belong to a specific Hindu caste (Imamuddin, Hasan, & Alam, 1989). Historically Shakhari Bazar area was named after these *Shakharis* (conch-shell artisans) who carry on their trade of shell cutting in this area (Fig. 3.2). The *shankha* ornaments have a specific socio-cultural value, applied only to married Hindu women. *Shankha* is the symbol that indicates that a Hindu woman who wearing *shankha* is married. The *Shakhari* people are an artisan caste. Most belong to the *Vaishnava* branch of Hinduism, and some to the *Shakta* cult; many are vegetarian (Naaz, 2012). The *Shakharis* were among the earliest residents of the city in the point of having retained their group identity. The name comes down since the Pre-Mughal days and the locality formed part of Pre-Mughal Dhaka.

Tavenier had mentioned the conch-shell export trade of Dhaka during the Mughal period, in 1666 CE (Haider, 1967). According to historian James Wise *Shakharis* were originally inhabitants of South India who migrated to this region with Hindu ruler *Ballal Sen* some 800 years ago and settled in Vikrampur a place close to Dhaka. Subsequently in 17th century CE, they received official patronage from Mughal ruler who brought them to Dhaka, allotted a free chunk of land in present area and waived taxes, duties to encourage the growth of trade (Imamuddin, Hasan, & Alam, 1989). The *Shakharis* came to Dhaka with the enticement of land and each chose a plot individually in the present Shakhari Bazar area. According to James Wise the reason behind the uniqueness of the shop-house architecture of the *Shakharis* is that, the plots given to them were very linear resulting in a narrow and congested physical development. The reason behind the 'Burgage plot' arrangement was to provide each allottee a plot with street frontage due to trading practice. However, it is claimed that in the middle of 19th century CE, Shakhari Bazar was one of the highest priced areas in Dhaka (Mamun, 1989). During this period there were about 500 *Shakharis* in Shakhari Bazar area to manufacture these conch shell products in the shop-houses (Ahmed S. , 1986, p. 94). *Shakhari* women maintain strong privacy. James mention the frequent abducting of beautiful *Shakhari* women by influential Zaminders around the area (Mamoon, 2017) (Wise, 1883). The complex planning and ambiguity of the access especially in the deep interior of the building might be the consequence of such insecurity.

After the partition of India, Dhaka became part of Pakistan and the richer Hindus migrated to India. Thus, many shop-houses in Shakhari Bazar were abandoned and the local government of Bangladesh is leasing them on long terms to the Hindu population mainly. Now it is a single street specialised in the conch-shell trade. Even though for centuries the whole area was inhabited only by *Shakharis,* today a wide variety of trade and traders such as goldsmiths, musical instruments, sponge woodwork, miscellaneous element of *puja* and ritual and other business persons reside permanently within this locality.

Another interesting phenomenon is the reconstruction of new shop-houses following the same old traditional style. Holding no. 109 and 123 followed this pattern which was recorded in 1989 by Imamuddin, but now these buildings are replaced by modern construction and the pattern of reconstruction is no more practiced (Imamuddin, Hasan, & Alam, 1989).

3.2.2 Tanti Bazar

Within the confined area of Old Dhaka, the position of Tanti Bazar is about in the central part of the old city. Tanti Bazar is one of the *oldest mahallas* and important commercial centres of Old Dhaka. Historically a renowned occupational group, the *Tantis* used to live in Tanti Bazar (Khatun, 1991). From the Pre-Mughal period, this *mahalla* belonged to the *Tanti* (weavers) community, reputed for the famous *Muslin* and *Tussor* of the Bengal. Other references also pronounce that during the beginning of Mughal reign, Islam khan and his large army found scattered settlements along the river, southeast of Babu Bazar area, inhabited mostly by Hindu settlements, Tanti Bazar is one of those areas (Rabbani, 2006). The *mahalla* borrowed its name 'Tanti Bazar' according to the profession of the people of the community. Dhaka's cotton products, especially *Muslin,* manufactured by the craftsmen of Tanti Bazar became an item of world trade and commerce during the 16th and 17th centuries CE, under the patronage of the Sultani and Mughal rulers (Hasan, 2008). After the foundation of the capital in Dhaka in 1608 CE, many *Tantis* moved to the city and established their adobes in Tanti Bazar area. Later, some of them moved to other places like Nawabpur (Hassan, 2008).

Among the artisan group, the number of *Tantis* was the highest in Old Dhaka. They used to live and set their weaving machine (*Tat*) in the same house of their own (Karim A. , 1994). Thus it is apparent that the houseform of *Tantis* was indisputably shop-house which comprises living and working unit together. Influence of rural traditional houseform is also observed in traditional neighborhoods of urban areas. The settlement of Tanti Bazaar also exhibits this traditional form of house pattern. The early houseform of Tanti Bazaar was observed as a thatched hut, from the etching from plate 16 of Charles D'Oyly ‘Antiquities of Dacca’, titled as 'a *Tantee* or Indian Weaver’ (Fig. 3.3).

During 1757, an urban revival took place in Dhaka due to the advent of English colonizers. With the shifting of capital from Dhaka to Kolkata and introduction of 'mule twist', Dhaka's commercial prosperity received its severe shock. In 1817, muslin factory was closed and weavers deserted Dhaka to seek employment in agriculture (Ahsan, 1991). After the decline of *Muslin* in British era, this community first moved into trading of cotton fabrics. Dhaka's cotton fabrics come to an end by the early 19th century with the coming of the mill-made cheap cloths from Britain and the imposition of many discriminating laws against the export of cloths from Dhaka. The *Tantis,* however, continued their manufacture of cloth for domestic use (Hassan, 2008).

Figure 3.2 S*hakharis* working with their traditional tools in Shakhari Bazar at recent time

Source: Smita, 2015, p. 161

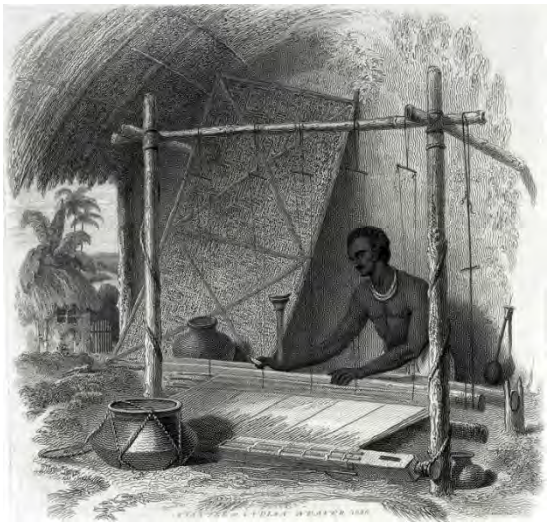


Figure 3.3 The etching from plate 16 of Charles D'Oyly 'Antiquities of Dacca', titled as 'a Tantee or Indian Weaver'

Source: http://www.bl.uk/onlinegallery/onlineex/apac/other/019xzz000000628u00016000.html

Finally, residents of that area devoted setting into themselves to the tradition of gold business and Tanti Bazaar became a place for the Goldsmiths, which was practiced there since Mughal period in a small scale to supply gold work for gold patterned Muslin. The original habitat of goldsmiths and silversmiths of Old Dhaka were in Kamarnagar and Banianagar area during Mughal period (Karim A. , 1994). Eventually, they shifted to Tanti Bazar area after the decline of Muslin and cotton. During late 1850s the weaver's quarter of Tanti Bazar was namely invaded by many newcomers outside Dhaka, including the educated middle class (Ahmed S. , 1986) and newly emerged bullion or money lending businessmen. The gold business and money lending which flourished on the economic boom that Dhaka enjoyed during that period. The boom also resulted in the urban redevelopment of the *mahalla* and the surrounding areas. Soon the adobe shop-houses of *Tantis* replaced with permanent shop-houses of detached introvert manner where the shops placed in a detached structure in the road side and the residence was built in the back separated by a courtyard. The elite businessmen also built many residences of introverted courtyard type. In the 18th and 19th century, Tanti Bazar used to be considered as one of the elite neighborhoods of the city.

The area again lost its grandeur because of the migration of the rich inhabitants specially the Hindu businessperson to India after the partition in 1947. In the present context, the profession of the people of Tanti Bazar is mainly goldsmith (*Sharnaker*) and silversmith. According to the local senior residents, the existence of *Tantis* in Tanti Bazar was evident up to late 1960's. Only three holdings of Bashi Chandra Sen Lane are identified where the *Tantis* resided along with

their shops and workshops. These are holding number 19, 19/A, and 92 of Bashi Chandra Sen Lane. Of them shop-house no.19/A was a *Bihari tat* shop along with the residence of the weaver (Khan F. M., 2013). Now the site is occupied with newly constructed mixed use development and the concept of single occupational group is not practiced but different classes, occupation and religious groups of people reside in the changed form of shop-houses in Tanti Bazar.

3.2.3 Panni Tola

Panni Tola located in the Rakhal Chandra Basak Lane which is the longitudinal extension of Tanti Bazar Bashi Chandra Sen Lane connected the Shakhari Bazar street with a narrow passage. The name Panni Tola basically came from the first settling area of the *Panniwalas*, people who used to make the foil of tin (Mamoon, 2017), (Haider, 1967). In Hindi *'Panni'* refers to 'a piece of thin and flexible sheet metal' or 'cover or back with foil' or 'a thread with glittering metal foil attached' or 'a showy decoration that is basically valueless' (www.shabdkosh.com, 2018). The living style of the *Panniwalas* was similar to the *Shakhari* people. It is assumed that at Panni Tola the *Panniwalas* used to supply delicate and small accessories of gold and silver to the adjacent Shakhari Bazar and Tanti Bazar area as both *Muslin* and *Shankha* products sometimes ornamented with gold or silver decoration for high end clients.

Still at the present context shops at Panni Tola sold delicate small units of ornament or decoration items and instruments or raw materials which are required for gold or silver works and supply Tanti Bazar at north and Shakhari bazar at south.

3.3 Reconnaissance Survey on the Study Area

In area level study, field (reconnaissance) survey, cartographic maps and records study have been done to explore the morphological characteristic of study area with respect to the organization of shop-houses. The field survey has been conducted within the year of 2019 on Shakhari Bazar, Tanti Bazar i. e. Bashi Chandra Sen Lane and Panni Tola i.e. Rakhal Chandra Bashak Lane. Shop-houses of these particular roads have been surveyed as these roads still demonstrate considerable number of traditional form of buildings. During the study process, field survey has been conducted to understand the existing morphology of the study area in terms of functional and physical aspects that are identified as the indicators of urban morphological characteristic. For this purpose, the data of field survey have been recorded in the field survey observation sheet (Appendix C).

In the present condition, the surge of new development is tremendous in the study area. The demand of shops has been increased in this area for last few decades. Lot of traditional buildings had demolished to make new high-rise mixed-use buildings. Here mixed-use denotes

combination of the functions like commercial, industrial, institutional, recreational etc. in the same building with residential units. So at the first sight the buildings of the study area can be separated into two categories, one is traditional, buildings which built before Pakistani Period, other is contemporary, buildings constructed after British Colonial Era.

In Shakhari Bazar among 143 buildings 72 found as traditional, in Tanti Bazar 52 traditional buildings found within 133 buildings and in Panni Tola 28 traditional buildings found among 48 buildings (Fig. 3.4).

3.3.1 Functional and physical aspects of the study area in present context

3.3.1.1 Land-use pattern

Land use indicates the type of use in individual plots of the study area. In order to understand the land use pattern of the study area and to identify the number of shop-houses in the present context, all the holdings of Shakhari Bazar Street, Tanti Bazar i.e. Bashi Chandra Sen Lane and Panni Tola i.e. Rakhal Chandra Bashak Lane have been surveyed. Mostly shop-houses dominated in the study area. From the field survey 255 holdings out of 324 are found to have shop-houses in both traditional and modern buildings, which indicate that about 79% holdings have shop-houses in the study area (Fig. 3.5). At present multiple trade activity is evident in shop-houses of all three areas like light food shops, telecommunication outlet, pharmacy, tailors, VCD shop, stationary, confectionary, medicine shop, religious paraphernalia, barber shop, gas cylinder shop etc. are found in the study area. Fig. 3.6-3.8 is the graphical representation of present trade activity and timeline of the buildings of Shakhari Bazar, Tanti Bazar and Panni Tola respectively.

3.3.1.2 Street pattern

In present context, the streets of the three study areas are narrow (vary from 6 feet to 28 feet) and almost straight. However some of the parts of the streets are wide. It is known from the field survey that those wider part of the streets were used as the parking of "*Ghorar gari*" (horse cart) a typical transportation of British Dhaka. The existing street width has not been changed from the previous condition. But, in the present context, different temporary shops and different road side utilities are often found to be developed on both sides of the narrow street. Thus, the street gives the look of congestion and an image of a bazar street which also seems lively.

3.3.1.3 Arrangement of plot

The plots are linear in pattern. At Shakhari Bazar the plots are east-west elongated while at Tanti Bazar and Panni Tola they are north-south elongated. Traditionally there was a tendency of the sub-division of the plots into two or three numbers of plots mostly found to be divided among the successors. But the recent tendency of amalgamation of plots is evident due to develop multistoried (five storied to ten storied) buildings with large number of shops and residential units in a large chunk of land specifically near the nodes.

Figure 3.4 Traditional and contemporary buildings in the study area

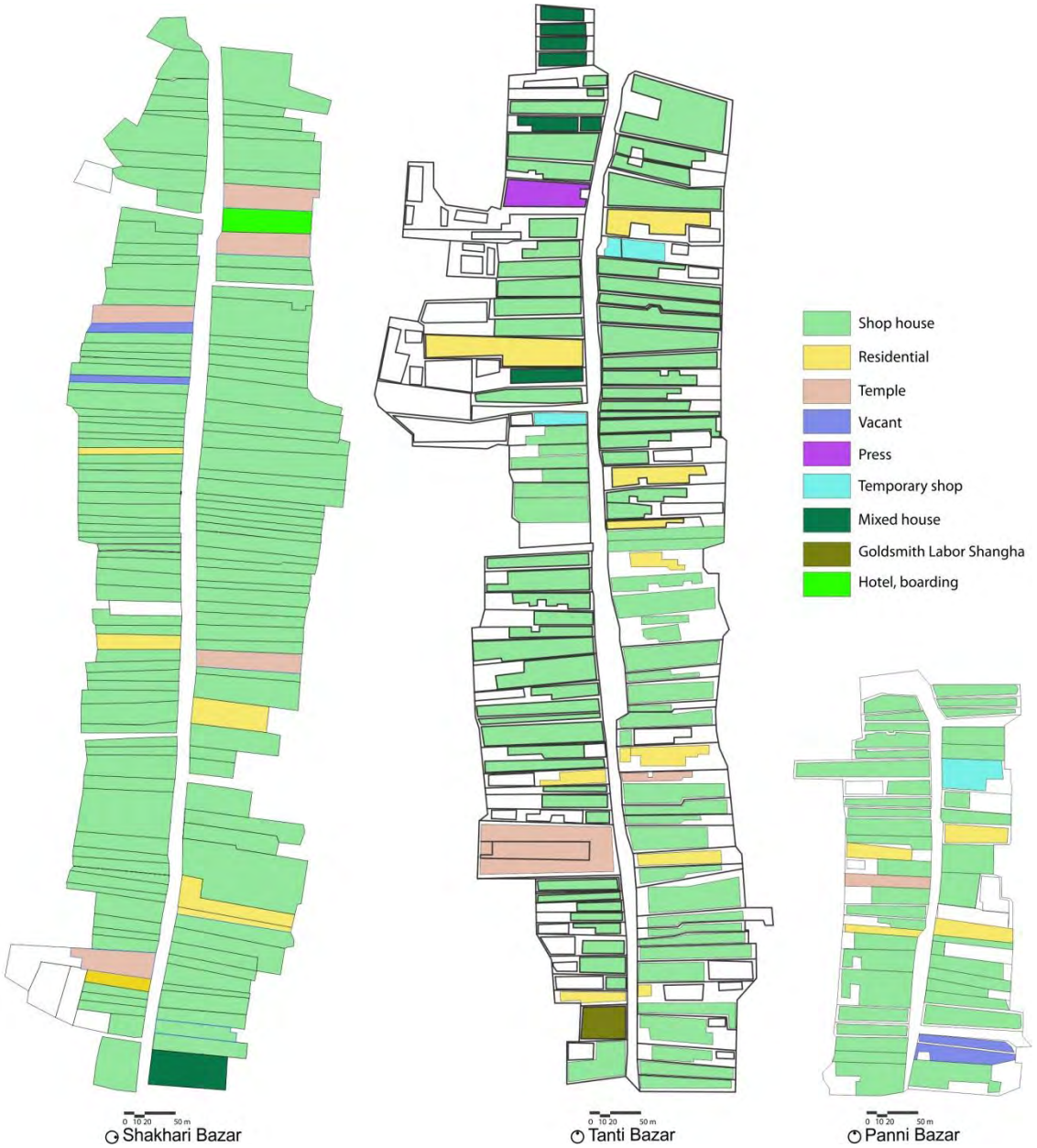


Figure 3.5 Land use pattern of the study area

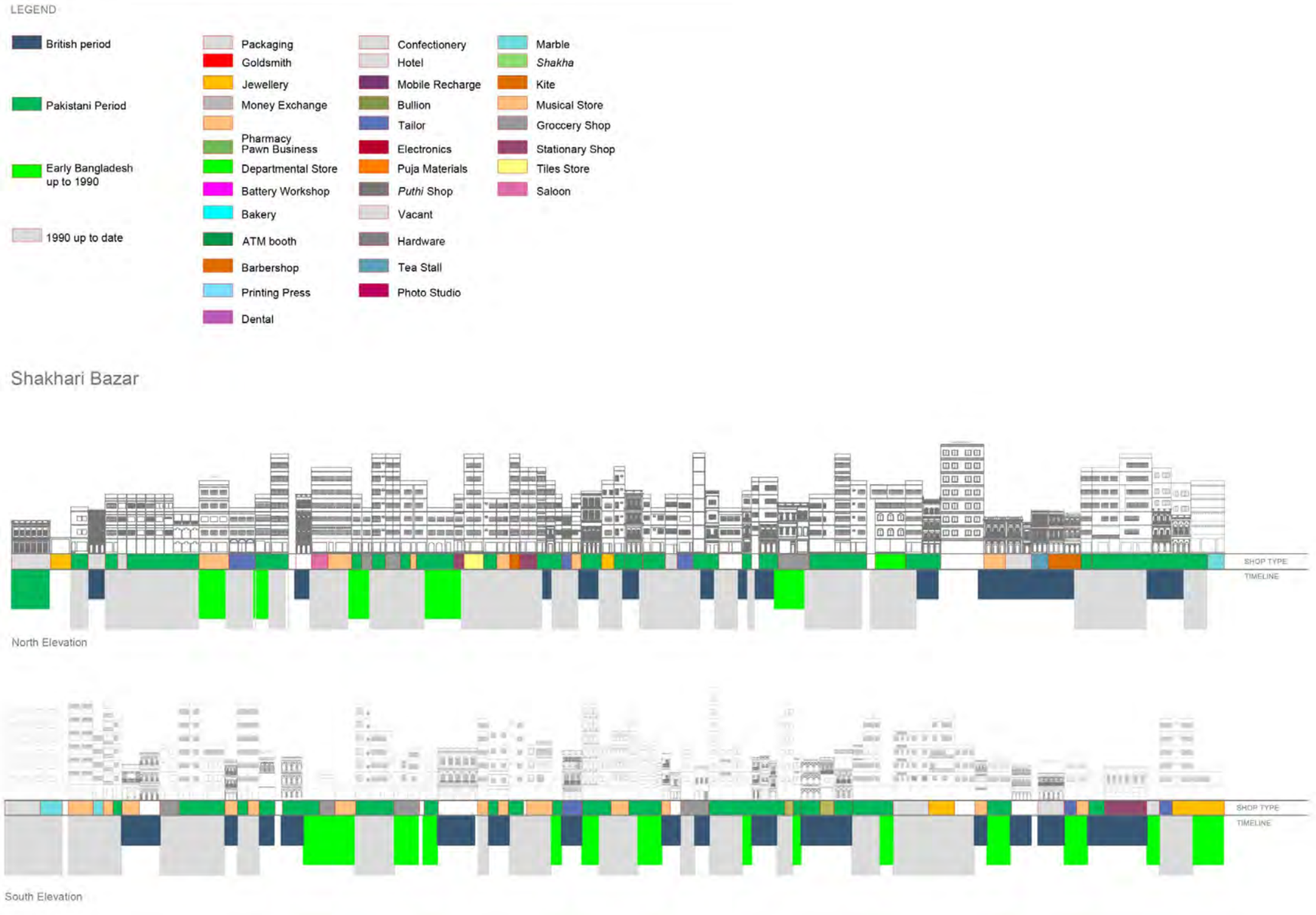


Figure 3.6 Present trade activity and timeline of Shakhari Bazar buildings

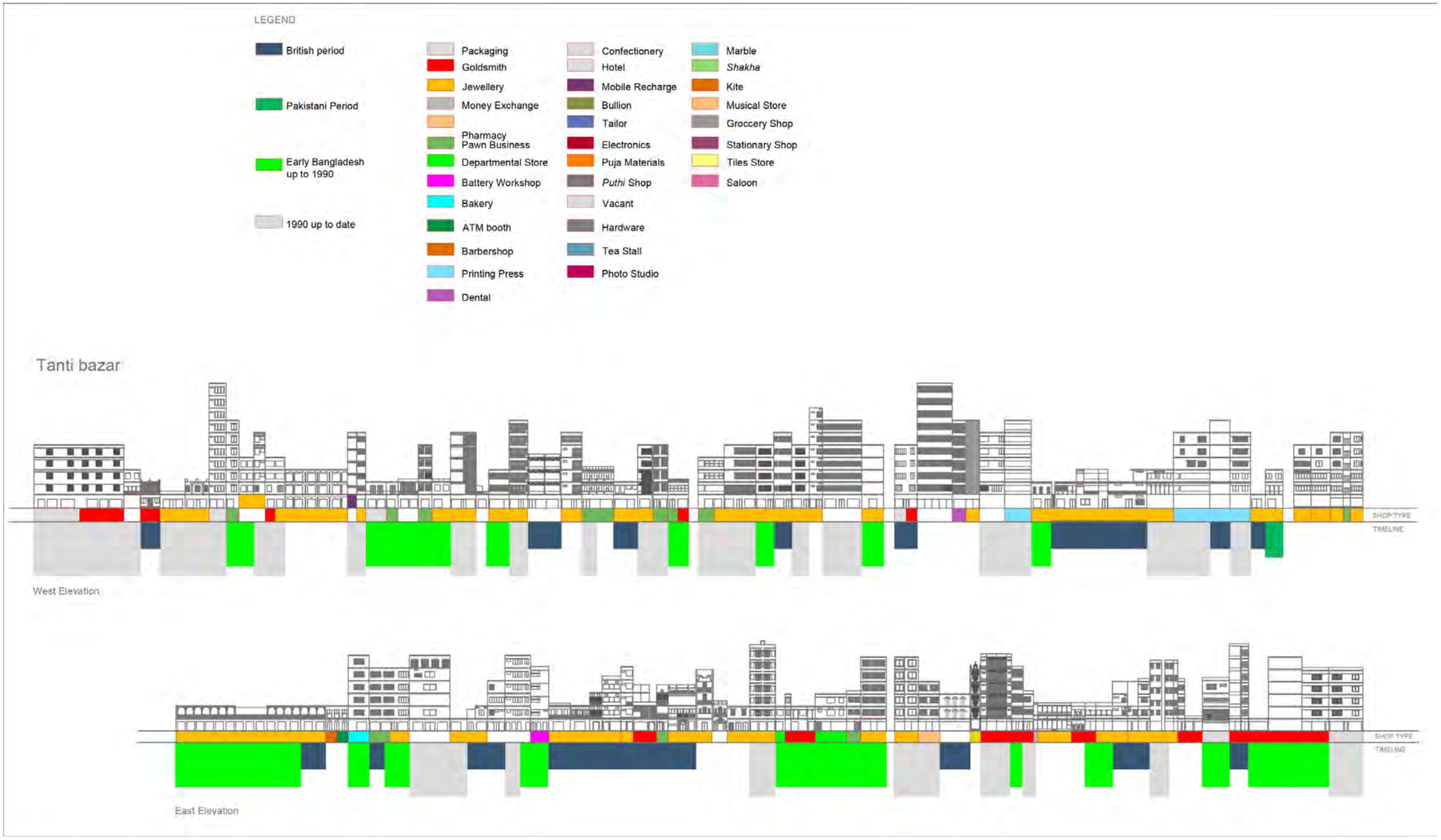


Figure 3.7 Present trade activity and timeline of Tanti Bazar buildings

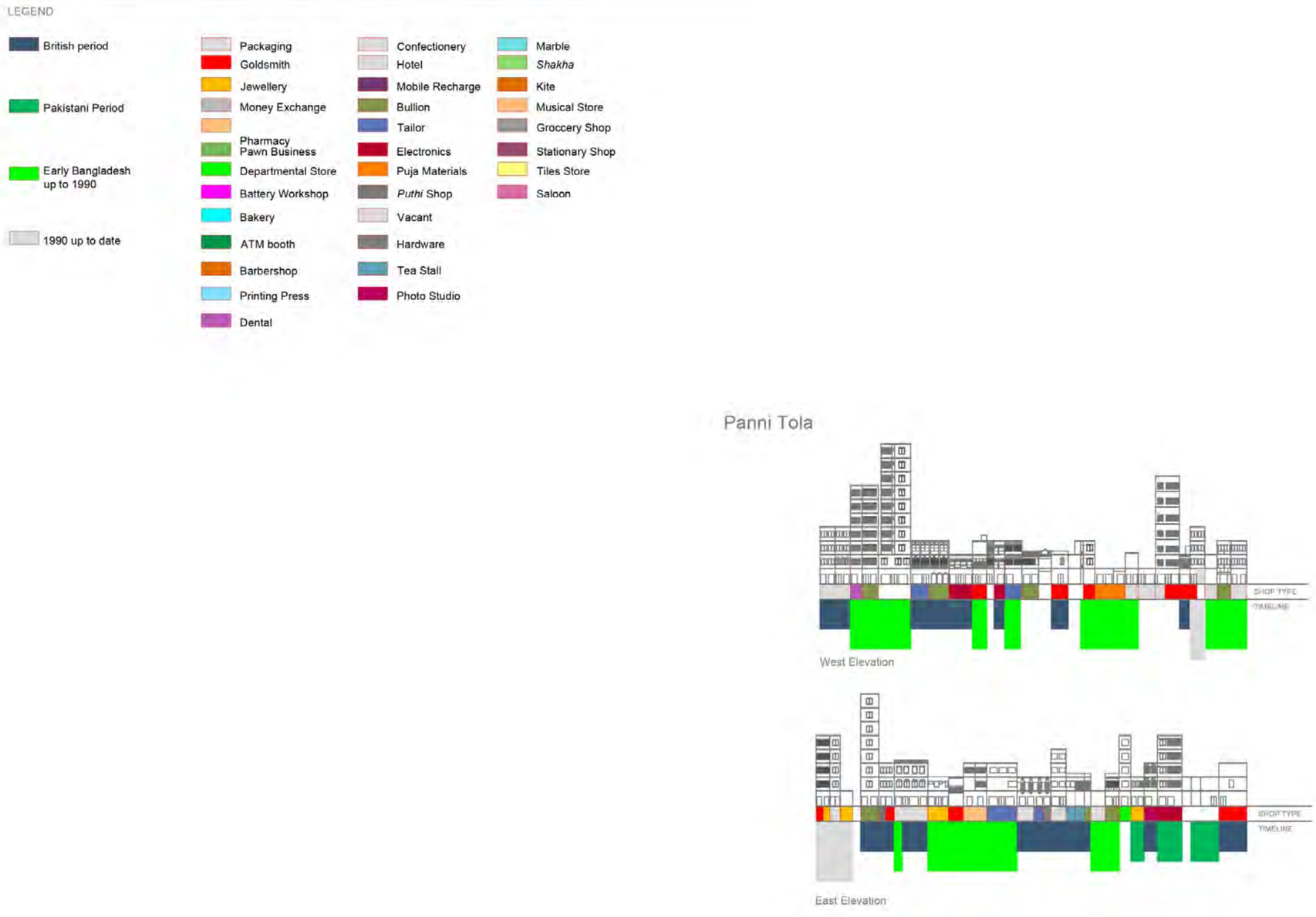


Figure 3.8 Present trade activity and timeline of Panni Tola buildings

3.3.1.4 Built form and related open space

The important changes of the built form of shop-houses are the change of building height and footprint. Considering the building height, owners of the shop-houses have the tendency to build multi-storied shop-houses especially near the nodes to make them more profitable as the accessibility of streets is high along the node. Moreover, the footprint of the shop-houses has also increased in individual plots. Along with the growth of the built up area, the open spaces of the plots have decreased accordingly.

3.3.2 Functional and physical aspects of the traditional shop-houses

Considering the functional aspects, the shop-houses had been changed historically in type of trades and commodity, pattern of ownership and use pattern. On the other hand, in terms of physical aspects, the shop-houses had undergone historical changes in organization of shops and residences, access and circulation, structure, open space, interface and street width-building height ratio (Khan F. M., 2013). The historically changed morphology of shop-houses in the study area is discussed in the following part.

Type of trade and commodity

Originally single occupational group inhabited in a particular area, *Shakharis* or conch-shell artisans in Shakhari Bazar, *Tantis* or weavers in Tanti Bazar and *Panniwala* or tin foil maker in Panni Tola, from where the area derived its name. With the course of time through the historic evolution process although *shakaries* in Shakhari Bazar localities retained the original settlement with the earliest trade and commodity, while Tanti Bazar and Panni Tola locality observed a change in its original settlement due to the shrinkage and fall of the particular trade, but the name of the locality still bears the evidence of the original trade. Soon new trade developed due to the locational importance and weaving replaced by Bullion and Jewellery business in Tanti Bazar and foil making replaced with other trades like supply of raw materials, instruments and delicate small accessories to support gold and silver craft.

Pattern of ownership

It is known from the literatures that traditional shop-houses were occupied by single families (Imamuddin, Hasan, & Alam, 1989, p. 42), so the buildings were usually had single owners. Historically the patterns of single ownership remained unchanged because the plots were sub-divided into two or more numbers of plots among the successors when the family members increased and separated from each other.

Use pattern

A good number of traditional residences have been transformed into shop-houses by converting the front rooms of the ground floor of the building into shops particularly in Tanti Bazar and Panni Tola locality. Out of 15 cases, 7 buildings were residences which historically altered into shop-houses. In such situations, mostly the rooms of the residence that were

adjacent to the road have been altered into shops in different periods. These types of historically modified shop-houses are considered as altered category in the thesis. Moreover, slight adjustment of different functions and division of spaces are carried out in some traditional shop-houses according to the needs of the residents.

Organization of shops and residential units

The popular site configuration of traditional shop-houses in Old Dhaka was a thin long strip. The strength and growth of the trade in the *mahallas* forced greater subdivision on the value of shop frontage (Khan I. M., 1987). Therefore, the plots were aligned perpendicular to the street to take the advantage of street front for business purposes. The configuration of the plot of traditional shop-houses is narrow and elongated; therefore, different functions in the shop-houses are generally arranged in a sequence from the street i.e. shops at the front, residences at the middle and services at the rear of the plot. In the case of multistoried shop-houses the upper floors are usually used for residential purposes.

Access and circulation

Nature of access and circulation vary from one shop-house to another depending on the organization of shops and residential units. Traditionally most of the shop-houses were provided with separate entries are for shops and residential units. Entry to shops was kept directly from the road or through a covered walkway, verandah or shaded platform and a separate corridor is kept either at one side of the plot or in between the shops as residential entry. The existence of service entry as *'methor goli* ' was present in some of the shop-houses constructed during British and Pakistan period. The shop-houses having separate entries, maintained the control between shops and residences by a door placed at the front of the residential entry. Thus, level of privacy was good in such arrangement.

Structure

Traditionally built shop-houses showed load bearing masonry walls of bricks with flat roof supported by wooden or steel beam/joist as rafter (*Barga*) with wooden purlin (*Kari*), as the structural system.

Courtyards and open space

Most of the cases front yards, internal courtyards or backyards were incorporated in the traditional shop-houses as an integral part in its configuration. Courtyard was used in traditional shop-houses for manufacturing, sorting and storing of products and backyard was used by the female members for service activities. Open spaces have found in traditional shop-houses in the form of terraces, accessible rooftops and unused yards at back.

Interface and building height-street width ratio

Traditionally the Shakhari Bazar shop-houses were two to four storied high in order to accommodate the large joint or extended family which was dominant social system in the early

socio-cultural context whereas the Tanti Bazar and Panni Tola shop-houses were mostly single or two storied. Traditional shop-houses had single rows of shops along the street which were usually approached by covered walkway or shaded platform or verandah in the ground floor. Many traditional shop-houses had '*roaks'* and steps at front of the shops to provide opportunity for the local people to spend time in gossiping. Street width and building height ratio vary from 1:1 to 1:3 or 1:4 in the traditional houseform.

3.3.3 Building layout of the traditional shop-house

Most of the shop-houses of Study area are attached to each other by sharing the same wall. These shop-houses are elongated in the north-south direction along the plot in Shakhari Bazar and in the east-west direction in Tanti Bazar and Panni Tola. The synchronized elevation treatment in the street front façade of the traditional shop-houses indicates that, each owner presented a facade to its street in order to enrich the visual symphony of the ensemble, where each building keeping its own identity blended with the harmonious whole.

The shop-houses are mostly leaner-rectangular in shape. The depth is almost two to ten times than frontage to suit the building in burgage plot. The width of the building varies widely. Narrowest building with only 6 ft. width found in both Shakhari Bazar Holding no. 92, and Tanti Bazar Holding no. 20. Raised plinth and verandah created the transition space between the house and the street.

From above descriptions, some common physical properties have been found in these shop-houses of the study area. Such as courtyard, corridors, shops, open spaces with the served and service spaces. Individual house temple is another significant feature of these shop-houses. These spaces played a significant role in the spatial organization as well as accessibility to the internal spaces of the buildings. Thus they help to determine the physical as well as the spatial character of these buildings.

3.3.4 Classification of shop-houses on physical properties

The shop-houses are mainly divided into three segments: the commercial part facing the street also provide a sense of privacy from the roadside, the residential area in the middle and the service area consisting of toilets and washing areas in the open courts at the rear. As per the classification of urban houseform the shop-houses are mainly of introverted type of buildings. From physical analysis the traditional shop-houses of the study area can be broadly divided into three types according to their plan layout (Appendix-E).

Type-1: Enclosed courtyard type

This type of shop-house showing a shop frontage then sequentially comes the court yard which separates the residential zone from the shop space and at the back there is the service court

having a well or *Indra* with separate kitchen and toilets. Most of the case study shop-houses are of this type.

Type-2: Detached type

Shop-houses of this type show a comparatively loose pattern having an open front court with a detached out house or shops in front and another or more inner courtyards in a sequence as informal and service court. Residential zone placed in-between the front court and informal courtyard while separate kitchen and toilets arranged around the service court. PT-17 and PT-40 are detached type shop-house.

Type-3: Narrow introvert type

Another pattern of shop-house observed in narrower plots (6 feet width); this contains a single narrow mass having a narrow passage lead to the rear service court yard. In this type of arrangement one room needs to be accessed through another room. TB-20 and PT-43 are the example of this type of shop-house.

3.4 Selection and Processing of Sample

3.4.1 Sample selection procedure

A sample of five (5) shop-houses will be selected from each case study area (3 areas) based on following criteria:

- Shop-house which retained their original houseform i.e. the traditional shop-houses;
- Shop-houses must be occupied by original owner or their descendants;
- Shop-houses must have residential and commercial occupancy at present.

The case studies have been conducted on those shop-houses (Fig. 3.9), where residents allowed the researcher to study the existing floor plans. Moreover they cooperated to provide the background history and the activity pattern of the traditional houseform. The samples were labeled by the abbreviation of the area name, SB for Shakhari Bazar, TB for Tanti Bazar and PT for Panni Tola, with its present holding no. e.g. ‘SB-10’ is the shop-house located in Shakhari Bazar with the holding no. 10.

3.4.2 Observation and interviewing process

The main criterion for participant selection was their willingness to be interviewed and visited at home by the researcher. For each shop-house the researcher spent between 1 to 2 hours for collecting data. Sometimes a second and a third visit was necessary. Since existing graphic resources were not available, plans of each shop-house were sketched and measured during each visit.

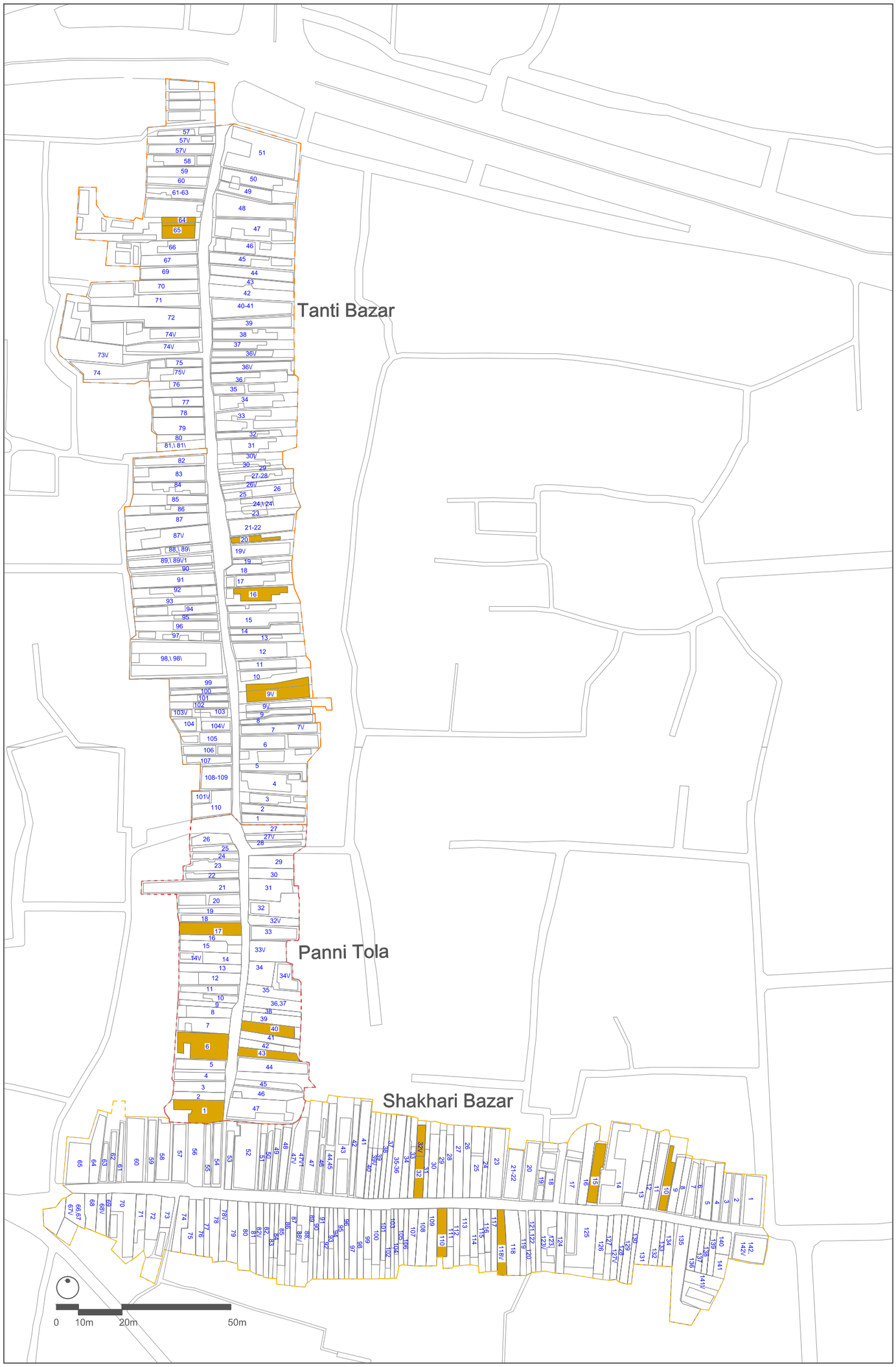


Figure 3.9 Site plan of the study area showing the case study plots

During the physical survey, existing floor plans of the selected shop-houses have been documented, analyzed and then the original floor plans and activity pattern of the shop-houses have been prepared through the discussion with owners, senior local citizens and through the keen observation of the construction technique and building materials. The original uses were identified with the help of senior inhabitants or by observing the position and size of the space by the researcher.

