

Functional Mix and Changing Morphology of Dhaka

Fatema Meher Khan

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Fatema Meher Khan

ORCID ID: 0000-0003-4761-7836

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Abstract

'Functional Mix' has re-emerged in the field of urban planning, inspired by the pioneering work of Jane Jacobs. As opposed to the modernist urban planning approach of functional segregation, Jacobs argued that different functions of the city work in synergy and understanding the synergies and co-functioning of different uses is primary to comprehending how cities work. Spontaneously-developed mixed-use functions characterise many cities of the global South. Dhaka is one of them, where an extensive mix has been developed in an unregulated way. At present, the nature of such mixing has created a composite land-use pattern, which is often seen as a crisis rather than an advantage. A common criticism is that the unplanned intricate functional mix, including the incompatible mixing of uses, is bringing challenges to community life. However, not much empirical research on informal mix has been done until now. This thesis has attempted to fill the gap by exploring the morphology of the informal mix in Dhaka, how 'mix of uses' co-functions, how it has changed over time, what forces are accountable for the growth of the mix and the process of its governance in informal urban contexts.

To gain a comprehensive and comparative multi-scalar understanding of the functional mix and related morphologies, three urban areas, representative of the Historic Core, Semi-planned and Planned settlements of Dhaka, have been selected for case studies. A combination of qualitative and quantitative methods, including field and archival surveys, interviews, functional mix mapping, morphological mapping, and content analysis has been applied for data collection and evaluation.

The study shows that the interrelation of the mix of uses with connectivity and concentration has sustained its development in Dhaka. A high-density intensive mix of uses is prevalent across the Historic Core, compared to the Semi-planned and Planned areas. However, informal mixes are also notable in Planned neighbourhoods. The urban fabrics and buildings of Dhaka are flexible and adaptive. This phenomenon, coupled with factors like economic demand, unemployment, lack of community facilities and weak governance, have influenced the growth of informal mix of uses in the city. Hence, the urban fabric has been incrementally transformed over time, along with the development of the mix through its horizontal and vertical extension into buildings, amalgamation and subdivision of plots, increase in connectivity and building density.

Declaration

This is to certify that:

1. the thesis comprises only my original work towards the degree of PhD
2. due acknowledgement has been made in the text to all other material used
3. the thesis is fewer than 100,000 words in length, exclusive of tables, maps, bibliographies and appendices

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Chapter-1: Introduction

1.1 Background

This study was triggered by the opposing ideas of the functional mix pertaining to the cities of the global South and North. In the global South, a spontaneously-developed functional mix is commonly viewed as a crisis for breaking social cohesiveness, causing unplanned land-use conversions, incompatible mix of functions, a lack of privacy, safety, inadequate provision of utility services, insufficient parking facilities, and so on (Nahrin, 2008, p.39; Ratnayake, 2015, p.54; Mitra and Mitra, 2015; Verma, 1993; Raharjo, 2005, p.36). In contrast, the cities of the global North value a mix of uses, considering its benefits, like ensuring vitality, efficient use of land, reducing the need for travel, increasing a sense of security, building a cohesive community and the like (Jacobs, 1961; Davis, 2012, p.89; Barer, 2011, p.22, Frank et al. 2006, p.75; Rabianski et al., 2009, p.206). Based on the empirical study and mapping, this research intends to understand: how do functional mixes work in informal contexts?

'Functional mix' denotes the combination of different uses within a building, neighbourhood or urban district (Coupland, 1997, p.5). A functional mix has roots in the historical development of urban areas. With the advent of industrialisation, zoning regulations were introduced to create the spatial segregation of different functions. Scholars, like Lewis Mumford and Victor Gruen, condemned the adverse impacts of modernist planning on society and valued the necessity of the mix of uses in cities (Mumford, 1961; Gruen, 1965). Many scholars have noted the classic work by Jane Jacobs (1961) as the prime catalyst for the re-birth of the concept of mix in the 1990s (Grant, 2002; Hoppenbrouwer and Louw, 2005; Rabianski et al., 2009; Rowley, 1996). In her book 'Death and Life of Great American Cities', Jacobs argued that a mix of 'primary uses' (housing, shopping, offices, production, education, recreation and so on) and the various forms of co-functioning between them was one of the fundamental principles for understanding how cities work. By primary uses, Jacobs meant those, which by themselves can bring people to a particular space, as being the main attractors. She emphasised the significance of mix, as opposed to the modernist segregation of cities that has an impact on synergistic flows of urban life. For Jacobs, a mix is essential for socio-economic vitality and intensity of the city, while ensuring the presence of different people on the streets using diverse facilities at different times of the day (Jacobs, 1961, pp.152-160). Different post-modern urban theories, like new urbanism or neo traditionalism or traditional neighbourhood development, are also more aligned to the concept of traditional socio-spatial structure and advocate for urban development that encourages a mix of uses for urban liveliness (Bohl, 2000, p.762).

Informality is integral to the global South (Waibel, 2016, p.1; Dovey, 2012, p.349). Notably, in many cities of South and Southeast Asia, formal zoning has never been effective (Lau et al., 2003, p.367; Lau et al., 2005, p.529) and a complex mix of functions has been the norm

(Hwang et al. 2013; Rabianski et al., 2009, p.207). A diverse mix of uses has emerged mainly in these cities to cater to the demands of the people. Such informal economic practices have been developed over time outside the legal framework of the state (De Soto, 1989; Roy and Alsayyad, 2004). At present, a high degree of informal mixes in these Asian cities are perceived as problematic and are alleged to have adverse impacts on the urban fabric and community life (Nahrin, 2008, p.39; Ratnayake, 2015, p.54; Verma, 1993; Raharjo, 2005, p.36).

Until now, functional mix and informality have been studied separately. Despite the known benefits of mixed-use functions and the widespread existence of informal mixes in the developing cities, their co-functioning and morphology have not been explored much in literature. This study is primarily an attempt to understand the co-functioning of the mix of uses and its related morphology in multiple scales in Dhaka, where an informal mix of uses with compact urban development is an emerging urban pattern (Zaman and Lau, 2000, p.151). Hence, it is an urban design study that relates the functional mix to the various components of urban morphology - grain size, interface, public space network, and building density. It is crucial to study these, as a functional mix is embedded within the components of urban form and it is the way of their relations that makes a functional mix valuable and/or challenging in urban life.

1.2 Problem Statement

South and Southeast Asian cities have largely emerged informally through the micro-adaptation and intensification process over time. As a result, informality i.e., informal settlements and informal economics, has been an important ingredient for their development. Hence, informal economics has become crucial for the economic progress of developing cities. A research conducted by the World Bank in 2016 showed that more than 50% of the urban economy was informal in developing countries. In particular, informal employment comprises 82% of all non-agricultural employment in South Asia and 66% in East and Southeast Asia. In developing cities, formal and informal do not operate independently. The formal economy depends on services provided by the informal sector (Reed et al., 2017, p.2). Many informal enterprises also have production and distribution relations with formal enterprises (Chen, 2007, p.2). Because of its rapid transforming nature, informality in the developing world is often criticised as 'chaotic', but informal networks are very ordered within the informal network itself (Revell, 2010, p.5). The different structural characteristics of the urban economies, the limited impact of modernist practices and the less ability to control urban growth are considered to be the prime reasons for the distinguished character of the informal mix in the developing cities (Burgess, 2000, p.18). Considering the above facts, it is crucial to understand how the informal mix of uses works and how it is integrated within the formal structure of informal cities.

Dhaka, as a case of South Asian megacities, is one of the densest cities in the world, with a growing population of about 17.32 million living in an area of 307 km² (Rajdhani Unnayan Karttripakkha, 2015, p.45). Like the other informal Asian cities, Dhaka is complex, multi-layered

and has evolved gradually without any effective deliberate government planning until recently¹. At present, Dhaka is dominated by extensive informal economic activities (Rajdhani Unnayan Karttripakkha, 2015, p.38). A study conducted in 1999 showed that about 65% of all employment of Dhaka city was in the informal sector during that period (Rajdhani Unnayan Karttripakkha, 2015, p.38). Since its inception, the lack of urban services, slow infrastructural provision, and weak governance have influenced the development of the informal mix (Nahrin, 2008, p.39). A common criticism is that the planning authority never conducted the need assessment of the growing population and therefore, planned different areas without adequate supporting features. Consequently, mixed-use functions have grown spontaneously as the supporting features in different areas of the city. From time to time, the regulatory authority has accredited the informal mix of uses in certain areas, considering their need for the common people (Zaman and Lau, 2000, p.148).