During the visit, the head of the household, housekeeper, and other family members were interviewed concerning their daily living activities. The questions were designed to provide basic information about the primary uses of spaces in the houses. The respondents were asked to identify activities usually performed in specific spaces of the house. Generally, the unstructured research questionnaire, attached in Appendix D, dealt with meaningful issues of everyday life in shop-houses, such as what, when, where, and with whom activities take place, the age of the shop-house, the primary use of the shop-house in general, and the type of shop. The questions also included information concerning their cultural background such as their religion, ownership type, the number and age of family members, the traditional ceremonies (e.g., annual *puja*, marriage or other social or religious gathering) in which they participate at home, and the variety of relationship occurring among occupants in the house. The family background information is needed to clearly differentiate the groups of participants.

3.4.3 Grouping area wise trade community

The research conducted the study across three diverse trade groups historically living in three separate but adjacent locations, the *Shakharis* (conce shell cutters), the *Tantis* (weavers) and the *Panniwalas* (tin foil artists) in Shakhari Bazar, Tanti Bazar and Panni Tola respectively. Most information about trade group profession relies basically on information provided by respondents and from recorded literature from secondary sources. Although in Shakhari Bazar the *Shakharies* continued their presence, while in Tanti Bazar and Panni Tola the original settlements replaced with goldsmiths and delicate accessories supplier. Traders of individual locality exhibit difference in their trades, in their time of establishment and in their social group ideology.

3.4.4 Grouping shop-houses according to original and altered category

Because most traditional shop-houses are remodeled, rebuilt, or demolished over time, the plans of existing shop-houses may not represent the characteristics of the earliest i.e. the very traditional ones. Therefore criteria were established in order to identify and categorize original and altered shop-houses.

• Those shop-houses that are rebuilt or remodeled but retain the traditional forms and initial uses of both commercial and residential characteristics are categorized as ‘original’. Generally

these shop-houses are built not earlier than the Late Colonial period i.e. previously to 1947 while some of them are still bearing the evidence of Mughal period of construction techniques, mainly the shop-houses of Shakhari Bazar few in Panni Tola and northern portion of Tanti Bazar. For the sake of the study the original plans are retrieved from the uncontrolled and half hazard development with the keen observation of building materials and techniques, and information collected from the old inhabitants and other elderly persons of the locality.

• After being rebuilt or remodeled, an original residential structure which does not maintain its active role in solely domestic activities but introduced some sort of commercial activity by adding or converting spaces into shops is determined as 'altered'. In this case only the historically altered shops and the associated developments at that phase considered in this study. The recent half hazard developments were avoided to draw the floor plans of the traditional shop-houses.

Among the fifteen case studies eight found as original shop-house and seven as altered category. Among the selected five shop-houses in Shakari Bazar, all are original. Among five shop-houses in Tanti Bazar, all are altered. In Panni Tola, among the five case studies three are original and two are altered shop-houses.

3.4.5 Grouping activities

According to the previous studies it was seen that in residences family activities such as working, eating, sleeping, cooking, etc. are performed in the inner part of the house while formal activities such as socializing, receiving guests, which include participation in the community are performed in the outer part of the house near to the entry (Khan F. A., 1999). But the fundamental activity pattern found in shop-houses in our context was not yet established in available secondary sources. This was done prior to the field research of this study. The final classifications used in this study categorized in seven primary functional spaces of activity patterns i.e. Shops, Circulation, Courts, Open Spaces, Served Space, Service Space and Temple.

Francesco Cacciatore introduces an alternative means of understanding Kahn's hierarchical relationship between served and servant space in the work of Aires Mateus. Cacciatore employs the terms main and auxiliary as a means of distinguishing the served and servant or service spaces. The **main spaces** are the **served zones** or the primary areas, such as living rooms, bedrooms, etc., whereas the **auxiliary spaces** are the **servant zones** or secondary areas, such as kitchens, storerooms, closets, bathrooms, circulation, stairs, etc. (Cacciatore, 2011)

Table 3.1 is a summary of the grouping activities and spaces in which they take place. Some activities occur in more than one space. For example, in some shop-houses the verandah is designated as a sleeping space at night as well as a temporary storage; some households dry their clothes at the corridor; most shops are guest receiving areas as well as the public places for buying and selling goods or services. In these cases, the prime activity is considered in labeling those spaces.

Table 3.1 Group of labeled space and activities

Labeled space	**Activities**
Shops	Shop (Buying and selling goods) Workshop or small industry Shop Store
Circulation Spaces	Corridor Intervening Space (IVS) Stair
Courts	Front yard Courtyard (Children's play, women's gossiping) Service Backyard (Washing, cooking preparation, presence of *Indra tala*)
Open Spaces	Terraces (Drying cloths, women's gossiping) Roof (Flying kites, Children's play) Unused Yards
Served Spaces	Sleeping and resting Eating Living Social Space (Guest receiving or encountering with visitors) Recreation (Indoor games) Children's Studying Puja Space or prayer space
Service Spaces	Cooking in kitchen, outside kitchen Bathing Extracting Store
Temple	In-house Temple (Mandir)

3.4.6 Convex Space Break-Up

This study emphasizes the uses of space, therefore a justified gamma map and convex breakup for each shop-house was produced based on space use as well as the shape of space. The criteria for breaking down convex space are elaborated as follows:

• Exterior space that is in front of the house is considered a single space.

• Generally any outside space with access that cannot be controlled by the household is considered as exterior space. If the outside space can be controlled by the householders then it is considered as intimal space, for example a backyard or open terrace, although on the outside, is considered an intimal space if its access is controlled by householders.

• Regardless of shape or size, a stair is considered one single convex space.

Basic syntactic data is obtained by using **'JASS'** computer based 'Justified Graphs' analysis software. The basic syntactic data mostly needed for this research is integration values, mean depth, depth level, control value and connectivity.

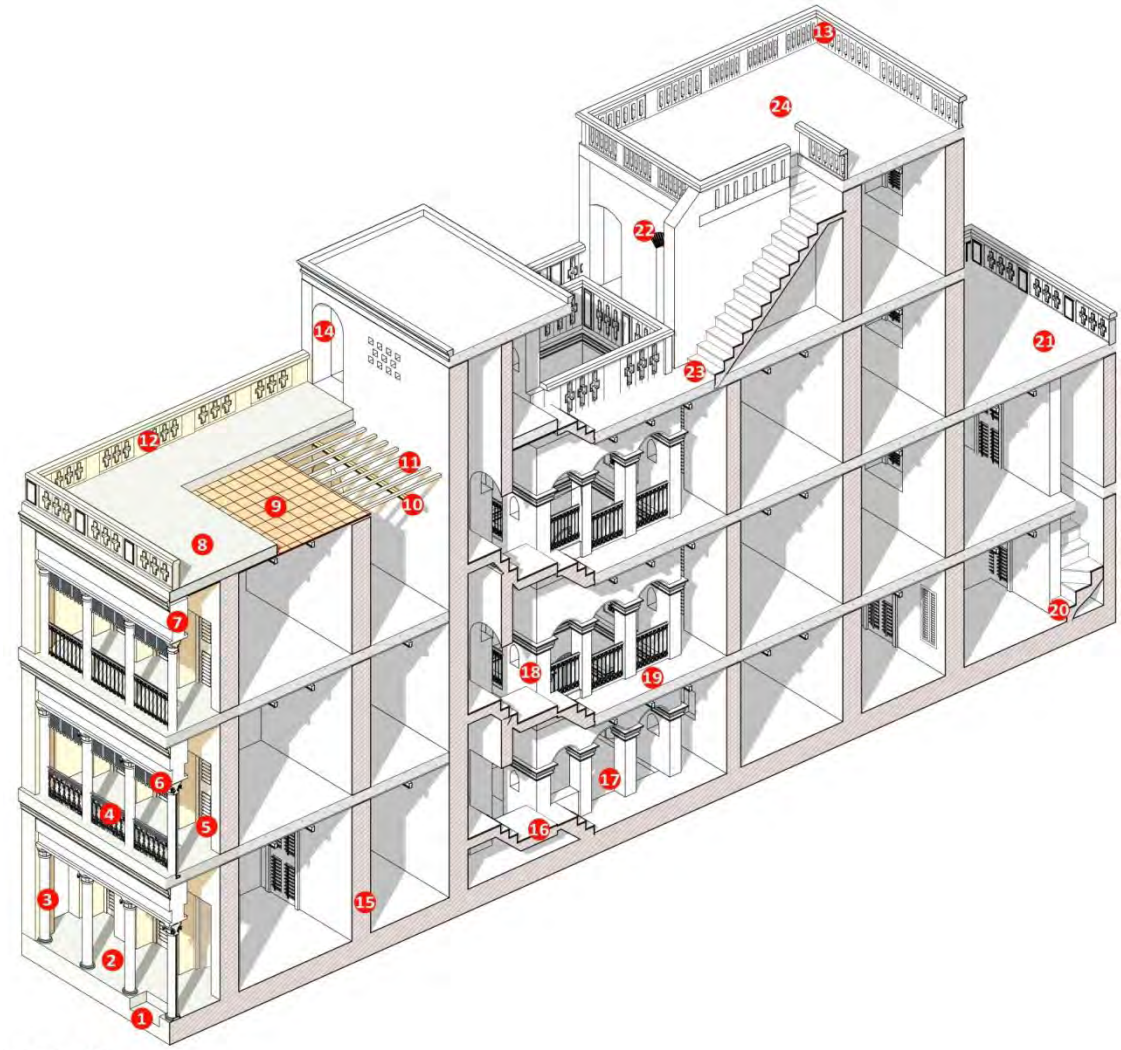
3.5 Case Study

3.5.1 Shakhari Bazar shop-houses

In Shakhari Bazar most of the traditional shop-houses found are similar in nature; all are of introverted courtyard type and originally built as shop-houses. By sharing the same thick party walls, narrow and extensively deep shop-houses moves up to three to four storey high with delicate front façade and mostly inhabited by a specific trade group, the *shakharis*.

3.5.1.1 Case study: SB-10

Located at 10, Shakhari Bazar Street, the shop-house is an example of enclosed courtyard typology. This shop-house has an enclosed central court with colonnade which separates the living and commercial zone of the building in the ground floor. The shop is placed at the front of the house separated by a verandah from the road. The room behind the shop is used as storage and workshop approached from the shop only. The entrance corridor went to the back of the house to a shaded service yard where a stair serves the double storey back-quarter of the shop-house. The habitable four storied building is served with the main staircase placed in the central courtyard. One of the remarkable characters of the building is its connection with the adjacent 11 nos. building at second and third floor open terraces from stair lobby. The building had its own terrace in the front side of third floor while from middle it is connected to the adjacent terrace of 11 no. shop-house and the back is comprised of habitable spaces with a separate stair to the roof of the rear part of the building. The room are covers the entire width of the house; therefore, access to the rearmost rooms is only possible through the foremost room beside stairs.



LEGEND

1. Rock step	9. Clay tiles layer	17. Inner courtyard
2. Veranda	10. Kari (purlin)	18. Kuthuri
3. Corinthian column with capital	11. Barga (rafter)	19. Connecting bridge
4. Wrought iron railing	12. Parapet wall type 1	20. Back stairs
5. Louverd door	13. Parapet wall type 2	21. Back terrace
6. Wooden screen	14. Arched opening	22. Arched opening
7. Corbel	15. Load bearing brick wall	23. Stairs towards roof
8. Lime-surkey slab	16. Main stairs	24. Roof

Figure 3.10 Organization of Shakhari Bazar shop-house (SB-10)

In space syntax analysis it is seen that the shops and residential area of this building has been separated both physically and syntactically by a number of integrated circulation spaces. Only in this building shop is found in the segregated zone with a high average RRA value of 2.14 and high average mean depth value of 8.08 (Table 3.2) among the others buildings of Shakhari Bazar.

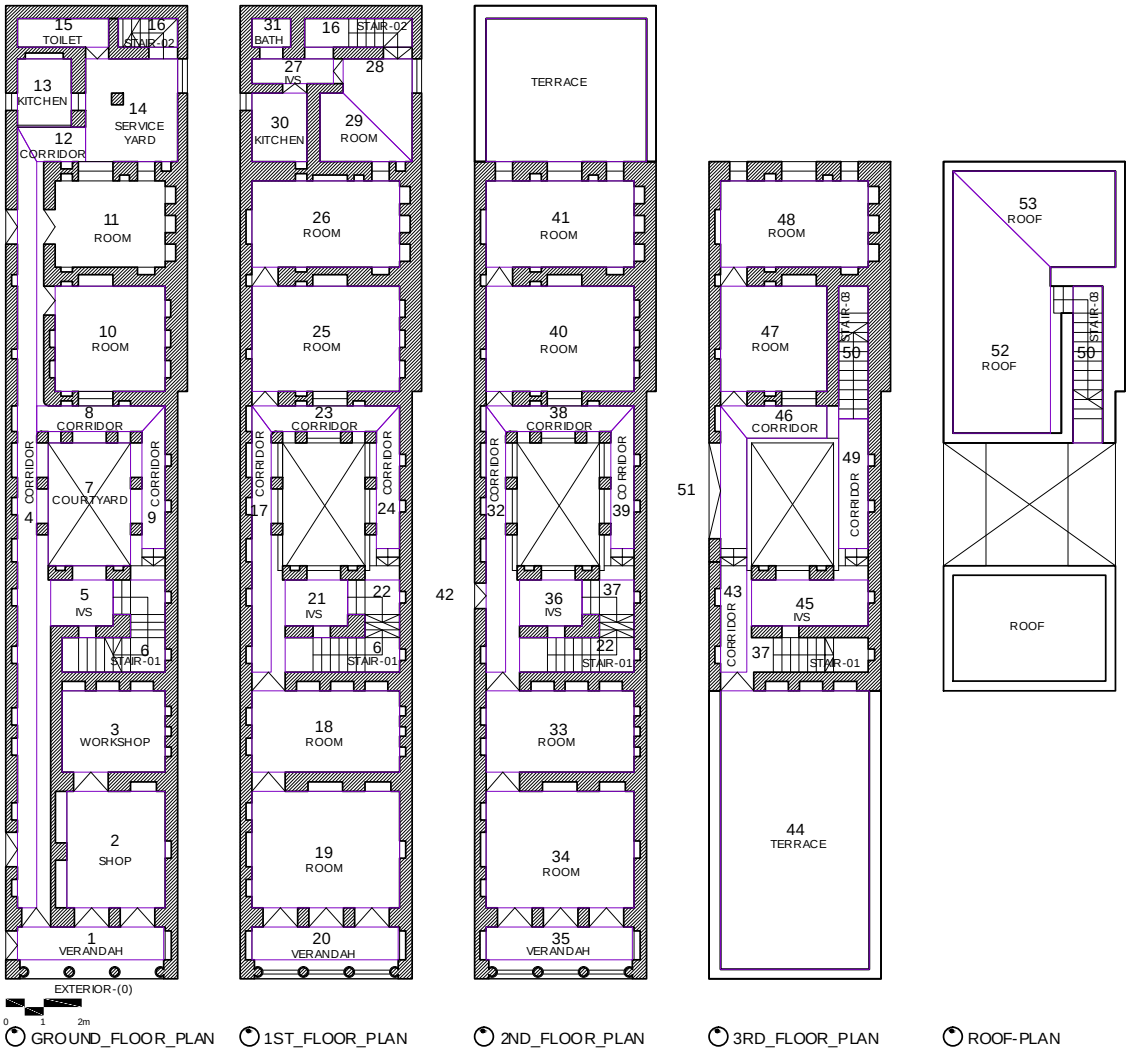


Figure 3.11 Shop-house SB-10

Table 3.2 Summery of syntactic data of SB-10

SHOP-HOUSE	ACTIVITY	DEPTH	MD	CV	RRA	CN
SB10	EXTERIOR	0	7.62	0.33	2.01	1.00
	SHOP	2.5	8.08	0.92	2.14	1.50
	CIRCULATION	7.08	6.45	1.33	1.65	3.04
	COURTS	3.5	6.59	1.49	1.69	3.50
	OPEN SPACES	12.8	8.81	0.52	2.37	1.20
	SERVED	8.29	7.65	0.87	2.02	1.57
	SERVICE	7	8.50	0.36	2.27	1.00
	TEMPLE	N/A	N/A	N/A	N/A	N/A
TOTAL GRAPH	MINIMUM	0	5.00	0.14	1.21	1.00
	MEAN	7.48	7.30	1.00	1.91	2.19
	MAXIMUM	16.00	11.45	3.58	3.17	7.00

The highest integration with a RRA value of 1.21 is found in the first floor corridor (Table A1), space no. 17 with the lowest mean depth value 5.00. The long corridor at ground level space no. 4 has the highest control value of 3.58 with highest connectivity 7.00. The central court

remained as an integrated space with the RRA value of 1.53. Served spaces are integrated and service spaces are segregated in this shop-house.

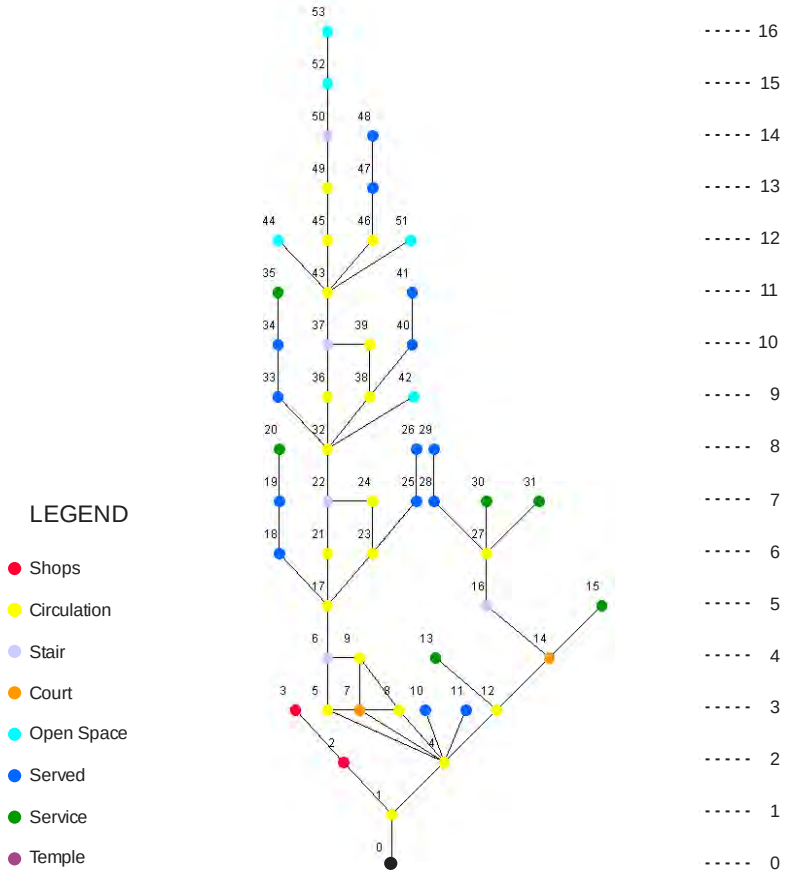


Figure 3.12 J-graph of SB-10

The J-graph is 16 steps deep (Fig. 3.12) with small rings around the corridor of the central court and no large exterior rings found. It indicates the sharing of spaces among the inhabitants rather with the visitors.

3.5.1.2 Case study: SB-15

The shop-house located in 15, Shakhari Bazar Street is also an example of enclosed courtyard typology. The present condition of the four storied shop-house is mostly dilapidated.

In Shakhari Bazar many shop-house has the characteristic of shared courtyard, light well or backyard in ground level and shared terraces and roofs in upper levels within two or more adjacent shop-houses. The back yard of this shop-house was extended to the adjacent plot no.14 sharing another similar yard that's making the back yard larger.

Leaving the stair towards the upper floor the entry corridor goes directly to the service courtyard from where another stair way serves the three storied rear-quarter of the shop-house. The front part of the building served with two stairs, after reaching the first floor corridor the stair shifts in the frontal side of the building and with a straight stair reaches to second or third floor. To use

this straight stair one needs to move through the served rooms and thus this portion of building act like a triplex. This kind of ambiguous positioning of staircases found in many shop-houses of Shakhari Bazar. The upper floors are mostly used as served rooms. There are terraces in second and third floor in the front part of the building and roof of the back part of building is accessible with an open stair.

Figure 3.13: Shop-house SB-15

From Space syntax analysis it is found that the shops in the configuration are the most integrated spaces with average low RRA value of 1.38 and average low mean depth value of 5.66. It indicates that the function of the shop is closely related to its inhabitants (Table 3.3).

Table 3.3 Summary of syntactic data of SB15

SHOP-HOUSE	ACTIVITY	DEPTH	MD	CV	RRA	CN
SB15	EXTERIOR	0	6.61	0.33	1.66	1.00
	SHOP	2.5	5.66	0.31	1.38	1.50
	CIRCULATION	6.75	7.10	1.52	1.81	3.00
	COURTS	4.5	5.85	3.36	1.44	5.00
	OPEN SPACES	10.33	9.68	0.61	2.57	1.33
	SERVED	6.76	7.19	0.77	1.83	1.71
	SERVICE	6.25	7.13	0.33	1.82	1.08
	TEMPLE	N/A	N/A	N/A	N/A	N/A
TOTAL GRAPH	MINIMUM	0	4.70	0.13	1.10	1.00
	MEAN	6.49	7.17	1.00	1.83	2.11
	MAXIMUM	12	11.30	5.23	3.05	8.00

The highest integration with a RRA value of 1.10 is found in the ground floor corridor, space no. 3, with the lowest mean depth value 4.70 (Table A2). The informal court at ground level space no. 10 has the highest control value of 5.23 with highest connectivity 8.00. The court remained as highly integrated space with the RRA value of 1.12. Served spaces are more segregated than service spaces and both are in the segregated zone in this shop-house.

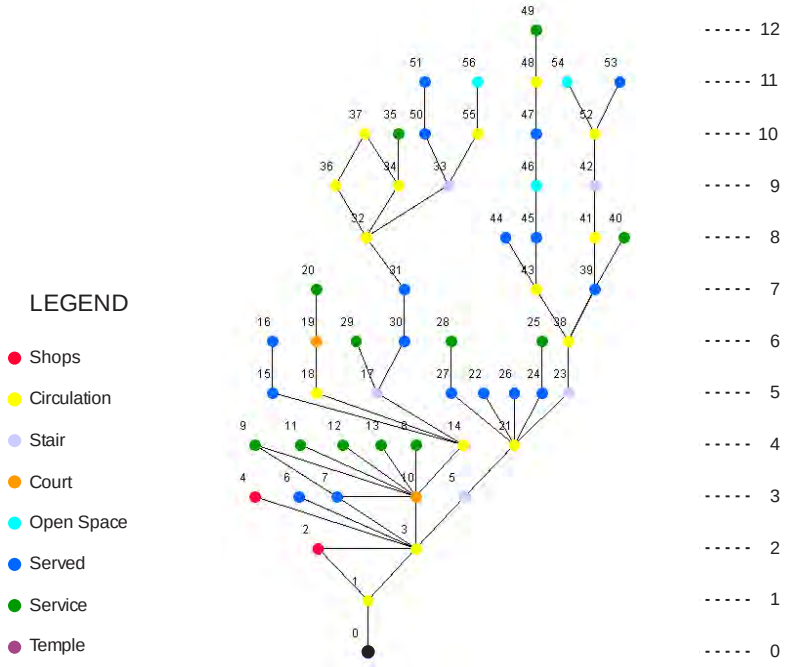


Figure 3.14 J-graph of SB-15

The building formed a 12 steps deep tree like sequence with some small rings in the shallower part up to the depth level 4 of the justified graph (Fig. 3.14).

3.5.1.3 Case study: SB-32

Located in 32, Shakhari Bazar Street the shop-house is also an example of enclosed courtyard typology. The four storied shop-house was constructed in late 19th century. (Haque, 1997, p. 95) The ground floor is totally covered except the backyard forming the service court. The front

part of the ground floor had an entry verandah. The narrow corridor runs along the side wall and directly opens to the service courtyard from where a stair serves a three storey rear-quarter. Leaving a kitchen the service court move towards backyard where baths and toilets are found. The four storied frontal part of the building have the typical stair solution as of building no. 15. The open to sky terrace in the second floor with a linear stair connects a single room to third floor.

From Space syntax analysis it is found that the shops in the configuration are highly integrated spaces with average low RRA value of 1.70 and average low mean depth value of 6.62 (Table 3.4). It indicates that the function of the shop is closely related to its inhabitants.

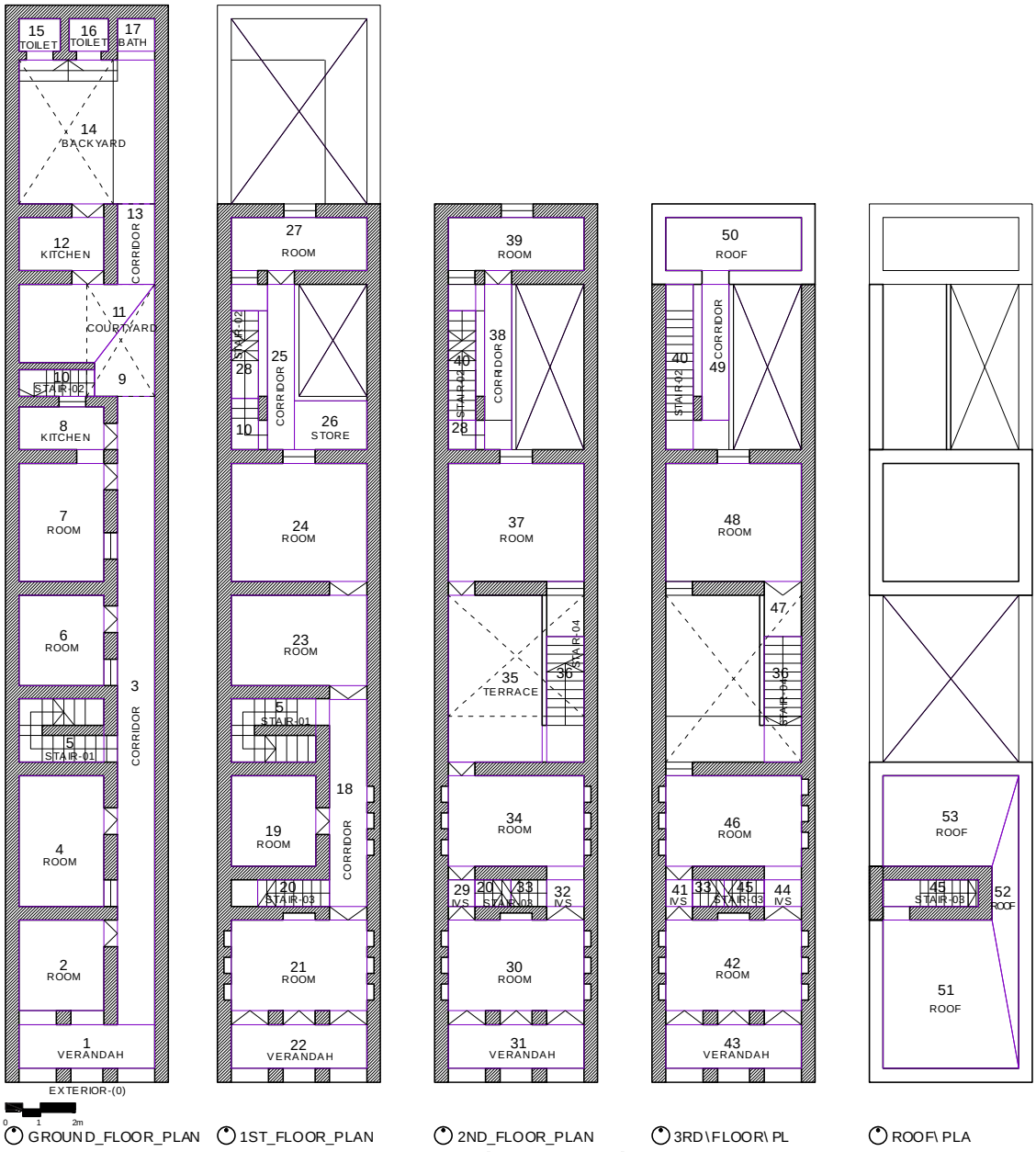


Figure 3.15 Shop-house SB-32

Table 3.4 Summary of syntactic data of SB-32

SHOP-HOUSE	ACTIVITY	DEPTH	MD	CV	RRA	CN
SB32	EXTERIOR	0	7.08	0.33	1.84	1.00
	SHOP	2.5	6.62	0.24	1.70	1.00
	CIRCULATION	7.19	7.54	1.41	1.98	2.76
	COURTS	4.33	6.58	2.10	1.69	3.67
	OPEN SPACES	12	10.61	0.96	2.91	1.75
	SERVED	6.93	7.28	0.74	1.9	1.71
	SERVICE	6.78	7.97	0.35	2.11	1.22
	TEMPLE	N/A	N/A	N/A	N/A	N/A
TOTAL GRAPH	MINIMUM	0	5.15	0.14	1.26	1.00
	MEAN	6.94	7.68	1.00	2.02	2.11
	MAXIMUM	16	13.11	4.17	3.67	7.00

The highest integration with a RRA value of 1.26 is found in the main stair at ground floor, space no. 5, with the lowest mean depth value 5.15 (Table A3). The long corridor at ground level space no. 3 has the highest control value of 4.17 with highest connectivity 7.00. The courts remained as highest integrated space with the average RRA value of 1.69. Served spaces are integrated and service spaces are segregated in this shop-house.

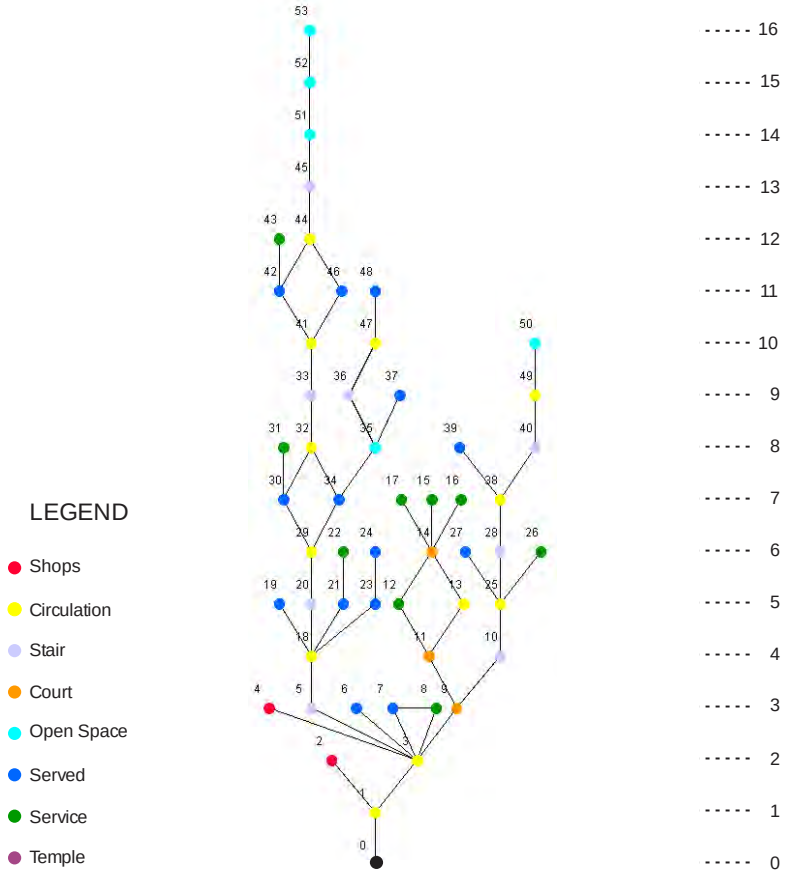


Figure 3.16 J-graph of SB-32

The J-graph is 16 steps deep with many small rings around the stair and served spaces (Fig. 3.16).

3.5.1.4 Case study: SB-110

The shop-house located in 110, Shakhari Bazar Street is also an example of enclosed courtyard typology. The arrangement of the three storied shop-house is similar to the shop-house no. 32 except the presence of a unique temple in the second floor. The temple is separated by an enclosed open to sky courtyard and placed in the extreme north side keeping its almost solid back towards the roadside as ritually the Hindu temples facing to the south.

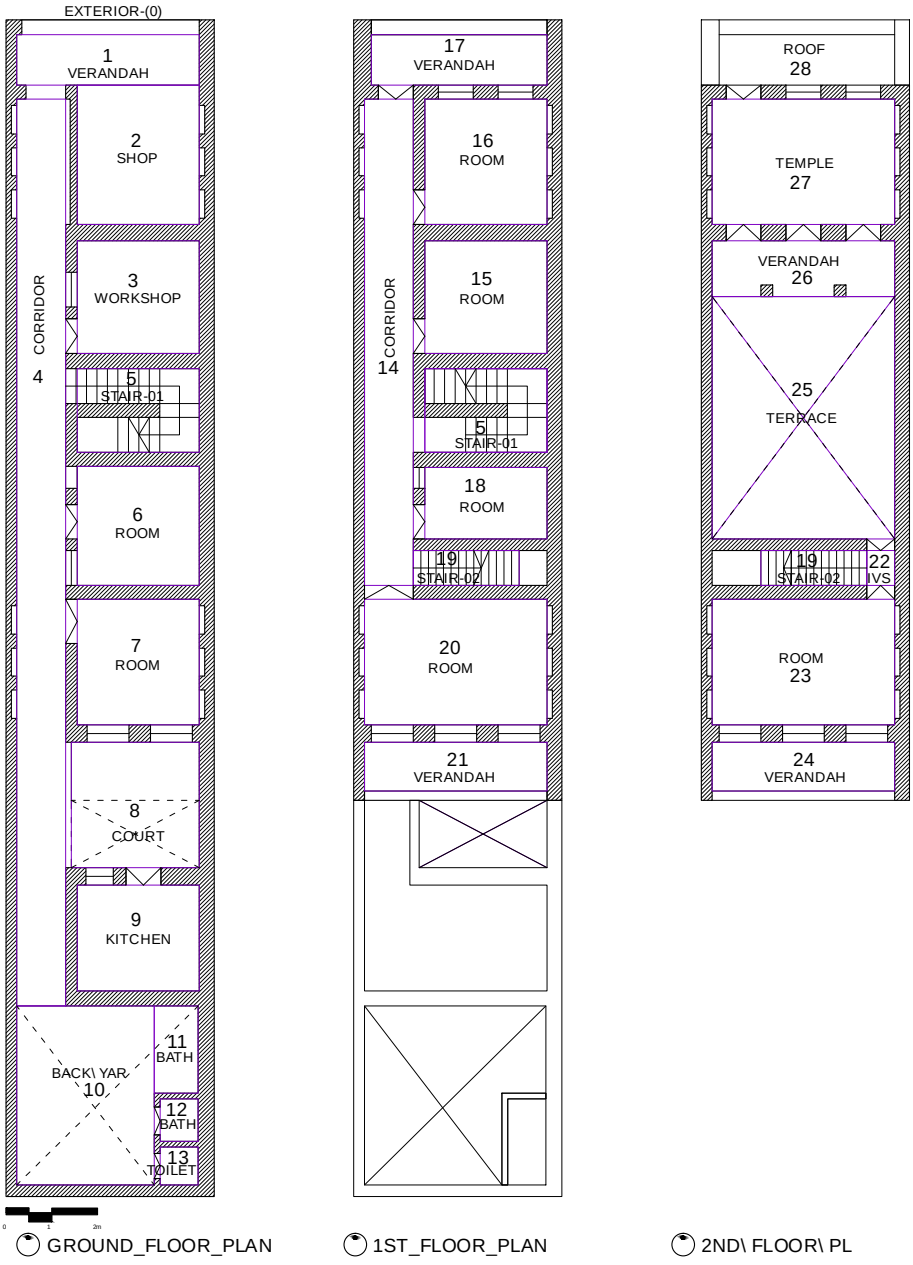


Figure 3.17 Shop-house SB-110

The shops in the configuration are in the integrated zone with average low RRA value of 1.36 and average mean depth value of 4.37 (Table 3.5).

Table 3.5 Summary of syntactic data of SB-110

SHOP-HOUSE	ACTIVITY	DEPTH	MD	CV	RRA	CN
SB110	EXTERIOR	0	4.79	0.33	1.52	1.00
	SHOP	2.5	4.37	0.24	1.36	1.00
	CIRCULATION	3.5	3.29	2.41	0.92	4.00
	COURTS	3	3.82	2.14	1.13	3.00
	OPEN SPACES	8.5	5.95	0.67	1.99	1.50
	SERVED	4.71	3.98	0.46	1.2	1.29
	SERVICE	5.38	4.83	0.42	1.54	1.13
	TEMPLE	9	6.32	1.50	2.14	2.00
TOTAL GRAPH	MINIMUM	0.00	2.86	0.14	0.75	1.00
	MEAN	4.62	4.33	1.00	1.34	1.93
	MAXIMUM	10.00	7.29	5.50	2.52	7.00

The highest integration with a RRA value of 0.75 is found in first floor corridor, space no. 14, with the lowest mean depth value 2.86 and also with the highest control value of 5.50 (Table A4). The long corridor at ground level space no. 4 has the highest connectivity value of 7.00. The courts remained in high integrated zone with the average RRA value of 1.13. Served spaces are integrated and service spaces are segregated in this shop-house.

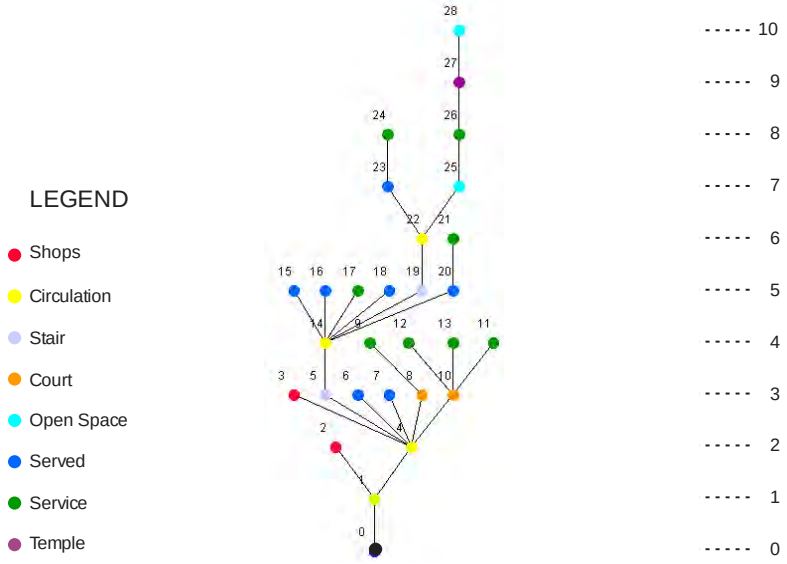


Figure 3.18 J-graph of SB-110

The J-graph is 10 steps deep with a tree like configuration without any rings (Fig. 3.18).

3.5.1.5 Case study: SB-118/1

Located in 118/1, Shakhari Bazar Street the shop-house is also an example of enclosed courtyard typology. The arrangement of the three storied shop-house is similar to the shop-house no. 110 with the presence of a unique temple in the second floor. The temple is higher than the typical floor height.

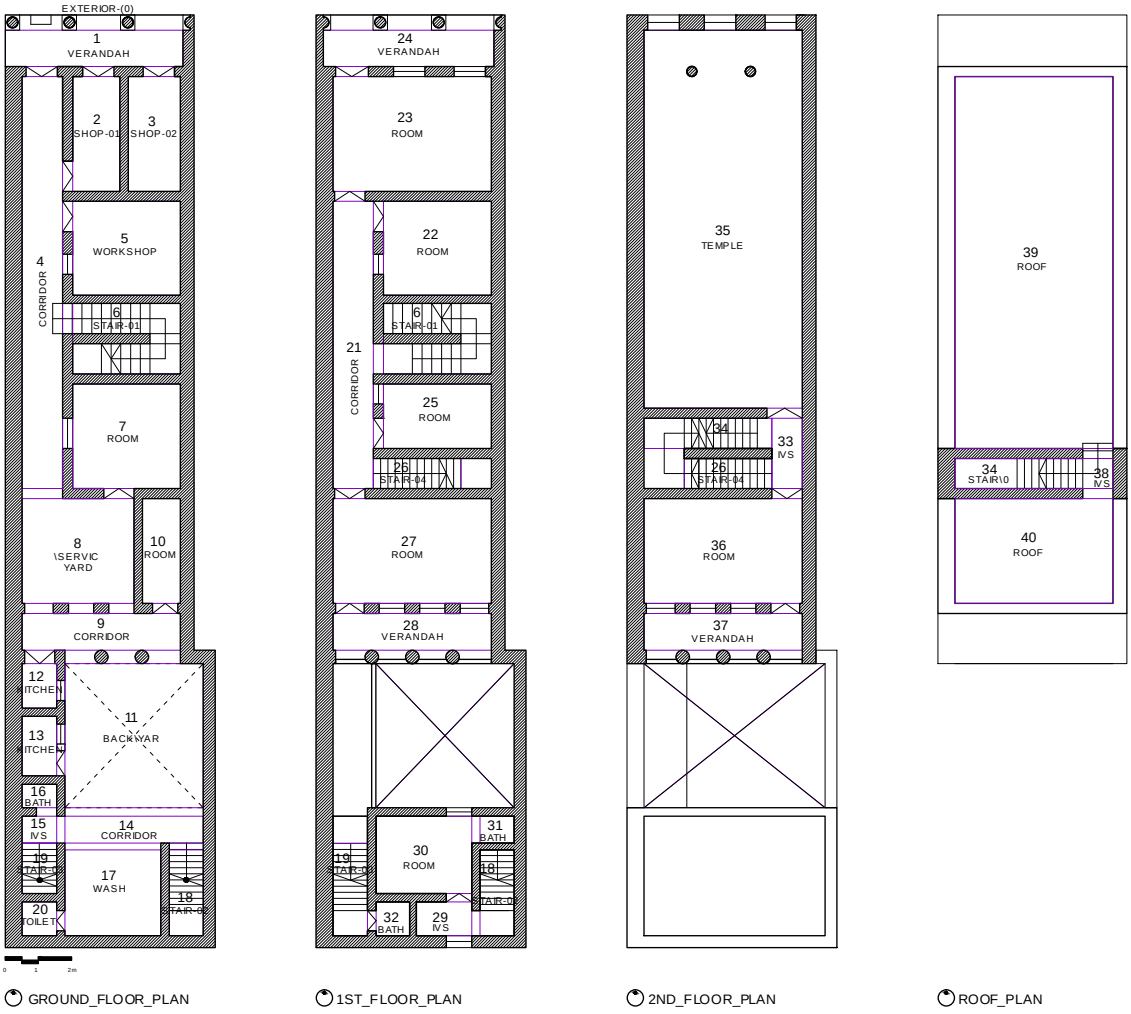


Figure 3.19 Shop-house SB-118/1

From Space syntax analysis it is found that the shops in the configuration are highly integrated spaces with average low RRA value of 1.44 and average low mean depth value of 5.25 (Table 3.6). It indicates that the function of the shop is closely related to its inhabitants.

Table 3.6 Summary of syntactic data of SB-118/1

SHOP-HOUSE	ACTIVITY	DEPTH	MD	CV	RRA	CN
SB118/1	EXTERIOR	0	5.83	0.25	1.64	1.00
	SHOP	2.33	5.23	0.28	1.44	1.33
	CIRCULATION	5.43	5.53	1.86	1.54	3.29
	COURTS	4	4.48	0.96	1.18	2.50
	OPEN SPACES	9	8.28	0.33	2.48	1.00
	SERVED	5.5	5.77	0.73	1.62	1.5
	SERVICE	7.3	6.84	0.52	1.99	1.10
	TEMPLE	7	6.58	0.25	1.90	1.00
TOTAL GRAPH	MINIMUM	0	4.00	0.17	1.02	1.00
	MEAN	5.68	5.99	1.00	1.70	2.00
	MAXIMUM	10	8.85	4.00	2.67	6.00

The highest integration with a RRA value of 1.02 is found in the long circulation corridor at ground floor, space no. 4, with the lowest mean depth value 4.00 (Table A5). The main corridor at first level space no. 21 has the highest control value of 4.00 with highest connectivity 6.00. The courts remained as highest integrated space with the average RRA value of 1.18. Served spaces are integrated and service spaces are segregated in this shop-house.

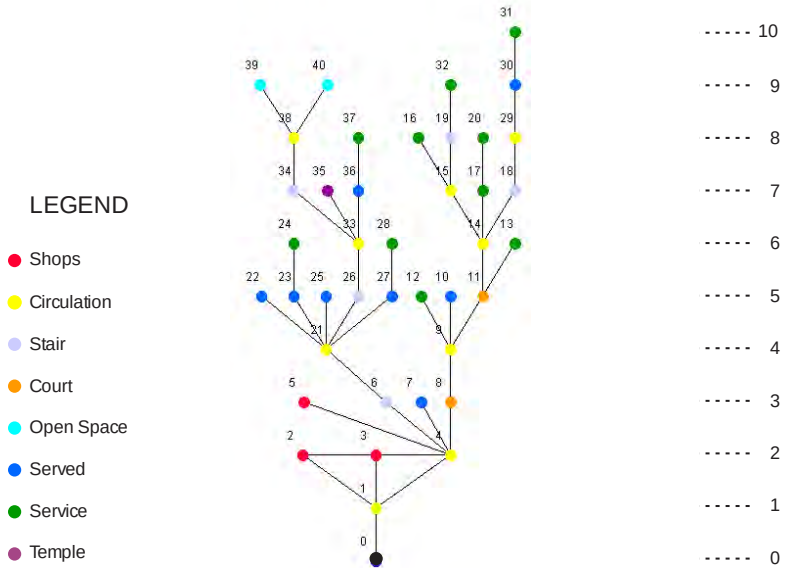


Figure 3.20 J-graph of SB-118/1

The J-graph is 10 steps deep tree like configuration. The only ring is seen in this shop-house with its shop in the shallower arm of the graph (Fig. 3.20).

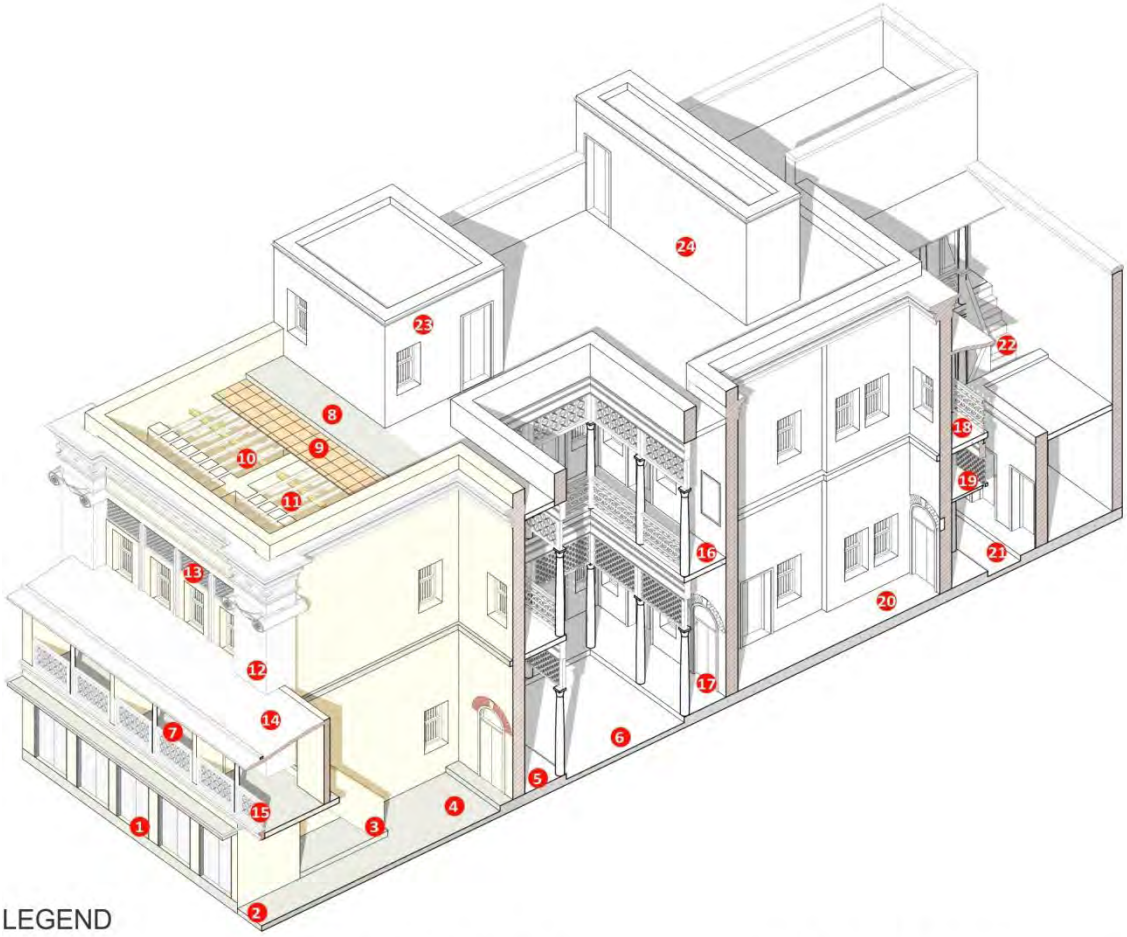
3.5.2 General syntactic properties of Shakhari Bazar shop-houses

The physical layouts of individual shop-houses in Shakhari Bazar are similar in their type, the syntactic properties that are found in the above case studies summarized below:

In Shakhari Bazar most of the cases the shops are found as highly integrated spaces within the configuration with low average RRA value (Table 4.1) and low average mean depth value (Table 4.8). It indicates that the function of the shop is closely related to its inhabitants and shops are conceived as an integral part of the whole configuration. The highest integration with lowest RRA value is mostly found in the circulation corridor with the lowest mean depth value. Which mean the main circulation corridor is strongly integrated while the served and service space remained segregated. In few cases the served spaces are more segregated than the service space e.g. SB-15. This is because service spaces around the service courtyard in those shop-houses are more integrated and the upper floor served spaces are more segregated. Mostly the main corridor has the highest control value with highest connectivity. The courts also remain integrated sometime with high control value. Mostly the J-graphs are tree like configuration some with few small rings. No large exterior rings are found in Shakhari Bazar case studies.

3.5.3 Tanti Bazar shop-houses

In Tanti Bazar the traditional shop-houses shows diversity in nature. The permanent structures are comparatively later development than the shop-houses of Tanti Bazar. Along with the enclosed courtyard type many detached type shop houses also found in this locality. Many buildings originally built for residential purpose then altered in to shop-houses by converting the road side rooms in to shops or adding shops in the front setback of the building. Most of the shop-houses are two to three storey high with delicate front façade and mostly inhabited by goldsmiths or silversmiths.



LEGEND

1. Shop
2. Corridor
3. Stair 1
4. Front yard
5. Corridor
6. Courtyard
7. Workshop
8. Lime-surkey slab
9. Clay tiles layer
10. Kari (purlin)
11. Barga (rafter)
12. Decorative Column
13. Decorative ventilator
14. Curve Sloped roof
15. Lime mortar railing
16. Corridor
17. Arched door with keystone
18. Terrace
19. Storage space
20. Corridor
21. Backyard
22. Stair 4
23. Stair 2
24. Stair 3

Figure 3.21 Organization of Tanti Bazar shop-house (TB-10)

3.5.3.1 Case study: TB-10

Located in 10, Bashi Chandra Sen Lane, Tanti Bazar the shop-house is an example of enclosed courtyard typology. The construction system and style of the shop-house seems that it was constructed at early 20th century during the British period. (Khan F. M., 2013, p. 134) Initially the building was a residence (Fig. B1). After liberation war the open front side was altered into shops. This introverted type building has two courts. The open to sky passage leads to the central courtyard which is adjacent to the south boundary and surrounded by shaded corridor on three sides with served rooms. A grand stairway leads to first floor served spaces which continue to roof. In this premises one large room contains single flight stairs up to the roof. The central courtyard is connected with the backyard with another open to sky passage which surrounded by service and served spaces and another stair to the first floor which is separated from the front part of the house. The rear part thus isolated and there is no access to the roof from this part.

Five shops were constructed in the setback area making the entrance narrower and a separate stair at the entry passage to the first floor workshop area. This is completely a new addition to the original building.

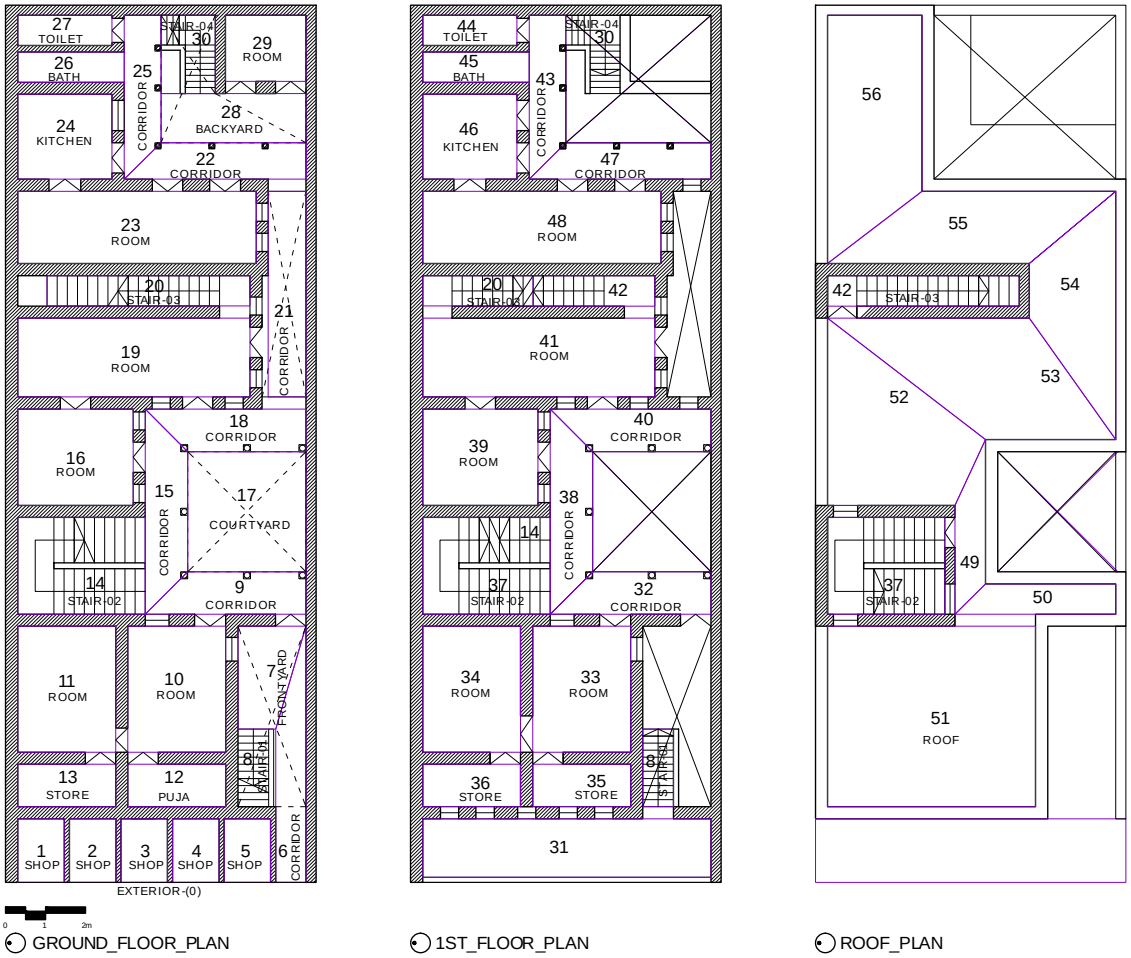


Figure 3.22 Shop-house TB-10

In space syntax analysis it is seen that the shops and residential area of this building has been separated both physically and syntactically. Shops are found in the segregated zone with a high average RRA value of 2.03 and high average mean depth value of 7.86 (Table 3.7).

The highest integration with a RRA value of 0.97 is found in the ground floor corridor, space no. 15 with the lowest mean depth value 4.29 (Table A6). Exterior shows the highest control value of 5.50 with highest connectivity 6.00. The central court remained as an integrated space with the RRA value of 1.05. Served spaces are integrated and service spaces are segregated in this shop-house.

Table 3.7 Summary of syntactic data of TB-10

SHOP-HOUSE	ACTIVITY	DEPTH	MD	CV	RRA	CN
TB10	EXTERIOR	0	6.98	5.50	1.77	6.00
	SHOP	1.5	7.86	0.22	2.03	1.00
	CIRCULATION	6.47	5.74	1.21	1.41	3.00
	COURTS	4.67	5.30	1.30	1.28	3.33
	OPEN SPACES	10.57	7.99	0.98	2.07	1.86
	SERVED	7	6.34	1.16	1.58	2.36
	SERVICE	9.4	7.71	0.38	1.99	1.20
	TEMPLE	N/A	N/A	N/A	N/A	N/A
TOTAL GRAPH	MINIMUM	0	4.29	0.17	0.97	1.00
	MEAN	6.86	6.70	1.00	1.69	2.28
	MAXIMUM	13	9.82	5.50	2.61	6.00

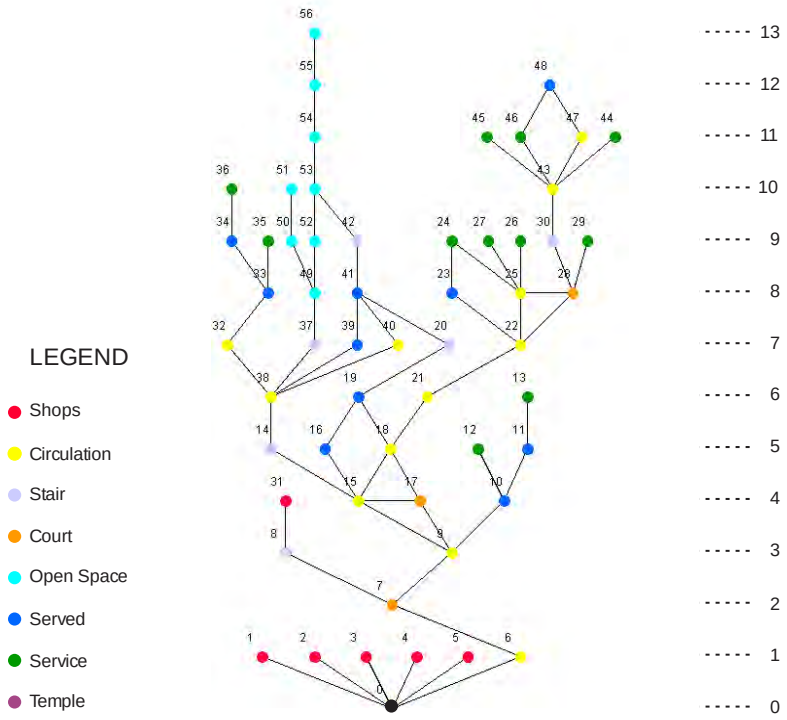


Figure 3.23 J-graph of TB-10

The building is thirteen steps deep from the carrier which has been taken from the street (Fig. 3.23). A large number of rings are seen in this building. Both the ground floor spaces and the first floor spaces have large rings around the served spaces but no exterior rings found. The deep ringy tree of this house at the same time ensures the privacy of living and functional areas of the building from the visitors and gives the inhabitants the freedom to move around the served space of the house.

3.5.3.2 Case study: TB-18

The shop-house located in 18, Bashi Chandra Sen Lane, Tanti Bazar and an enclosed courtyard type building. Initially the building was a residence (Fig. B2) during the time of construction later rooms was added in the front yard of the house as shops in several times in late Pakistan period. (Khan F. M., 2013, p. 135) Owners of the existing shop-house got the plot and the house from the hereditary ownership. The ground floor of the shop-house has a front yard leading to a central corridor along which the served spaces are arranged and leads towards another linear backyard in the rear part of the building which separated the served and service zones. Service spaces are arranged around the backyard most of which are in dilapidated condition at present. From the corridor the stair served the served spaces on first and second floor and reaches roof through an open to sky terrace. The shop which is a homeopathy doctor's chamber is directly accessible from outside and connected inside with a medicine making room which again connected to the served space of the residential zone.

Figure 3.24 Shop-house TB-18

From Space syntax analysis it is found that the shops in the configuration are the most integrated spaces with average low RRA value of 1.46 and average low mean depth value of 5.51 (Table 3.8). It indicates that the function of the shop is closely related to its inhabitant's activity.

The highest integration with a RRA value of 1.07 is found in the ground floor corridor, space no. 3, with the lowest mean depth value of 4.31 (Table A7). This corridor links the outdoor with the indoor spaces and is linked to almost all the spaces in the ground floor. The service backyard at ground level space no. 13 has the highest control value of 8.33 with highest connectivity 10.00. Among the enclosed rooms, room no 11 in the middle of the building acted as the transitional space between the indoor spaces and the rear court. As a result, it remained a strongly integrated space with a RRA value of 1.17 in the configuration. Served spaces are in integrated zone while service spaces are in the segregated zone in this shop-house.

Table 3.8 Summary of syntactic data of TB-18

SHOP-HOUSE	ACTIVITY	DEPTH	MD	CV	RRA	CN
TB18	EXTERIOR	0	6.11	0.83	1.65	2.00
	SHOP	1.67	5.51	0.97	1.46	2.67
	CIRCULATION	6.09	5.59	1.19	1.49	3.09
	COURTS	4.5	5.84	3.12	1.57	4.50
	OPEN SPACES	10.67	8.50	1.06	2.43	1.67
	SERVED	6.38	6.32	0.74	1.72	1.81
	SERVICE	6.38	6.76	0.21	1.87	1.00
	TEMPLE	N/A	N/A	N/A	N/A	N/A
TOTAL GRAPH	MINIMUM	0.00	4.31	0.10	1.07	1.00
	MEAN	5.98	6.27	1.00	1.70	2.26
	MAXIMUM	12.00	9.67	8.33	2.81	10.00

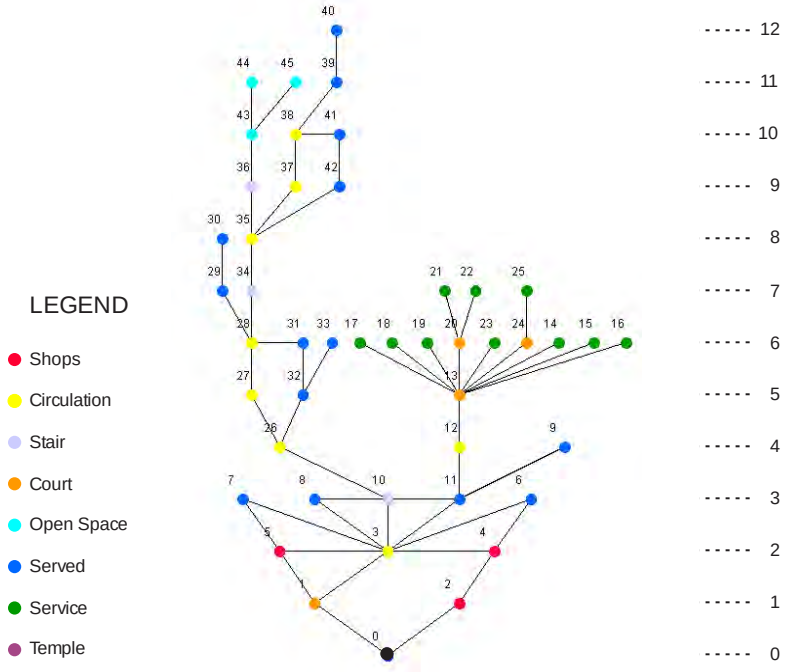


Figure 3.25 J-graph of TB-18

Space syntax analysis shows that the building has a complex ringy tree and is 12 steps deep from the root point that has been taken from outside (Fig. 3.25). The rooms in the frontal part of ground floor are also distributed in exterior rings.

3.5.3.3 Case study: TB-20

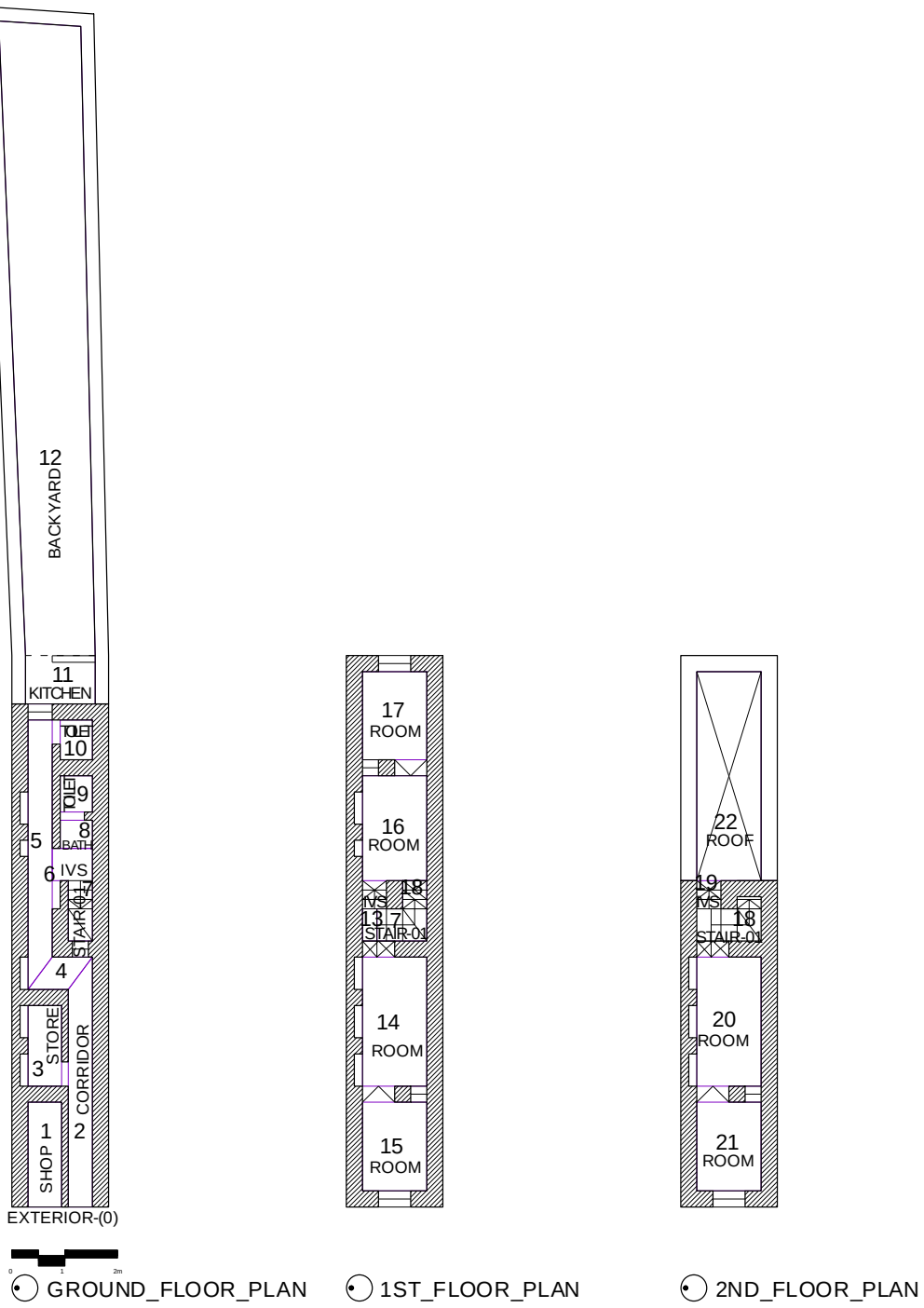


Figure 3.26 Shop-house TB-20

The shop-house located in 20, Bashi Chandra Sen Lane, Tanti Bazar and a narrow introvert type building. The present owners got the plot from hereditary ownership. At the initial stage, the building was used as residence (Fig. B3). Eventually during 1970 the front room was altered into a shop because of the economic demand of the family. Then another shop was arranged with temporary structure at the entrance corridor of the shop-house during 2000, but this modification is not considered in this study. The rear side of the plot had an open space. It is a three storied shop-house and the narrowest in Tanti Bazar with a width of 6 feet and length of 70 feet. Due to the narrowness and elongation of the plot, every spaces of the residential unit are organized one after another; every room is approached through another room.

Table 3.9 Summary of syntactic data of TB-20

SHOP-HOUSE	ACTIVITY	DEPTH	MD	CV	RRA	CN
TB20	EXTERIOR	0	5.73	1.33	2.15	2.00
	SHOP	1.5	6.25	0.42	2.39	1.00
	CIRCULATION	4.75	4.09	1.35	1.41	2.75
	COURTS	5	5.41	0.50	2.01	1.00
	OPEN SPACES	10	6.18	0.33	2.36	1.00
	SERVED	8.5	5.3	0.97	1.95	1.67
	SERVICE	4.75	4.60	0.83	1.64	1.50
	TEMPLE	N/A	N/A	N/A	N/A	N/A
TOTAL GRAPH	MINIMUM	0.00	3.36	0.25	1.08	1.00
	MEAN	5.48	4.90	1.00	1.77	1.91
	MAXIMUM	11.00	7.05	2.33	2.75	4.00

The narrow dark corridor leads to the middle of the structure and changed its direction transversely and continues towards the back yard. This corridor links almost all the spaces of the building in ground floor. Centrally positioned stiff stair moves to first floor leaving served spaces on both sides towards second floor where served spaces occupied the front portion and an open to sky terrace in back. Service spaces are at the ground floor of the structure.

The shops in the configuration are at the extreme segregated zone with average high RRA value of 2.39 and average high mean depth value of 6.25 (Table 3.9).

The highest integration with a RRA value of 1.08 is found in intervening space in front of stair, space no. 6, with the lowest mean depth value of 3.36 (Table A8). The corridor at ground level space no. 5 has the highest control value of 2.33 and highest connectivity value of 4.00. The backyard remained in integrated zone with the RRA value of 2.01. Service spaces are more integrated than the served spaces and both are at the integration zone of the configuration.

In Space syntax analysis it is found that the shop-house is in a uni-linear sequence with eleven steps deep without any ringy property (Fig. 3.27).

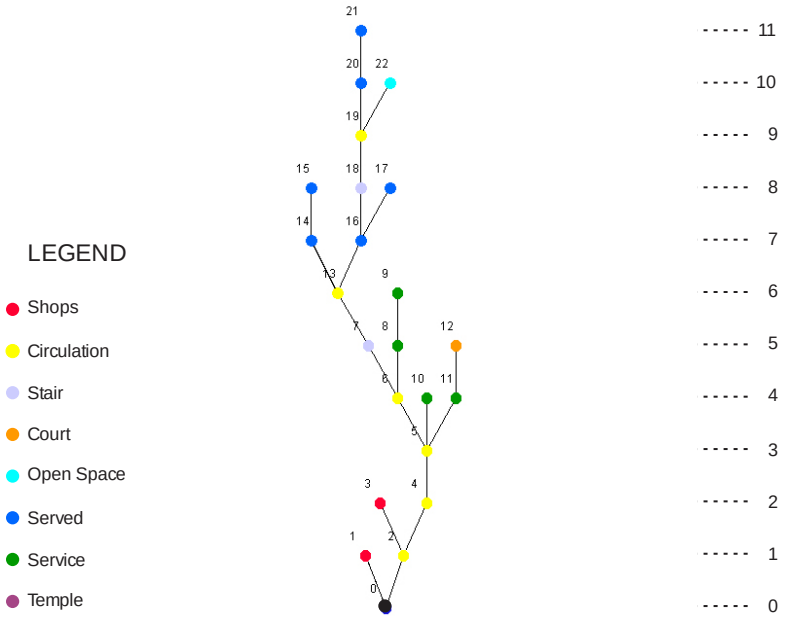


Figure 3.27 J-graph of TB-20

3.5.3.4 Case Study: TB-64

The shop-house located in 64, Bashi Chandra Sen Lane, Tanti Bazar and an enclosed courtyard type building. The original owners of holding no. 64 and 65 Bashi Chandra Sen Lane were two Hindu brothers. Though it was constructed as a single building eventually it separated into two about the same period, the thick brick boundary wall in between plot 64 and 65 left the proof of that. During the Indo-Pak war in 1965 the owner of holding no. 64 sold the plot to Muslim person whose descendants are now living in the building.

In the British period the building was residential (Fig. B4). As some parts of the building of 64 and 65 Bashi Chandra Sen Lane have interlocked between themselves the outline of shop-house no. 65 has shown in the layout plan. Several structures were added in the middle side of the plot in the Pakistan period. After 1980s the front passage of the building was altered into shops. Moreover single storied rooms were constructed at the rear side of the plot in recent time which is now used as non-oven bag factory but not considered in the study.

It is a two storied shop-house where part of the entrance passage was altered into a shop. Serving few rooms the corridor opens to central courtyard. Service spaces and first floor stair of the front part of the building are located in the court. The back part of the building is also two storied high served with separate stair. Back yard left as unused.

The shops in the configuration are at the extreme segregated zone with average high RRA value of 1.86 and average high mean depth value of 5.46 (Table 3.10).

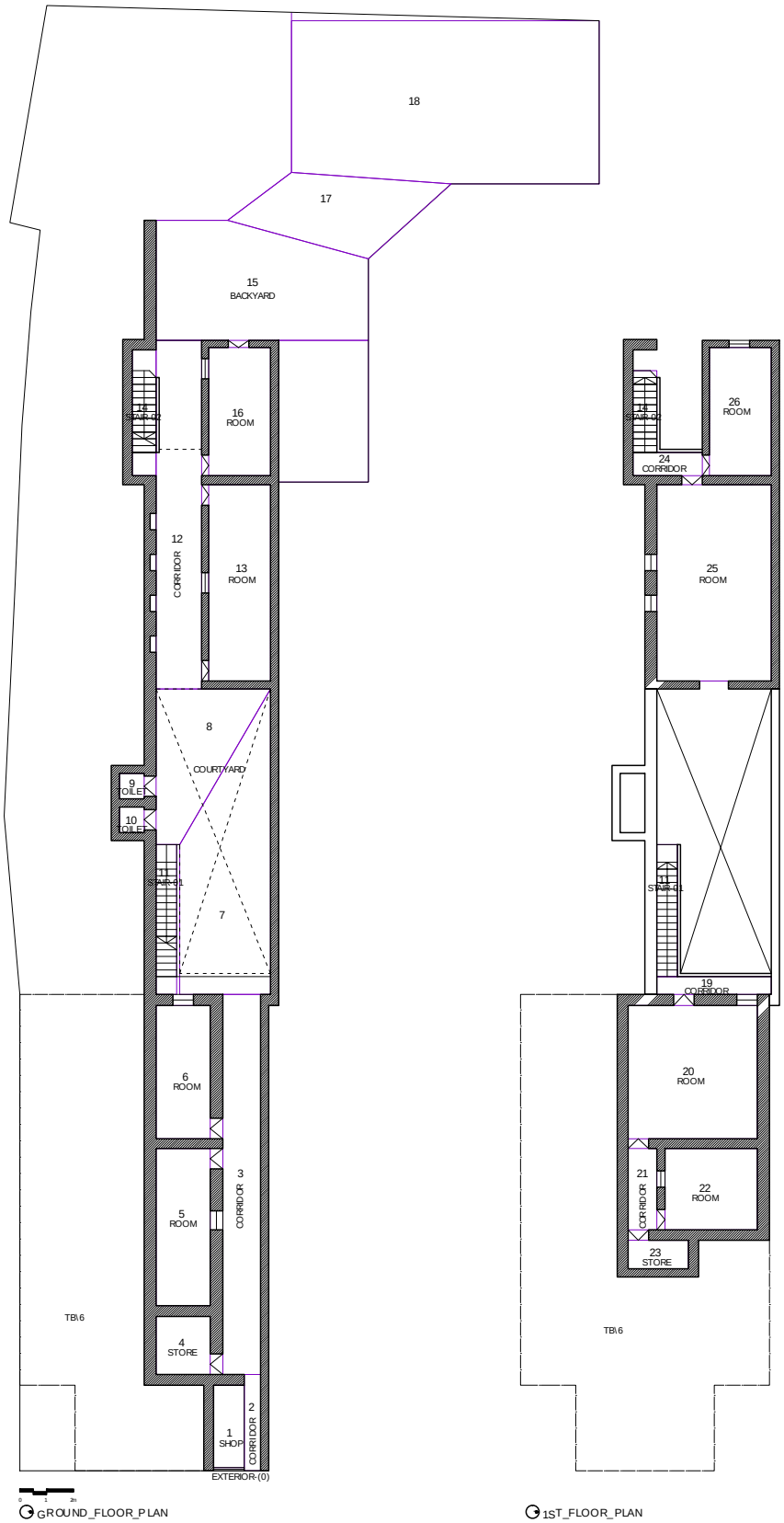


Figure 3.28 Shop-house TB-64

The highest integration with a RRA value of 0.75 is found in the courtyard, space no. 8, with the lowest mean depth value of 2.81 (Table A9). The entry corridor at ground level, space no. 3 has the highest control value of 3.83 and highest connectivity value of 5.00. The backyard remained in segregated zone. Served and service spaces are in segregated zone of the configuration.

Table 3.10 Summary of syntactic data of TB-64

SHOP-HOUSE	ACTIVITY	DEPTH	MD	CV	RRA	CN
TB64	EXTERIOR	0	5.46	0.83	1.86	2.00
	SHOP	1	5.46	0.83	1.86	2.00
	CIRCULATION	5	4.10	1.79	1.29	3.00
	COURTS	3.5	3.02	1.83	0.84	3.50
	OPEN SPACES	7	4.72	1.19	1.55	2.00
	SERVED	6.38	5.08	0.35	1.7	1.13
	SERVICE	5.5	4.69	0.23	1.54	1.00
	TEMPLE	N/A	N/A	N/A	N/A	N/A
TOTAL GRAPH	MINIMUM	0.00	2.81	0.20	0.75	1.00
	MEAN	5.26	4.57	1.00	1.49	2.00
	MAXIMUM	9.00	6.54	3.83	2.31	5.00

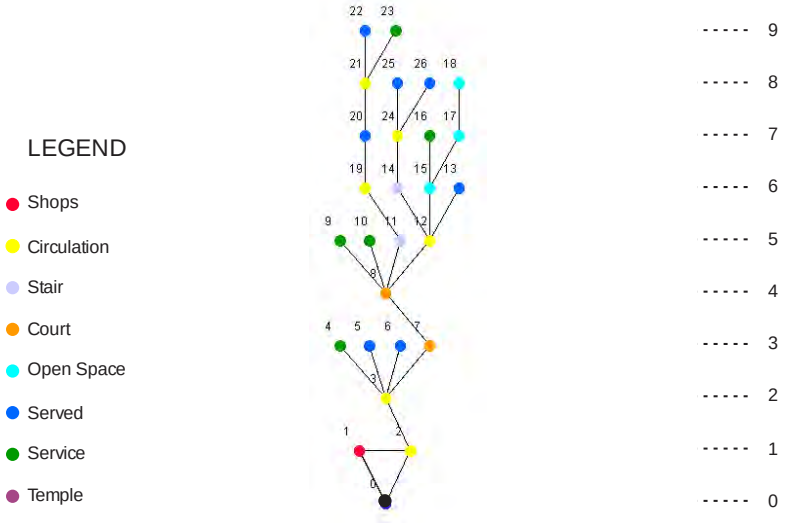


Figure 3.29 J-graph of TB-64

In Space syntax analysis it is found that the shop-house is in a uni-linear sequence with nine steps deep with only a single ring at the shop area (Fig. 3.29).