Largely, the privately-initiated practices of the growth of informal mixes have transformed the morphology and social character of different parts of Dhaka (Nahrin, 2008, p.39; Zaman and Lau, 2000; Ahamed and Hasan, 2010). For the last few years, the growth of the mix of uses has influenced the unplanned land-use conversion, densification, and sub-division/amalgamation of plots in different neighbourhoods (Zaman and Lau, 2000; Zareen, 2009; Ferdous and Nilufar, 2007). Considering these issues, it is crucial to study the morphological transformation of the mixed-use areas, which will lead to understanding the micro-adaptation mechanism of the dense urban fabric, and the incremental growth process of the informal mix of uses. Furthermore, due to the diverse morphology of different areas, their disparate levels of informality, and varied socio-economic conditions, the pattern of the mix has been different, which needs to be analysed to reveal how diverse parts of the city are working with the informal mix at present.

The functioning of the mix of uses is better revealed in the micro-scale at building level (Narvaez et al., 2015; Davison, 2006). In the mixed-use buildings of Dhaka, diverse uses are integrated into a complex adaptive system and the different spaces can transform into various uses at any time. 'Adaptability and flexibility' are often noted as two essential criteria for mixed-use buildings (Davis, 2012; Mateo-Babiano and Darchen, 2013, p.6). However, a general criticism of the mixed-use buildings is that unplanned and informally developed non-residential uses often contradict residential functions (Rabianski et al., 2009) and remain in a complex interrelationship with different building components. Hence, the functional organisation of mixed-use buildings requires investigating for a comprehensive and multi-scalar understanding of the informal mix.

1.3 Research Gap and Research Questions

Until now, there has been a dearth of academic survey-based research on the informal development of the functional mix, particularly in the South and Southeast Asian urban context.

¹ Dhaka city is more than 400 years old. The first formal master planning effort of Dhaka began in 1917. However, the first gazette development plan of Dhaka [Dhaka Metropolitan Development Plan (DMDP)] was done in 1995.

However, there are records and studies on the history, morphology, and pattern of traditional shop-houses and street traders (Imammuddin et al, 1989; Aranha, 2013; Elnokaly and Wong, 2014; Guan, 2011; Han and Beisi, 2015; Ismail and Shamsuddin, 2005; Yam and Ju, 2016; Bromley, 2000; Bhowmik, 2005), but the operation of the informal mix in the urban and building levels and the associated impacts of its development on urban morphology have not been well investigated. This study, therefore, has addressed the gap between research on informality and functional mix.

Based on the issues discussed above, five research questions have been explored here. They are:

- How does the functional mix vary in different neighbourhoods of Dhaka and what is the process of transformation of the functional mix over time?
- What are the forces underlying the growth of mix?
- How does the 'mix of uses' co-function in dense urban contexts?
- How are the different mixed functions organised within a building?
- How is the functional mix governed?

These questions have investigated the pattern, related morphology, and transformation of the informal mix of uses to reveal its operation process in diverse morphologies (historic core, semi-planned, planned area) of the city.

1.4 Research Approach

This research is aimed at understanding the synergy of different functions and their mixes in the city, and how the city works as a whole with such interconnections. The conception of 'functional mix' is the antithesis of the modernised version of zoning-based city development. 'Functional mix' is multi-scalar and embodies the intensive multiplicity of functions that are changed by the addition of new ingredients in the system. Since the mix of uses relevant to this study is characterised by incremental change, where individual functions can change the whole system, there is a need to understand the mix of uses at multiple scales and the co-functioning between uses. This research, therefore, adopts the principle of 'functional mix' for investigating the synergy of different uses through empirical study.

1.5 Contribution

The outcome of this research contributes to the fields of urban morphology and urban informality by exploring the form and process of the informal mix and its impact on the urban fabric. Through the multi-scalar analysis of functional mixes from macro to micro, this research offers a comprehensive knowledge of mixes. It has a particular contribution in understanding the process of informal mixes at building scale, which is unique in the study of the mix of uses. Further, the study of the transformation of urban districts adds to the knowledge, by mapping incremental changes of mixes and associated morphological elements. The findings regarding informal mixes might be useful to urban managers and professionals, like urban planners, urban

designers, and architects, while creating policy guidelines regarding the future development of functional mixes in the cities of the global South.

1.6 Thesis Structure

This thesis is divided into 9 chapters. Chapter 2 reviews the literature on the functional mix, informality, urban morphology and the status of the informal mix in broader South and Southeast Asian contexts. It also reviews the theories and concepts of assemblage, resilience, complex adaptive systems, and urban economics that frame the research approach. Chapter 3 explains the research strategy and case studies and outlines the selected methods of data collection and analysis. To conduct the study, three case study sites have been selected from Dhaka, corresponding to three types of urban morphology: Historic Core, Semi-planned and Planned areas. Chapter 4 discusses the historic development of the informal mix, factors affecting its growth, and governance in Dhaka, in the light of relevant literature and interviews.

Chapters 5, 6 and 7 present the analytical findings regarding the current morphology, transformation, and governance of the informal mix in three case study areas: Historic Core, Semi-planned and Planned residential areas respectively. Chapter 8 analyses the syntactic structures of 30 individual mixed-use buildings from these study areas. In this chapter, the building plans and syntactic structures explain the spatial organisation, depth and circulation pattern of mixed-use functions. Chapter 9 summarises the findings of the thesis. It compares the three case study areas to discuss the related urban and building morphology, transformation, co-functioning, and governance of the informal mix of uses in Dhaka. This chapter also provides some propositions and a brief direction for further research.

Chapter-2: Literature Review

2.1 Introduction

This chapter is a review of literature that discusses the notion, pattern, and related morphological aspects of an informally-developed functional mix and other theoretical toolkits to comprehend the working process of the mix as an urban system. The chapter is structured into six parts. The first part defines the functional mix and also discusses the significance and forces affecting the emergence of the mix in the urban fabric. The second part confers urban informality. The third part outlines the related morphological aspects of the functional mix at different scales. The fourth part explains the interrelationships between co-functioning (mix), connectivity (access), and concentration (density). The fifth part illustrates the pattern, related morphology, and politics of the informal mix in South and Southeast Asian cities. The last part of the chapter reviews the theoretical approach including assemblage thinking, resilience thinking, complex adaptive systems, and urban economics to understand how an informal mix operates as a system through the interaction of different uses.

2.2 Functional Mix

Functional Mix and Fundamental aspects

The mix of uses has been defined in many ways by scholars. Le Corbusier (1957) defined urban functions into categories like living, working, and leisure and proposed cities into specialised areas for these functions. Jane Jacobs (1961) defined urban functions in terms of primary and secondary uses, where primary uses (dwelling, factories, offices) attract people to a given neighbourhood and secondary uses (shops) depend on primary uses for their viability. Jacobs noted that the city's vitality requires a variety of primary uses. According to her, the district and its different parts must preferably serve more than two primary functions. She also argued that primary functions like housing, offices, production, education, recreation, and so on work in interactions and walkable connections between them are crucial. Hence, she emphasised the mix of primary uses and the co-functioning between them to form synergies. Hoek (2008) has defined mix of uses as the proportion of housing (mix of housing program) versus non-housing uses (amenities, shops, offices, production, administration and so on) in an urban district in terms of grain size. Urban Land Institute - ULI (1987) - has specified 'mixed-use' as the mixture of three different revenue-producing uses (such as retail/entertainment, office, residential, hotel, and/or civic/cultural/recreation) in an architectural project (Grant, 2002, p.73).

Other researchers have also discussed a mix of uses under the term 'mixed-use/mixed-use development'. However, the term 'mixed-use' has been criticised for being ambiguous (Grant, 2002; Hoppenbrouwer and Louw, 2005; Rabianski et al., 2009). The difficulty of defining mixed-use lies in the fact that there are several ways of mixing land uses and almost infinite forms of

development (Gentin, 2009, p.10). The past definitions also lack conceptual clarification of these new forms of development produced by the mixing of two and/or more uses. So, there was a need for a critical definition of the term in order to limit the number of developments that fall within its category.