3.5.3.5 Case Study: TB-65

The shop-house located in 65, Bashi Chandra Sen Lane, Tanti Bazar and an enclosed courtyard type building. As previously described the original owners of holding no. 64 and 65 Bashi Chandra Sen Lane was two Hindu brothers who had built the buildings on the plots during the British period.

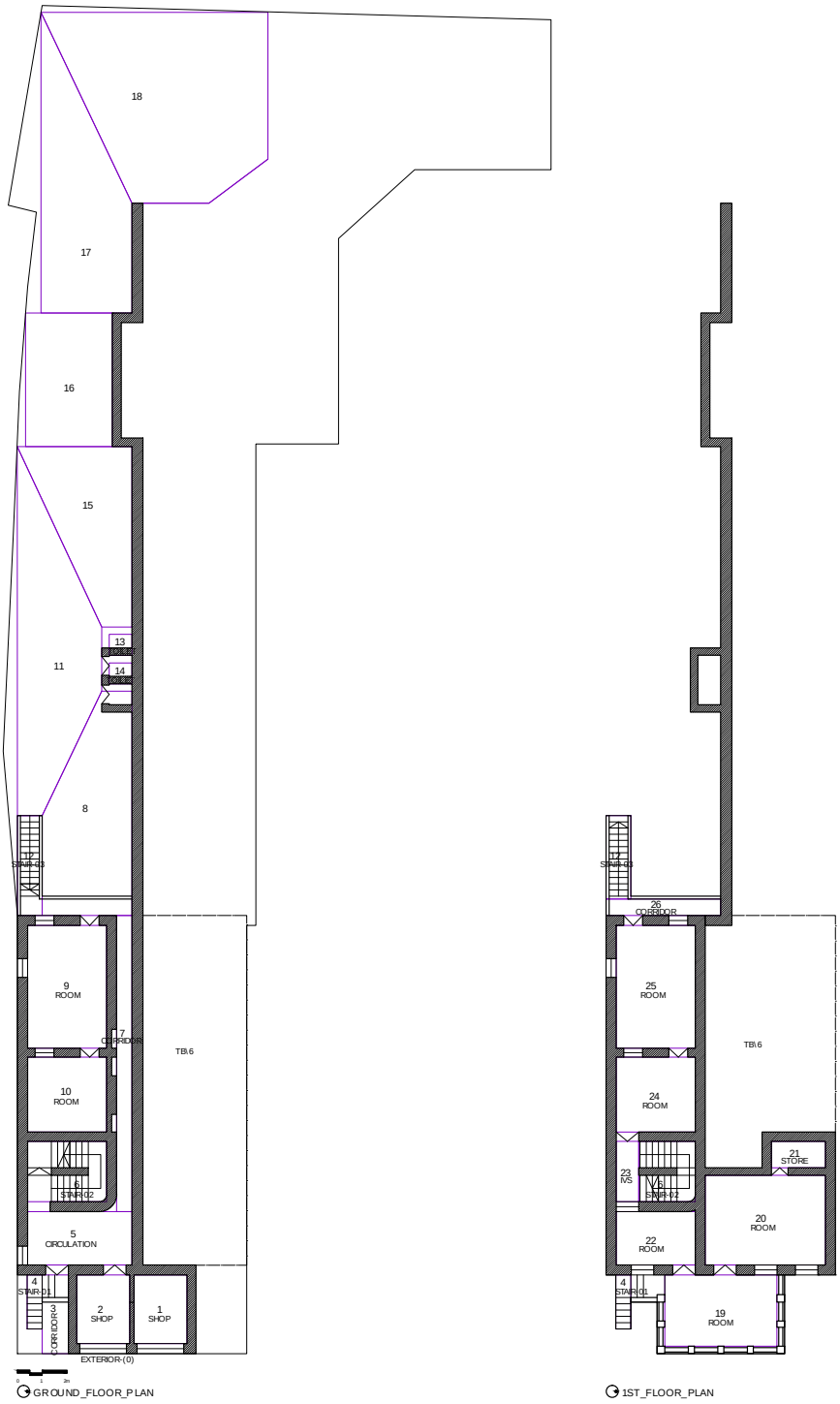


Figure 3.30 Shop-house TB-65

Though it was constructed as a single building eventually it separated into two about the same period, the thick brick boundary wall left the proof of that. After the Indo-Pak war in 1965 the owners of the plot 65 went to India and the plot became enemy property. Presently Government leased the plot to its present residents. Both Hindu and Muslim families live in this shop-house.

In the British period the building was residential (Fig. B4). After 1980s the front room of the building was altered into two shops. Some parts of the building of 64 and 65 Bashi Chandra Sen Road have interlocked between themselves. That is why while drawing the holding no. 65 Bashi Chandra Sen Lane the outline of shop-house no. 64 has shown in the layout plan. Several structures were added in the middle and back side of the plot in the recent periods which was not considered in this study.

The two storied shop-house consist three staircases. The entrance leads to a lobby where the original stair way found and a narrow corridor open to the central court. The court has some service spaces and goes deep inside vacant back yard. From the inside courtyard and from outside other two stairs added to reach the first floor. All three stairs interlinked the served and service spaces of first floor.

Table 3.11: Summary of syntactic data of TB-65

SHOP-HOUSE	ACTIVITY	DEPTH	MD	CV	RRA	CN
TB65	EXTERIOR	0	4.38	3.00	1.41	4.00
	SHOP	1	5.35	0.25	1.81	1.00
	CIRCULATION	3.38	4.40	0.86	1.42	2.13
	COURTS	4.5	3.79	2.27	1.16	4.00
	OPEN SPACES	7.5	5.90	0.93	2.04	1.75
	SERVED	4.29	5.65	1.07	1.94	1.86
	SERVICE	5.33	5.77	0.30	1.99	1.00
	TEMPLE	N/A	N/A	N/A	N/A	N/A
TOTAL GRAPH	MINIMUM	0.00	3.62	0.20	1.09	1.00
	MEAN	4.22	5.12	1.00	1.72	2.00
	MAXIMUM	9.00	7.62	3.33	2.76	5.00

The shops in the configuration are at the segregated zone with average RRA value of 1.81 and average mean depth value of 5.35 (Table 3.11).

The highest integration with a RRA value of 1.09 is found in the circulation lobby, space no. 5, with the lowest mean depth value of 3.62 (Table A10). The service courtyard at ground level, space no. 11 has the highest control value of 3.33 and highest connectivity value of 5.00. Served and service spaces are in segregated zone of the configuration.

In Space syntax analysis it is found that the shop-house is in a uni-linear sequence which is nine steps deep with a unique exterior ring connected the upper floor from front and back (Fig. 3.31). This allows both the visitors and the inhabitants more freedom to access the interior.

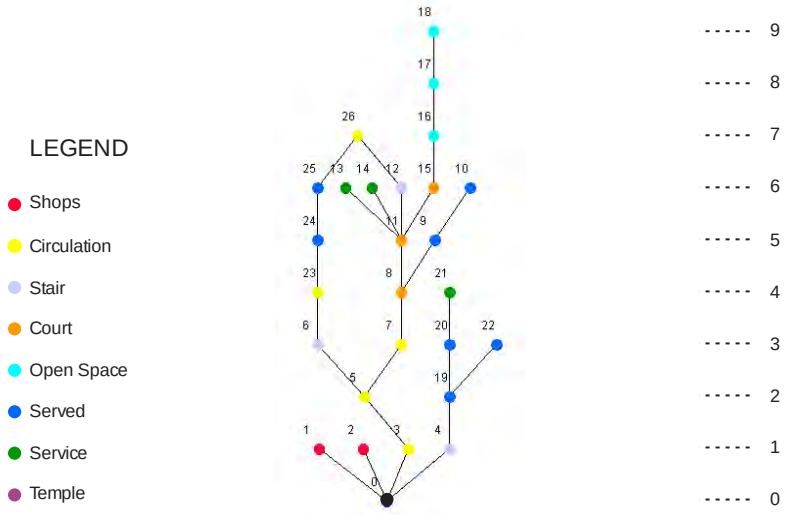


Figure 3.31 J-graph of TB-65

3.5.4 General syntactic properties of Tanti Bazar shop-houses

The syntactic properties that are found in the Tanti Bazar shop-houses are summarized below:

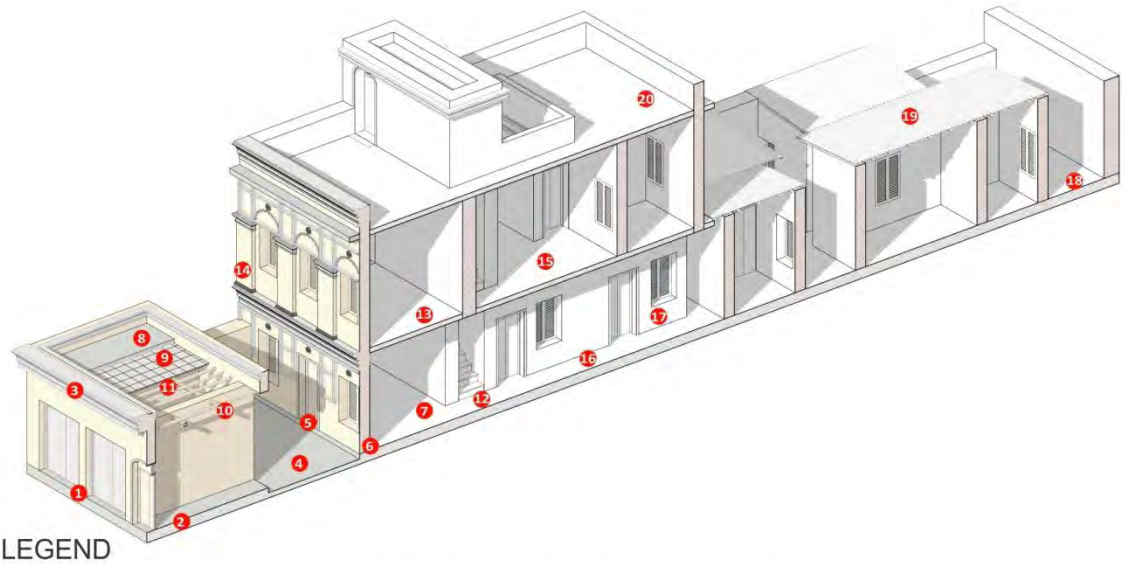
In Tanti Bazar the shops are found in highly segregated spaces with high average RRA value and high average mean depth value. This indicates that the shops are not at all conceived as an integral part of the total configuration of the shop-house. In fact all the case study shop-houses of Tanti Bazar are altered type shop-houses where the shops are incorporated later on. Only exception is TB-18, which shows the shops in the most integrated side with the lowest RRA value and lowest mean depth value, where the owner himself opens a homeopathic doctor's chamber which has a laboratory in another room deep inside.

The highest integration with lowest RRA value is mostly found in the circulation corridor with the lowest mean depth value. Like Shakhari Bazar in few cases the served spaces are more segregated than the service space TB-20 and TB-64. Mostly the courts have the highest control value with highest connectivity. The courts also remain integrated most of the cases with lowest mean RRA value.

The J-graphs are mostly ringy type configuration, three out of five shop-houses, TB-10, TB-18 and TB-65 with large exterior rings.

3.5.5 Panni Tola shop-houses

Traditional shop-houses of Panni Tola are more similar with the Tanti Bazar shop-houses. Though Panni Tola has few shop-houses in a relatively small area, they show a large variety like Tanti Bazar. Along with the enclosed courtyard type many detached type shop houses also found in this locality. Shop-houses of altered category are also evident in this locality. Like Tanti Bazar the locality is mostly inhabited by goldsmiths or silversmiths.



LEGEND

1. Shop	8. Lime-surkey slab	15. Courtyard
2. Corridor	9. Clay tiles layer	16. Corridor
3. Cornice	10. Kari (purlin)	17. Louvored Window
4. Front yard	11. Barga (rafter)	18. Backyard
5. Entrance door	12. Stairs	19. Corrugated sheet roof
6. Load bearing wall	13. Room	20. Roof
7. Room	14. Decorative column	

Figure 3.32 Organization of Panni Tola shop-house (PT-17)

3.5.5.1 Case study: PT-01

Located in 01, Rakhal Chandra Bashak Lane, Panni Tola, the shop-house is an example of enclosed courtyard typology. The structure was partly two (north wing) and partly three (south wing) storied residential building (Fig. B5) in the British period. (Khan F. M., 2013, p. 137)

After 1975 the first shop was introduced by converting the north side room at the front of the building. The shop-house was later extended two storey more i.e. up to four storied in the north-western and eastern part of the site, make a workshop in the front yard and add two more storey above it in the south-eastern part of the site during early 2000s. Eventually in 2008 another shop was hosted by converting the south side room adjacent to the street, and added another storey in the south-eastern part of the site to make it four storied. But none of these modifications except the introduction of first shop in to the original structure was considered in this study. The original owners eventually sold the northern block to other three persons.

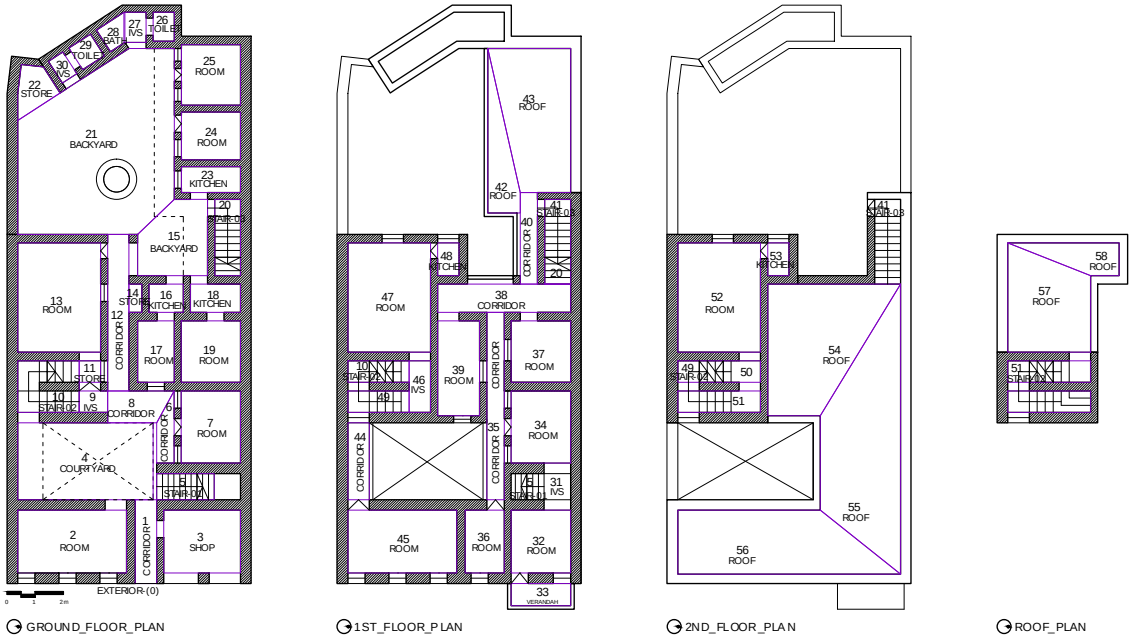


Figure 3.33 Shop-house PT-01

This introverted type building has two courts. The narrow entry corridor leads to the front courtyard. Two staircases placed on both sides of the court and a long corridor connects the backyard which act more like a service zone and had another stair up to the first floor roof. Structures on the service area were single storied. The northern part of the building is served with two stairs one from front and other from back which was originally a two storied building. Southern building placed at the middle of the plot which was three storied and served with a separate stair.

Table 3.12 Summary of syntactic data of PT-01

SHOP-HOUSE	ACTIVITY	DEPTH	MD	CV	RRA	CN
PT01	EXTERIOR	0	6.31	2.00	1.55	3.00
	SHOP	1	7.29	0.33	1.84	1.00
	CIRCULATION	5.55	5.51	1.33	1.32	2.80
	COURTS	4	4.29	3.13	0.96	6.00
	OPEN SPACES	10.29	8.33	0.93	2.14	1.71
	SERVED	6.07	6.13	0.55	1.5	1.33
	SERVICE	6.58	6.15	0.49	1.50	1.17
	TEMPLE	N/A	N/A	N/A	N/A	N/A
TOTAL GRAPH	MINIMUM	0.00	3.93	0.13	0.86	1.00
	MEAN	6.20	6.11	1.00	1.49	2.10
	MAXIMUM	12.00	10.16	5.23	2.68	8.00

In space syntax analysis it is found that the shop is in the segregated zone with a high average RRA value of 1.84 and high average mean depth value of 7.29 (Table 3.12).

The highest integration with a RRA value of 0.86 is found in the ground floor corridor, space no. 15 with the lowest mean depth value 3.93 (Table A11). This corridor connects the front yard with the backyard. Backyard shows the highest control value of 5.23 with highest connectivity 8.00. The front court remained as an integrated space with the RRA value of 1.02. Served and service spaces are integrated in this shop-house with the overall configuration.

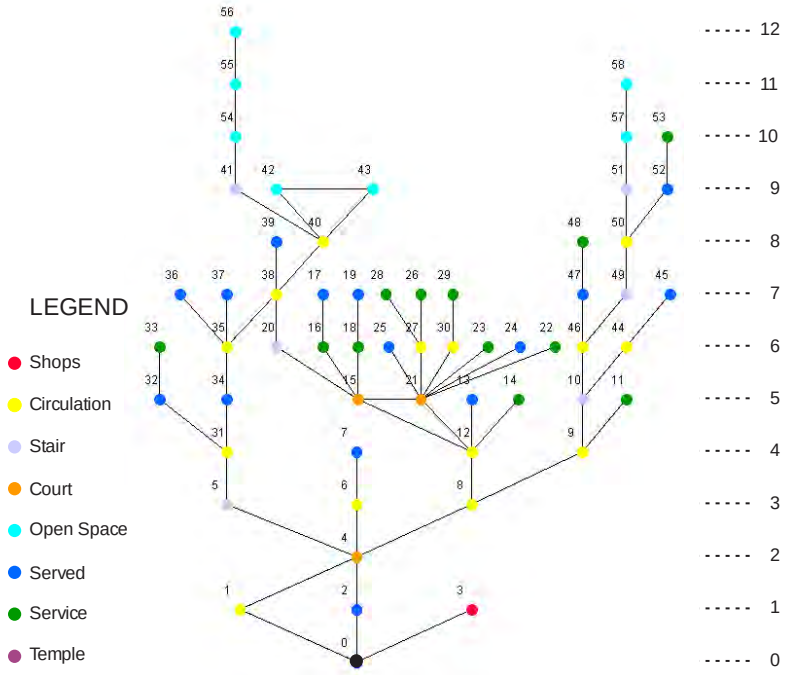


Figure 3.34 J-graph of PT-01

The building is twelve steps deep from the carrier which has been taken from the street ((Fig. 3.34)). One extended ring with few small rings is seen in this building. Both the ground floor spaces and the first floor spaces of the north wing have large rings around the served spaces but the south wing is separated from the large ring.

3.5.5.2 Case study: PT-06

The shop-house located in 06, Rakhal Chandra Bashak Lane, Panni Tola and an enclosed courtyard type building. The shop-house was constructed in the early 20th century during some times in 1940. (Khan F. M., 2013, p. 136) The existing Muslim owner purchased the shop-house from the original Hindu owner. Originally the building was a two storied residence (Fig. B6). The *Baitak Khana* of the residence at the front was altered into shops in the year 1955. The present owner added a storey at the top during 1970s and eventually another storey was added more recently to make it a four storey structure but these modifications is not considered in this study.

This is a symmetrically organized building with two courtyards. The wide entrance leads to leaner front yard surrounded with shaded corridor of wrought iron colonnade and served rooms on around. The main stair leads to upper floor with the same arrangement. The side corridors

became narrower and open to the backyard service zone. A service stair at the rear connects the upper floor rear side of the building. A well-articulated public, semi private and private sequence is reflected in the building morphology.

From Space syntax analysis it is found that the shops in the configuration are in the integrated zone with average low RRA value of 1.27 and average mean depth value of 5.36 (Table 3.13). It indicates that the function of the shop is closely related to its inhabitant's activity.

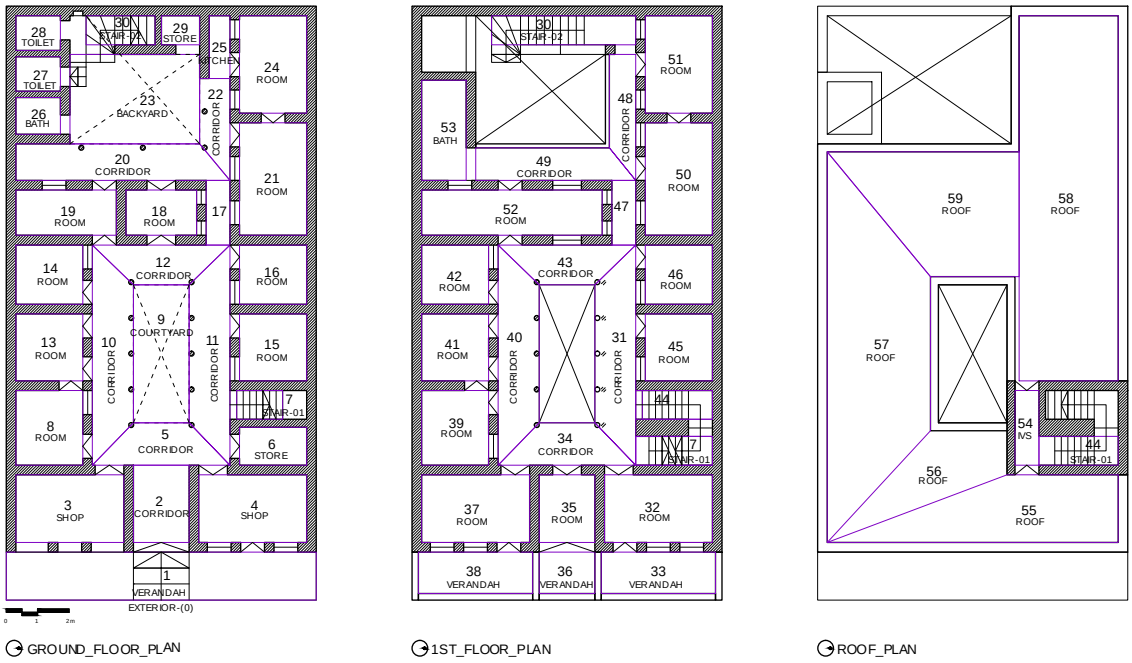


Figure 3.35 Shop-house PT-06

Table 3.13 Summary of syntactic data of PT-06

SHOP-HOUSE	ACTIVITY	DEPTH	MD	CV	RRA	CN
PT06	EXTERIOR	0	7.22	0.25	1.81	1.00
	SHOP	2	5.36	0.42	1.27	2.00
	CIRCULATION	6.2	4.69	1.83	1.07	4.10
	COURTS	6	4.69	2.77	1.07	5.50
	OPEN SPACES	9.8	7.02	0.93	1.75	2.00
	SERVED	7.5	5.39	0.47	1.28	1.5
	SERVICE	8.7	6.06	0.27	1.47	1.00
	TEMPLE	N/A	N/A	N/A	N/A	N/A
TOTAL GRAPH	MINIMUM	0.00	3.78	0.14	0.81	1.00
	MEAN	7.10	5.41	1.00	1.28	2.47
	MAXIMUM	11.00	8.12	4.90	2.07	7.00

The highest integration with a RRA value of 0.81 is found in the first floor corridor connected with main stair, space no. 31, with the lowest mean depth value of 3.78 (Table A12). The same corridor at ground floor, space no. 11 also has the lowest mean depth value of 3.78 with the highest connectivity value of 7.00. Courts are in the most integrated zone with average RRA

value of 1.07. Served spaces are in integrated zone while service spaces are in the segregated zone in this shop-house.

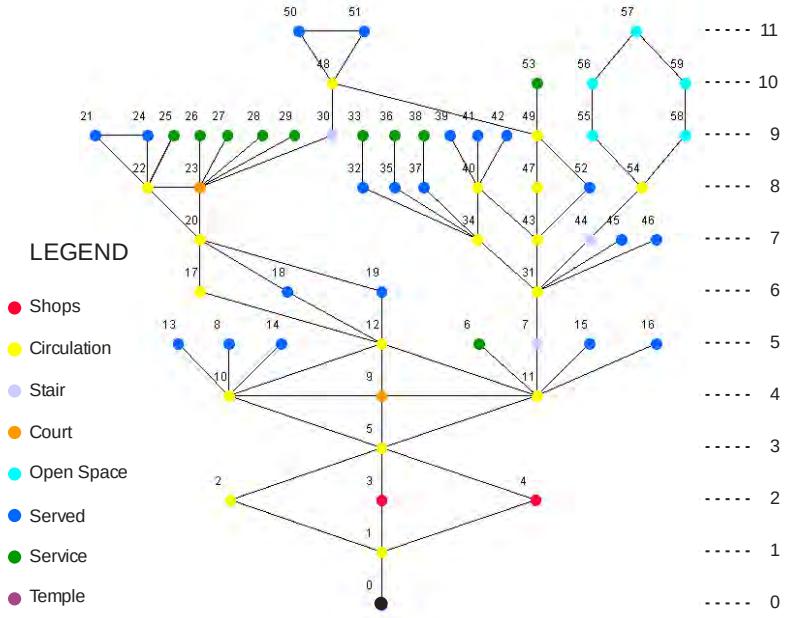


Figure 3.36 J-graph of PT-06

Space syntax analysis shows that the building has a complex ringy tree and is 11 steps deep from the root point that has been taken from outside (Fig. 3.36). The transitional spaces are distributed with the outdoor in large exterior rings.

3.5.5.3 Case study: PT-17

The original shop-house located in 17, Rakhal Chandra Bashak Lane, Panni Tola and a detached type building. The descendant of the original owner lives in the building. Two shops are in a separate single storey structure adjacent to the streets left a narrow corridor leading to the front yard. The residential part is a separate two storied structure with highly decorated font facade. The doorway of this block leads to a large front room followed by a straight stair and a side corridor which goes to the service yard and continues till it reaches to the back yard. All the services are arranged on both sides of middle and back court. The first floor contains served spaces with an open to sky terrace in the middle from where a linear stair went to the roof.

The shops in the configuration are at the extreme segregated zone with average high RRA value of 2.55 and average high mean depth value of 8.06 (Table 3.14).

The highest integration with a RRA value of 1.08 is found in the ground floor interior corridor, space no. 6, with the lowest mean depth value of 4.00 (Table A13). The connecting corridor inbetween informal court and service court at ground level, space no. 16 has the highest control

value of 5.33 and highest connectivity value of 7.00. The backyard remained in segregated zone. Served and service spaces are in integrated zone of the configuration.

Figure 3.37 Shop-house PT-17

In Space syntax analysis it is found that the shop-house is in a uni-linear sequence with 12 steps deep with few small rings at connecting open areas (Fig. 3.38).

Table 3.14 Summary of syntactic data of PT-17

SHOP-HOUSE	ACTIVITY	DEPTH	MD	CV	RRA	CN
PT17	EXTERIOR	0	7.09	2.50	2.20	3.00
	SHOP	1	8.06	0.33	2.55	1.00
	CIRCULATION	6.36	5.25	1.84	1.54	3.36
	COURTS	6.8	5.89	0.73	1.77	2.20
	OPEN SPACES	10.6	7.55	0.93	2.37	2.20
	SERVED	6.5	5.68	0.54	1.69	1.33
	SERVICE	8.33	6.38	0.16	1.94	1.00
	TEMPLE	N/A	N/A	N/A	N/A	N/A
TOTAL GRAPH	MINIMUM	0.00	4.00	0.14	1.08	1.00
	MEAN	6.89	6.13	1.00	1.85	2.17
	MAXIMUM	12.00	8.66	5.33	2.77	7.00

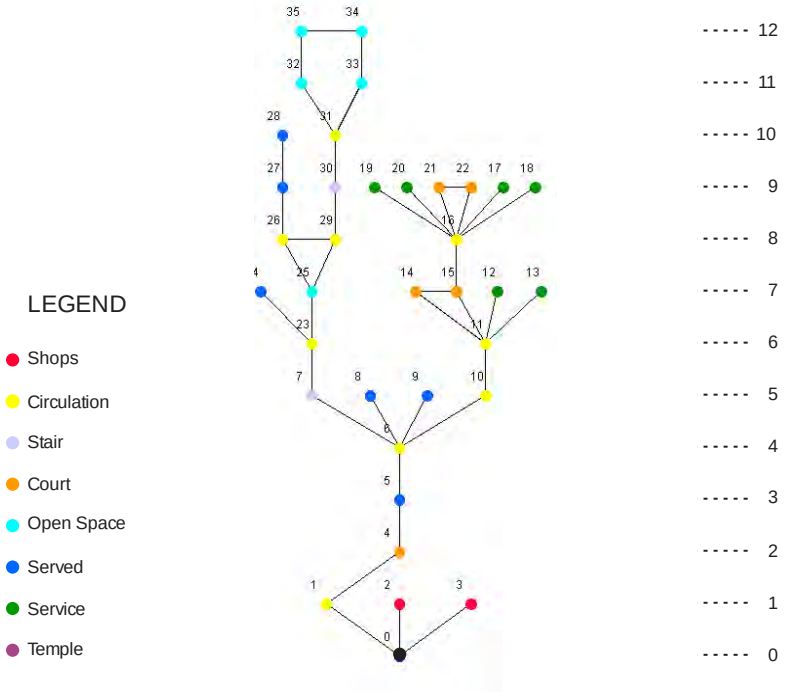


Figure 3.38 J-graph of PT-17

3.5.5.4 Case study: PT-40

The shop-house located in 40, Rakhal Chandra Bashak Lane, Panni Tola and a detached type building. This is an original shop-house inhabited by the descendent of the original owner. The pattern of the shop-house is almost similar to the shop-house of holding no. 17. A shop in a separate two storey structure is positioned in the front of the house. Wide entrance corridor leads to the front yard where the only stair of the house found. This entrance corridor is now using as a shop, which is not consider in this thesis. A long side corridor connects directly to the back yard where the services are plotted. Served spaces are accessed from the corridor. The open to sky stair from the front yard leads to first floor served spaces on front and middle of the shop-house. Again a long corridor went back where an open to sky terrace and service spaces found.

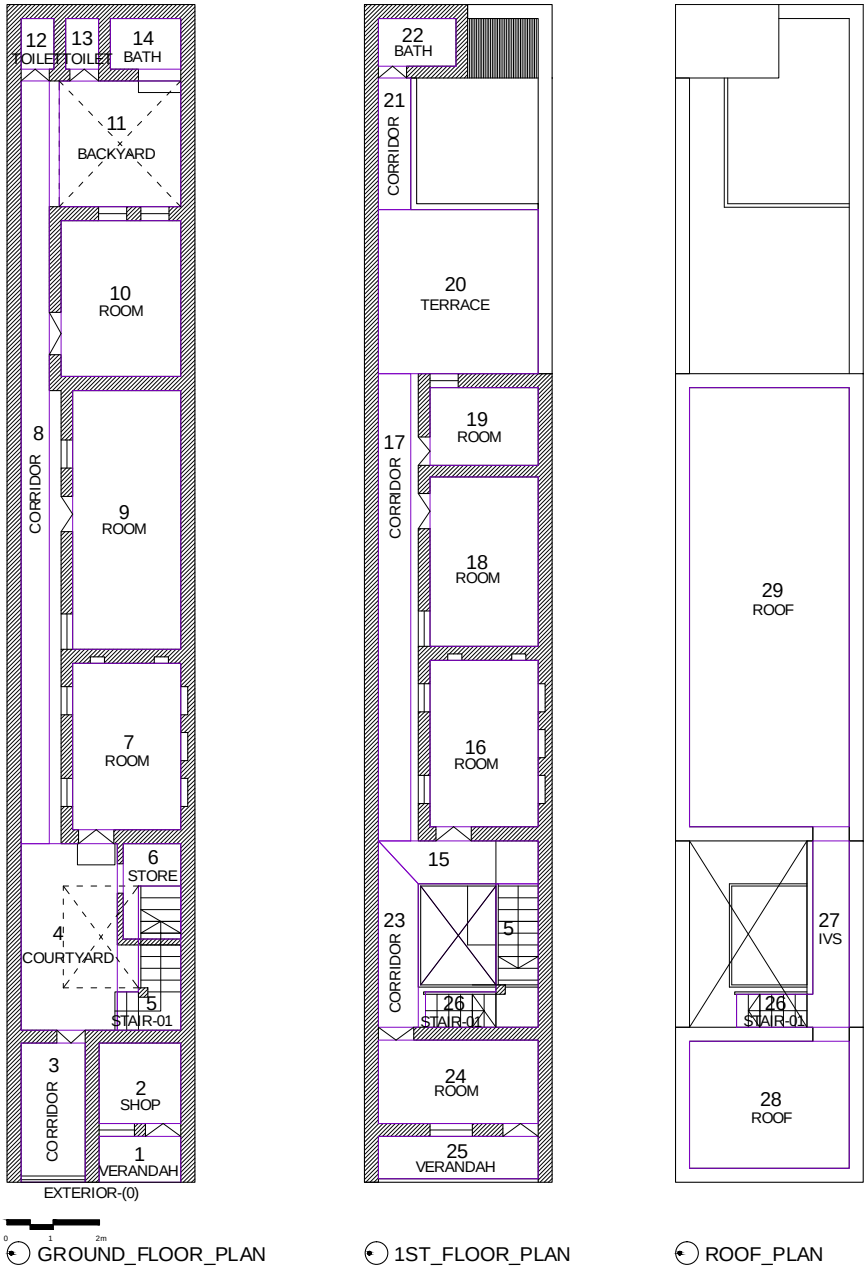


Figure 3.39 Shop-house PT-40

The shops in the configuration are at the extreme segregated zone with average high RRA value of 2.23 and average high mean depth value of 6.66 (Table 3.15).

The highest integration with a RRA value of 0.20 is found in the front room, space no. 7. The front yard, space no. 4 has the highest control value of 3.25 and the highest connectivity value of 5.00 (Table A14). The backyard also has the same control value. Served spaces are integrated and the service spaces are at the segregation zone of the configuration.

Table 3.15 Summary of syntactic data of PT-40

SHOP-HOUSE	ACTIVITY	DEPTH	MD	CV	RRA	CN
PT40	EXTERIOR	0	4.79	1.00	1.50	2.00
	SHOP	2	6.66	0.50	2.23	1.00
	CIRCULATION	4.2	4.23	1.59	1.28	2.80
	COURTS	3	3.86	3.25	1.13	4.50
	OPEN SPACES	7.33	5.69	0.47	1.85	1.33
	SERVED	4.67	4.51	0.42	1.38	1.17
	SERVICE	5.57	5.33	0.31	1.71	1.00
	TEMPLE	N/A	N/A	N/A	N/A	N/A
TOTAL GRAPH	MINIMUM	0.00	3.14	0.20	0.84	1.00
	MEAN	4.63	4.77	1.00	1.49	1.93
	MAXIMUM	8.00	6.66	3.25	2.23	5.00

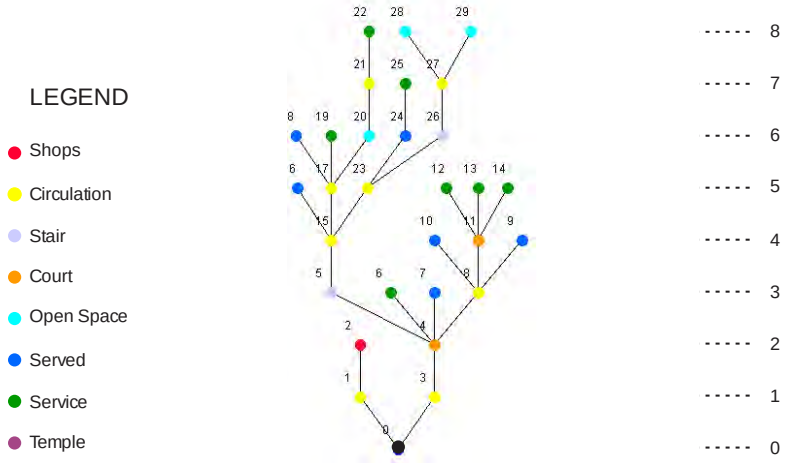


Figure 3.40 J-graph of PT-40

In Space syntax analysis it is found that the shop-house is in a uni-linear sequence with only 8 steps deep without any ringy property (Fig. 3.40).

3.5.5.5 Case Study: PT 43

The shop-house located in 43, Rakhal Chandra Bashak Lane, Panni Tola and a narrow introvert type building. The original owner of shop-house purchased the plot with two storied shop-house having a Ration shop at the ground floor during 1950s. (Khan F. M., 2013, p. 130) Eventually during 1960s a storey was added at front part of the building. A three storey column-beam structure was constructed at the rear part of the building in recent time which is not considered in the study. After 1988 when the rationing system was withdrawn by the government, the Ration shop was closed. During 2003-2004, the present owners started the photo studio business in the plot.

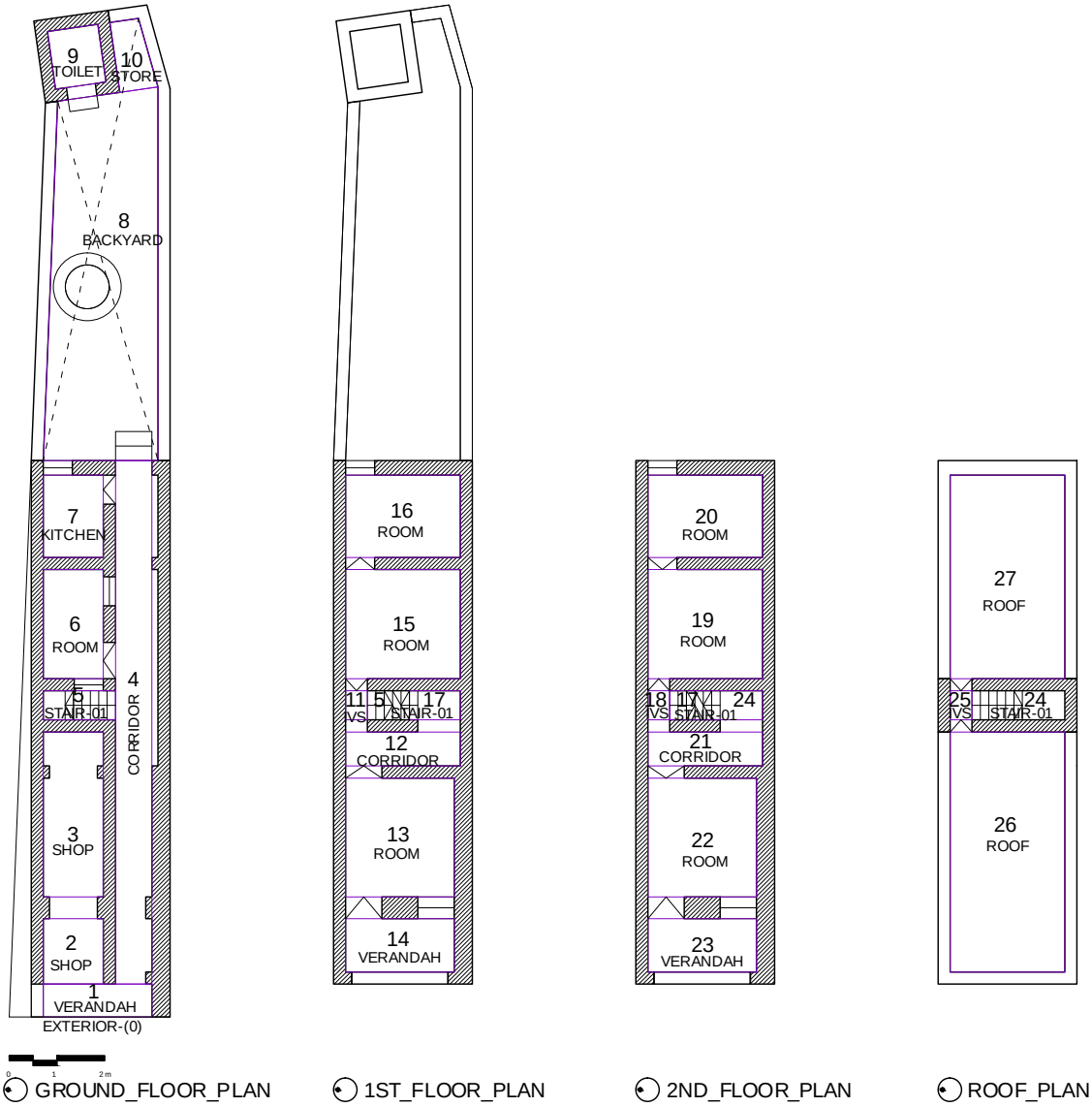


Figure 3.41 Shop-house PT-43

It is a three storied shop-house, one of the narrowest in Panni Tola. The narrow corridor leads directly to the backyard. This corridor links all the spaces of the building in ground floor. Centrally positioned stiff stair with only seven steps leads to the first floor where served spaces are placed on both sides. The stair then went towards the second floor with same arrangements. Service spaces are at the back yard of the building.

The shops in the configuration are at the segregated zone with average high RRA value of 2.17 and average high mean depth value of 6.30 (Table 3.16).

The highest integration with a RRA value of 1.09 is found in the first floor Intervening space, space no. 11 and first floor corridor, space no. 12 with the highest mean depth value of 3.67 (Table A15). The main corridor at the ground floor has the highest control value of 3.17 and the highest connectivity value of 5.00. The backyard remains in the integration zone with RRA

value of 1.64. Served spaces are integrated and the service spaces are at the segregation zone of the configuration.

Table 3.16 Summary of syntactic data of PT-43

SHOP-HOUSE	ACTIVITY	DEPTH	MD	CV	RRA	CN
PT43	EXTERIOR	0	5.89	0.33	2.00	1.00
	SHOP	2.5	6.30	0.92	2.17	1.50
	CIRCULATION	6	4.43	1.43	1.40	2.89
	COURTS	3	5.00	2.20	1.64	3.00
	OPEN SPACES	11	7.22	0.33	2.54	1.00
	SERVED	6.57	5.21	0.93	1.72	1.57
	SERVICE	5.6	5.83	0.37	1.98	1.00
	TEMPLE	N/A	N/A	N/A	N/A	N/A
TOTAL GRAPH	MINIMUM	0.00	3.67	0.20	1.09	1.00
	MEAN	5.85	5.31	0.97	1.76	1.89
	MAXIMUM	11.00	7.22	3.17	2.54	5.00

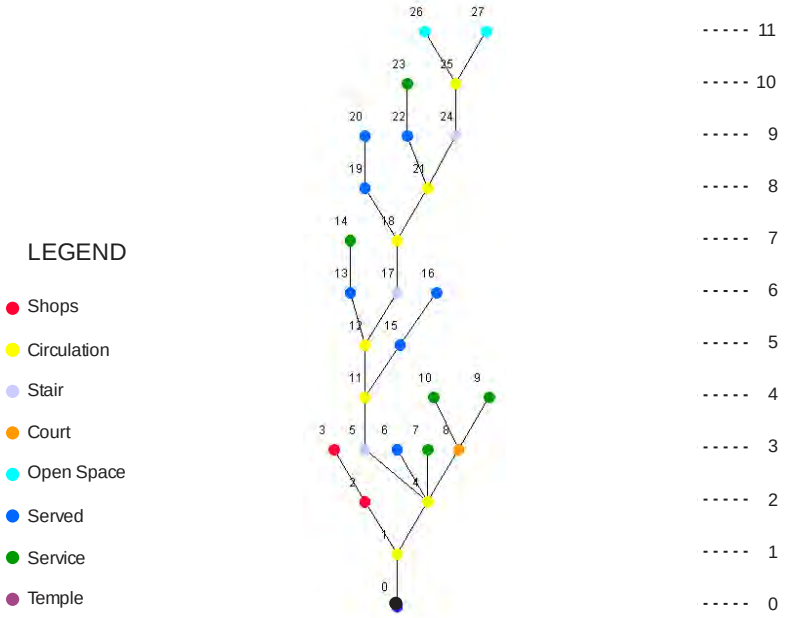


Figure 3.42 J-graph of PT-43

In Space syntax analysis it is found that the shop-house is in a uni-linear sequence with 11 steps deep without any ringy property (Fig. 3.42).

3.5.6 General syntactic properties of Panni Tola shop-houses

In Panni Tola the physical layouts of individual shop-houses varied a lot according to their volume and types and original-altered category, now the syntactic properties of the above case studies are summarized below:

Mostly the J-graphs are tree like configuration some with few small rings. No large exterior rings are found in Shakhari Bazar case studies. In Panni Tola the shops are found in highly segregated spaces with high average RRA value and high average mean depth value. Here the

original three shop-houses PT-17, PT-40 and PT-43 are of detached and narrow type shop-house. It indicates that shops in these types of shop-houses are not conceived as an integral part of the whole configuration. The highest integration with lowest RRA value is mostly found in the circulation corridor with the lowest mean depth value. Mostly the courts have the highest control value with highest connectivity. The courts also remain integrated sometime with high control value. The J-graphs of the altered category shows ringy type configuration with large and complex exterior rings whereas the original shop-houses shows tree like configuration with minimum small rings.

3.6 Summary

From reconnaissance survey it is found that the case study area still demonstrated a good number of traditional shop-houses. But for last few decades the surge of new development creates a tremendous demand of shops in the study area. As a consequence traditional building was demolished to make new high-rise mixed-use buildings. The functional and physical aspects of traditional shop-houses also recognized and classification of shop-house is done according to its physical space articulation. The physical properties and shop-house type not only varied among themselves, they also varied among area based trade groups and time based original and altered category. But the daily living activities performed by the household members or interaction with outsiders are not so much different among the shop-houses as the physical characteristics of the house. This indicates certain socio-cultural factors influence the activity pattern of the traditional shop-houses. First procedure of the research involves a social interpretation of spatial genotypes of shop-houses. The objective is to establish the spatial genotypes by using syntactic data. To evaluate the spatial arrangements and activity within the spaces, space syntax methodology applied to find out the syntactic properties of the shop-houses. The second procedure is to investigate two research questions. The first question concerns the differences between area based trade groups and their influences on spatial configuration. Beside the original shop-houses, an altered category was found which were built as residential and then again altered into shop-houses among the traditional buildings found in Tanti Bazar and Panni Tola locality. Therefore the second question deals with the differences of spatial configuration between original shop-houses and altered i.e. residence which transformed into shop-houses. It proposes that although the physical characteristics of original and altered shop-houses may have been varying, their spatial configuration remains constant. It is hypothesized that the average syntactic values-RRA, mean depth, connectivity, and control values of shop-houses from each location and each physical category will not be different. If the results from this research indicate any significant difference, then the trade groups represented by shop-houses in the three different locations expressed distinct social and cultural aspects of their social life through the spatial configurations of their houses, similarly the original and altered category expressed distinct spatial configuration over time.

Chapter 04 ANALYSIS

4.1 Introduction

With the findings of the basic syntactic properties of the case studies this chapter tries to establish the general genotype of shop-house in its first part. Syntactic data such as the distribution of RRA values are used to seek the possible general pattern of space uses. It is expected that there will be a general tendency of space use pattern to be seen embedded in the spatial configuration of shop-houses. To examine the strength of the configurational differences between spaces within the shop houses the analyses of Difference Factors have been conducted. The pattern of justified graph and Space Link Ratio of the shop houses also been analyzed in this part to find out the space sequence.

The second part deals with the effect of different trade groups, as defined in terms of each location on spatial configuration of shop-houses; this part also tests whether the original and altered shop-houses affects the spatial pattern of the houses. Statistical analysis is used to test the differences among groups of shop-houses with respect to typology and location. If significant difference results, then typology and trade group (location) do influence the way spaces are organized and structured. It is presumed that the social and cultural contents are revealed in the spatial structure and organization of a dwelling.

4.2 Space Uses in Shop-Houses

Basic organization

All the shop-houses investigated in this study, are multi storied in height. Shop or commercial activities in all of the shop-houses are confined in the frontal part of the ground level adjacent to the street. Residential functions basically the services occupy the rear part of the ground floor. The upper floors mainly consist of various served spaces with the access of open to sky terraces and roofs.

Shops

The shop is always on the ground floor at the front of the building. Only one altered shop-house TB-10 is found with a workshop in the first floor. Social encounters between inhabitants and visitors usually occur in the shop space.

Circulation spaces

Generally long narrow corridors connecting the courts and the interior spaces. These narrow corridors or the colonnades around the court yard served as main circulation space. The vertical circulation is managed by one or more stairways. Many intervening spaces are provided for the ease of circulation in the shop-houses.

Courts

All of the studied shop-houses have at least one court or open yard. The courtyard is one of the most significant characteristic in the local context of Bengal. The shop-houses also demonstrated a variety of front yard, formal and informal courtyard and service backyard. These spaces not only permits air and light to the deep interior of these mostly long and narrow plots, but also serve many activities in and around them. In Shakhari Bazar one shop-hose SB-10 has a formal courtyard separating the commercial and residential activities with a shaded service yard at back, while other four shop-houses have one informal courtyard and then another backyard at the rear end of the plot. In Tanti Bazar TB-10 have front yard which separates the commercial and residential access with an informal courtyard and a service backyard. TB-18 has a front yard and a service backyard, TB-64 has an informal courtyard and an unused open backyard, TB-20 and TB-65 have mostly unused backyards. In Panni Tola shop-house PT-17 has front yard, informal courtyard and service backyard, PT-43 have only a service backyard and rest three have a formal courtyard followed by a rear service backyard.

Open spaces

Many shop-houses have open to sky terraces at different level of the house. Almost all shop-houses have access to the roof except SB-110, TB-64 and TB-65. The roof and terraces accommodate many recreational activity and social interaction among family members as well as neighbors and outsiders in special occasion. Exclusively kite flying is very popular in Old Dhaka. Kite festival also known as *Shakrain* or *Ghuri Utsab* is an annual celebration held at the end of the Bengali ninth month *Poush* i.e. in *'Poush Sangkranti'* or 'end of *Poush*'. (The Daily Star, 2011)

Served spaces

Generally the rare rooms of the buildings and the upper floors are the location of the sleeping or resting quarters, studying or recreation space, intimate and family guest receiving, the prayer room or *puja ghar* and store room. Sometimes these spaces also used for dining or temporary cooking. With the exception of few service areas the various rooms of these shop-houses are rarely designated for a single activity. The use of most spaces changes both diurnally and seasonally.

Service spaces

Kitchen usually located in the rear of the house or in-between the informal court and the backyard. Some shop-houses also have outdoor cooking space just like the traditional rural homestead of Bangladesh. As traditionally the cooking fuel were wood, leaves, cow-dung, kerosene or coal, the cooking generally done in the rear part of the house at ground level only. Shed for the cooking fuel was also evident in some shop-houses. Lot of activities generates

around the cooking zone at day time as social encounters between family members and between visitors and householders usually take place in and around the cooking space.

The backyard is usually used for bathing, extracting or washing. Toilets and baths are regularly located here. There are basically two reason for that, one is technical, as at the time when the shop-houses were built the service corridor was at the rear side of the plots, usually a camel or *kacha* drain had been used to take away the soil and waste water; another is social, generally the Hindus built their toilets in a long distance from the residential wing. In few cases the baths were built in the first floor but there's almost no evidence of toilets in upper floors for technological constrain.

Verandah is one of the common utility space mostly use for drying cloths in daytime, some used as temporary stores and resting or even sleeping at night in summer time.

Temple

Though in the study area there are lot of common temples, still many shop-houses has individual in-house temple or *mandir* which is a unique feature of the Old Dhaka traditional shop-houses. Traditionally the temple was located in the highest position of the building and the access to the temple roof was prohibited thus no stair left for temple roof. Ritually the Hindu temple faces south, that's why the temples located at the road end with an almost solid façade towards road side in the south side shop-houses of Shakhari Bazar while on the opposite side the temples placed to the rear side of the plot with an open terrace in front.

General character

From the previous chapter it is found that though the shop-houses in Shakhari Bazar differ physically from those in Tanti Bazar and Panni Tola, their daily living activities are not so much different as the physical characteristics of the house. The shop space is located on the ground floor, usually at the front of the house. All shop-houses have some sort of courts with lot of activities in and around them. Most of the shop-houses have side way entrance except three, TB-18, PT-01 & PT-06, in the studied houses. Almost all the shop-houses have open terraces or at least accessible roof for recreational and other family or social gathering. The informal courtyards usually provide the location for household services such as the kitchen and storage. Also they serve as the outdoor cooking and outdoor living space. The rear of the house usually belongs to service spaces such as bathrooms, showers, and toilets. It is clear that across the sample there exist certain tendency in the activity patterns regardless to their area wise trade groups and original or altered typologies. It gives a clue that certain genotype is present among the traditional shop-houses of Old Dhaka.

4.3 Spatial Genotypes of Shop-Houses of Old Dhaka

The procedure defines the underlying principles governing spatial configuration of shop-houses. In this regard the integration distribution analysis is being conducted. It relies on Hillier's conception of "inequality genotype." The analysis focuses on the measurement of inequality by using the difference factor, and depth property of the shop-house. One of the main objectives is to find the repetition of spatial configuration across the sample. According to the spatial configuration, it is expected that the general tendency of spatial integration pattern of activities such as household activity, cooking, entertaining guests, and so forth will reveal cultural and social significance. These results will reveal the social and cultural interpretation of spatial structure.

4.3.1 Distribution of RRA values

It is anticipated that the range of daily living activities as defined by the distribution of integration values will reveal the social and cultural patterns found in this type of dwellings. It was also anticipated that there would be a tendency for certain activity patterns to occur across the sample. For example, service and open space are anticipated to be some of the most segregated spaces in the house while circulation and court space would be among the most integrated spaces. As integration values are the reverse value of RRA, by ordering the mean RRA value of space with regard to its designated activity pattern, the next procedure establishes the genotypes of shop-houses.

To obtain the genotype, the mean RRA values of each activity pattern are ordered from the most integrated to the most segregated (i.e., from the least to the most RRA value). Integration value can be calculated from the reverse value of RRA (1/RRA). Since certain activities tend to occur in more than one space, the mean RRA value of each activity pattern here represent the average RRA of all spaces where that particular activity type occurs in the house. The mean RRA for all 15 shop-houses is presented in Table 4.1.

Regardless of the rank orders of integration or segregation, the discussion of genotype will emphasize on the general tendency of a certain space use patterns that falls on either the integration or segregation side of the complex. In this study, the 'average value' of mean RRA of all activity patterns in a particular shop-house is considered as the transitional level of the integrated and segregated domain of the complex. Mean RRA of the activity pattern which are below or equal to the 'average value' of mean RRA of all activity patterns are defined as integrated and the higher values as segregated spaces. However, if the mean RRA values of any two spaces coincide, in association with other properties, such as the privacy need of that space, are taken into account to determine on which side of integration they should fall.

Table 4.1 Mean RRA values of activity patterns of 15 shop-houses

LOCALITY	TYPOLOGY	SHOP-HOUSE	EXTERIOR	CIRCULATION	COURTS	OPEN SPACES	SHOP	SERVED	SERVICE	TEMPLE
SHAKHARI BAZAR	ORIGINAL	SB10	2.01	1.65	1.69	2.37	2.14	2.02	2.27	N/A
	ORIGINAL	SB15	1.66	1.81	1.44	2.57	1.38	1.83	1.82	N/A
	ORIGINAL	SB32	1.84	1.98	1.69	2.91	1.70	1.9	2.11	N/A
	ORIGINAL	SB110	1.52	0.92	1.13	1.99	1.36	1.2	1.54	2.14
	ORIGINAL	SB118/1	1.64	1.54	1.18	2.48	1.44	1.62	1.99	1.90
		MEAN	1.73	1.58	1.43	2.46	1.60	1.71	1.95	2.02
		SD	0.19	0.40	0.27	0.33	0.33	0.32	0.28	0.17
TANTI BAZAR	ALTERED	TB10	1.77	1.41	1.28	2.07	2.03	1.58	1.99	N/A
	ALTERED	TB18	1.65	1.49	1.57	2.43	1.46	1.72	1.87	N/A
	ALTERED	TB20	2.15	1.41	2.01	2.36	2.39	1.95	1.64	N/A
	ALTERED	TB64	1.86	1.29	0.84	1.55	1.86	1.7	1.54	N/A
	ALTERED	TB65	1.41	1.42	1.16	2.04	1.81	1.94	1.99	N/A
		MEAN	1.77	1.40	1.37	2.09	1.91	1.78	1.81	
		SD	0.27	0.07	0.44	0.35	0.34	0.16	0.21	
PANNI TOLA	ALTERED	PT01	1.55	1.32	0.96	2.14	1.84	1.5	1.50	N/A
	ALTERED	PT06	1.81	1.07	1.07	1.75	1.27	1.28	1.47	N/A
	ORIGINAL	PT17	2.20	1.54	1.77	2.37	2.55	1.69	1.94	N/A
	ORIGINAL	PT40	1.50	1.28	1.13	1.85	2.23	1.38	1.71	N/A
	ORIGINAL	PT43	2.00	1.40	1.64	2.54	2.17	1.72	1.98	N/A
		MEAN	1.81	1.32	1.31	2.13	2.01	1.51	1.72	
		SD	0.30	0.17	0.37	0.33	0.49	0.19	0.24	
TOTAL 15 CASES		MINIMUM	1.41	0.92	0.84	1.55	1.27	1.20	1.47	1.90
		MEAN	1.77	1.44	1.37	2.23	1.84	1.67	1.82	2.02
		MAXIMUM	2.20	1.98	2.01	2.91	2.55	2.02	2.27	2.14
	ORIGINAL	MEAN	1.80	1.52	1.46	2.39	1.87	1.67	1.92	2.02
		SD	0.26	0.33	0.28	0.34	0.46	0.27	0.23	0.17
	ALTERED	MEAN	1.74	1.34	1.27	2.05	1.81	1.67	1.71	N/A
		SD	0.24	0.14	0.40	0.31	0.37	0.24	0.23	N/A

The integration order for all 15 shop-houses is presented in Table 4.2. The list of RRA distribution in Table 4.2 shows that it is possible to have more than one space use pattern that occupies the most integrated or the most segregated space in a shop-house. The RRA order indicates that the activities that tend to occur in the integrated domain are courts, circulation and served spaces. When exterior spaces are excluded from the integration order, the activities that occur mostly in the segregated domain are service, temple and open spaces. However, if exterior space is included then the segregated domains are exterior, service, temple and open spaces.

Table 4.2 Order of activity pattern of 15 shop-houses

LOCALITY	SHOP-HOUSE	INTEGRATED ZONE							SEGREGATED ZONE
SHAKHARI BAZAR	SB10	CIRCULATION	< COURTS	< EXTERIOR	< SERVED	< SHOP	< SERVICE	< OPEN	
	SB15	SHOP	< COURTS	< EXTERIOR	< CIRCULATION	< SERVICE	< SERVED	< OPEN	
	SB32	COURTS	< SHOP	< EXTERIOR	< SERVED	< CIRCULATION	< SERVICE	< OPEN	
	SB110	CIRCULATION	< COURTS	< SERVED	< SHOP	< EXTERIOR	< SERVICE	< OPEN	< TEMPLE
	SB118-1	COURTS	< SHOP	< CIRCULATION	< SERVED	< EXTERIOR	< TEMPLE	< SERVICE	< OPEN
	MEAN	**COURTS**	**< CIRCULATION**	**< SHOP**	**< SERVED**	**< EXTERIOR**	**< SERVICE**	**< TEMPLE**	**< OPEN**
TANTI BAZAR	TB10	COURTS	< CIRCULATION	< SERVED	< EXTERIOR	< SERVICE	< SHOP	< OPEN	
	TB18	SHOP	< CIRCULATION	< COURTS	< EXTERIOR	< SERVED	< SERVICE	< OPEN	
	TB20	CIRCULATION	< SERVICE	< SERVED	< COURTS	< EXTERIOR	< OPEN	< SHOP	
	TB64	COURTS	< CIRCULATION	< SERVICE	< OPEN	< SERVED	< EXTERIOR	= SHOP	
	TB65	COURTS	< EXTERIOR	< CIRCULATION	< SHOP	< SERVED	< SERVICE	< OPEN	
	MEAN	**COURTS**	**< CIRCULATION**	**< EXTERIOR**	**< SERVED**	**< SERVICE**	**< SHOP**	**< OPEN**	
PANNI TOLA	PT01	COURTS	< CIRCULATION	< SERVED	= SERVICE	< EXTERIOR	< SHOP	< OPEN	
	PT06	COURTS	= CIRCULATION	< SHOP	< SERVED	< SERVICE	< OPEN	< EXTERIOR	
	PT17	CIRCULATION	< SERVED	< COURTS	< SERVICE	< EXTERIOR	< OPEN	< SHOP	
	PT40	COURTS	< CIRCULATION	< SERVED	< EXTERIOR	< SERVICE	< OPEN	< SHOP	
	PT43	CIRCULATION	< COURTS	< SERVED	< SERVICE	< EXTERIOR	< SHOP	< OPEN	
	MEAN	**COURTS**	**< CIRCULATION**	**< SERVED**	**< SERVICE**	**< EXTERIOR**	**< SHOP**	**< OPEN**	
TOTAL 15 CASES		**COURTS**	**< CIRCULATION**	**< SERVED**	**< EXTERIOR**	**< SERVICE**	**< SHOP**	**< TEMPLE**	**< OPEN**
ORIGINAL		**COURTS**	**< CIRCULATION**	**< SERVED**	**< EXTERIOR**	**< SHOP**	**< SERVICE**	**< TEMPLE**	**< OPEN**
ALTERED		**COURTS**	**< CIRCULATION**	**< SERVED**	**< SERVICE**	**< EXTERIOR**	**< SHOP**	**< OPEN**	

Among spaces on the integration side of the 15 shop-houses, the most integrated spaces are as follows:

• Court space in 8 cases.

• Circulation space in 5 cases.

• Shop space in 2 cases.

It should be noted that served and service space never occur as the most integrated space. Shop is the most integrated space in only two cases, shop-house SB-15 and TB-18. Both shop-houses have shops deep to the interior linked with the main circulation. In Shakhari Bazar except SB-10 remaining four shop-houses have shop space in the integrated domain. While except TB-18 and PT-06 in Tanti Bazar and Panni Tola respectively, the remaining eight shop-houses have shop space in the segregated domain.

Among those spaces on the segregation side, the most segregated spaces are summarized as follows:

• Exterior space, if included in the analysis, results in 1 case that is the most segregated space.

• Open space in 9 cases.

• When exterior space is excluded, open space is the most segregated space in 10 cases.
• Shop space in 4 cases.
• Temple space in 1 case.

By summarizing the integration and segregation domain of 15 shop-houses, the space-use patterns that occur most frequently in the integration domain are courts, circulation and served space, while open space and service space occur most frequently in the segregation domain. With regard to space-use pattern, the results indicate that activities involving encounters, either formal or informal, occurring between inhabitants and visitors, or between inhabitants and inhabitants, occur in integrated space such as shop and court. Activities that require a high degree of privacy such as service and temple space occur in segregated space.

By ordering the mean RRA values of each space-use pattern, a consistent order of spaces regarding to RRA value is shown as follows:
• The general genotype of overall samples:
COURTS < CIRCULATION < SERVED < EXTERIOR < SERVICE < SHOP < TEMPLE < OPEN

• The general genotype of shop-houses in Shakhari Bazar:
COURTS < CIRCULATION < SHOP < SERVED < EXTERIOR < SERVICE < TEMPLE < OPEN

• The general genotype of shop-houses in Tanti Bazar:
COURTS < CIRCULATION < EXTERIOR < SERVED < SERVICE < SHOP < OPEN

• The general genotype of shop-houses in Panni Tola:
COURTS < CIRCULATION < SERVED < SERVICE < EXTERIOR < SHOP < OPEN

The comparison between these genotypes indicates the similarity of the underlying genotype of shop-houses. The most integrated spaces are courts, circulation and served spaces; and the most segregated spaces are service, temple and open spaces. Shop and exterior spaces can be either on the integration or segregation side of the house, but their RRA values may not be high or low enough to be in the most integrated or the most segregated domain. The differences between these genotypes were found only within category of integration.

4.3.2 Analysis of Difference Factor (BDF)

In order to examine the strength of the configurational differences between spaces within a shop-house, a difference factor was calculated. According to Hillier (Hillier, Hanson, & Graham, 1987) the degree of integration differentiation among spaces relates to the strength of spatial structure. The difference factor actually ranges from 0, which indicates a strong degree of differentiation, to 1, which indicates no difference in integration among spaces. If the value of

the difference factor is high (weak difference factor) then the household has less differentiation among spaces. Since this study deals with space use patterns or activities occurring within spaces, the undifferentiated space may imply the undifferentiating among space use patterns. In other words, various domestic activities tend to interchange in multifunctional space, and they are spatially undifferentiated.

From this study the base difference factor (BDF) is the difference factor calculated from the mean, minimum, and maximum RRA value of each shop-house. The BDF value of each shop-house is presented in Table 4.3. The BDF value from the sample of 15 shop-houses ranges from 0.72 to 0.86. The mean BDF of these shop-houses is 0.81.

Table 4.3 Base Difference Factor and Space Link Ratio of 15 shop-houses.

AREA	SHOP-HOUSE	TYPOLOGY	No. of Spaces	No. of Links	SLR	RRA			BDF
						Min	Mean	Max	
SHAKHARI BAZAR	SB10	ORIGINAL	54	59	1.11	1.21	1.91	3.17	0.82
	SB15	ORIGINAL	57	60	1.07	1.10	1.83	3.05	0.80
	SB32	ORIGINAL	54	57	1.07	1.26	2.02	3.67	0.77
	SB110	ORIGINAL	29	28	1.00	0.75	1.34	2.52	0.72
	SB118-1	ORIGINAL	41	42	1.05	1.02	1.70	2.67	0.82
	MEAN				1.06				0.79
TANTI BAZAR	TB10	ALTERED	57	65	1.16	0.97	1.69	2.61	0.82
	TB18	ALTERED	46	53	1.17	1.07	1.70	2.81	0.82
	TB20	ALTERED	23	22	1.00	1.08	1.77	2.75	0.83
	TB64	ALTERED	27	27	1.04	0.75	1.49	2.31	0.78
	TB65	ALTERED	27	27	1.04	1.09	1.72	2.76	0.83
	MEAN				1.08				0.81
PANNI TOLA	PT01	ALTERED	59	62	1.07	0.86	1.49	2.68	0.75
	PT06	ALTERED	60	74	1.25	0.81	1.28	2.07	0.83
	PT17	ORIGINAL	36	39	1.11	1.08	1.85	2.77	0.84
	PT40	ORIGINAL	30	29	1.00	0.84	1.49	2.23	0.82
	PT43	ORIGINAL	28	27	1.00	1.09	1.76	2.54	0.86
	MEAN				1.09				0.82
TOTAL 15 CASES		MEAN			1.08				0.81
ORIGINAL		MEAN			1.05				0.81
ALTERED		MEAN			1.10				0.81

From Table 4.3, the mean BDF for Shakhari Bazar, Tanti Bazar and Panni Tola are 0.79, 0.81, and 0.82 respectively, which indicates weak differentiation among space-use pattern structure. However, the mean BDF for shop-houses in Shakhari Bazar suggests weaker differentiation in comparison with Tanti Bazar and Panni Tola.

The almost identical BDF across groups indicates the similarity in differentiation pattern of shop-houses. The findings of high difference factors or weak differentiation of most shop-houses suggest that there is no strong presence of individual specific-use among spaces of shop-houses; most activities tend to be inseparably involved in large single spaces, which result in the presence of such multifunctional or multipurpose spaces in most shop-houses.

4.3.3 Pattern of Justified Access Graph

Tree-like Layout

Tree like homes share a property that movement about the interior and in relation to the exterior is highly controlled and predictable from the layout, a feature which is made use of in the way activities and functions are assigned to domestic space. Tree like domestic space arrangements produced strongly programmed forms of domestic space arrangements (Hanson J. , 1998, p. 278).

In tree like room arrangements, whether the tree branches shallow or deep, the node that represents the exterior is at one pole of the justified access graph and the room or rooms which are deepest into the house are at the other extremity in a branching sequence which links together all the spaces in the house by way of the trunk of the tree. Eliminating the exterior has little effect on the overall configuration of the complex. That's why tree-like houses normally support strongly framed social situations where access to and movement about the house need to be controlled in intersect of an individual inhabitant or group of residents. Examples of tree-like J-graph are SB-110 (Fig. 3.18), TB-20 (Fig. 3.27), PT-40 (Fig. 3.40) and PT-43 (Fig. 3.42).

Ringy Layout

Plans with rings are more difficult to characterize as they permit route choice by adding connections within the configuration over and above the minimum necessary to ensure the continuity of the system. A trivial ring which links only two or three immediately adjacent rooms can have only localized effects within the layout. While large rings which links the physically remote parts of the house together tend to have large-scale effects and the act of blocking movement around the ring may be more obvious or less predictable depending on where the ring is cut. Spaces where rings intersect are usually powerful places occupied by key functions.

Where the exterior participates in a ring through the house, its elimination will have an overall segregating effect on those spaces. Ringy houses usually support social situations where the dominant interface in the dwelling is between an individual host and his guests or between some group of residents in the house and their visitors. Examples of ringy J-graph with large exterior rings are TB-10 (Fig. 3.23), TB-65 (Fig. 3.31), PT-01 (Fig. 3.34) and PT-06 (Fig. 3.36).

From the analysis of the space-link ratio values (SLR) of each group it is found that shop-houses in Shakhari Bazar have lower SLR (the average SLR is 1.06) while Tanti Bazar and

Panni Tola have SLR relatively higher, the average SLR is 1.08 and 1.09 respectively. As discussed in previous chapters, shop-houses with SLR close to 1 indicate a linear sequence of spaces, a tree-like system, whereas the high SLR value indicates a ring-like system. The more ring-like system tends to have more alternative routes of permeability within the house-so called distributedness. The higher SLR of shop-houses in Tanti Bazar and Panni Tola is evidence of a higher distributed system. With regard to the organization of the system, they tend to be more ring-like, have more access and connectivity between spaces when compared with shop-houses in Shakhari Bazar.

With their tree-like system, spaces in shop-houses in Shakhari Bazar have a more linear arrangement than shop-houses in Tanti Bazar and Panni Tola. This results in the exterior world being brought closer to the daily domestic activities.

4.4 Effect of Location Wise Trade and Traditionally Varied Category

The first analysis deals with the influences on the pattern of space use of the location wise trade groups and traditionally varied original and altered category. Did the culture of the three different trade groups in three different locality or two traditionally varied typology i.e. original and altered shop-houses have any effect on space use patterns of the 15 shop-houses?

Analysis of variance was conducted on three locations and two categories each with regard to eight activity patterns, to test the effect of the area wise trade groups and traditionally varied categories of the shop-house on each syntactic measurement (i.e., RRA, MD, Connectivity, and Control value). The variables are the three locations, two varied categories of shop-houses, and seven primary activity patterns and exterior space.
The basic questions for each analysis are as follows:
1. Is there a difference between the average syntactic values of each activity pattern of shop-houses in Shakhari Bazar, Tanti Bazar, and Panni Tola?
2. Is there a difference between the average syntactic values of each activity pattern of shop-houses in original and altered typologies?

4.4.1 Analysis of variance on RRA values

Tables 4.4 show mean and standard deviation of RRA values of each activity pattern by locations and Table 4.5 is the summery of the results of ANOVA on those values.

Table 4.6 show mean and standard deviation of RRA values of each activity pattern by varied typologies and Table 4.7 is the summery of the results of ANOVA on those values.

Table 4.5 and Table 4.7 summarize the results of the analysis of variance on RRA values. The results show that:

1. Location of trade groups: There is no significant difference (at 0.05 level) of RRA values of activity patterns between Shakhari Bazar, Tanti Bazar, and Panni Tola which indicates that the integration values of different activity spaces are statistically similar regardless their location wise trade groups.

Table 4.4 Descriptive statistics of RRA values by locations and activity patterns

Activity Pattern	Locations					
	Shakhari Bazar		Tanti Bazar		Panni Tola	
	M	SD	M	SD	M	SD
EXTERIOR	1.73	0.19	1.77	0.27	1.81	0.30
SHOP	1.60	0.33	1.91	0.34	2.01	0.49
CIRCULATION	1.58	0.40	1.40	0.07	1.32	0.17
COURTS	1.43	0.27	1.37	0.44	1.31	0.37
OPEN SPACES	2.46	0.33	2.09	0.35	2.13	0.33
SERVED	1.71	0.32	1.78	0.16	1.51	0.19
SERVICE	1.95	0.28	1.81	0.21	1.72	0.24
TEMPLE	2.02	0.17				

Table 4.5 Analysis of variance on RRA values by locations and activity patterns

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Shakhari Bazar	8	14.488332	1.8110415	0.1068624
Tanti Bazar	7	12.128	1.7325714	0.067653
Panni Tola	7	11.824	1.6891429	0.1034731

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.0576981	2	0.028849	0.3088426	0.7379136	3.5218933
Within Groups	1.7747936	19	0.0934102			
Total	1.8324917	21				

Where *SS*=Sum of Squares, *df*=Degrees of Freedom, *MS*=Mean Squares, as the p-value is 0.7379, which is more than the significance level of 0.05 and *F crit* > *F*, the null hypothesis cannot be rejected.

Table 4.6 Descriptive statistics of RRA values by varied typologies and activity patterns

Activity Pattern	Category			
	Original		Altered	
	M	SD	M	SD
EXTERIOR	1.80	0.26	1.74	0.24
SHOP	1.87	0.46	1.81	0.37
CIRCULATION	1.52	0.33	1.34	0.14
COURTS	1.46	0.28	1.27	0.40
OPEN SPACES	2.39	0.34	2.05	0.31
SERVED	1.67	0.27	1.67	0.24
SERVICE	1.92	0.23	1.71	0.23
TEMPLE	2.02	0.17		

Table 4.7 Analysis of variance on RRA values by varied typologies and activity patterns

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Original	8	14.636457	1.8295572	0.0882431
Altered	7	11.595714	1.6565306	0.072436

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.1117692	1	0.1117692	1.3807622	0.2610455	4.6671927
Within Groups	1.0523174	13	0.0809475			
Total	1.1640866	14				

2. Varied typology of the shop-house: There is no significant difference of RRA values of activity patterns between the original category and altered category of shop-houses. Which indicates the integration values of different activity spaces are statistically similar regardless their varied typologies. That is, no significant effect of physical alteration of the shop-houses was found on the mean RRA values of activity pattern. This can be interpreted that the order of shops in the overall configuration remains same in spatial morphological terms while shops were introduced in altered types.

Figures 4.1 and 4.2 present the comparison of RRA values of each activity pattern across area wise trade groups and varied typologies.

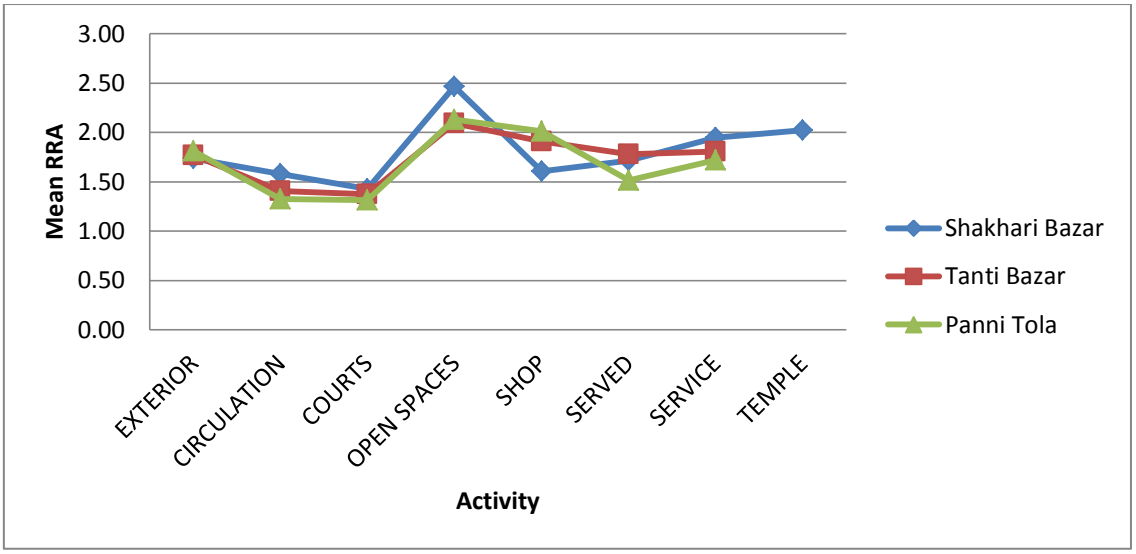


Figure 4.1 Mean RRA of space use pattern by locations

From Figure 4.1, regarding location, The RRA value of exterior carrier is almost same in three locations. The RRA value of open space is much higher and the RRA value of shop is much lower in the shop-houses of Shakhari Bazar when compared to those of Tanti Bazar and Panni Tola, but they are not statistically different. The RRA value of served space is also low in Panni Tola shop-houses when compared with other two locations. The almost parallel lines of Tanti Bazar and Panni Tola indicate that the sequence of RRA distribution of activity pattern is almost similar across the trade groups but concerning shop and open space they are different with Shakhari Bazar. Shops in Shakhari Bazar shop-houses are more integrated with the configuration but in Tanti Bazar and Panni Tola shops are segregated with its overall configuration. This implies that the shop activity is more family orientated and integrated with other household activities in Shakhari Bazar community with their specified hereditary trade. While the activity in the open spaces is more segregated, this implies that Shakhari Bazar shop-houses were more reluctant to permit the outsiders in their domestic activity.