The principal of a mix of uses that have been applied in this thesis is 'functional mix'. Scholars like Dovey and Pafka have explained the concept of 'mix of uses' critically intending to map it in the urban fabric. Embracing the idea of Hoek (2008), Dovey and Pafka (2017, pp.249-267) divided urban functions into three primary categories of 'live', 'work', and 'visit' (Fig. 1). This categorisation is based primarily on the argument that the population in a building, street or neighbourhood at any particular time remains there because they live there, work there or visit the place. According to this principle, 'functional mix' encompasses the notion of mixed-use within a neighbourhood or building, whether it is vertical or horizontal and thus more acquiescent to multi-scalar thinking. The 'land-use mix' is different from the functional mix. 'Land-use' embodies the notion that each plot of land has a single-use and the emphasis is on a larger scale than a smaller one. Prior studies considered urban functions in categories, like residential, industrial, commercial, retail, education, entertainment, recreation, health, transport, government, community, parking, vacant, hospitality, etc., which is a modernist way to segregate the city into different categories. Dovey and Pafka argued that there is a problem of consistency with such categorisation since the boundaries of many of these categories overlap and can become subsets of another.

This concept seeks to understand functional mix within the framework of assemblage and resilience thinking as an intensive multiplicity with different kinds of mix with various measures and mappings at diverse scales. Therefore, a triangular model has been suggested by Dovey and Pafka as a framework for mapping the city as an assemblage of flows between different functions. This mapping index is represented as the LWV (Live, Work, Visit) triangular (Fig.1) with three primary colours (Red, Blue, and Green) plus various forms of a mix between them

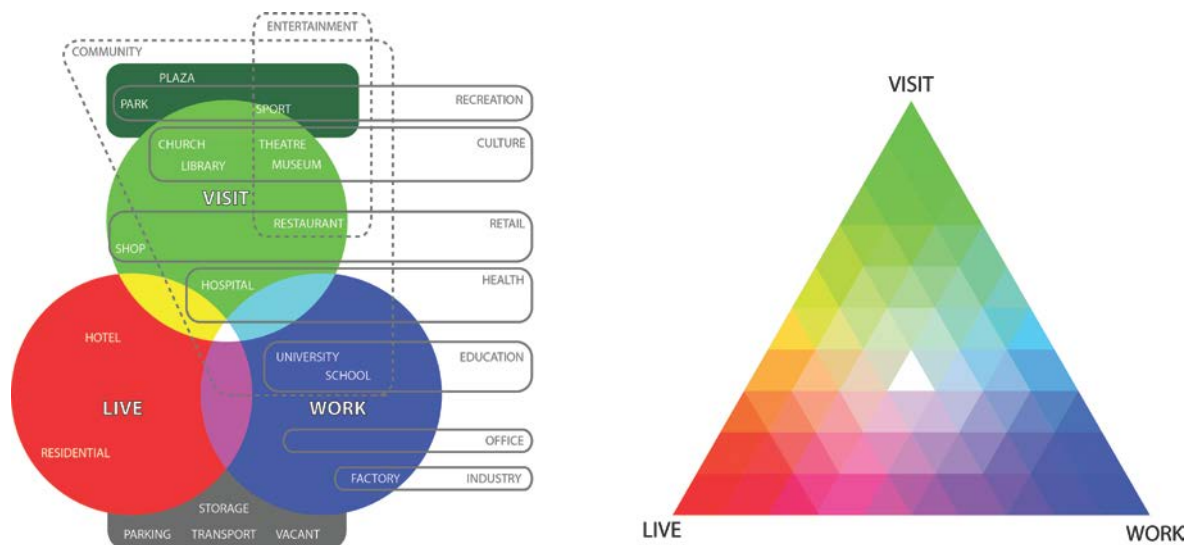


Fig 2.1: Overlapping functions and Live/Work/Visit triangle - (adapted from Hoek, 2008)
(Dovey and Pafka, 2017, p.255)

that fade towards white for the mix of all three functions. This triangular scheme is not focused on the primary functions; instead on the mix and flows between them. The three primary uses of the functional mix also incorporate other uses. 'Live' incorporates everything that is considered housing, like residence and hotel. 'Work', denotes offices, factories, and educational institutions. 'Visit' denotes shops, restaurants, libraries, theatres, museums, parks, sports, hospitals and so on - i.e., all functional categories other than the residential, office, education, and industry (Dovey and Pafka, 2017, p.255).

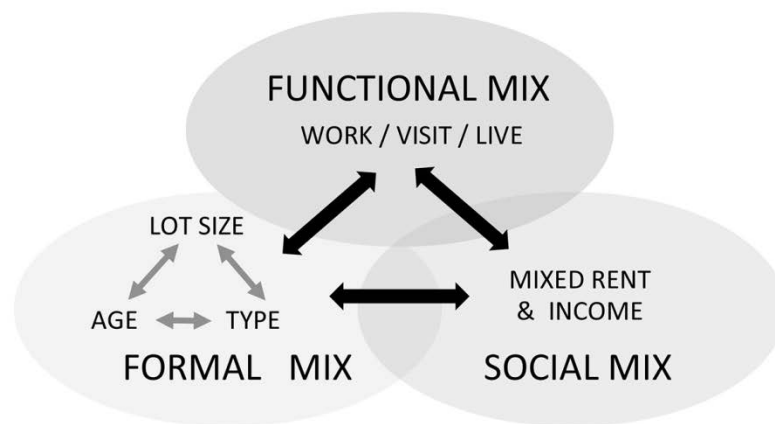


Fig 2.2: Synergies of mixes (Dovey, 2016, p.30)

The functional mix does not exist alone in a city. A range of different functions needs different buildings of various lot sizes that link to the range of diverse people who live and work there. Thus, the urban mix is the relation between different functions, buildings, and people - the interconnections, alliances, synergies, and flows between them (Fig.2). This is ultimate, a mix of mixes. The relations between functions, buildings, and people are not causal but reciprocal - forms of synergy, where one mix is geared to another that is geared to another in turn (Dovey, 2016, pp.29-35).

In this study, 'functional mix' has also been termed 'mixed-use function' and 'mix of uses' and all these terms have the same meaning.

Significance

Different researchers have depicted various significances of the functional mix. Notably, sociologists and urban observers, like Jacobs and Whyte, have heralded the social, economic, and cultural benefits of a mix. According to Jacobs, a mix of uses ensures '24/7' vitality and increases a sense of security within a neighbourhood due to its nature of mixing of different people in public space and complementary hours of operation. While explaining the advantages of the mix, Jacobs and other researchers stated that in a mixed-use neighbourhood, both community and businesses can mutually support each other to maintain socio-economic vitality and their existence (Jacobs, 1961, p.153; Davis, 2012, p.89; Anunobi et al., 2015, p.52). Whyte (1980, pp.19-57), in his influential book 'Social Life of Small Urban Spaces', provided a critique of urban spaces and the ways, these spaces can be improved. He emphasised the

development of multiple uses, particularly retail that can attract more people in public spaces to enhance liveliness.

Urban centres are now interested in a mix of uses because it provides a safe and attractive urban environment (Wardner, 2014, p.5; Rabianski et al. 2009, p. 210; Anunobi et.al., 2015, p.52). A functional mix not only creates 'in-between' spaces that link live, work, and visit, but it also emphasises a public domain that is shared by all members of a community. Thus, it allows the people to interact socially and helps to build a cohesive community (Barer, 2011, p.22; Carmona, et al, 2003, p.115).

A functional mix brings together different uses and makes them accessible in one location. Thus, the mix creates a vibrant street life and a sense of place through the diversification of different but complementary activities. Additionally, as all the uses are located nearby, people do not need to travel too far, and that brings people together in pedestrian environments (Barer, 2011, p.22; Coupland, 1997, p.152; Rabianski, 2009, p.210). Thus, a mix of uses promotes a walkable neighbourhood, which also reduces adverse health effects (Frank, et al. 2006, p.75). Further, it increases housing, employment, business, and investment choices, so that people of varying ages and economic ability can live and work in the same place (Delisle and Grissom, 2013, p.26).

Forces Affecting the Emergence of Mix

In the scholarly field, there is a growing appreciation of a mix and its growth in urban settings. Inspired by the classic work of Jacobs, the concept of the mix has re-emerged in urban planning in late 20th C. Urban critics - like Mumford (Mandelkar, 1962) and Gruen (Azrieli, 1997) wrote about mix and diversity in urban environments. In his seminal work, Alexander (1965) showed that modernist zoning was antithetical to the ways in which a city works. He argued that by separating functions, zoning seeks to turn the city into a 'tree' like structure which characterises non-overlapping functions and disassociation of internal elements that leads to destruction. Duany and Calthorpe (Grant, 2006), leading contributors to the charter of 'New Urbanism', encouraged a mix as a crucial ingredient for a viable model for neighbourhood development.