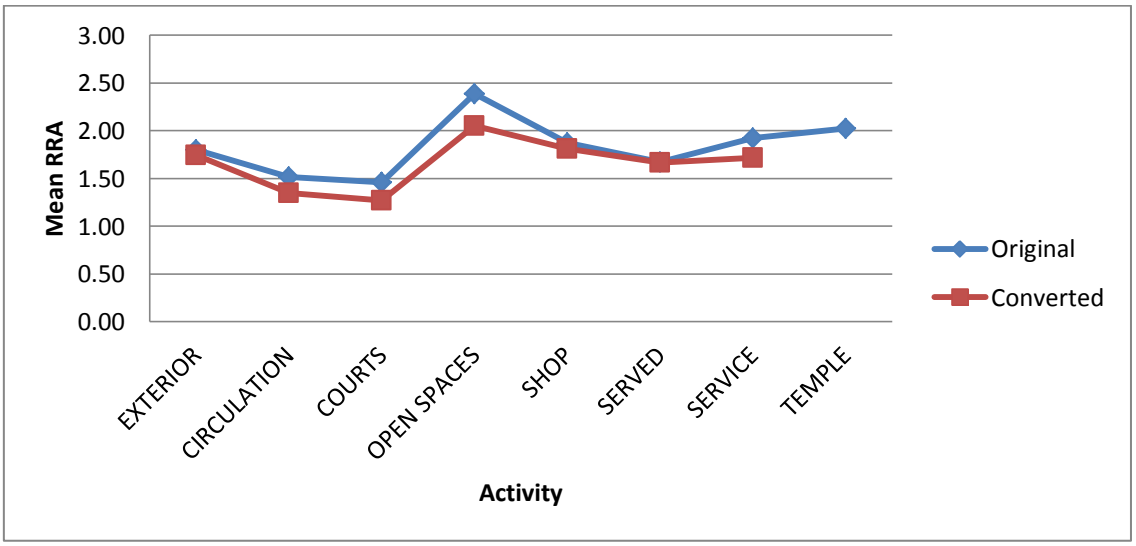


Figure 4.2 Mean RRA of space use pattern by varied typologies

Figure 4.2 indicates a similar pattern of RRA on space use patterns across original and altered typology. Activities in original shop-houses tend to have higher RRA values when compared to those in altered shop-houses which mean the altered shop-houses have a more integrated system than the original shop-houses, but this is not statistically significant. Circulation and courts are more integrated when compared to shop, service space and open space. This implies that the altered typology which was basically residence shows more integrated configuration even after their alternation as shop-houses than the original ones.

4.4.2 Analysis of variance on Mean Depth (MD)

Table 4.8 is the summary of descriptive statistics (i.e., mean and standard deviation) of locations on mean depth values and Table 4.9 is the summery of the results of ANOVA on those values.

Table 4.8 Descriptive statistics of Mean Depth values by locations and activity patterns

Activity Pattern	Locations					
	Shakhari Bazar		Tanti Bazar		Panni Tola	
	M	SD	M	SD	M	SD
EXTERIOR	6.39	1.11	5.73	0.95	6.26	0.99
SHOP	5.99	1.42	6.09	1.05	6.73	1.02
CIRCULATION	5.98	1.68	4.78	0.82	4.82	0.54
COURTS	5.46	1.26	4.67	1.21	4.75	0.77
OPEN SPACES	8.67	1.76	6.66	1.56	7.16	0.96
SERVED	6.37	1.52	5.74	0.58	5.38	0.60
SERVICE	7.05	1.41	5.91	1.34	5.95	0.40
TEMPLE	6.45	0.18				

Table 4.9 Analysis of variance on Mean Depth values by locations and activity patterns

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Shakhari Bazar	8	52.36743	6.545929	0.944683
Tanti Bazar	7	39.576	5.653714	0.498751
Panni Tola	7	41.05748	5.865354	0.861911

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	3.30507	2	1.652535	2.124835	0.14696	3.521893
Within Groups	14.77676	19	0.777724			
Total	18.08183	21				

Table 4.10 is the summary of descriptive statistics (i.e., mean and standard deviation) of varied typologies on mean depth values and Table 4.11 is the summery of the results of ANOVA calculated on those values.

Table 4.10 Descriptive statistics of Mean Depth values by varied typologies and activity patterns

Activity Pattern	Category			
	Original		Altered	
	M	SD	M	SD
EXTERIOR	6.21	1.07	6.03	0.96
SHOP	6.37	1.29	6.15	1.03
CIRCULATION	5.48	1.48	4.87	0.72
COURTS	5.26	1.13	4.62	0.99
OPEN SPACES	7.97	1.72	6.95	1.42
SERVED	5.91	1.35	5.74	0.52
SERVICE	6.60	1.27	5.96	1.10
TEMPLE	6.45	0.18		

Table 4.11 Analysis of variance on Mean Depth values by varied typologies and activity patterns

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Original	8	50.254317	6.2817896	0.6913771
Altered	7	40.331429	5.7616327	0.6274996

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	1.010103	1	1.010103	1.5260769	0.2385624	4.6671927
Within Groups	8.6046377	13	0.6618952			
Total	9.6147406	14				

Table 4.9 and 4.11 are the summary of the results of ANOVA on mean depth of each activity pattern. The results show that:

1. Location of trade groups: With regard to the mean depth, there is no significant difference of activity pattern between shop-houses in Shakhari Bazar, Tanti Bazar, and Panni Tola.

2. Varied typology of shop-house: There is no significant difference of mean depth of activity pattern between original shop-houses and the altered category. Therefore the effect of physical conversion on the mean depth of activity pattern is undetermined.

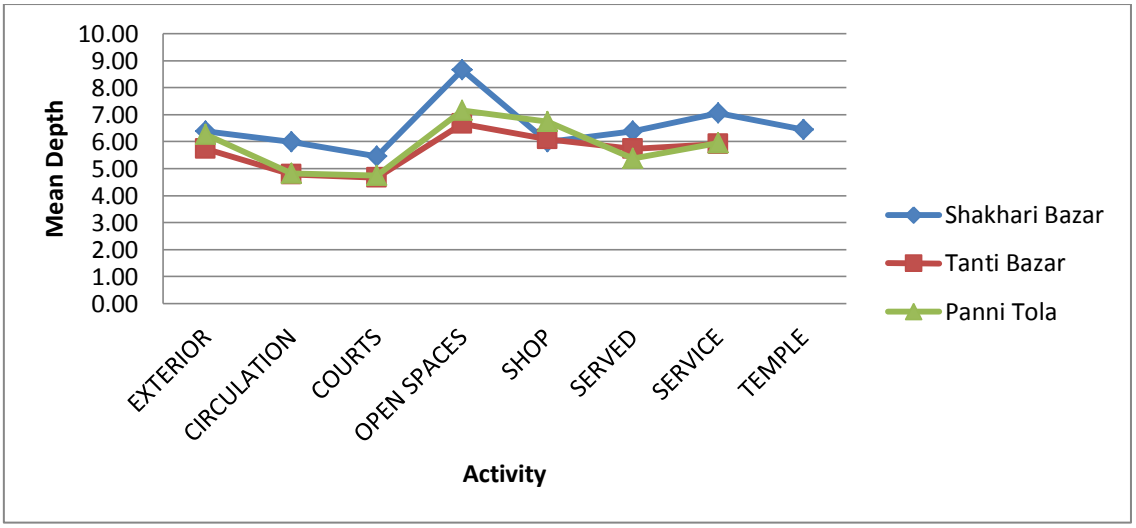


Figure 4.3 Mean Depth of space use pattern by locations

Figure 4.3 illustrates the pattern of mean depth of each activity pattern across locations. It suggests that shop-houses in Shakhari Bazar have a higher mean depth than those in Tanti Bazar and Panni Tola. However, the almost parallel lines of each location determined that the patterns of mean depth distribution for each activity pattern between these three locations are nearly similar except the open space of Shakhari Bazar have comparatively higher mean depth than the other two areas and the mean depth of served space in Panni Tola is little lower than the other two areas. The mean depth of activity patterns from shop-houses in Tanti Bazar and Panni Tola are almost indistinguishable. Open space, service space and exterior space have high mean depth whereas circulation, courts, and served space tend to occur in space with low mean depth. In association with the results from analysis of RRA values, activities that have high mean depth tend to occur in spaces with high RRA values (low integration), whereas activities with low mean depth occur in spaces with low RRA values (high integration). It implies that the overall activity patterns in Shakhari Bazar are less integrated than the overall activity pattern of Tanti Bazar and Panni Tola shop-houses.

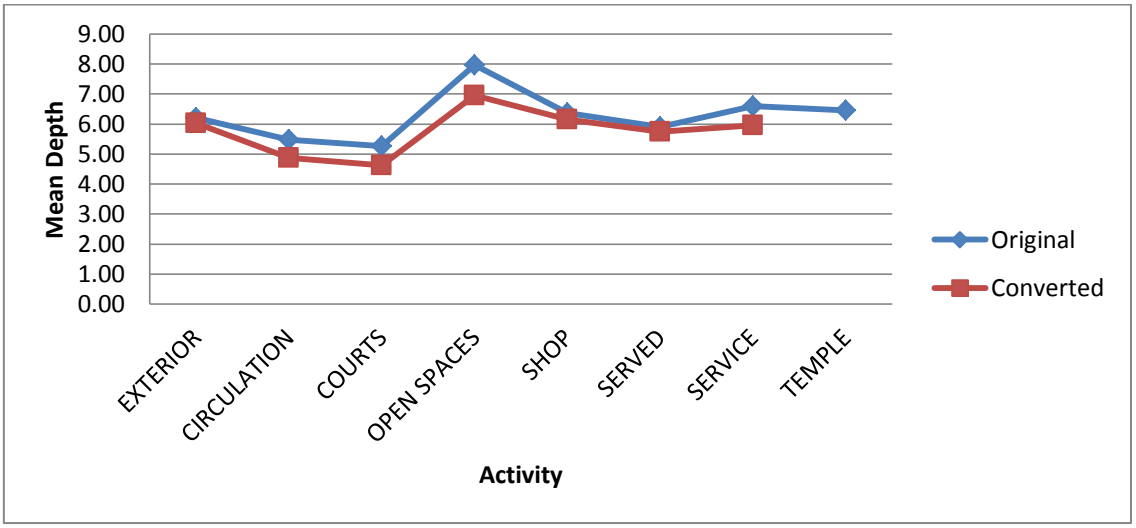


Figure 4.4 Mean Depth of space use pattern by varied typologies

The comparison of mean depth distribution between two varied typologies is illustrated in Figure 4.4. The results show that activities from shop-houses in the original category tend to have higher mean depth values than those in altered typology. However, the patterns of mean depth distribution of activity pattern in shop-houses in both original and altered categories are similar. Activities, such as open spaces and service occur in spaces with high mean depth, whereas circulation, courts and served space tend to occur in spaces with lower mean depth values. It implies that the overall activity patterns of original shop-houses are less integrated compare to the overall activity patterns of altered typology.

4.4.3 Analysis of variance on Connectivity (CN)

Table 4.12 is the summary of descriptive statistics (mean and standard deviation) of connectivity value (CN) of each activity pattern across locations and Table 4.13 is the summery of the results of ANOVA calculated on those values.

Table 4.12 Descriptive statistics of Connectivity values by locations and activity patterns

Activity Pattern	Locations					
	Shakhari Bazar		Tanti Bazar		Panni Tola	
	M	SD	M	SD	M	SD
EXTERIOR	1.00	0.00	3.20	1.79	2.00	1.00
SHOP	1.27	0.25	1.53	0.77	1.30	0.45
CIRCULATION	3.22	0.48	2.79	0.39	3.19	0.56
COURTS	3.53	0.94	3.27	1.35	4.24	1.62
OPEN SPACES	1.36	0.29	1.66	0.39	1.65	0.49
SERVED	1.56	0.17	1.77	0.44	1.38	0.16
SERVICE	1.11	0.08	1.14	0.22	1.03	0.08
TEMPLE	1.50	0.71				

Table 4.13 Analysis of variance on Connectivity values by locations and activity patterns

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Shakhari Bazar	8	14.536	1.817	0.9669474
Tanti Bazar	7	15.356	2.1937143	0.7567272
Panni Tola	7	14.792	2.1131429	1.3792585

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.5989315	2	0.2994658	0.2905275	0.7511322	3.5218933
Within Groups	19.584546	19	1.0307656			
Total	20.183478	21				

Tables 4.14 is the summary of descriptive statistics (mean and standard deviation) of connectivity value (CN) of each activity pattern across varied typologies and Table 4.15 is the summery of the results of ANOVA calculated on those values.

Table 4.14 Descriptive statistics of Connectivity values by varied typologies and activity patterns

Activity Pattern	Category			
	Original		Altered	
	M	SD	M	SD
EXTERIOR	1.38	0.74	2.86	1.68
SHOP	1.23	0.25	1.52	0.69
CIRCULATION	3.14	0.41	2.98	0.59
COURTS	3.42	0.96	3.98	1.64
OPEN SPACES	1.41	0.40	1.71	0.34
SERVED	1.48	0.20	1.67	0.40
SERVICE	1.07	0.08	1.12	0.19
TEMPLE	1.50	0.71		

Table 4.15 Analysis of variance on Connectivity values by varied typologies and activity patterns

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Original	8	14.62875	1.8285938	0.8300497
Altered	7	15.841429	2.2630612	1.0507187

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.7047114	1	0.7047114	0.7562118	0.4002882	4.6671927
Within Groups	12.11466	13	0.9318969			
Total	12.819372	14				

Table 4.13 and 4.15 are the summary of the results of ANOVA on connectivity values of each activity pattern. The results show that:

1. Location of trade groups: With regard to the connectivity values, there is no significant difference of activity pattern between shop-houses in Shakhari Bazar, Tanti Bazar, and Panni Tola.
2. Varied typology of shop-house: There is no significant difference of connectivity values of activity pattern between original shop-houses and the altered category.

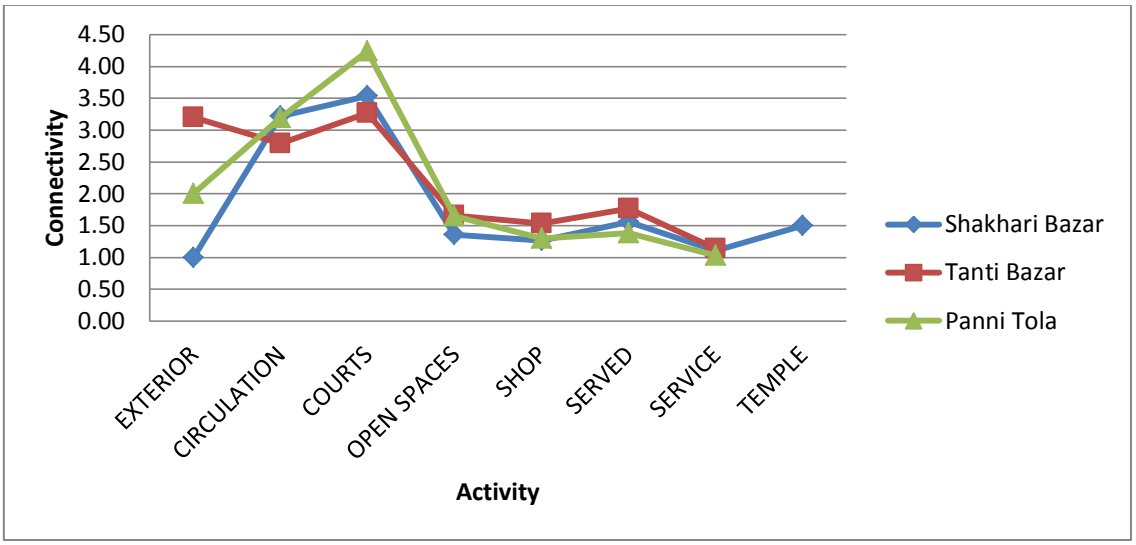


Figure 4.5 Mean Connectivity of space use pattern by locations

Figure 4.5 illustrates the pattern of connectivity of each activity pattern across locations. It shows that except the connectivity value of exterior space all other activity spaces demonstrate a similar nature in all three locations. Low connectivity in the exterior space of Shakhari Bazar shop-houses implies that total interior configuration of the buildings are less connected with the exterior while in Tanti Bazar high connectivity in exterior space implies that the exterior is more connected with the rest of the interior configuration.

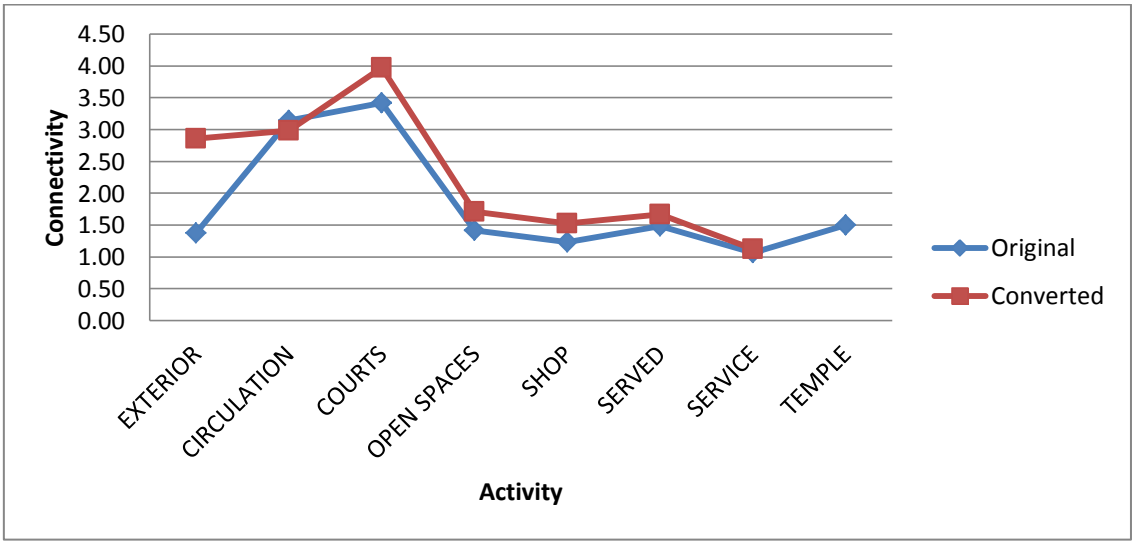


Figure 4.6 Mean Connectivity of space use pattern by varied typologies

Figure 4.6 illustrates the pattern of connectivity of each activity pattern across varied typologies. It shows that except the connectivity value of exterior space all other activity spaces demonstrate a similar nature in both original and altered category. Low connectivity in the exterior space of original shop-houses implies that total interior configuration of the buildings are less connected with the exterior while in altered shop-houses high connectivity in exterior space implies that the exterior is more connected with the rest of the interior spaces.

4.4.4 Analysis of variance on Control Values (CV)

Tables 4.16 present the mean and standard deviation of control values across locations and Table 4.17 is the summery of the results of ANOVA calculated on those values.

Table 4.16 Descriptive statistics of Control Values by locations and activity patterns

Activity Pattern	Locations					
	Shakhari Bazar		Tanti Bazar		Panni Tola	
	M	SD	M	SD	M	SD
EXTERIOR	0.31	0.04	2.30	2.00	1.22	1.00
SHOP	0.40	0.29	0.54	0.34	0.50	0.25
CIRCULATION	1.71	0.44	1.28	0.34	1.60	0.23
COURTS	2.01	0.90	1.80	0.99	2.42	1.03
OPEN SPACES	0.62	0.23	0.90	0.33	0.72	0.29
SERVED	0.71	0.15	0.86	0.32	0.58	0.20
SERVICE	0.40	0.08	0.39	0.25	0.32	0.12
TEMPLE	0.88	0.88				

Table 4.17 Analysis of variance on Control Values by locations and activity patterns

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Shakhari Bazar	8	7.0316667	0.8789583	0.4059392
Tanti Bazar	7	8.066	1.1522857	0.4772326
Panni Tola	7	7.3566667	1.0509524	0.5607712

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.2883356	2	0.1441678	0.3020187	0.7428083	3.5218933
Within Groups	9.069597	19	0.4773472			
Total	9.3579326	21				

Tables 4.18 present the mean and standard deviation of control values across age categories and Table 4.19 is the summery of the results of ANOVA calculated on those values.

Table 4.18 Descriptive statistics of Control Values by varied typologies and activity patterns

Activity Pattern	Category			
	Original		Altered	
	M	SD	M	SD
EXTERIOR	0.68	0.78	1.96	1.80
SHOP	0.47	0.29	0.49	0.29
CIRCULATION	1.67	0.36	1.37	0.34
COURTS	2.03	0.96	2.13	0.99
OPEN SPACES	0.60	0.24	0.91	0.27
SERVED	0.68	0.19	0.76	0.32
SERVICE	0.35	0.10	0.39	0.22
TEMPLE	0.88	0.88		

Table 4.19 Analysis of variance on Control Values by varied typologies and activity patterns

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Original	8	7.3583333	0.9197917	0.363296
Altered	7	8.0042857	1.1434694	0.483006

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.1867851	1	0.1867851	0.4462706	0.5157971	4.6671927
Within Groups	5.441108	13	0.4185468			
Total	5.6278931	14				

Table 4.17 and 4.19 are the summary of the results of ANOVA on control values of each activity pattern. The results show that:

1. Location of trade groups: With regard to the control values, there is no significant difference of activity pattern between shop-houses in Shakhari Bazar, Tanti Bazar, and Panni Tola.

2. Varied typology of shop-house: There is no significant difference of control values of activity pattern between original shop-houses and the altered category.

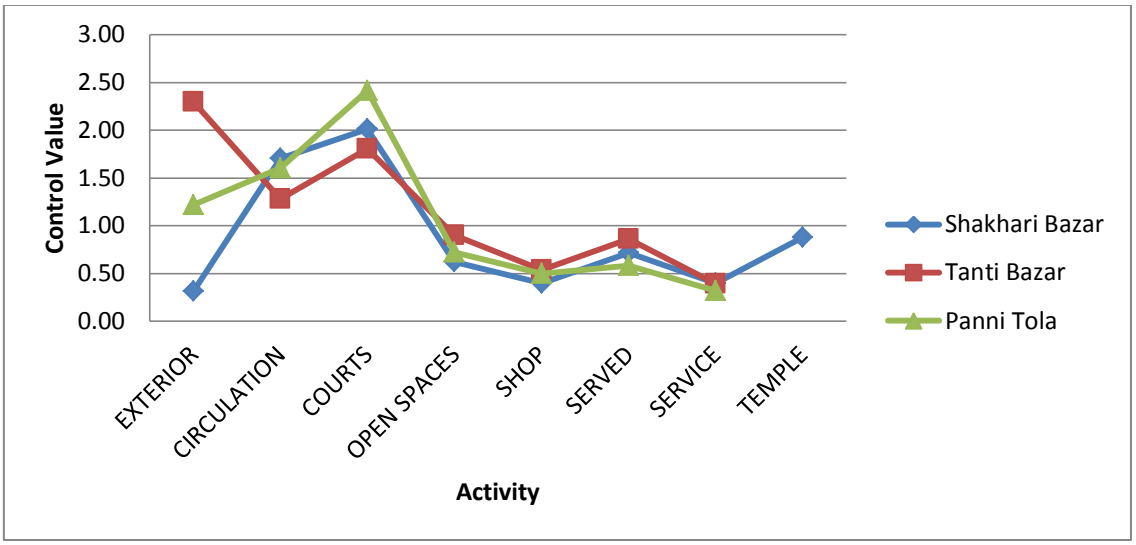


Figure 4.7 Mean Control Value of space use pattern by locations

Figure 4.7 illustrates the pattern of control of each activity pattern across locations. It suggests that shop-houses in Shakhari Bazar have a lower control value in its exterior activity space than those in Panni Tola shop-houses while shop-houses in Tanti Bazar have the highest. High control values indicate strong control. However, rest of the activity spaces shows a similar pattern. As high control value indicates strong control the exterior space of Shakhari Bazar shop-houses exhibits less control with low mean control value while the exterior space of Tanti Bazar shop-houses exhibits high control with high mean control value.

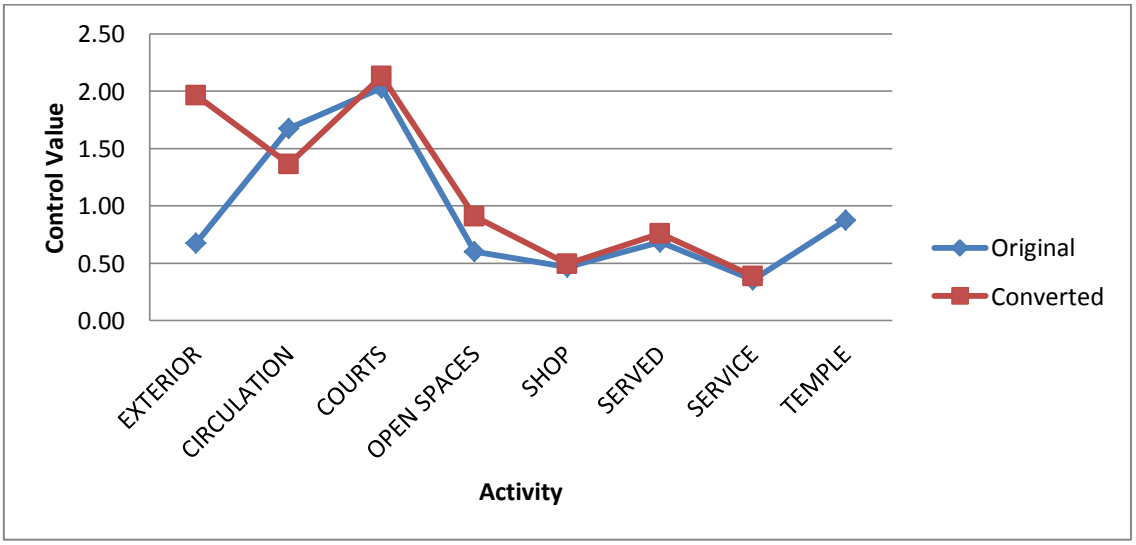


Figure 4.8 Mean Control Value of space use pattern by varied typologies

Figure 4.8 illustrates the pattern of control of each activity pattern across original and altered category. It suggests that the control value of exterior activity space in original category have a lower control value than those in altered shop-houses while the other activity spaces show a similar pattern. As high control value indicates strong control the exterior space of original

shop-houses exhibits less control with low mean control value while the exterior space of altered shop-houses exhibits high control with high mean control value.

4.5 Summary

In the first part the genotype of Old Dhaka shop-house was established with the analysis of syntactic data such as the distribution of RRA values of activity pattern in the shop-houses. A general tendency of space use pattern has been found that embedded in the spatial configuration of shop-houses.

The sequence of spaces among Shakhari Bazar, Tanti Bazar and Panni Tola shows the similarity of the underlying genotype of shop-houses. Again the sequence of spaces in traditionally modified original and altered typologies also shows similarity.

The second part deals with the effect of different trade groups, as defined in terms of each location on spatial configuration of shop-houses; the second is tests whether the original and altered shop-houses affects the spatial pattern of the houses.

The sequence of the general genotype of overall samples reflects the social and cultural interpretation of Old Dhaka society that entrenched in the spatial configuration of the shop-houses.

Statistically there is no significant difference of RRA, Mean Depth, Connectivity and Control Values of activity patterns between Shakhari Bazar, Tanti Bazar, and Panni Tola or between the original and altered category of traditionally modified shop-houses. The finding indicates that the underlying principles of social and cultural dimensions rule over the pattern of spatial configuration of Old-Dhaka shop-houses.

Chapter 05 CONCLUSION

5.1 Introduction

In Southeast Asia the shop-house is an archetypal vernacular urban houseform that implies a significant impact in the development of the city. Like many other Asian cities the origin of the shop-house in Old Dhaka can be traced back since its earliest settlement period. During the Pre-Mughal rule, the craftsmen and businessmen carried out light manufacturing and production in the shop-houses in a number of settlements around the pre urban core of Old Dhaka. Shakhari Bazar, Tanti Bazar and Panni Tola are those areas where the development of shop-houses was first evident in Dhaka city. The development of shop-house by various trade groups in different locations had played an essential role in the evolution of the city.

Traditionally Tanti Bazar and Panni Tola are more urban than Shakhari Bazar i.e. the existing traditional development found in Shakhari Bazar area are older than the existing traditional shop-houses of other two areas . When compared to Shakhari Bazar, the plot distribution and pattern of shop-houses are more similar, narrow and elongated form of shop-houses, than other two areas that are comparatively more diverse in nature, wide and narrow plot with various form of shop-houses.

Generally the shop-houses were closely built most of the cases adjacent to each other; arranged on both side of a narrow street running across the urban space of Bazar Street. The shop-houses are mostly leaner-rectangular in shape. The depth is almost two to ten times than frontage to suit the building in burgage plot. The width of the building varies widely.

The shop-houses are mainly comprised of three segments: street facing commercial part, the residential area in the middle and the service area in the open courts at the rear arranged sequentially and separated by one or more courtyard.

In shop-houses, most activities such as receiving family guests, chatting with neighbors, preparing food, washing and so forth occur in the informal or service court or in spaces nearby. The social relationship among occupants and between inhabitants and visitors also strongly influence the way activities occur in a particular space. It is the relationship among these people that defines or controls the movement from one space to another.

5.2 Shop-houses in Old Dhaka

5.2.1 Types of shop-houses

As per the classification of urban houseform of Dhaka, the shop-houses of Old Dhaka categorized into three broad types according to their arrangement of space analyzed from plan layout. They are enclosed courtyard type, detached type and narrow introvert type.

Enclosed courtyard type

Shop-house consists with a shop frontage then sequentially comes the court yard which separates the residential zone from the trade zone and at the back there is the service court all enclosed by party walls on both sides.

Detached Type

Shop-house with completely detached shops in front by an open front court and another or more inner courtyards in a sequence as informal and service court. Residential zone placed in-between the front court and informal courtyard while separate kitchen and toilets arranged around the service court.

Narrow Introvert Type

In narrower plots this type of shop-house contains a single narrow mass having a narrow passage lead from the shop frontage through the residential zone to the rear service court yard. In this type of arrangement one room needs to be accessed through another room.

5.2.2 Genotype of Old Dhaka shop-house

By ordering the reverse integration values or the mean RRA values of each space-use pattern, a consistent order of spaces has been found across the samples of case study shop-houses. The sequence of the general genotype of overall samples from the integration side to the segregation side are courts, circulation, served, exterior, service, shop, temple and open space. The sequence is the reflection of the social and cultural interpretation of spatial configuration of the Old Dhaka shop-houses.

The comparison between the order of spaces among Shakhari Bazar, Tanti Bazar and Panni Tola also indicates the similarity of the underlying genotype of shop-houses. Again the order of spaces in traditionally modified original and altered typologies also show similarity in their sequence.

In the traditional shop-houses of Old Dhaka the space-use patterns that occur most frequently in the integration domain are courts, circulation and served space, while open space and service space occur most frequently in the segregation domain.

With regard to space-use pattern, it is found that activities involving encounters, either formal or informal, occurring between inhabitants and visitors, or between inhabitants and inhabitants, occur in integrated domain such as shop and court. While activities that require a high degree of privacy such as service and temple space occur in segregated domain.

Shop and exterior spaces can be found either on the integration or segregation side of the house, but their RRA values never are high or low enough to be in the most integrated or the most segregated domain. The differences between these genotypes were found only within category of integration. The order of space-use patterns within the same integration group differs slightly between each location wise trade group or between original and altered typologies. Served and service spaces never occur as the most integrated space.

The almost indistinguishable BDF across groups indicates the similarity in differentiation pattern of shop-houses. The findings of high difference factors or weak differentiation of most shop-houses suggest that there is no strong presence of individual specific-use among spaces of shop-houses; most activities tend to be inseparably involved in large single spaces. This explains the presence of such multifunctional or multipurpose spaces in most shop-houses.

From the analysis of the space-link ratio values (SLR) of each group it is found that shop-houses in Shakhari Bazar shows more tree-like configuration with lower SLR while Tanti Bazar and Panni Tola shop-houses exhibit ringy configuration with comparatively higher SLR. The more ring-like system tends to have more alternative routes of permeability within the house that is termed as distributedness. The higher SLR of shop-houses in Tanti Bazar and Panni Tola is evidence of a higher distributed system. With regard to the organization of the system, they tend to be more ring-like, have more access and connectivity between spaces when compared with shop-houses in Shakhari Bazar. With the tree-like system, spaces in shop-houses in Shakhari Bazar have a more linear arrangement than shop-houses in Tanti Bazar and Panni Tola. This results in the exterior world being brought closer to the daily domestic activities in Tanti Bazar and Panni Tola shop-houses.

5.2.3 Influence of location wise trade groups

Statistically there is no significant difference of RRA values of activity patterns between Shakhari Bazar, Tanti Bazar, and Panni Tola which indicates the integration values of different activity spaces are similar regardless their location wise trade groups. This implies that the shop activity is more integrated with other household activities in Shakhari Bazar community. While the activity in the open spaces is more segregated, this implies that Shakhari Bazar shop-houses were more reluctant to permit the outsiders in their domestic activity.

Shop-houses in Shakhari Bazar have a higher mean depth than those in Tanti Bazar and Panni Tola. The mean depth of activity patterns from shop-houses in Tanti Bazar and Panni Tola are almost indistinguishable. Open space, service space and exterior space have high mean depth whereas circulation, courts, and served space tend to occur in space with low mean depth. It implies that the overall activity patterns in Shakhari Bazar are less integrated than the overall activity pattern of Tanti Bazar and Panni Tola shop-houses.

Except the connectivity value of exterior space all other activity spaces demonstrate a similar nature in all three locations. Low connectivity in the exterior space of Shakhari Bazar shop-houses implies that total interior configuration of the buildings are less connected with the exterior while in Tanti Bazar high connectivity in exterior space implies that the exterior is more connected with the rest of the interior configuration.

Shop-houses in Shakhari Bazar have a lower control value in its exterior activity space than those in Panni Tola shop-houses while shop-houses in Tanti Bazar have the highest. High control values indicate strong control. As high control value indicates strong control the exterior space of Shakhari Bazar shop-houses exhibits less control with low mean control value while the exterior space of Tanti Bazar shop-houses exhibits high control with high mean control value.

5.2.4 Influence of traditionally varied original and altered typology

There is no significant difference of RRA values of activity patterns between the original and altered category of traditionally modified shop-houses. The integration values of different activity spaces are statistically similar regardless their typologies. That is, no significant effect of physical alteration of the shop-houses was found on the mean RRA values of activity pattern. This can be interpreted that the order of shops in the overall configuration remains same in spatial morphological terms while shops were introduced in altered types. This concludes that physical alteration does not overcome the cultural behavior of the inhabitants of the shop-houses.

Shop-houses in the original category tend to have higher mean depth values than those in altered category. However, the patterns of mean depth distribution of activity pattern in shop-houses in both original and altered categories are similar. Activities, such as open spaces and service occur in spaces with high mean depth, whereas circulation, courts and served space tend to occur in spaces with lower mean depth values. It implies that the overall activity patterns of original shop-houses are less integrated compare to the overall activity patterns of altered typology.

Except the connectivity value of exterior space all other activity spaces demonstrate a similar nature in both original and altered category. Low connectivity in the exterior space of original shop-houses implies that total interior configuration of the buildings are less connected with the exterior while in altered shop-houses high connectivity in exterior space implies that the exterior is more connected with the rest of the interior spaces.

Control value of exterior activity space in original category have a lower control value than those in altered shop-houses while the other activity spaces show a similar pattern. As high control value indicates strong control the exterior space of original shop-houses exhibits less control with low mean control value while the exterior space of altered shop-houses exhibits high control with high mean control value.

5.3 Conclusion

With regard to the objective of the study mentioned in the first chapter to investigate, if social relations and cultural aspects of built form can reveal the spatial organization regardless of any physical alteration of dwelling forms, the findings indicate that, to some extent, the socio-cultural background of communities has a stronger influence on space use patterns and spatial configurations of shop-houses when physical alteration are examined. In some cases, although it may seem that the physical changes of the house affect the spatial pattern of the house, but in fact it is the changes in social and cultural order of the society that causes the modifications of spatial arrangement.

This study confirms the systematic and meaningful methodology of space syntax in the analysis of social and cultural content of built forms. Generally, shop-houses in Tanti Bazar and Panni Tola differ from those in Shakhari Bazar. The physical transformation over time of the buildings does not play a vital role in the difference in spatial arrangement between shop-houses in this study. Those that are detected may be the results of the antecedent culture in each location, or as a direct result of the change toward urbanization. The dissimilarity between them is not revealed in the genotype or pattern of space use but occurs in the way each space-use pattern tends to occur in a certain place, and how all of them combine to affect the way the whole complex is organized.

The study suggests that the effects of cultural behavior of each trade group determine the organization of space within shop-houses. Yet the physical transformation over time of the buildings, represented by two categories, does not alter the organization of space within a house. Another finding from the study confirms that the more complex societies tend to incorporate more specific space use in their house organization when compared with space use in houses in societies, which are less complex.

Moreover, the underlying principle of space use pattern also reflects the consistent pattern across the sample. The findings determined that space-use pattern within shop-houses tends to be spatial association between various domestic activities and results in multifunctional space- use pattern with indefinite boundary in terms of spatial partitioning.

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APPENDICES

Appendix A: Syntactic Data of Case Study Shop-houses

Table A 1: Shop-house SB-10

Space Name	Space Location	Space Number	Depth	Mean Depth(MD)	Control Value	RRA	Connectivity
Exterior		0	**0.00**	**7.62**	**0.33**	**2.01**	**1.00**
Circulation	Ground Floor	1	1.00	6.64	1.64	1.71	3.00
		4	2.00	5.77	3.58	1.45	7.00
		5	3.00	5.47	0.73	1.35	3.00
	Stair 1 (G-1)	6	4.00	5.19	0.92	1.27	3.00
		8	3.00	6.08	0.73	1.54	3.00
		9	4.00	5.77	0.92	1.45	3.00
		12	3.00	6.42	1.48	1.64	3.00
	Stair 2 (G-1)	16	5.00	7.92	0.58	2.10	2.00
	First Floor	17	5.00	5.00	1.67	1.21	4.00
		21	6.00	5.09	0.58	1.24	2.00
	Stair 1 (1-2)	22	7.00	5.15	1.20	1.26	3.00
		23	6.00	5.43	1.25	1.34	3.00
		24	7.00	5.53	0.67	1.37	2.00
		27	6.00	8.75	3.00	2.35	4.00
	Second Floor	32	8.00	5.34	2.67	1.31	5.00
		36	9.00	5.85	0.53	1.47	2.00
	Stair 1 (2-3)	37	10.00	6.32	1.20	1.61	3.00
		38	9.00	5.98	1.20	1.51	3.00
		39	10.00	6.49	0.67	1.66	2.00
	Third Floor	43	11.00	6.92	3.33	1.79	5.00
		45	12.00	7.75	0.70	2.05	2.00
		46	12.00	7.83	0.70	2.07	2.00
		49	13.00	8.62	1.00	2.31	2.00
	Stair 3 (3-4)	50	14.00	9.53	1.00	2.58	2.00
	Mean		**7.08**	**6.45**	**1.33**	**1.65**	**3.04**
Courts	Courtyard	7	3.00	6.06	1.14	1.53	4.00
	Service Yard	14	4.00	7.13	1.83	1.86	3.00
			3.50	**6.59**	**1.49**	**1.69**	**3.50**
Open Spaces	SideTerrace 2nd	42	9.00	6.32	0.20	1.61	1.00
	Terrace 3rd	44	12.00	7.91	0.20	2.09	1.00
	SideTerrace 3rd	51	12.00	7.91	0.20	2.09	1.00
	Roof 4th	52	15.00	10.47	1.50	2.87	2.00
	Roof 4th	53	16.00	11.45	0.50	3.17	1.00
	Mean		**12.80**	**8.81**	**0.52**	**2.37**	**1.20**
Shop		2	2.00	7.58	1.33	1.99	2.00
	Workshop	3	3.00	8.57	0.50	2.29	1.00
	Mean		**2.50**	**8.08**	**0.92**	**2.14**	**1.50**
Served Space	Ground Floor	10	3.00	6.75	0.14	1.74	1.00
		11	3.00	6.75	0.14	1.74	1.00
	First Floor	18	6.00	5.91	0.75	1.49	2.00
		19	7.00	6.85	1.50	1.77	2.00
		25	7.00	6.38	1.33	1.63	2.00
		26	8.00	7.36	0.50	1.93	1.00
		28	7.00	9.70	1.25	2.63	2.00
		29	8.00	10.68	0.50	2.93	1.00
	Second Floor	33	9.00	6.25	0.70	1.59	2.00
		34	10.00	7.19	1.50	1.87	2.00
		40	10.00	6.92	1.33	1.79	2.00
		41	11.00	7.91	0.50	2.09	1.00
	Third Floor	47	13.00	8.77	1.50	2.35	2.00
		48	14.00	9.75	0.50	2.65	1.00

	Mean		**8.29**	**7.65**	**0.87**	**2.02**	**1.57**
Service Spaces	Gr: Kitchen	13	4.00	7.40	0.33	1.94	1.00
	Toilet	15	5.00	8.11	0.33	2.15	1.00
	1st: Veravdah	20	8.00	7.83	0.50	2.07	1.00
	Kitchen	30	7.00	9.74	0.25	2.65	1.00
	Bath	31	7.00	9.74	0.25	2.65	1.00
	2nd: Veravdah	35	11.00	8.17	0.50	2.17	1.00
	Mean		**7.00**	**8.50**	**0.36**	**2.27**	**1.00**
Temple							
TOTAL	MEAN		7.48	7.30	1.00	1.91	2.19
	MINIMUM		0.00	5.00	0.14	1.21	1.00
	MAXIMUM		16.00	11.45	3.58	3.17	7.00

Table A 2: Shop-house SB-15

Space Name	Space Location	Space Number	Depth	Mean Depth(MD)	Control Value	RRA	Connectivity
Exterior		0	**0.00**	**6.61**	**0.33**	**1.66**	**1.00**
Circulation	Ground Floor	1	1.00	5.63	1.64	1.37	3.00
		3	2.00	4.70	3.79	1.10	7.00
	Stair 1 (G-1)	5	3.00	4.86	0.31	1.14	2.00
		14	4.00	5.07	1.46	1.21	4.00
	Stair 2 (G-1)	17	5.00	5.59	1.75	1.36	3.00
		18	5.00	5.98	0.75	1.48	2.00
	First Floor	21	4.00	5.05	4.00	1.20	6.00
	Stair 3 (1-2)	23	5.00	5.50	0.50	1.33	2.00
		32	8.00	7.46	1.67	1.92	4.00
	Stair 2 (1-2)	33	9.00	8.30	1.25	2.16	3.00
		34	9.00	8.38	1.75	2.19	3.00
		36	9.00	8.41	0.75	2.20	2.00
		37	10.00	9.32	0.83	2.47	2.00
	Second Floor	38	6.00	5.98	1.17	1.48	3.00
		41	8.00	7.59	0.83	1.95	2.00
	Stair 3 (2-3)	42	9.00	8.46	0.83	2.21	2.00
		43	7.00	6.75	1.83	1.70	3.00
		48	11.00	10.32	1.50	2.76	2.00
	Third Floor	52	10.00	9.38	2.50	2.48	3.00
		55	10.00	9.25	1.33	2.44	2.00
	Mean		**6.75**	**7.10**	**1.52**	**1.81**	**3.00**
Courts	Courtyard	10	3.00	4.77	5.23	1.12	8.00
	Back Yard	19	6.00	6.93	1.50	1.76	2.00
	Mean		**4.50**	**5.85**	**3.36**	**1.44**	**5.00**
Open Spaces	Terrace 2nd	46	9.00	8.46	1.00	2.21	2.00
	Roof 3rd	54	11.00	10.36	0.33	2.77	1.00
	Roof 3rd	56	11.00	10.23	0.50	2.74	1.00
	Mean		**10.33**	**9.68**	**0.61**	**2.57**	**1.33**
Shop		2	2.00	5.64	0.48	1.38	2.00
	Workshop	4	3.00	5.68	0.14	1.39	1.00
	Mean		**2.50**	**5.66**	**0.31**	**1.38**	**1.50**
Served Space	Ground Floor	6	3.00	5.68	0.14	1.39	1.00
		7	3.00	5.20	0.77	1.24	3.00
		15	5.00	6.02	1.25	1.49	2.00
		16	6.00	7.00	0.50	1.78	1.00
	First Floor	22	5.00	6.04	0.17	1.49	1.00
		24	5.00	6.00	1.17	1.48	2.00
		26	5.00	6.04	0.17	1.49	1.00
		27	5.00	6.00	1.17	1.48	2.00
		30	6.00	6.18	0.83	1.53	2.00
		31	7.00	6.80	0.75	1.72	2.00

	Second Floor	39	7.00	6.75	1.83	1.70	3.00
		44	8.00	7.73	0.33	2.00	1.00
		45	8.00	7.59	0.83	1.95	2.00
		47	10.00	9.38	1.00	2.48	2.00
		50	10.00	9.25	1.33	2.44	2.00
		51	11.00	10.23	0.50	2.74	1.00
	Third Floor	53	11.00	10.36	0.33	2.77	1.00
	Mean		**6.76**	**7.19**	**0.77**	**1.83**	**1.71**
Service Spaces	Gr: Store	8	4.00	5.75	0.13	1.41	1.00
	Kitchen	9	4.00	5.73	0.46	1.40	2.00
	Kitchen	11	4.00	5.75	0.13	1.41	1.00
	Bath	12	4.00	5.75	0.13	1.41	1.00
	Bath	13	4.00	5.75	0.13	1.41	1.00
	Toilet	20	7.00	7.91	0.50	2.05	1.00
	1st: Veravdah	25	6.00	6.98	0.50	1.77	1.00
	Kitchen	28	6.00	6.98	0.50	1.77	1.00
	Bath	29	6.00	6.57	0.33	1.65	1.00
	Kitchen	35	10.00	9.36	0.33	2.48	1.00
	2nd: Veravdah	40	8.00	7.73	0.33	2.00	1.00
	Kitchen	49	12.00	11.30	0.50	3.05	1.00
	Mean		**6.25**	**7.13**	**0.33**	**1.82**	**1.08**
Temple							
TOTAL	MEAN		6.49	7.17	1.00	1.83	2.11
	MINIMUM		0.00	4.70	0.13	1.10	1.00
	MAXIMUM		12.00	11.30	5.23	3.05	8.00

Table A 3: Shop-house SB-32

Space Name	Space Location	Space Number	Depth	Mean Depth(MD)	Control Value	RRA	Connectivity
Exterior		0	**0.00**	**7.08**	**0.33**	**1.84**	**1.00**
Circulation	Ground Floor	1	1.00	6.09	2.14	1.54	3.00
		3	2.00	5.19	4.17	1.27	7.00
	Stair 1 (G-1)	5	3.00	5.15	0.34	1.26	2.00
	Stair 2 (G-1)	10	4.00	6.17	0.58	1.57	2.00
		13	5.00	7.11	0.53	1.85	2.00
	First Floor	18	4.00	5.15	3.00	1.26	5.00
	Stair 3 (1-2)	20	5.00	5.38	0.53	1.33	2.00
		25	5.00	6.85	3.00	1.77	4.00
	Stair 2 (1-2)	28	6.00	7.64	0.58	2.01	2.00
	Second Floor	29	6.00	5.64	1.17	1.41	3.00
		32	8.00	6.55	1.17	1.68	3.00
	Stair 3 (2-3)	33	9.00	7.19	0.67	1.87	2.00
	Stair 4 (2-3)	36	9.00	7.75	0.83	2.05	2.00
		38	7.00	8.47	2.00	2.26	3.00
	Stair 2 (2-3)	40	8.00	9.38	0.83	2.54	2.00
	Third Floor	41	10.00	7.87	1.33	2.08	3.00
		44	12.00	9.42	1.33	2.55	3.00
	Stair 3 (3-4)	45	13.00	10.28	0.83	2.81	2.00
		47	10.00	8.70	1.50	2.33	2.00
		49	9.00	10.32	1.50	2.82	2.00
	Roof	52	15.00	12.13	1.50	3.37	2.00
	Mean		**7.19**	**7.54**	**1.41**	**1.98**	**2.76**
Courts	Courtyard	9	3.00	5.53	0.98	1.37	3.00
	Courtyard	11	4.00	6.28	1.33	1.60	3.00
	Back Yard	14	6.00	7.94	4.00	2.10	5.00
	Mean		**4.33**	**6.58**	**2.10**	**1.69**	**3.67**
Open Spaces	Terrace 2nd	35	8.00	6.85	1.83	1.77	3.00
	Roof 3rd	50	10.00	11.30	0.50	3.12	1.00

	Roof 4th	51	14.00	11.19	1.00	3.09	2.00
	Roof 4th	53	16.00	13.11	0.50	3.67	1.00
	Mean		**12.00**	**10.61**	**0.96**	**2.91**	**1.75**
Shop		2	2.00	7.08	0.33	1.84	1.00
	Workshop	4	3.00	6.17	0.14	1.57	1.00
	Mean		**2.50**	**6.62**	**0.24**	**1.70**	**1.00**
Served Space	Ground Floor	6	3.00	6.17	0.14	1.57	1.00
		7	3.00	6.15	0.64	1.56	2.00
	First Floor	19	5.00	6.13	0.20	1.55	1.00
		21	5.00	6.09	1.20	1.54	2.00
		23	5.00	6.09	1.20	1.54	2.00
		24	6.00	7.08	0.50	1.84	1.00
		27	6.00	7.83	0.25	2.07	1.00
	Second Floor	30	7.00	6.17	1.67	1.57	3.00
		34	7.00	6.02	1.00	1.52	3.00
		37	9.00	7.83	0.33	2.07	1.00
		39	8.00	9.45	0.33	2.56	1.00
	Third Floor	42	11.00	8.62	1.67	2.31	3.00
		46	11.00	8.66	0.67	2.32	2.00
		48	11.00	9.68	0.50	2.63	1.00
	Mean		**6.93**	**7.28**	**0.74**	**1.90**	**1.71**
Service Spaces	Gr: Kitchen	8	3.00	6.15	0.64	1.56	2.00
	Kitchen	12	5.00	7.11	0.53	1.85	2.00
	Toilet	15	7.00	8.92	0.20	2.40	1.00
	Toilet	16	7.00	8.92	0.20	2.40	1.00
	Bath	17	7.00	8.92	0.20	2.40	1.00
	1st: Veravdah	22	6.00	7.08	0.50	1.84	1.00
	Store	26	6.00	7.83	0.25	2.07	1.00
	2nd: Veravdah	31	8.00	7.15	0.33	1.86	1.00
	3rd: Veravdah	43	12.00	9.60	0.33	2.61	1.00
	Mean		**6.78**	**7.97**	**0.35**	**2.11**	**1.22**
Temple							
TOTAL	MEAN		6.94	7.68	1.00	2.02	2.11
	MINIMUM		0.00	5.15	0.14	1.26	1.00
	MAXIMUM		16.00	13.11	4.17	3.67	7.00

Table A 4: Shop-house SB-110

Space Name	Space Location	Space Number	Depth	Mean Depth(MD)	Control Value	RRA	Connectivity
Exterior		0	**0.00**	**4.79**	**0.33**	**1.52**	**1.00**
Circulation	Ground Floor	1	1.00	3.82	2.14	1.13	3.00
		4	2.00	3.00	4.58	0.80	7.00
	Stair 1 (G-1)	5	3.00	2.89	0.29	0.76	2.00
	First Floor	14	4.00	2.86	5.50	0.75	7.00
	Stair 2 (1-2)	19	5.00	3.32	0.48	0.93	2.00
	Second Floor	22	6.00	3.86	1.50	1.15	3.00
	Mean		**3.50**	**3.29**	**2.41**	**0.92**	**4.00**
Courts	Court Yard	8	3.00	3.89	1.14	1.16	2.00
	Backyard	10	3.00	3.75	3.14	1.10	4.00
	Mean		**3.00**	**3.82**	**2.14**	**1.13**	**3.00**
Open Spaces	Terrace 2nd	25	7.00	4.61	0.83	1.45	2.00
	Roof	28	10.00	7.29	0.50	2.52	1.00
	Mean		**8.50**	**5.95**	**0.67**	**1.99**	**1.50**
Shop		2	2.00	4.79	0.33	1.52	1.00
	Workshop	3	3.00	3.96	0.14	1.19	1.00
	Mean		**2.50**	**4.37**	**0.24**	**1.36**	**1.00**
Served Space	Ground Floor	6	3.00	3.96	0.14	1.19	1.00
		7	3.00	3.96	0.14	1.19	1.00

	First Floor	15	5.00	3.82	0.14	1.13	1.00
		16	5.00	3.82	0.14	1.13	1.00
		18	5.00	3.82	0.14	1.13	1.00
		20	5.00	3.75	1.14	1.10	2.00
	Second Floor	23	7.00	4.75	1.33	1.51	2.00
	Mean		**4.71**	**3.98**	**0.46**	**1.20**	**1.29**
Service Spaces	Gr: Kitchen	9	4.00	4.86	0.50	1.55	1.00
	Bath	11	4.00	4.71	0.25	1.49	1.00
	Toilet	12	4.00	4.71	0.25	1.49	1.00
	Toilet	13	4.00	4.71	0.25	1.49	1.00
	1st: Veravdah	17	5.00	3.82	0.14	1.13	1.00
	Veravdah	21	6.00	4.71	0.50	1.49	1.00
	2nd: Veravdah	24	8.00	5.71	0.50	1.89	1.00
	Veravdah	26	8.00	5.43	1.00	1.78	2.00
	Mean		**5.38**	**4.83**	**0.42**	**1.54**	**1.13**
Temple		27	**9.00**	**6.32**	**1.50**	**2.14**	**2.00**
TOTAL	MEAN		4.62	4.33	1.00	1.34	1.93
	MINIMUM		0.00	2.86	0.14	0.75	1.00
	MAXIMUM		10.00	7.29	5.50	2.52	7.00

Table A 5: Shop-house SB-118-1

Space Name	Space Location	Space Number	Depth	Mean Depth(MD)	Control Value	RRA	Connectivity
Exterior		0	**0.00**	**5.83**	**0.25**	**1.64**	**1.00**
Circulation	Ground Floor	1	1.00	4.85	2.67	1.31	4.00
		4	2.00	4.00	3.75	1.02	6.00
	Stair 1 (G-1)	6	3.00	4.18	0.33	1.08	2.00
		9	4.00	4.40	2.83	1.16	4.00
		14	6.00	5.25	1.67	1.45	4.00
		15	7.00	6.08	1.75	1.73	3.00
	Stair 2 (G-1)	18	7.00	6.08	0.75	1.73	2.00
	Stair 3 (G-1)	19	8.00	7.00	1.33	2.04	2.00
	First Floor	21	4.00	4.40	4.00	1.16	6.00
	Stair 4 (1-2)	26	5.00	4.98	0.42	1.35	2.00
		29	8.00	6.95	1.00	2.03	2.00
	Second Floor	33	6.00	5.60	2.50	1.57	4.00
	Stair 4 (2-3)	34	7.00	6.43	0.58	1.85	2.00
	Roof	38	8.00	7.30	2.50	2.14	3.00
	Mean		**5.43**	**5.53**	**1.86**	**1.54**	**3.29**
Courts	Service Yard	8	3.00	4.18	0.42	1.08	2.00
	Back Yard	11	5.00	4.78	1.50	1.29	3.00
	Mean		**4.00**	**4.48**	**0.96**	**1.18**	**2.50**
Open Spaces	Roof	39	9.00	8.28	0.33	2.48	1.00
	Roof	40	9.00	8.28	0.33	2.48	1.00
	Mean		**9.00**	**8.28**	**0.33**	**2.48**	**1.00**
Shop		2	2.00	4.90	0.42	1.33	2.00
		3	2.00	5.83	0.25	1.64	1.00
	Workshop	5	3.00	4.98	0.17	1.35	1.00
	Mean		**2.33**	**5.23**	**0.28**	**1.44**	**1.33**
Served Space	Ground Floor	7	3.00	4.98	0.17	1.35	1.00
		10	5.00	5.38	0.25	1.49	1.00
	First Floor	22	5.00	5.38	0.17	1.49	1.00
		23	5.00	5.33	1.17	1.47	2.00
		25	5.00	5.38	0.17	1.49	1.00
		27	5.00	5.33	1.17	1.47	2.00
		30	9.00	7.88	1.50	2.34	2.00
	Second Floor	36	7.00	6.53	1.25	1.88	2.00
	Mean		**5.50**	**5.77**	**0.73**	**1.62**	**1.50**

Service Spaces	Gr: Kitchen	12	5.00	5.38	0.25	1.49	1.00
	Kitchen	13	6.00	5.75	0.33	1.62	1.00
	Bath	16	8.00	7.05	0.33	2.06	1.00
	Wash Yard	17	7.00	6.18	1.25	1.76	2.00
	Toilet	20	8.00	7.15	0.50	2.09	1.00
	1st: Veravdah	24	6.00	6.30	0.50	1.80	1.00
	Veravdah	28	6.00	6.30	0.50	1.80	1.00
	Store	31	10.00	8.85	0.50	2.67	1.00
	Bath	32	9.00	7.98	0.50	2.37	1.00
	2nd: Veravdah	37	8.00	7.50	0.50	2.21	1.00
	Mean		**7.30**	**6.84**	**0.52**	**1.99**	**1.10**
Temple		35	**7.00**	**6.58**	**0.25**	**1.90**	**1.00**
TOTAL	MEAN		5.68	5.99	1.00	1.70	2.00
	MINIMUM		0.00	4.00	0.17	1.02	1.00
	MAXIMUM		10.00	8.85	4.00	2.67	6.00

Table A 6: Shop-house TB-10

Space Name	Space Location	Space Number	Depth	Mean Depth(MD)	Control Value	RRA	Connectivity
Exterior		0	**0.00**	**6.98**	**5.50**	**1.77**	**6.00**
Circulation	Ground Floor	6	1.00	6.18	0.50	1.53	2.00
	Stair 1 (G-1)	8	3.00	6.36	1.33	1.59	2.00
		9	3.00	4.75	1.20	1.11	4.00
	Stair 2 (G-1)	14	5.00	4.59	0.40	1.06	2.00
		15	4.00	4.29	1.83	0.97	5.00
		18	5.00	4.39	1.37	1.01	4.00
	Stair 3 (G-1)	20	7.00	5.29	0.58	1.27	2.00
		21	6.00	4.84	0.50	1.14	2.00
		22	7.00	5.32	1.45	1.28	4.00
		25	8.00	6.04	3.00	1.49	5.00
	Stair 4 (G-1)	30	9.00	6.71	0.45	1.69	2.00
	First Floor	32	7.00	5.73	0.53	1.40	2.00
	Stair 2 (1-2)	37	7.00	5.59	0.53	1.36	2.00
		38	6.00	4.89	2.50	1.15	5.00
		40	7.00	5.59	0.45	1.36	2.00
	Stair 3 (1-2)	42	9.00	6.29	0.58	1.57	2.00
		43	10.00	7.52	3.50	1.93	5.00
		47	11.00	8.46	0.70	2.21	2.00
	Roof	49	8.00	6.29	1.50	1.57	3.00
	Mean		**6.47**	**5.74**	**1.21**	**1.41**	**3.00**
Courts	Frontyard	7	2.00	5.41	1.25	1.31	3.00
	Courtyard	17	4.00	4.55	0.70	1.05	3.00
	Back Yard	28	8.00	5.95	1.95	1.47	4.00
			4.67	**5.30**	**1.30**	**1.28**	**3.33**
Open Spaces	Roof 2nd	50	9.00	7.23	1.33	1.85	2.00
	Roof 2nd	51	10.00	8.21	0.50	2.14	1.00
	Roof 2nd	52	9.00	6.98	0.67	1.77	2.00
	Roof 2nd	53	10.00	6.98	1.50	1.77	3.00
	Roof 2nd	54	11.00	7.89	0.83	2.04	2.00
	Roof 2nd	55	12.00	8.84	1.50	2.32	2.00
	Roof 2nd	56	13.00	9.82	0.50	2.61	1.00
	Mean		**10.57**	**7.99**	**0.98**	**2.07**	**1.86**
Shop		1	1.00	7.96	0.17	2.06	1.00
		2	1.00	7.96	0.17	2.06	1.00
		3	1.00	7.96	0.17	2.06	1.00
		4	1.00	7.96	0.17	2.06	1.00
		5	1.00	7.96	0.17	2.06	1.00
	Workshop	31	4.00	7.34	0.50	1.88	1.00

	Mean		**1.50**	**7.86**	**0.22**	**2.03**	**1.00**
Served Space	Ground Floor	10	4.00	5.63	1.75	1.37	3.00
		11	5.00	6.57	1.33	1.65	2.00
		12	5.00	6.61	0.33	1.66	1.00
		16	5.00	4.98	0.53	1.18	2.00
		19	6.00	4.98	1.25	1.18	3.00
		23	8.00	6.27	0.75	1.56	2.00
	First Floor	33	8.00	6.61	2.00	1.66	3.00
		34	9.00	7.55	1.33	1.94	2.00
		39	7.00	5.59	0.45	1.36	2.00
		41	8.00	5.59	2.00	1.36	4.00
		48	12.00	9.41	1.00	2.49	2.00
	Mean		**7.00**	**6.34**	**1.16**	**1.58**	**2.36**
Service Spaces	Gr: Store	13	6.00	7.55	0.50	1.94	1.00
	Kitchen	24	9.00	6.98	0.70	1.77	2.00
	Bath	26	9.00	7.02	0.20	1.78	1.00
	Toilet	27	9.00	7.02	0.20	1.78	1.00
	Store	29	9.00	6.93	0.25	1.76	1.00
	1st: Store	35	9.00	7.59	0.33	1.95	1.00
	Store	36	10.00	8.54	0.50	2.23	1.00
	Toilet	44	11.00	8.50	0.20	2.22	1.00
	Bath	45	11.00	8.50	0.20	2.22	1.00
	Kitchen	46	11.00	8.46	0.70	2.21	2.00
	Mean		**9.40**	**7.71**	**0.38**	**1.99**	**1.20**
Temple							
TOTAL	MEAN		6.86	6.70	1.00	1.69	2.28
	MINIMUM		0.00	4.29	0.17	0.97	1.00
	MAXIMUM		13.00	9.82	5.50	2.61	6.00

Table A 7: Shop-house TB-18

Space Name	Space Location	Space Number	Depth	Mean Depth(MD)	Control Value	RRA	Connectivity
Exterior		0	**0.00**	**6.11**	**0.83**	**1.65**	**2.00**
Circulation	Ground Floor	3	2.00	4.31	3.25	1.07	8.00
	Stair 1 (G-1)	10	3.00	4.40	0.46	1.10	2.00
		12	4.00	5.00	0.35	1.29	2.00
	First Floor	26	4.00	4.53	1.33	1.14	3.00
		27	5.00	4.82	0.58	1.24	2.00
		28	6.00	5.09	2.00	1.32	4.00
	Stair 1 (1-2)	34	7.00	5.58	0.50	1.48	2.00
	Second Floor	35	8.00	6.11	2.00	1.65	4.00
	Stair 2 (2-3)	36	9.00	6.96	0.58	1.93	2.00
		37	9.00	6.93	0.58	1.92	2.00
		38	10.00	7.76	1.50	2.19	3.00
	Mean		**6.09**	**5.59**	**1.19**	**1.49**	**3.09**
Courts	Courtyard	1	1.00	5.20	0.96	1.36	3.00
	Back Yard	13	5.00	5.44	8.33	1.44	10.00
	Back Yard	20	6.00	6.33	2.10	1.73	3.00
	Back Yard	24	6.00	6.38	1.10	1.74	2.00
	Mean		**4.50**	**5.84**	**3.12**	**1.57**	**4.50**
Open Spaces	Roof 3rd	43	10.00	7.84	2.50	2.22	3.00
	Roof 3rd	44	11.00	8.82	0.33	2.53	1.00
	Roof 3rd	45	11.00	8.82	0.33	2.53	1.00
	Mean		**10.67**	**8.50**	**1.06**	**2.43**	**1.67**
Shop		2	1.00	6.11	0.83	1.65	2.00
	Workshop	4	2.00	5.20	1.13	1.36	3.00
	Store	5	2.00	5.22	0.96	1.37	3.00
	Mean		**1.67**	**5.51**	**0.97**	**1.46**	**2.67**

Served Space	Ground Floor	6	3.00	5.24	0.46	1.37	2.00
		7	3.00	5.27	0.46	1.38	2.00
		8	3.00	4.93	0.38	1.27	2.00
		9	4.00	5.58	0.25	1.48	1.00
		11	3.00	4.60	2.13	1.17	4.00
		14	6.00	6.42	0.10	1.76	1.00
		15	6.00	6.42	0.10	1.76	1.00
	First Floor	29	7.00	6.02	1.25	1.63	2.00
		30	8.00	7.00	0.50	1.94	1.00
		31	6.00	5.38	0.58	1.42	2.00
		32	5.00	5.09	1.83	1.32	3.00
		33	6.00	6.07	0.33	1.64	1.00
		39	11.00	8.69	1.33	2.49	2.00
	Second Floor	40	12.00	9.67	0.50	2.81	1.00
		41	10.00	7.80	0.83	2.20	2.00
		42	9.00	6.98	0.75	1.94	2.00
	Mean		**6.38**	**6.32**	**0.74**	**1.72**	**1.81**
Service Spaces	Gr: Kitchen	16	6.00	6.42	0.10	1.76	1.00
	Kitchen	17	6.00	6.42	0.10	1.76	1.00
	Kitchen	18	6.00	6.42	0.10	1.76	1.00
	Kitchen	19	6.00	6.42	0.10	1.76	1.00
	Toilet	21	7.00	7.31	0.33	2.04	1.00
	Toilet	22	7.00	7.31	0.33	2.04	1.00
	Bath	23	6.00	6.42	0.10	1.76	1.00
	Bath	25	7.00	7.36	0.50	2.06	1.00
	Mean		**6.38**	**6.76**	**0.21**	**1.87**	**1.00**
Temple							
TOTAL	MEAN		5.98	6.27	1.00	1.70	2.26
	MINIMUM		0.00	4.31	0.10	1.07	1.00
	MAXIMUM		12.00	9.67	8.33	2.81	10.00

Table A 8: Shop-house TB-20

Space Name	Space Location	Space Number	Depth	Mean Depth(MD)	Control Value	RRA	Connectivity
Exterior		0	**0.00**	**5.73**	**1.33**	**2.15**	**2.00**
Circulation	Ground Floor	2	1.00	4.86	2.00	1.76	3.00
		4	2.00	4.18	0.58	1.45	2.00
		5	3.00	3.59	2.33	1.18	4.00
		6	4.00	3.36	1.25	1.08	3.00
	Stair 1 (G-1)	7	5.00	3.41	0.67	1.10	2.00
	First Floor	13	6.00	3.55	1.33	1.16	3.00
	Stair 1 (1-2)	18	8.00	4.55	0.67	1.61	2.00
	Second Floor	19	9.00	5.23	2.00	1.92	3.00
	Mean		**4.75**	**4.09**	**1.35**	**1.41**	**2.75**
Courts	Back Yard	12	**5.00**	**5.41**	**0.50**	**2.01**	**1.00**
Open Spaces	Roof	22	**10.00**	**6.18**	**0.33**	**2.36**	**1.00**
Shop		1	1.00	6.68	0.50	2.59	1.00
	Store	3	2.00	5.82	0.33	2.19	1.00
	Mean		**1.50**	**6.25**	**0.42**	**2.39**	**1.00**
Served Space	First Floor	14	7.00	4.41	1.33	1.55	2.00
		15	8.00	5.36	0.50	1.99	1.00
		16	7.00	3.95	1.83	1.34	3.00
		17	8.00	4.91	0.33	1.78	1.00
	Second Floor	20	10.00	6.09	1.33	2.32	2.00
		21	11.00	7.05	0.50	2.75	1.00
	Mean		**8.50**	**5.30**	**0.97**	**1.95**	**1.67**

Service Spaces	Bath	8	5.00	4.23	1.33	1.47	2.00
	Toilet	9	6.00	5.18	0.50	1.90	1.00
	Toilet	10	4.00	4.55	0.25	1.61	1.00
	Kitchen	11	4.00	4.45	1.25	1.57	2.00
	Mean		**4.75**	**4.60**	**0.83**	**1.64**	**1.50**
Temple							
TOTAL	MEAN		5.48	4.90	1.00	1.77	1.91
	MINIMUM		0.00	3.36	0.25	1.08	1.00
	MAXIMUM		11.00	7.05	2.33	2.75	4.00

Table A 9: Shop-house TB-64

Space Name	Space Location	Space Number	Depth	Mean Depth(MD)	Control Value	RRA	Connectivity
Exterior		0	**0.00**	**5.46**	**0.83**	**1.86**	**2.00**
Circulation	Ground Floor	2	1.00	4.54	1.20	1.48	3.00
		3	2.00	3.73	3.83	1.14	5.00
	Stair 1 (G-1)	11	5.00	3.38	0.70	0.99	2.00
		12	5.00	3.08	2.03	0.87	4.00
	Stair 2 (G-1)	14	6.00	3.81	0.58	1.17	2.00
	First Floor	19	6.00	4.04	1.00	1.27	2.00
		21	8.00	5.58	2.50	1.91	3.00
		24	7.00	4.62	2.50	1.51	3.00
	Mean		**5.00**	**4.10**	**1.79**	**1.29**	**3.00**
Courts	Courtyard	7	3.00	3.23	0.40	0.93	2.00
	Courtyard	8	4.00	2.81	3.25	0.75	5.00
	Mean		**3.50**	**3.02**	**1.83**	**0.84**	**3.50**
Open Spaces	Back Yard	15	6.00	3.81	1.75	1.17	3.00
	Back Yard	17	7.00	4.69	1.33	1.54	2.00
	Back Yard	18	8.00	5.65	0.50	1.94	1.00
	Mean		**7.00**	**4.72**	**1.19**	**1.55**	**2.00**
Shop		1	**1.00**	**5.46**	**0.83**	**1.86**	**2.00**
Served Space	Ground Floor	5	3.00	4.69	0.20	1.54	1.00
		6	3.00	4.69	0.20	1.54	1.00
		13	6.00	4.04	0.25	1.27	1.00
		16	7.00	4.77	0.33	1.57	1.00
	First Floor	20	7.00	4.77	0.83	1.57	2.00
		22	9.00	6.54	0.33	2.31	1.00
		25	8.00	5.58	0.33	1.91	1.00
		26	8.00	5.58	0.33	1.91	1.00
	Mean		**6.38**	**5.08**	**0.35**	**1.70**	**1.13**
Service Spaces	Gr: Store	4	3.00	4.69	0.20	1.54	1.00
	Toilet	9	5.00	3.77	0.20	1.15	1.00
	Toilet	10	5.00	3.77	0.20	1.15	1.00
	1st: Store	23	9.00	6.54	0.33	2.31	1.00
	Mean		**5.50**	**4.69**	**0.23**	**1.54**	**1.00**
Temple							
TOTAL	MEAN		5.26	4.57	1.00	1.49	2.00
	MINIMUM		0.00	2.81	0.20	0.75	1.00
	MAXIMUM		9.00	6.54	3.83	2.31	5.00

Table A 10: Shop-house TB-65

Space Name	Space Location	Space Number	Depth	Mean Depth(MD)	Control Value	RRA	Connectivity
Exterior		0	**0.00**	**4.38**	**3.00**	**1.41**	**4.00**

Circulation	Ground Floor	3	1.00	3.96	0.58	1.23	2.00
	Stair 1 (G-1)	4	1.00	5.04	0.58	1.68	2.00
		5	2.00	3.62	1.50	1.09	3.00
	Stair 2 (G-1)	6	3.00	4.27	0.83	1.36	2.00
		7	3.00	3.65	0.67	1.11	2.00
	Stair 3 (G-1)	12	6.00	4.54	0.70	1.48	2.00
	First Floor	23	4.00	4.92	1.00	1.64	2.00
		26	7.00	5.19	1.00	1.75	2.00
	Mean		**3.38**	**4.40**	**0.86**	**1.42**	**2.13**
Courts	Courtyard	8	4.00	3.69	1.20	1.12	3.00
	Courtyard	11	5.00	3.88	3.33	1.20	5.00
	Mean		**4.50**	**3.79**	**2.27**	**1.16**	**4.00**
Open Spaces	Back Yard	15	6.00	4.62	0.70	1.51	2.00
	Back Yard	16	7.00	5.42	1.00	1.84	2.00
	Back Yard	17	8.00	6.31	1.50	2.21	2.00
	Back Yard	18	9.00	7.27	0.50	2.61	1.00
	Mean		**7.50**	**5.90**	**0.93**	**2.04**	**1.75**
Shop		1	1.00	5.35	0.25	1.81	1.00
		2	1.00	5.35	0.25	1.81	1.00
	Mean		**1.00**	**5.35**	**0.25**	**1.81**	**1.00**
Served Space	Ground Floor	9	5.00	4.58	1.33	1.49	2.00
		10	6.00	5.54	0.50	1.89	1.00
		19	2.00	5.77	2.00	1.99	3.00
	First Floor	20	3.00	6.65	1.33	2.36	2.00
		22	3.00	6.73	0.33	2.39	1.00
		24	5.00	5.12	1.00	1.72	2.00
		25	6.00	5.15	1.00	1.73	2.00
	Mean		**4.29**	**5.65**	**1.07**	**1.94**	**1.86**
Service Spaces	Gr: Toilet	13	6.00	4.85	0.20	1.60	1.00
	Toilet	14	6.00	4.85	0.20	1.60	1.00
	1st: Store	21	4.00	7.62	0.50	2.76	1.00
	Mean		**5.33**	**5.77**	**0.30**	**1.99**	**1.00**
Temple							
TOTAL	MEAN		4.22	5.12	1.00	1.72	2.00
	MINIMUM		0.00	3.62	0.20	1.09	1.00
	MAXIMUM		9.00	7.62	3.33	2.76	5.00

Table A 11: Shop-house PT-01

Space Name	Space Location	Space Number	Depth	Mean Depth(MD)	Control Value	RRA	Connectivity
Exterior		0	**0.00**	**6.31**	**2.00**	**1.55**	**3.00**
Circulation	Ground Floor	1	1.00	5.40	0.53	1.29	2.00
	Stair 1 (G-1)	5	3.00	4.91	0.53	1.14	2.00
		6	3.00	5.43	1.20	1.30	2.00
		8	3.00	3.98	0.73	0.87	3.00
		9	4.00	4.48	1.67	1.02	3.00
	Stair 2 (G-1)	10	5.00	5.05	1.17	1.18	3.00
		12	4.00	3.93	2.66	0.86	5.00
	Stair 3 (G-1)	20	6.00	4.55	0.45	1.04	2.00
		27	6.00	5.19	2.13	1.22	3.00
		30	6.00	5.22	1.13	1.23	2.00
	First Floor	31	4.00	5.34	1.50	1.27	3.00
		35	6.00	5.48	2.75	1.31	4.00
		38	7.00	4.98	2.00	1.16	4.00
		40	8.00	5.76	1.75	1.39	4.00
	Stair 3 (1-2)	41	9.00	6.64	0.75	1.65	2.00
		44	6.00	6.00	1.33	1.46	2.00
		46	6.00	5.72	1.33	1.38	3.00

	Stair 2 (1-2)	49	7.00	6.50	0.67	1.61	2.00
	Second Floor	50	8.00	7.31	1.50	1.84	3.00
	Stair 2 (2-3)	51	9.00	8.22	0.83	2.11	2.00
			5.55	**5.51**	**1.33**	**1.32**	**2.80**
Courts	Courtyard	4	2.00	4.48	2.33	1.02	5.00
	Back Yard	15	5.00	4.12	1.83	0.91	5.00
	Back Yard	21	5.00	4.28	5.23	0.96	8.00
			4.00	**4.29**	**3.13**	**0.96**	**6.00**
Open Spaces	Roof 1st	42	9.00	6.72	0.75	1.67	2.00
	Roof 1st	43	9.00	6.72	0.75	1.67	2.00
	Roof 2nd	54	10.00	7.55	1.00	1.92	2.00
	Roof 2nd	55	11.00	8.50	1.50	2.19	2.00
	Roof 2nd	56	12.00	9.48	0.50	2.48	1.00
	Roof 3rd	57	10.00	9.17	1.50	2.39	2.00
	Roof 3rd	58	11.00	10.16	0.50	2.68	1.00
	Mean		**10.29**	**8.33**	**0.93**	**2.14**	**1.71**
Shop		3	**1.00**	**7.29**	**0.33**	**1.84**	**1.00**
Served Space	Ground Floor	2	1.00	5.40	0.53	1.29	2.00
		7	4.00	6.41	0.50	1.58	1.00
		13	5.00	4.91	0.20	1.14	1.00
		17	7.00	6.05	0.50	1.48	1.00
		19	7.00	6.05	0.50	1.48	1.00
		24	6.00	5.26	0.13	1.24	1.00
		25	6.00	5.26	0.13	1.24	1.00
	First Floor	32	5.00	6.29	1.33	1.55	2.00
		34	5.00	5.53	0.58	1.33	2.00
		36	7.00	6.47	0.25	1.60	1.00
		37	7.00	6.47	0.25	1.60	1.00
		39	8.00	5.97	0.25	1.45	1.00
		45	7.00	6.98	0.50	1.75	1.00
		47	7.00	6.67	1.33	1.66	2.00
	Second Floor	52	9.00	8.26	1.33	2.12	2.00
	Mean		**6.07**	**6.13**	**0.55**	**1.50**	**1.33**
Service Spaces	Gr: Store	11	5.00	5.47	0.33	1.31	1.00
	Kitchen	14	5.00	4.91	0.20	1.14	1.00
	Kitchen	16	6.00	5.07	1.20	1.19	2.00
	Kitchen	18	6.00	5.07	1.20	1.19	2.00
	Store	22	6.00	5.26	0.13	1.24	1.00
	Kitchen	23	6.00	5.26	0.13	1.24	1.00
	Toilet	26	7.00	6.17	0.33	1.51	1.00
	Bath	28	7.00	6.17	0.33	1.51	1.00
	Toilet	29	7.00	6.21	0.50	1.52	1.00
	1st: Veravdah	33	6.00	7.28	0.50	1.83	1.00
	Kitchen	48	8.00	7.66	0.50	1.95	1.00
	2nd: Kitchen	53	10.00	9.24	0.50	2.41	1.00
	Mean		**6.58**	**6.15**	**0.49**	**1.50**	**1.17**
Temple							
TOTAL	MEAN		6.20	6.11	1.00	1.49	2.10
	MINIMUM		0.00	3.93	0.13	0.86	1.00
	MAXIMUM		12.00	10.16	5.23	2.68	8.00

Table A 12: Shop-house PT-06

Space Name	Space Location	Space Number	Depth	Mean Depth(MD)	Control Value	RRA	Connectivity
Exterior		0	**0.00**	**7.22**	**0.25**	**1.81**	**1.00**
Circulation	Ground Floor	1	1.00	6.24	2.50	1.52	4.00
		2	2.00	5.36	0.42	1.27	2.00