The factors that influence the emergence of a mix in cities for the past several decades can be understood in terms of social life, regulations, politics, economics, property markets, and design trends.

According to Wardner (2014, p.11), the most important catalyst for the growth of a mix of uses is the basic human need that motivates people to choose to live closer to their necessary daily activities. The growing socio-political demand for real places in placeless suburbs has encouraged the growth of mix. Planning plays a substantial role in promoting a mix. In particular, increasing traffic congestion and air pollution has influenced planners to consider land-use patterns that can reduce automobile trips and increase pedestrian movement. Planned unit development (PUD) ordinances, mixed-use zoning, and other flexible zoning have also

allowed local communities to permit a mix (Herndon, 2011, p.1; Rabianksi, 2009, p.206; Loehr, 2013, p.7; Jones, 2012, p.2; Schwanke, 2003, p.26).

Rabianski (2009) has argued that the successful integration of a mix depends on the pre-existing local economy of the particular context. Land value often acts as a prime motivator for the development of functional mix. Increased land value in urban areas influences the actors in the building industry to build mixed-use functions for higher economic return (Rabianksi, 2009, p.211).

While explaining the development of a mix of uses in formal cities, Schwanke (2003, p.26) stated that the growth of a service economy over the past two decades had created a demand for a mix to encounter the increasing need of office space. He further explained that the larger the office project, the larger the need for amenities like restaurants, retail shops, hotels, and residences to serve office workers.

2.3 Urban Informality

This thesis studies the functional mix in a context of high levels of urban informality - those economic and settlement practices that fall mostly outside the formal control of the state (Sinha and Kanbur, 2012; Roy and Alsayyad, 2004). As informality is defined as an unregulated activity, it is often understood to be unplanned (Roy, 2009, p.84). According to economists, the informal sector consists of small-scale units engaged in the production and distribution of goods, with the aim of creating employment for their participants (Thomas, 1992, p.57). Economists with the World Bank have defined informality based on the characteristics of formal and informal sectors. Their definition implies that the formal sector involves modern technology and capital-intensive methods of production with labour and product markets. In contrast, the informal sector involves traditional labour-intensive methods of production with both labour and final output markets being highly competitive. Informal-sector activities are also characterised by ease of entry, family ownership of enterprises, low capital endowments and an unskilled work force (Wahnschafft, 1982, p.432; Handmer, and Choong, 2006, p.11). The informal sector in developing countries is based on self-employed with a small-sized firm, and a homemaker (Thomas, 1992, pp. 81 - 333).

Urban informality can be divided into two. First, it includes informal practices within public spaces, such as trading, parking, hawking and so on. Second, it involves informal morphologies of construction and settlement, whether on public or private land. These forms of informality are integrated with an informal economy and informal politics (Dovey, 2012, p.374). Thus, the urban informal economy includes a variety of activities, such as market operatives, traders, street hawkers, caterers, bar attendants, carriers, commission agents and dealers, launderers, shoe-shiners, barbers, vehicle repairers and other maintenance workers, brokerage and mediators, ritual services and home-based enterprises (Thomas, 1992, p.54; Brown and McGranahan, 2016, p.98).

Informality is generated by a bottom-up, piecemeal, collective, self-organised process and is focused on functional outcomes (Kang, 2009, p.230). Informality can transform and adapt to meet the demands of people very promptly, as people's needs define informality. It is highly resilient because it can continue to meet the unexpected needs and shocks of the upcoming future (Revell, 2010, p.7). According to Bayat (1997, p.57), informality is a result of silent "encroachment of the ordinary people". This encroachment is often the feature of undemocratic political systems, where traditional institutions serve as an alternative to civic associations and social movements. Dovey (2013, p.83) defined informality as 'transgressive' because their inhabitants are likely to move beyond the limits of formally state-based codes, in terms of tenure, urban design, and planning and construction.

Informal sector enterprises can grow and enter into the formal framework (Thomas, 1992, p.82). According to Perera (2016, p.223), informal/formal are interlinked - they compete, interact, complement, overlap, and coexist. In urban terms, cities may be more or less formal, but all cities embody a mix of formal and informal processes (Dovey, 2012, p.372; Bruggmann, 2010). Dovey has defined informal/formal conception from the theoretical frameworks of assemblage and complex adaptive systems. The twofold concepts of rhizomic/tree and smooth/striated resonate with the informal/formal construct. Informal practices are rhizomic in contrast with tree-like structures, as they involve minor adaptations and network connectivity in contrast to the significant strategies of master planning and hierarchical control. Thus, informality can create an organic and incrementally adaptive urban form that leads to pedestrianised, community-centric, network-based, high-density mixed-use and low-rise streetscapes (Perera, 2016, p.154).

Informality usually negotiates with a formal framework to make its own space. In the process of informality, ordinary people or small institutions negotiate with relevant administrative or political systems to make their own space through coping, recovery and resisting social and spatial impositions. Here, negotiation refers to the process where people try to change the social and spatial assignments which they are obliged to inhabit (Perera, 2016, pp.4-5; Yeoh, 1996, pp.216-269). Thus, in the process of creating space people transform 'abstract spaces' into 'lived spaces' for daily activities and cultural practices. Abstract spaces are generally provided by the authorities and are intended to be used for a given purpose. Lived spaces are the abstract spaces that are transformed by people for their own needs. The resulting spaces are messy, contested, complex, hybrid and intertwined. These lived spaces are not territorially confined, but they are connected and influenced by other places across cities, states, and regions. In this process, the individual actors who are bound by the formal/legal system work within their capabilities to transform the environment. In the case of negotiating space, the reverse process is also common where space is produced by ordinary people and is later negotiated by the authorities and dominant actors (Perera, 2016, pp.221-235). In this way, ordinary people try to ensure the redistribution of opportunity and the attainment of autonomy from formal institutions through illegal and un-institutionalised mechanisms. Thus, urban informal politics involves "a set of conflicts and the attendant implications between a collective

populace and the authorities, usually expressed in the physical and social space of the streets" (Bayat, 1997, p.63).

In the informal context, the significance of informal trade in the local economy makes it a priority issue. Paddison et al. (1990, p.7) has identified unemployment as a factor, which influenced the growth of informal trading in the city. According to him, rural to urban migration has been the major contributor to urban growth in third world countries like Bangladesh, Nepal, Vietnam, Cambodia and so on while the economies of these cities have failed to generate sufficient employment for growing populations in the formal sector. Surplus populations are forced to generate their employment. Thus, the informal sector has always been a potential solution to unemployment in developing countries (Dewar and Watson, 1990, p.7; Indira, 2014, p.281). Additionally, occupational patterns in the informal sector are attractive to immigrants, as they provide the opportunity of employment with minimal capital investment and technical constraints (Paddison et al. 1990, p.7; Bhowmik, 2005, p.2263).

2.4 Urban and Building Morphology

This section identifies the related morphological aspects of the functional mix in urban settings. The first part of this section discusses the functional and physical elements of urban form, their morphogenetic process, and how these elements influence the texture of the urban fabric. The last part discusses the operational processes of different uses and spaces of mixed-use buildings.

Urban morphology is the study of the physical fabric of urban form and processes shaping it (Oliveira, 2016, p.3). Urban morphologists "analyse a city's evolution, from its formative years to its subsequent transformations, identifying and dissecting its various components". Cities are the accumulation of individual group actions governed by cultural traditions and shaped by socio-economic forces over time. Hence, urban morphologists "focus on the tangible results of socio-economic forces; they study the outcomes of ideas as they take shape on the ground and mould our cities". The elements of urban form exist in a dynamic interrelationship. "The dynamic state of the city and the relationship between its elements have also led urban morphologists to prefer the term 'urban morphogenesis' to describe their field of study" (Moudon, 1997, p.3).

Systematic studies of urban form started separately in England, Italy, and France in the mid-20th century. Eventually, during the 1990s, an interdisciplinary international seminar on urban form and the publication of the Urban Morphology journal was started (Moudon, 1997). The contribution of the English school is more prominent for this study, as its focus is to reveal the evolutionary process of urban form. M.R.G. Conzen was the pioneer of the English school, which emerged following the rigorous town plan analysis. Conzen's work is also prominent because he originally defined the key elements of urban morphological analysis as land uses, streets, plot/lot, and buildings and their allied open spaces that can be understood at different levels of resolution, and these elements undergo continuous transformation and replacement in different historical periods (Conzen, 1960, 1978; Moudon, 1997, p.7; Marshall, 2009, p. 67;

Levy, 1999, p.80; Oliveira, 2013, p.22). These elements do not evolve in isolation but co-evolve. Thus, urban morphology changes over time as the new fabric is added, and the existing fabric is internally modified (Knox, 1995; Cadwallader, 1996).

Land-use is one of the prominent functional aspects of urban form and the term 'land-use' denotes the different functions of the urban environment (Dempsey et al., 2010, p.23). Land-use is generally guided by location, topography, and accessibility, and is shaped by various phases of histogenetic evolution (Prasad, 2014, p.2). According to Conzen (1960) and Birkhamshaw and Whitehand (2012), land-use changes more rapidly (Sanders and Woodward, 2015, p.9). Hence, it is generally the least resilient element of urban form (Mandal et al., 2016, p.337).

Another element of urban form is the individual lot/plot/grain, which defines the limit of territory for building and the subsequent transformation of the built space. Any settlement can be of either fine or coarse grain. Plot/grain size influences the texture of urban fabric. Finely grained settlements provide better opportunities for the development of a diverse mix of uses in close proximity in comparison to coarse grain settlements (Gentin, 2009, p.12). However, Dovey (2016, p.28) used the term small and large grain instead of fine and coarse and argued that there is a need for a combination of large and small grains that will help to sustain the mix of rents for both opulent and marginal enterprises. In the process of urban transformation, an individual plot can play a role by the amalgamation or sub-division with the changes of use pattern (Carmona et al., 2003, p.77; Dovey, 2016, p.28; Zareen, 2009, 25).

The smallest physical element of urban form is the individual building. Building density is a significant issue in urban planning. In urban discourse, density refers to specific quantities per unit area. Jacobs (1961) first used the term 'concentration' to refer to the densities of dwellings and people. The most commonly-used density measurement in architecture and urban planning is the floor area ratio (FAR), which is the ratio of the total floor area to the site area. FAR is commonly used to manage the amount of floor area and the total bulk of the building (Dovey, 2016, 32). This measurement of density may be either net or gross. Net density is calculated within a development site. Gross density includes the wider network of public space (Dovey and Pafka, 2014, p.67). Building height and plot coverage are also related to the density, where coverage means the ratio of the building footprint to the site area (Satu, 2014, p.69). In a given site, either the change of the height or plot coverage can affect the building density. Mix links to density through enabling a vertical mix (vertical organisation of mixed-use function). Higher density works in synergy with a mix in bringing more destinations closer together within walking distance (Dovey and Pafka, 2019, p.5). In the transformation process, the buildings generally have lower stability over time than plots or streets, as buildings may be extended, vacated, reused, and replaced by other buildings (Oliveira 2016, p.26; Zareen, 2009, p.25). Building density may also increase or decrease over time (Ryan, 2006, p.9).

The last element of urban form is the street that defines the street blocks and distinguishes what is public from what is private. Streets are the most stable element of urban form and their

character is influenced by other elements shaping it (Oliveira, 2016, p.15; Birkhamshaw and Whitehand, 2012, p.5; Sanders and Woodward, 2015, p.9). The study of permeability is related to the morphology of urban street networks. Its study helps understand the prospects of walkable public access - streets. Permeability can be defined as the extent to which an area is permeated by publicly accessible space (Marshall 2005, pp.88-89). Jacobs (1961, p.180) mentioned this morphological aspect of the city when discussing the need for small/short blocks. According to her, short blocks have various alternative routes to choose. For a neighbourhood to support several small commercial outlets, there is a need for a multiplicity of routes and corners, that permit pedestrian choice and variation in their journeys (Coupland, 1997, p.157). Regarding the physical properties of short blocks, Jacobs and others stated that short blocks tend to produce more potential plot frontages and finer-grained fabrics (Jacobs, 1961, p.180; Siksna, 1997, p.29; Maitland, 1984). Hence, Jacobs (1961) suggested that an active urban pedestrian network should limit block length to about 100 metres.

The interface is another significant part of urban morphology. It refers to the zone of transition, where public and private spaces meet and interact. Different researchers have categorised interfaces differently. Based on social attraction, Gehl (1987) has classified interfaces along with a variety of 'soft' or 'active' versus 'hard' or 'passive' interfaces. He incorporates factors like transparency, activity, diversity, design quality, and grain size to produce a five-part interface typology, which ranges from active (small-grain, useful details) to passive (large-grain, no details). Again, based on the criteria of permeability, transparency, setback, and car-dependency, Dovey (2016, p.59) has categorised five types of public/private interfaces, i.e., impermeable/blank, direct/opaque, direct/transparent, pedestrian/setback and car/setback. 'Impermeable/blank' is effectively the 'hard/passive' end of Gehl's continuum. Then, 'direct/opaque' involves an opaque entry directly on the street. 'Direct/transparent' is a transparent direct entry on the street. The 'pedestrian/setback' comprises a semi-private social space between the street and private space. The final type is the 'car/setback', where pedestrians effectively enter through a car park. The urban interface relates to mix because the different interface types are strongly geared to various functions. For example, residential properties are primarily geared to pedestrian/setback and direct/opaque interfaces. Small-grain retail is dependent on direct/transparent interface, and the small-grain industry is geared to direct/opaque and car/setback interfaces (Dovey and Wood, 2015, p.14). Even the impermeable/blank interfaces become essential since they are mostly used for informal street trading.

At micro-scale, 'functional mix' takes place within a building. At the building level, the potential of mix to create synergies from the various uses can be capitalised if the building components are correctly aligned. All uses need to be compatible and complementary so that each use can achieve its maximum potential and combine with other uses to perform as a whole and benefit

from one another. The property market factor is crucial. Therefore, each use needs to attract a considerable market demand of its own (Herndon, 2011, p.41; Ghosh, 2017, p.1).

'Adaptability and flexibility' are often noted as two essential criteria for buildings having a mix of uses (Mateo-Babiano and Darchen, 2013, p.6). 'Adaptability and flexibility' refers to the ability of a building to integrate different uses over time without alteration in its configuration, or to be able to alter its physical configuration with moveable walls or to make restorations, to help the building adapt to new demands. The ability of urban districts to accommodate a mix of functions depends on the existence of buildings whose architecture allows for this mix, and for the flexibility of buildings to allow commercial and residential functions to expand as needed (Davis, 2012).

2.5 The synergy between Co-functioning, Connectivity and Concentration

In her seminal work, Jacobs (1961) identified the attributes of density, mix, and access in the urban fabric and labelled these as 'need for concentration', 'mixed primary uses', and 'small blocks' respectively. She established that the presence of these aspects is vital for the functionality and diversity of the city.

Eventually, scholars like Dovey and Pafka (2016, 2020), reconfigured and elaborated Jacobs's ideas and emphasised the interconnections and synergies between density, mix, and access. They argued that density, mix, and access comprise several interrelated conceptions and they work together in synergies. This complex synergy was also labeled as 'the urban DMA'. Dovey and Pafka recognised that interconnection between density, mix, and access is necessary for the emergence of urban intensity, productivity, and creativity rather than just diversity.

Dovey (2016, p.16) noted that a mix of various uses generates flows between different people, buildings, and functions. A mix needs high density, as it brings different uses closer together. Density without a mix has no power to activate a place. Then again, access is useful for mix as poor connectivity can split up the effects of mixes. Without an access network, density and mix will not be able to work synergistically. The association of urban functions with accessibility has also been discussed by Hillier (1996, p.168), where he showed that economic functions especially the shops usually locate themselves on the accessible lines in the urban grid. Following the approach of 'assemblage' thinking, Dovey and Pafka (2020, p.104), explained the synergy of density, mix, and access as an 'intensive multiplicity' as these components involve into multiple relationships. These interrelationships between them can produce different levels of urban activity and movement and consequently, can affect the socio-economic performance of cities. However, Dovey and Pafka also noted that some cities of the global South do not maintain the synergy between density, mix, and access at all times. On a few occasions, high density and mixed-use functions direct to intensive street life with highly impermeable access networks. Also, in some parts of these cities, small-grain mixes and highly walkable access networks produce a vibrant street life with low densities (Dovey and Pafka, 2020, p.105).