		5	3.00	4.44	2.06	1.00	6.00
	Stair 1 (G-1)	7	5.00	3.78	0.31	0.81	2.00
		10	4.00	4.69	3.58	1.07	6.00
		11	4.00	3.78	4.08	0.81	7.00
		12	5.00	4.03	2.06	0.88	6.00
		17	6.00	4.47	0.37	1.01	2.00
		20	7.00	4.81	1.84	1.11	5.00
		22	8.00	5.39	2.34	1.27	5.00
	Stair 2 (G-1)	30	9.00	5.15	0.39	1.21	2.00
	First Floor	31	6.00	3.78	3.45	0.81	6.00
		34	7.00	4.42	1.87	0.99	5.00
		40	8.00	4.76	3.45	1.09	5.00
		43	7.00	4.12	1.37	0.91	4.00
	Stair 1 (1-2)	44	7.00	4.56	0.50	1.03	2.00
		47	8.00	4.56	0.50	1.03	2.00
		48	10.00	5.15	1.75	1.21	4.00
		49	9.00	4.90	2.25	1.13	4.00
	Second Floor	54	8.00	5.37	1.50	1.27	3.00
	Mean		**6.20**	**4.69**	**1.83**	**1.07**	**4.10**
Courts	Courtyard	9	4.00	4.22	0.64	0.94	4.00
	Back Yard	23	8.00	5.15	4.90	1.21	7.00
	Mean		**6.00**	**4.69**	**2.77**	**1.07**	**5.50**
Open Spaces	Roof 2nd	55	9.00	6.29	0.83	1.54	2.00
	Roof 2nd	56	10.00	7.20	1.00	1.80	2.00
	Roof 2nd	57	11.00	8.12	1.00	2.07	2.00
	Roof 2nd	58	9.00	6.29	0.83	1.54	2.00
	Roof 2nd	59	10.00	7.20	1.00	1.80	2.00
	Mean		**9.80**	**7.02**	**0.93**	**1.75**	**2.00**
Shop		3	2.00	5.36	0.42	1.27	2.00
		4	2.00	5.36	0.42	1.27	2.00
	Mean		**2.00**	**5.36**	**0.42**	**1.27**	**2.00**
Served Space	Ground Floor	8	5.00	5.68	0.17	1.36	1.00
		13	5.00	5.68	0.17	1.36	1.00
		14	5.00	5.68	0.17	1.36	1.00
		15	5.00	4.76	0.14	1.09	1.00
		16	5.00	4.76	0.14	1.09	1.00
		18	6.00	4.47	0.37	1.01	2.00
		19	6.00	4.47	0.37	1.01	2.00
		21	9.00	6.36	0.70	1.56	2.00
		24	9.00	6.36	0.70	1.56	2.00
	First Floor	32	8.00	5.37	1.20	1.27	2.00
		35	8.00	5.37	1.20	1.27	2.00
		37	8.00	5.37	1.20	1.27	2.00
		39	9.00	5.75	0.20	1.38	1.00
		41	9.00	5.75	0.20	1.38	1.00
		42	9.00	5.75	0.20	1.38	1.00
		45	7.00	4.76	0.17	1.09	1.00
		46	7.00	4.76	0.17	1.09	1.00
		50	11.00	6.12	0.75	1.49	2.00
		51	11.00	6.12	0.75	1.49	2.00
		52	8.00	4.56	0.50	1.03	2.00
	Mean		**7.50**	**5.39**	**0.47**	**1.28**	**1.50**
Service Spaces	Gr: Store	6	5.00	4.76	0.14	1.09	1.00
	Kitchen	25	9.00	6.37	0.20	1.56	1.00
	Bath	26	9.00	6.14	0.14	1.49	1.00
	Toillet	27	9.00	6.14	0.14	1.49	1.00
	Toilet	28	9.00	6.14	0.14	1.49	1.00
	Bath	29	9.00	6.14	0.14	1.49	1.00
	1st: Veravdah	33	9.00	6.36	0.50	1.56	1.00
	Veravdah	36	9.00	6.36	0.50	1.56	1.00
	Veravdah	38	9.00	6.36	0.50	1.56	1.00

	Bath	53	10.00	5.88	0.25	1.42	1.00
	Mean		**8.70**	**6.06**	**0.27**	**1.47**	**1.00**
Temple							
TOTAL	MEAN		7.10	5.41	1.00	1.28	2.47
	MINIMUM		0.00	3.78	0.14	0.81	1.00
	MAXIMUM		11.00	8.12	4.90	2.07	7.00

Table A 13: Shop-house PT-17

Space Name	Space Location	Space Number	Depth	Mean Depth(MD)	Control Value	RRA	Connectivity
Exterior		0	**0.00**	**7.09**	**2.50**	**2.20**	**3.00**
Circulation	Ground Floor	1	1.00	6.23	0.83	1.89	2.00
		6	4.00	4.00	3.50	1.08	5.00
	Stair 1 (G-1)	7	5.00	4.23	0.53	1.17	2.00
		10	5.00	4.29	0.40	1.19	2.00
		11	6.00	4.63	3.33	1.31	5.00
		16	8.00	5.80	5.33	1.73	7.00
	First Floor	23	6.00	4.51	1.83	1.27	3.00
		26	8.00	5.57	1.17	1.65	3.00
		29	8.00	5.46	1.17	1.61	3.00
	Stair 1 (1-2)	30	9.00	6.14	0.67	1.86	2.00
	Second Floor	31	10.00	6.89	1.50	2.13	3.00
	Mean		**6.36**	**5.25**	**1.84**	**1.54**	**3.36**
Courts	Courtyard	4	2.00	5.43	1.00	1.60	2.00
	Mid Courtyard	14	7.00	5.37	0.53	1.58	2.00
	Mid Courtyard	15	7.00	5.17	0.84	1.51	3.00
	Back Yard	21	9.00	6.74	0.64	2.08	2.00
	Back Yard	22	9.00	6.74	0.64	2.08	2.00
	Mean		**6.80**	**5.89**	**0.73**	**1.77**	**2.20**
Open Spaces	Terrace 1st	25	7.00	4.91	1.00	1.41	3.00
	Roof	32	11.00	7.77	0.83	2.45	2.00
	Roof	33	11.00	7.77	0.83	2.45	2.00
	Roof	34	12.00	8.66	1.00	2.77	2.00
	Roof	35	12.00	8.66	1.00	2.77	2.00
	Mean		**10.60**	**7.55**	**0.93**	**2.37**	**2.20**
Shop		2	1.00	8.06	0.33	2.55	1.00
		3	1.00	8.06	0.33	2.55	1.00
	Mean		**1.00**	**8.06**	**0.33**	**2.55**	**1.00**
Served Space	Ground Floor	5	3.00	4.69	0.70	1.33	2.00
		8	5.00	4.97	0.20	1.43	1.00
		9	5.00	4.97	0.20	1.43	1.00
	First Floor	24	7.00	5.49	0.33	1.62	1.00
		27	9.00	6.49	1.33	1.98	2.00
		28	10.00	7.46	0.50	2.33	1.00
	Mean		**6.50**	**5.68**	**0.54**	**1.69**	**1.33**
Service Spaces	Gr: Kitchen	12	7.00	5.60	0.20	1.66	1.00
	Kitchen	13	7.00	5.60	0.20	1.66	1.00
	Bath	17	9.00	6.77	0.14	2.09	1.00
	Toilet	18	9.00	6.77	0.14	2.09	1.00
	Kitchen	19	9.00	6.77	0.14	2.09	1.00
	1st: Toilet	20	9.00	6.77	0.14	2.09	1.00
	Mean		**8.33**	**6.38**	**0.16**	**1.94**	**1.00**
Temple							
TOTAL	MEAN		6.89	6.13	1.00	1.85	2.17
	MINIMUM		0.00	4.00	0.14	1.08	1.00
	MAXIMUM		12.00	8.66	5.33	2.77	7.00

Table A 14: Shop-house PT-40

Space Name	Space Location	Space Number	Depth	Mean Depth(MD)	Control Value	RRA	Connectivity
Exterior		0	**0.00**	**4.79**	**1.00**	**1.50**	**2.00**
Circulation	Ground Floor	1	1.00	5.69	1.50	1.85	2.00
		3	1.00	3.97	0.70	1.17	2.00
	Stair 1 (G-1)	5	3.00	3.14	0.45	0.84	2.00
		8	3.00	3.76	2.45	1.09	4.00
	First Floor	15	4.00	3.14	2.08	0.84	4.00
		17	5.00	3.76	2.75	1.09	4.00
		21	7.00	5.48	1.50	1.77	2.00
		23	5.00	3.69	1.25	1.06	3.00
	Stair 1 (1-2)	26	6.00	4.45	0.67	1.36	2.00
	Second Floor	27	7.00	5.28	2.50	1.69	3.00
			4.20	**4.23**	**1.59**	**1.28**	**2.80**
Courts	Courtyard	4	2.00	3.21	3.25	0.87	5.00
	Back Yard	11	4.00	4.52	3.25	1.39	4.00
			3.00	**3.86**	**3.25**	**1.13**	**4.50**
Open Spaces	Terrace 1st	20	6.00	4.59	0.75	1.42	2.00
	Roof	28	8.00	6.24	0.33	2.07	1.00
	Roof	29	8.00	6.24	0.33	2.07	1.00
			7.33	**5.69**	**0.47**	**1.85**	**1.33**
Shop		2	**2.00**	**6.66**	**0.50**	**2.23**	**1.00**
Served Space	Ground Floor	7	3.00	4.17	0.20	1.25	1.00
		9	4.00	4.72	0.25	1.47	1.00
		10	4.00	4.72	0.25	1.47	1.00
	First Floor	16	5.00	4.10	0.25	1.23	1.00
		18	6.00	4.72	0.25	1.47	1.00
		24	6.00	4.59	1.33	1.42	2.00
			4.67	**4.51**	**0.42**	**1.38**	**1.17**
Service Spaces	Gr: Store	6	3.00	4.17	0.20	1.25	1.00
	Toilet	12	5.00	5.48	0.25	1.77	1.00
	Toilet	13	5.00	5.48	0.25	1.77	1.00
	Bath	14	5.00	5.48	0.25	1.77	1.00
	1st: Kitchen	19	6.00	4.72	0.25	1.47	1.00
	Bath	22	8.00	6.45	0.50	2.15	1.00
		25	7.00	5.55	0.50	1.80	1.00
			5.57	**5.33**	**0.31**	**1.71**	**1.00**
Temple							
TOTAL	MEAN		4.63	4.77	1.00	1.49	1.93
	MINIMUM		0.00	3.14	0.20	0.84	1.00
	MAXIMUM		8.00	6.66	3.25	2.23	5.00

Table A 15: Shop-house PT-43

Space Name	Space Location	Space Number	Depth	Mean Depth(MD)	Control Value	RRA	Connectivity
Exterior		0	**0.00**	**5.89**	**0.33**	**2.00**	**1.00**
Circulation	Ground Floor	4	2.00	4.19	3.17	1.30	5.00
	Stair (G-1)	5	3.00	3.89	0.53	1.18	2.00
	First Floor	11	4.00	3.67	1.33	1.09	3.00
		12	5.00	3.67	1.33	1.09	3.00
	Stair (1-2)	17	6.00	3.89	0.67	1.18	2.00
	Second Floor	18	7.00	4.19	1.33	1.30	3.00
		21	8.00	4.70	1.33	1.51	3.00
	Stair (2-3)	24	9.00	5.44	0.67	1.82	2.00
	Third Floor	25	10.00	6.26	2.50	2.15	3.00
	Mean		**6.00**	**4.43**	**1.43**	**1.40**	**2.89**
Courts	Back Yard	8	**3.00**	**5.00**	**2.20**	**1.64**	**3.00**
Open Spaces	Roof	26	11.00	7.22	0.33	2.54	1.00
	Roof	27	11.00	7.22	0.33	2.54	1.00
	Mean		**11.00**	**7.22**	**0.33**	**2.54**	**1.00**
Shop		2	2.00	5.81	1.33	1.97	2.00
		3	3.00	6.78	0.50	2.36	1.00
	Mean		**2.50**	**6.30**	**0.92**	**2.17**	**1.50**
Served Space	Ground Floor	6	3.00	5.15	0.20	1.70	1.00
	First Floor	13	6.00	4.56	1.33	1.45	2.00
		15	5.00	4.56	1.33	1.45	2.00
		16	6.00	5.52	0.50	1.85	1.00
	Second Floor	19	8.00	5.07	1.33	1.67	2.00
		20	9.00	6.04	0.50	2.06	1.00
		22	9.00	5.59	1.33	1.88	2.00
	Mean		**6.57**	**5.21**	**0.93**	**1.72**	**1.57**
Service Spaces	Gr: Kitchen	7	3.00	5.15	0.20	1.70	1.00
	Toilet	9	4.00	5.96	0.33	2.03	1.00
	Bath	10	4.00	5.96	0.33	2.03	1.00
	1st: Verandah	14	7.00	5.52	0.50	1.85	1.00
	2nd: Verandah	23	10.00	6.56	0.50	2.27	1.00
	Mean		**5.60**	**5.83**	**0.37**	**1.98**	**1.00**
Temple							
TOTAL	MEAN		5.85	5.31	0.97	1.76	1.89
	MINIMUM		0.00	3.67	0.20	1.09	1.00
	MAXIMUM		11.00	7.22	3.17	2.54	5.00

Appendix B: Original Floor Plans of Altered Shop-houses

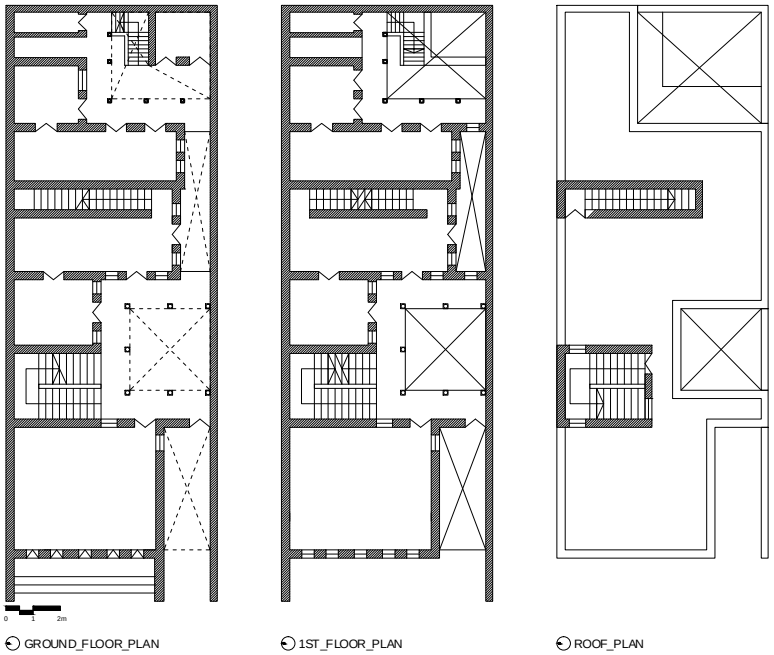


Figure B 1: Shop-house TB-10

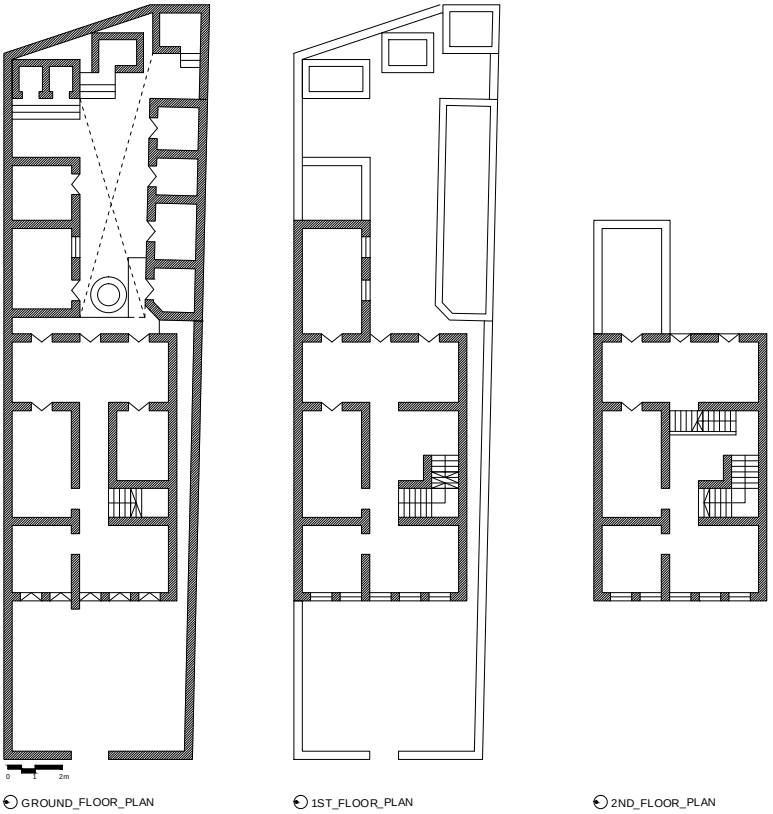


Figure B 2: Shop-house TB-18

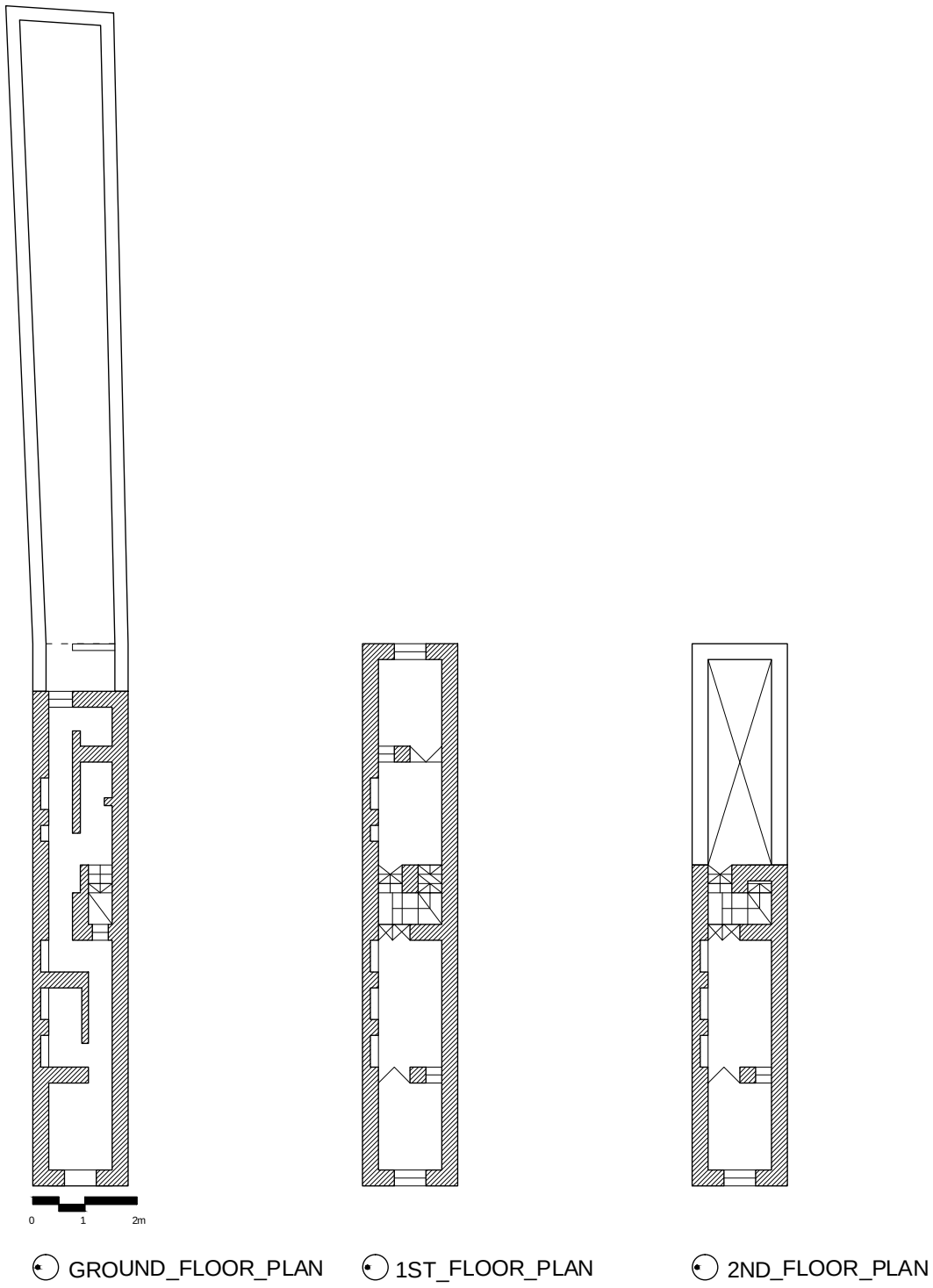
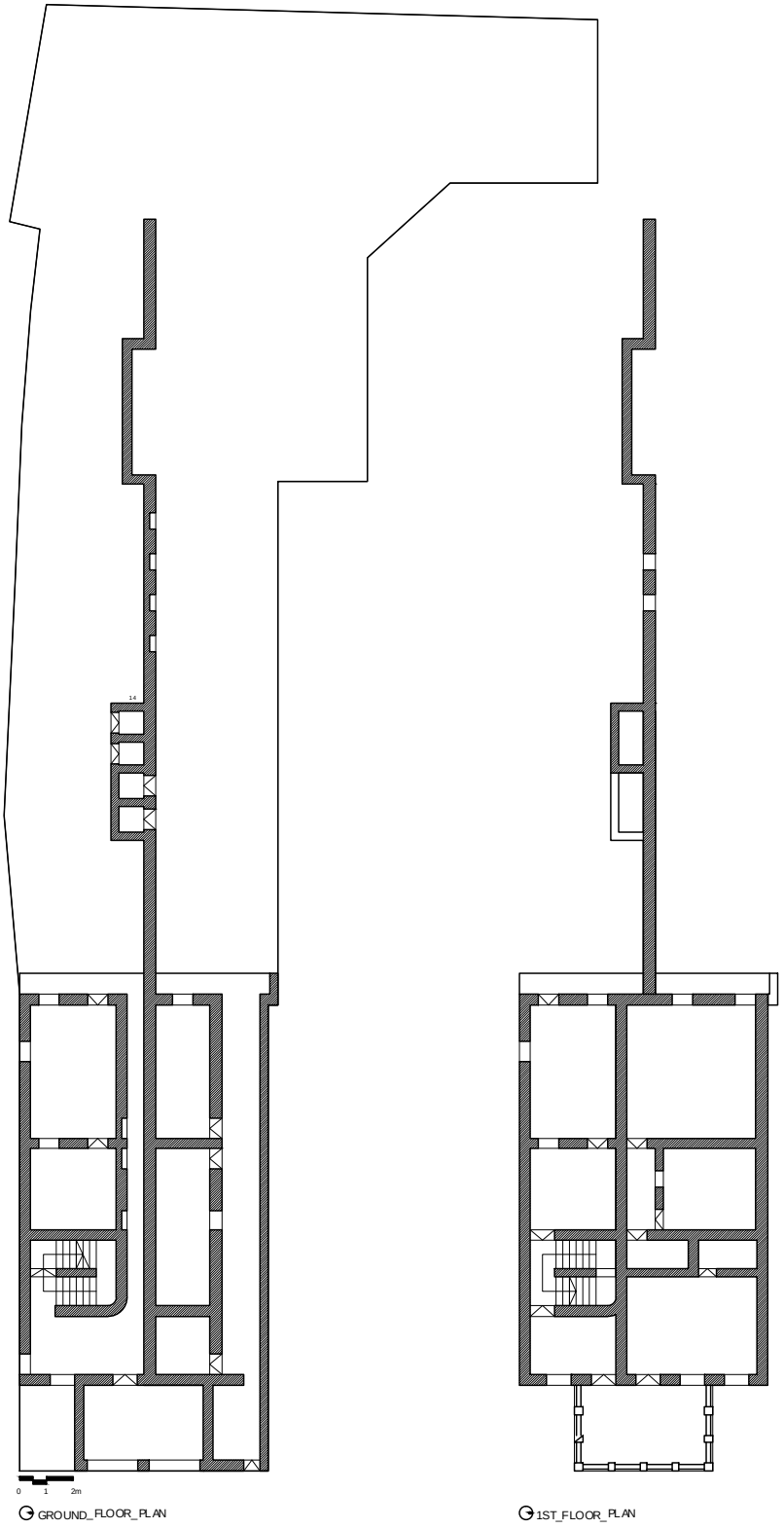


Figure B 3: Shop-house TB-20



TB-64

Figure B 4: Shop-house TB-64 & 65

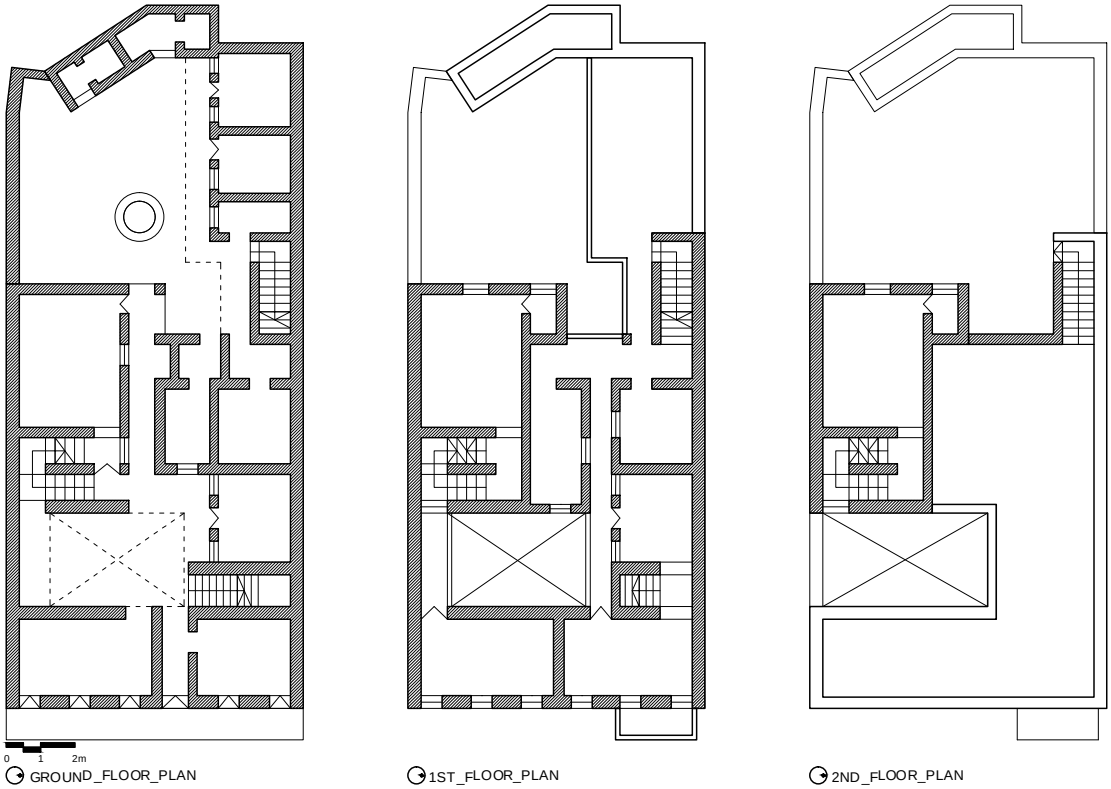


Figure B 5: Shop-house PT-01

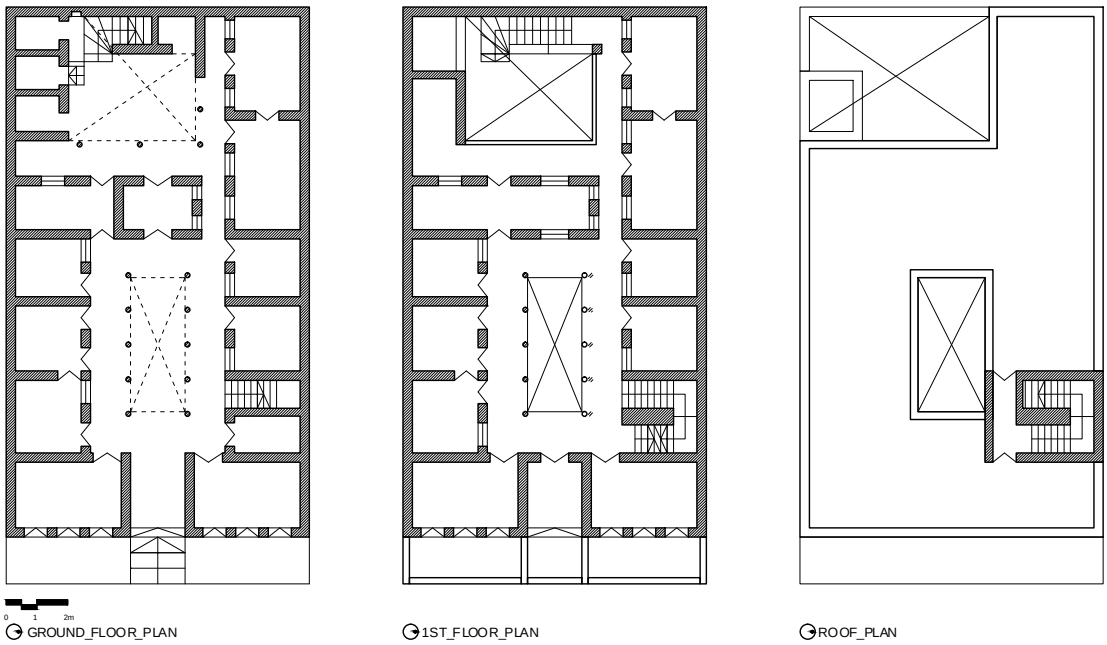


Figure B 6: Shop-house PT-06

Appendix C: Observation Sheet for Reconnaissance Survey

FIELD SURVEY OBSERVATION SHEET FOR THE STUDY OF SHOP-HOUSES IN OLD DHAKA
Topic: Study of Spatial Organization of the Traditional Shop-Houses in Old Dhaka.

SHOP HOUSE PROFILE

Shop-house Location: Date:

Holding No: Time:

LAND USE

1. Type of Building: ☐ Shop House ☐ Mixed use ☐ Other _____

BUILDING STYLE

2. Building Style: ☐ Traditional ☐ New Construction

HOUSE TYPE

3. Type of Shop House:

☐ Corridor Type: a. Single Side Corridor b. Single Middle Corridor c. Double Corridor

☐ Narrow Type ☐ Courtyard Type ☐ Other Type

HEIGHT

4. Building Height: 5. Number of Story:

TIME LINE

6. Building Construction Period:

☐ 17th Century (Mughal) ☐ 18th Century (Pre Colonial)
☐ 19th Century (Raj) ☐ After 20th Century (Contemporary)

SHOP TYPE

7. Type of Trade:

GENERAL INFORMATION

8. Plot Size: a) Length: ____FT. b) Width: ____FT. 11. Plot Area: ____SQF.

9. Plot Area Coverage (percentage of total land):

10. Open Space: ☐ Front yard ☐ Back yard ☐ Courtyard ☐ Light Well

11. Number of Entries: ____No.

☐ Separate entry for shops and residence
☐ Common entry for shops and residence ☐ Presence of Service Entry

12. Type of interface of the building with road:

Road Level: ☐ Verandah ☐ Shaded Platform ☐ Covered Walkway ☐ Other
Upper Level: ☐ Verandah ☐ Window ☐ Solid ☐ Other

13. Presence of Rock at front: ☐ Yes ☐ No

14. Presence of Plantation/Vegetation: ☐ Yes ☐ No

Appendix D: Questionnaire for Collecting Data

QUESTINONNEIRE FOR THE STUDY OF SHOP-HOUSES IN OLD DHAKA

Topic: Study of Spatial Organization of the Traditional Shop-Houses in Old Dhaka.

This research is in partial fulfillment of the requirement for the degree of Master in Architecture, Department of Architecture, Bangladesh University of Engineering and Technology (BUET). The purpose of this questionnaire is to obtain information about daily activities occurring in a shop-house and how cultural differences modify interior space configuration. All responses collected will be utilized for academic purpose only and shall be kept confidential. Your cooperation in this regard will be highly appreciated.

Saumen Hazra
M. Arch Student, BUET

SHOP HOUSE PROFILE

Shop-house Location: Date:

Holding No: Time:

PERSONAL INFORMATION

1. Name of Respondent: 2. Name of Owner:

3. Respondent-Owner Relationship: 4. Respondent Length of living in this house:

5. ☐ Male ☐ Female 6. Age:

7. Occupation: 8. Education:

9. Religion:

GENERAL INFORMATION

10. Plot Size: a) Length: ____FT. b) Width: ____FT. 11. Plot Area: ____SQF.

12. Building Height: 13. Number of Story:

14. Plot Area Coverage (percentage of total land):

15. Open Space: ☐ Front yard ☐ Back yard ☐ Courtyard ☐ Light Well

16. Number of Entries: ___
☐ Separate entry for shops and residence
☐ Common entry for shops and residence ☐ Presence of Service Entry

17. Type of interface of the building with road: ___

Road Level:	☐ Verandah	☐ Shaded Platform	☐ Covered Walkway	☐ Other
Upper Level:	☐ Verandah	☐ Window	☐ Solid	☐ Other

18. Presence of Rock at front: ☐ Yes ☐ No

19. Presence of Plantation/Vegetation: ☐ Yes ☐ No

20. Structural System: ☐ Load Bearing Wall ☐ Frame Structure ☐ Other

21. Condition of the structure: ☐ Good ☐ Moderate ☐ Bad

22. Overall living condition regarding Lightening, Ventilation and Safety:

a) Lightening	:	☐ Good	☐ Moderate	☐ Bad
b) Ventilation	:	☐ Good	☐ Moderate	☐ Bad
c) Safety:		☐ Good	☐ Moderate	☐ Bad

23. Building Style: ☐ Mughal ☐ Pre Colonial ☐ British Raj ☐ Neo Classical

CHANGE RELATED INFORMATION

24. Changes in built form, space use and type of trade:

Sl. No.	Built Form	Constructed in		No. of story	Previous use			
		Year	Period		Type of trade	No. of shops	No. of workshops	No. of residential units
a.	Original Structure							
b.	Modification Phase I							
c.	Modification Phase II							

SOCIO-CULTURAL INFORMATION

25. Ownership Type: ☐ Single ☐ Multiple ☐ Other

26. Ownership Nature: ☐ Hereditary ☐ Purchased ☐ Leased ☐ Other

27. Shop Ownership Type: ☐ Owner ☐ Descendent ☐ Rented to others ☐ Other

28. Nature of Occupancy: ☐ Landlord (Single Family) ☐ Owners (Extended Family) ☐ Descendent (Multiple Family) ☐ Tenant

29. Number of persons living in the house:

Sl. No.	Relationship	Age	Education	Occupation	Average income (BDT per month)	Expenditure (BDT per month)
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
Total						

30. Reasons for living here: ☐ Ancestral home ☐ Ownership ☐ Security ☐ Low-rent ☐ Religion ☐ Business ☐ Sense of belonging ☐ Others

31. The ceremony performed in this house during the year: Please specify: ☐ Marriage ☐ Funeral ☐ Puja ☐ Others

SPACE USE INFORMATION

32. Visitors information:

Sl. No.	Type of Visitor	Type of visit			By whom they received	Space to receive them	Other room(s) allow for visitors to go
		Socialization	Tradition or Religious	Business			
1.	Relatives						
2.	Neighbors						
3.	Friends Adults)						
4.	Friends (Children)						
5.	Customers						
6.	Suppliers/Salesmen						
7.	Others						

33. Space where Family Members perform the activities:

Sl. No.	Family member	Sleep		Eat			Spend most time when awake
		Day	Night	Breakfast	Lunch	Dinner	
1.	Husband						
2.	Wife						
3.	Children (Boys)						
4.	Children (Girls)						
5.	Grandfather						
6.	Grandmother						
7.	Maid (Male)						
8.	Maid (Female)						
9.	Employees (Male)						
10.	Employees (Female)						

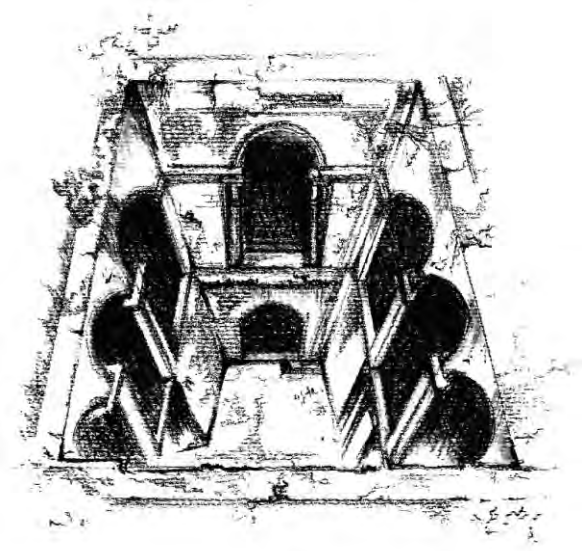
34. In which part of the house that you perform these activities:

Sl. No.	Activities	Space	Shared	Altered
1.	Excreting			
2.	Bathing			
3.	Dressing			
4.	Washing Clothes			
5.	Dry Clothes			
6.	Cooking			
7.	Dish Washing			
8.	Eating			
9.	Watching Television			
10.	Reading			
11.	Other hobbies			
12.	Women passing time/Chat			
13.	Prayer			
14.	Children Play			
15.	Exercise			
16.	Sleeping			
17.	Working			
18.	Sale or trade			

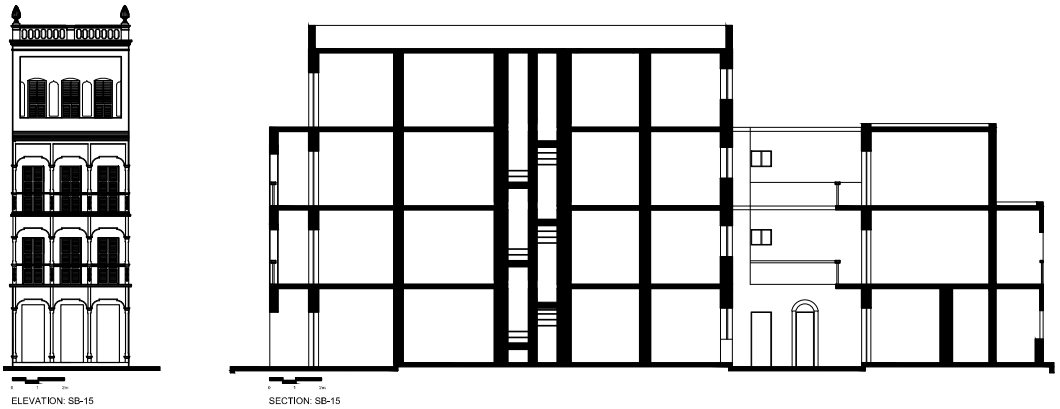
35. Spaces with Multiple use:

Sl. No.	Space	Activities I	Activities II	Activities III
1.	Street			
2.	Courtyard			
3.	Backyard			
4.	Roof			

Appendix E: Elevation and Section of Different Type of Shop-houses

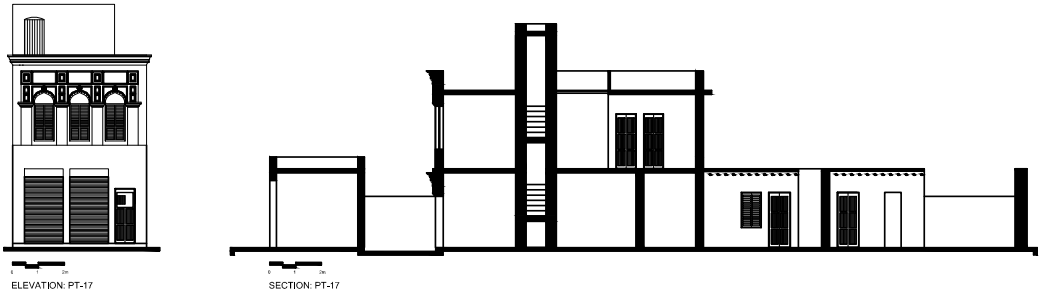


SKETCH OF A TYPICAL COURTYARD (SB-10)



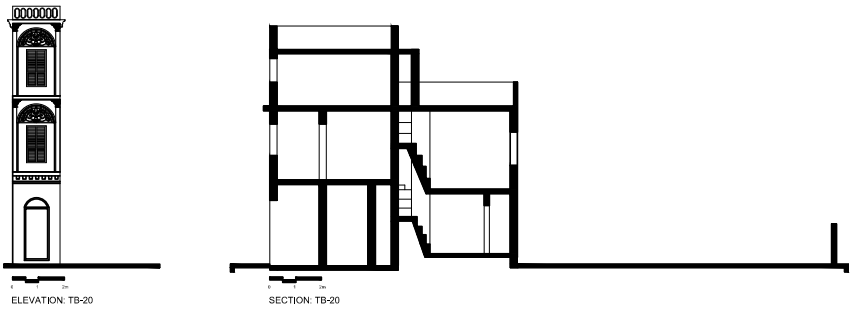
ELEVATION: SB-15 SECTION: SB-15

ENCLOSED COURTYARD TYPE



ELEVATION: PT-17 SECTION: PT-17

DETACHED TYPE



ELEVATION: TB-20 SECTION: TB-20

NARROW INTROVERT TYPE