2.6 Informal Mix in the South and Southeast Asian Context

The majority of South and Southeast Asian cities are generally characterised by high-levels of the functional mix (Verma, 1993; Ratnayake, 2015; Susantono, 1998; Wijesundara, 2015, Ray and Mishra, 2011, Han and Beisi, 2016). These cities have been experiencing rapid growth and relatively uncontrolled (informal) land use conversions in recent times (Shankar and Vidhya, 2013, p.678). At present, a higher concentration of functional mix is not only evident in city centres or major roads of these cities, but also along the local streets of residential neighbourhoods (Bahadure and Kotharkar, 2015, p.12165; Ratnayake, 2015, p.44; Mitra and Mitra, 2015, p.7; Verma, 1993, p.118; Raharjo, 2005, p.1).

A significant portion of the functional mix of developing Asian cities is unregulated. While explaining the growth of the mix in these cities, many scholars have observed that mixing of non-residential uses is generally unauthorised and informal, in the majority of the residential areas (Verma, 1993, p.118; Haque, 2015, p.7; Givental, 2013, p.36). In response to the lack of supporting community functions, these non-residential uses have developed incrementally to meet the increased need of the growing population (Haque, 2015, p.7; Zubir and Sulaiman, 2004, p.11; Simone, 2014). In this sense, these informal functions are useful and make the city work better. However, at times, these non-residential uses are incompatible; hence, they have various unfavorable impacts on urban environment (Ghosh, 2017, p.4; Tipple, 2002) that have been elaborated on later in this sector. Thus, a complex pattern of urban form has emerged in the developing Asian cities, where the 'informal' and the 'illegal' have developed an intricate relationship with the 'formal' and the 'legal' system (Chakrabarti, 2001, p.1).

The spontaneous development of functional mix is evident in South and Southeast Asian cities from their inception. In the traditional urban fabric of these cities, a mix of uses is commonly evident in the form of shop-houses. These shop-houses still exist in the Asian cities where individual buildings are arranged compactly on fine grains in a linear pattern along the streets (Mowla, 2016, p.23; Ferdous and Rahman, 2016, p.37; Imamuddin et al., 1989; Chun et al., 2005, p.12; Su-Jan et al., 2012, p.373). In plan, the traditional pattern of shop-house (combination of shop and residences) is characterised by a narrow and elongated layout, perpendicular to the street (Fig. 2.3 A and B). Many researchers noted that the growth of trade and multiple ownership trends in traditional cities had forced the plots to sub-divide on the value of street frontage (Khan, 1982). However, other researchers argued that the typical narrow plan of the traditional shop-house in Asia is a result of tax legislation based on the width of street frontage, imposed by the Colonial administrators (Ismail and Hashimah, 2012, p.60).

Traditional shop-houses are generally low storeyed buildings. In the case of one-storey shophouses, the shop is located in the front part of the building, while the rear portion is used as living units (Fig. 2.3 C). Multi-storied shop-houses (Fig. 2.3 D) involve vertical stacking of functions, usually residential over retailing, wholesaling, services or workshop (Mowla, 2016, p.22; Rabbani, 2006, p.35; Rabianski and Clements, 2007, p.5, Savage, 2001, p.6; Cohen,

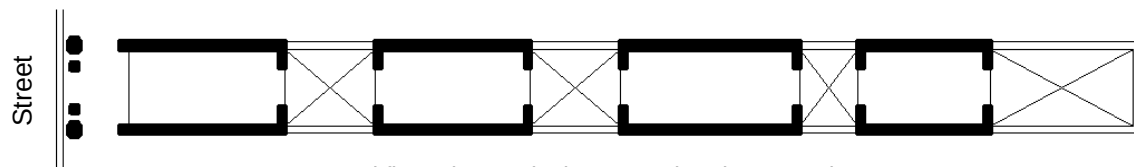


A: Layout plan of Shankharibazar, Dhaka, Bangladesh (Source: Imamuddin et.al., 1989)



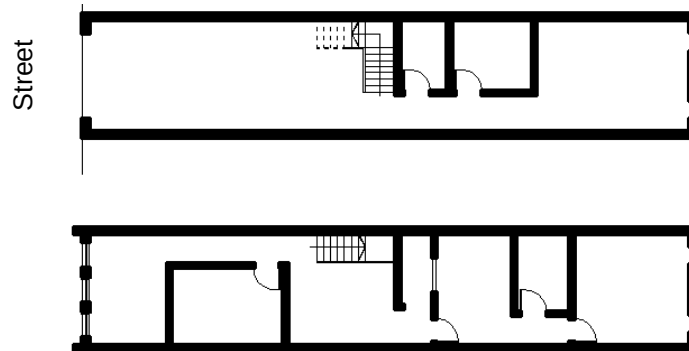
B: Street front of traditional shop-houses, Singapore

Source: <https://singaporelab2015july.wordpress.com/2015/04/30/peranakan-shophouses-modern-transformation-of-heritage-sites/>



C: Ground floor plan, A single-storey shop-house, Taiwan

Source: Li, 2018, p.67



D: Ground and first floor plans, A two-storey shop-house, Ho Chi Minh City, Vietnam

Source: Dang, 2017



E: Direct/Transparent interface
Shankharibazar, Bangladesh

Source: Author, 2017



F: Pedestrian/Setback interface,
(covered platform), Malaysia

Source: Wagner, 2017, p.24



G: Five-foot way,
(covered walkway), Singapore

Source: Guan, 2011, p.34

Fig 2.3: Traditional shop-houses of South and Southeast Asian cities

1985, p.12). Due to the high requirements of the accessibility of visit functions, shops are usually located in the front part of the shop-houses, adjacent to the street (Le Thi, 2017, p.46). Hence, the urban interface of traditional shop-houses is either characterised by direct/transparent interface of shops or/and pedestrian/setback interface of covered platform and 'five-foot way' (covered walkway) (Fig.2.3 E-G). 'Five-foot way' is a characteristic feature of the traditional shophouses of Southeast Asia. This covered sidewalk, originally five feet in width, is usually designed in front of the shops so that the customers can do their shopping in a shaded space (Azmi et al., 2017). With these transparent and pedestrian interfaces, the traditional shophouses offer a vibrant street frontage, along which most commercial, social, and cultural interactions take place (Khan, 1982; Ferdous and Rahman, 2016, p.44). Also, access to shophouses from the main road is crucial due to its mixed functions; generally, traditional shophouses have a single entry through the shops since the houses upstairs and/or at the rear have no separate entrances (Le Thi, 2017, p.46; Cohen, 1985, p.12). The mixed residential and commercial uses of these traditional shop-houses offer an opportunity for flexibility that can adapt and accommodate any transformation as family or community needs change (Aranha, 2013, p.332; Tirapas and Boonyachut, 2012).

Contemporary development of the mixed-use functions of Asian cities demonstrates some alternations from traditional shop-houses in terms of the type of functions, their spatial organisation, and building morphology. Weinberger (2010, p.7) argues that large-scale private developments and changing tastes in housing have largely excluded the original shop-house design from the new development of mixed-use functions. At present, functional mix contains uses like offices, restaurants, storages, and micro-industries along with wholesale, retail shops, and residences (Fig. 2.4 A-C) (Chadchan et al., 2010, p.70; Haque, 2015, p.7; Benjamin, 1996, p.57; Simone, 2014, p.184; Ujang, and Shamsuddin, 2008). Several cases have been noted, especially in designed residential areas lacking basic amenities, where small-scale endeavours led the way to the intrusion of large-scale, incompatible uses, often through the encroachment of open areas of individual plots (Hafiz et al., 2016, p.54). Currently, in multi-storeyed mixed-use functions, the number of non-residential uses varies from single to multiple. Generally, the entire ground floor of the building is divided into different units to accommodate the increased number of uses (Weinberger, 2010, p.50). These non-residential functions are not only organised at street level but also to the upper floors of the mixed-use buildings (Tipple, et al. 1996, p.11). While discussing the functional mix of Phnom Penh, Cambodia; Yam and Ju (2016, p.22) noted that visit functions, like shops and restaurants that need good accessibility from the street, are placed on the second to upper floors to satisfy the high demand of commercial functions. Hence, the mixed-use buildings which have shops at street level contain direct/transparent and pedestrian/setback interfaces (Fig. 2.4 D and E). On the contrary, buildings which are informally converted into work-places and visit functions from living quarters contain impermeable/blank and/or direct/opaque interfaces (Fig. 2.4 F).

In the mixed-use buildings, the number of residential functions has also increased in the form of



A: Work-visit mix, Cambodia

Source: Weinberger, 2010, p.57



B: Work-visit mix, Cambodia

Source: Weinberger, 2010, p.51



C: Work-visit mix,
Bangkok, Thailand

Source: Sintusingha, 2010, p.98



D: Live-visit mix, Cambodia

Source: Weinberger, 2010, p.32



E: Live-visit mix, Cambodia

Source: Weinberger, 2010, p.32



F: Interface of a live-visit mix
Dhaka, Bangladesh

Source: Author, 2017



G: Increased height of
shophouses, Cambodia

Source: Weinberger, 2010, p.68



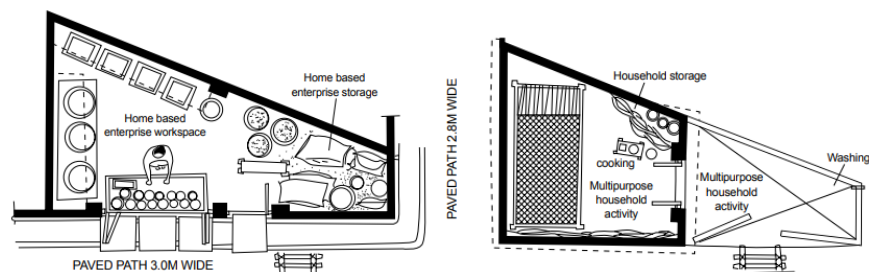
H: Ho Chi Minh City, Vietnam

Source: Givental, 2013, p.41



I: Ho Chi Minh City, Vietnam

Source: Tran, 2015, p.23



J: Ground and first floor plans, Home-based enterprise, Delhi, India

Source: Kellett, and Tipple, 2000, p.209

Fig 2.4: Current mixed-use functions of South and Southeast Asian cities

apartments, where each floor of the building is divided into multiple numbers of residential units (Fig. 2.4 D and E) (Weinberger, 2010, p.31). In some cases, residential spaces are fully converted to accommodate informal non-residential uses in mixed-use buildings (Haque, 2015, p.7). Hence, at present, the residential areas of developing cities have been affected in terms of the increasing density (i.e. building height and plot coverage) by the changing dynamics of land-use (Fig. 2.4 G-I) (Shankar and Vidhya, 2013, p.678; Yam, and Ju, 2016, p.17; Lau et al., 2005, p.536). While discussing the contemporary mixed-use functions of Vietnam, Indonesia, and Hong Kong; Kusno (2014, p.33), Girard et al. (1999) and Aranha (2013, p.326) noted the existence of four to over ten-storeyed mixed-use buildings.

Home-based enterprises (HBE) are a part of the informal sector and are very significantly found in South and Southeast Asian developing cities. A home-based enterprise is a type of mixed-use function which occupies a part and/or full home, using it as a work-place or production area (Fig. 2.4 J) (Tippel, 2005, p.613; Tippel, et al. 1996, pp.3-4). Home-based enterprises are generally involved with the production and repairing of food items, clothing, shoes, electronic items, mechanical items, craft items, furniture, woodwork, household items and so on (Tippel, 2006, p.169; Tippel, 2005, p.617). Tippel et al. (2005, p.626; 2002) observed that many home-based enterprises do not have a separate room for the work-place. Consequently, conflicts arise between home-based enterprises and domestic use when they are developed on small plots with the same space used for living and production, even if times of use are different. Such conflicts can be very sharply focused when gendered spaces such as kitchens are used for a male-operated cooking enterprise. The walled city of Kowloon in Hong Kong was an example of home-based enterprise, where high-density living quarters were integrated with production areas.

In South and Southeast Asia, street vendors or hawkers are an essential part of the informal mix and essential to the urban economy (Aranha, 2013, p.329). In these developing cities, street vending is considered an illegal activity and vendors are treated as lawbreakers. Most of the street vendors have no legal status to conduct their businesses. However, they are popular as they provide much-needed services that are neither given by the municipalities nor by the larger retailing outlets (Bhowmik, 2005, p.2256; Ray and Mishra, 2011, p.1; Batréau and Bonnet, 2016, p.30). In developing Asian cities, it does not take long for unauthorised commercial activity to spring up in and around housing projects. This is called natural markets, which grow in different places where people find them necessary (Bhowmik, 2010, 13). Informal economics may start with a temporary cart placed in a convenient public area. Very soon more permanent structures are built, and strips of commercial squatters develop and thrive (Aranha, 2013, p.329). The local authorities often oppose street vendors due to their street encroachment and inconvenience to street users (Oranratmanee, 2014, p.226; Tangworamongkon, 2014, p.1).

Based on the way of functioning, street vendors are divided into three types- (a) stationary; (b) peripatetic / partially mobile and (c) mobile (Bhowmik, 2005, p.2256; Dimas, 2008, p.2). Stationary vendors are those who carry out vending at a specific location regularly, for instance,



A: Stationary street vendors, Manila, Philippines
Source: Recio, 2018, p. 128



B: A stationary street vendor, Bangkok, Thailand
Source: Yasmeen, et al., 2014, p.6



C: Peripatetic street vendors, Gawahati, India
Source: Mahadevia, et al., 2016, p.5



D: Peripatetic street vendors, Manila, Philippines
Source: Recio, 2018, p. 2



E: Mobile street vendors, Vietnam
Source: Eidse, et al., 2016, p.344



F: A mobile street vendor, Bangkok, Thailand
Source: Yasmeen, et al., 2014, p.7

Fig 2.5: Street vendors of South and Southeast Asian cities

those occupying space on the sidewalks or other public places (Fig. 2.5 A and B). Some stationary vendors have purpose-built kiosks and they generally place themselves in front of the formal shops of the mixed-use buildings (Ujang, and Shamsuddin, 2008, p.52; JigyaSu, 2014, p.110). Peripatetic vendors are those who sell their goods on pushcarts or under temporary sheds and they have several rest/stop locations (Fig. 2.5 C and D). Mobile street vendors are those who move from place to place selling their goods or services on foot or by bicycle (Fig. 2.5 E and F). Street vendors are often criticised for creating conflict with the shop-owners of mixed-use buildings because they appropriate shop fronts and deter walking traffic into the shops, hence reducing the shops' business. Furthermore, street vendors often sell similar goods like the shops, then the shops' business is directly threatened. Hence, shop-owners consider street vendors as direct competitors, because the street vendors steal their customers out in front before the customers can enter the shops of mixed-use buildings (Dimas, 2008, p.3). There are also cases where an alliance is formed between the shop owners and vendors. According to Recio (2018, p.125), in Manila, the formal shops of shopping malls supply products to street vendors who sell the products to their customers.

Concerning governance, scholars have noted the weak management of South and Southeast Asian cities to control the development of informal uses. According to Butt and Ratnayake (2012), planning authorities in developing countries sometimes fail to enforce laws to stop the unauthorised conversion of land-use. At times, the related planning authority neglects the violation of land-use for their benefit. Regarding the management of informal uses, it is also known that although the informal uses of mixed-use buildings do not have business registration or authorisation, they still pay some sort of income and other local taxes to local municipalities as a revenue to run their business (Cling et al., 2010, p.28; Sandaratne, 2002, p.15). Like the shop-owners of informal mixed-use buildings, the street vendors also pay taxes to the related government authorities (Bhowmik, 2010, p.12; Recio, 2018). Most of these are informal taxes in the form of bribes. However, still, these street traders often face harassment from local police and Municipal Corporations. In some instances, unauthorised permanent structures constructed on public property have been destroyed as a part of an eviction (Indira, 2014, p.281; Sandaratne, 2002, p.15). In Bangladesh, sudden eviction is part of the hawking business and it is like a game between the police and the hawkers. Every day, when the police come to evict them, the hawkers get up and leave. However, after a few minutes, when the police have left, they get back in their spots again (Ratna, 2012, p.72). Consequently, the street traders have to pay a significant portion of their profits to the local police, shop owners and street-level bureaucrats to conduct business in their preferred place (Ratna, 2012, p.4; Bhatt and Nengroo, 2013, p.113; Kusakabe, 2006, p.30). There are different stakeholders, such as trade unions or member-based associations, who are trying to organise street traders by providing social security and credit, but their number is few. Some countries, like Malaysia, the Philippines and India, have policies and laws for regulating and protecting street vendors (Indira, 2014, p.281; Bhowmik, 2005).

In Asian cities, the impact of informal functions is double-sided. The informal functions contribute to urban economy and employment (Chen, 2007). These informal economic activities, mainly, the street traders keep the public spaces vibrant (Recio and Gomez, 2013, p.173). The street traders also provide cheap goods of daily use and they are easily accessible as they conduct their business in strategic locations in the city. Thus, the vendors subsidise the goods to the urban working poor for whom the government of these developing cities often fails to provide (Bhowmik, 2010, p.12).

One frequent criticism about the informal mix of Asian cities is that unplanned and incremental growth of mix in residential areas negatively affects the neighbourhood environment (Ratnayake, 2015, p.54; Nahrin, 2008, p.39). Notably, the unplanned land-use conversion is breaking social cohesiveness, causing a lack of privacy and safety, inadequate provision of utility services, creating insufficient parking facilities, etc. (Nahrin, 2008, p.39; Raharjo, 2005, p.36; Ghosh, 2017, p.8). Regarding the consequences of social life, Nahrin (2008, p.45) stated that land-use conversion is changing the social character of residential areas. She explained that residential neighbourhoods in a city provide a sense of belonging among the residents and this feeling promotes social cohesiveness and increases social security. The growth of an informal mix of uses invites intruders into the area, and hence, reduces the sense of security. Additionally, any transformation of land-use from the planning zone has a substantial impact on urban settings. The sub-division pattern of land and plot density has a significant impact on the amount of infrastructure to be provided. Transformation of land-use from residential to an informal mix induces higher population density as the number of users increases for work and visit purposes. Further, the unplanned division of residential blocks for the development of an informal mix makes it difficult and costly to provide public services by concerned authorities, as these areas were not initially designed for such uses. This creates stress on the supply of power, water and gas, improper solid waste management and visual obstruction (Nahrin, 2008, pp.41-46; Shankar and Vidhya, 2013, p.678; Raharjo, 2005, p.36).

Further, due to the informal conversion of the residential functions into mixed-use, residential occupants of mixed-use buildings experience troubles due to frequent visitors, noise, parking shortage and so on (Ghosh, 2017, p.8). Noise nuisance created by home-based enterprises is one of the arguments used against them in that home-based enterprises can disturb the calmness of other residential functions in a mixed-use neighbourhood. Machinery use is an indicator of the noise nuisance generated by home-based enterprises. (Tipple, 2002, p.11) Hence, for all the reasons above-mentioned, Butt and Ratnayake (2012) and Raharjo (2005, p.36) noted that the increase of informal mixed-use functions in residential areas might undermine the residential character in different ways.

2.7 Theories

In this section, theories like assemblage, complex adaptive systems, resilience, and urban economics are reviewed to develop an understanding of the working process of informal mixes

in the city. Theories of assemblage and complex adaptive systems are useful as these theories explain how the different heterogeneous components interact between themselves and adapt to changing conditions to form a complex relationship. Informal mixes are also complex in the sense that they contain diverse components and actors, which shows autonomy involving multiple interactions. As of assemblage and complex systems, informal mixes work in multiple scales. The theory of urban economics is also useful in this study as it explains the locational choices and spatial distribution of different functions in an urban settlement based on economic preference and interest.

Assemblage Thinking and Urban Assemblage

The 'Assemblage' theory is based on the book 'A Thousand Plateaus' by Deleuze and Guattari (1987), which was eventually developed by De Landa (2006). The word 'Assemblage' is derived from the French word 'agencement' which means 'arrangement', 'fitting' or 'fixing' (Phillips, 2006, p.108) and the process of putting together a mix of relations (Dewsbury, 2011, p.150). Assemblage is defined as the grouping of heterogeneous elements that co-function within a territory across multiple scales (Deleuze and Guattari, 1987, p.323; De Landa, 2010; McFarlane, 2011; Wise, 2005, pp.78- 85; Dovey, 2012, p.375). According to Anderson and McFarlane (2011, p.124), assemblages can be composed of human/non-human, organic/inorganic and technical/natural elements.

According to De Landa (2006, pp.5-18), an 'assemblage' is a whole "whose properties emerge from interactions between parts". The characteristics of an assemblage cannot be reduced to its parts, as it is characterised by connections and capacities, rather than the properties of parts. The different parts of an assemblage are contingent, mixed, and composed (Dovey, 2009, p.16). Relationships of parts of any assemblage are dynamic; they can be displaced and replaced within and among other bodies.

De Landa (2005) further linked assemblage-thinking to 'multiplicity', since the concept of 'multiplicity' refers to the ways of change and the 'space of possibilities'. Deleuze and Guattari (1987, p.33) talked about two basic kinds of multiplicity - extensive and intensive. An 'extensive multiplicity' is where their spatial extension characterises the parts and the additions of new components do not have any impact on other parts. On the contrary, an 'intensive multiplicity' is where the additions of each new ingredient can change the system, as it involves into new multiple relationships with other constituent parts (Dovey and Pafka, 2019, p.12).

An assemblage can be conceptualised into two intersecting axes (Deleuze and Guattari, 1987; De Landa, 2006). The first axis holds the pole of materiality versus expression that relates material connections of bodies and spaces with the expression of meaning through propositions, language, and representation (Dovey, 2009, p.16). The second axis holds the pole of territorialisation–deterritorialisation, which refers to the degree to which an assemblage is stabilised or destabilised. Territorialisation is a stabilisation of an assemblage (Deleuze and Guattari, 1987; DeLanda, 2006) and is viewed as the ordering of the bodies that create the

'assemblage'. Within this ordering, assemblages are further characterised by the processes of deterritorialisation and reterritorialisation. Deterritorialisation is the process by which territories are eroded. Reterritorialisation means where new components 'enter' and new articulations are forged, thus constituting a new assemblage (Deleuze and Guattari, 1987; Dovey, 2009, p.17).

The assemblage theory provides a wider range of twofold conceptions - tree-like/rhizomatic, smooth/striated, network/hierarchy, etc. - that were coherent with each other all through the work of Deleuze and Guattari (1987). These twofold concepts cannot be perceived as separate, rather in consistent with each other in assemblages (Dovey, 2012, p.376). A tree-like structure is plain, hierarchic, stratified, and without interconnections between its parts. Conversely, rhizomatic structures are loosely structured and have interconnections between their parts. Hierarchical cities generate rigid and homogenised structures, while rhizomatic (network system) promotes interlocking, heterogeneous elements (De Landa, 1997). Therefore, rhizomatic structures contribute more to the generation of resilient and flexible assemblages (Kamalipour and Peimani, 2015, p.404). Further, while conceptualising the spaces, Deleuze and Guattari (1987) identified that spaces are of two kinds: smooth and striated. Smooth space is identified with instability, through which stable territories are erased and new identities and spatial practices become possible (Dovey, 2009, p.22). Thus, smooth space is heterogeneous and is not measurable (Deleuze and Guattari, 1987, p.362). By contrast, in striated spaces, identities and spatial practices have become stabilised in bounded territories (Dovey, 2009, p.21). Hence, striated space is homogeneous, has a geometric form and is more measurable (Deleuze and Guattari, 1987, p.362). However, smooth and striated places also exist as overlapped spaces. Dovey (2009, p.13-24) argues that the task for the place theory is to move from stabilised spaces towards places of becoming.

Regarding urban assemblage, Dovey has argued that all places are assemblages. For example, a street is a collection of buildings, trees, cars, sidewalks, goods, people, signs, etc., but "it is the assembled connections among them that are crucial" and make it an assemblage. Based on this consideration, all cities and parts of cities are assemblages (Dovey, 2012, p.375).

Resilience Thinking and Complex Adaptive System

Resilience is the ability of a system to absorb disturbance while retaining its basic structure. In other words, it is the capacity to change without crossing a threshold to a different system regime (Holling, 1973, p.14; Walker and Salt, 2006; Walker, et al., 2004, p.2). We are all part of social-ecological systems. Walker and Salt (2006, pp.11-37) labelled these systems as complex adaptive systems. Resilience is the key to sustainability in these systems, which understands their way of functioning as dynamic, non-linear, and complex adaptive systems. In a complex system, its constituent "parts are independent (unpredictable) and interdependent - the parts adapt to each other in unpredictable ways, they organise themselves and self-organise" (Dovey,

2012, p.377) Hence, these systems are bottom-up and have emergent behaviour, which demonstrates that the changes in one component can alter the configuration of the whole. Change, fast or slow, is one of the primary prerequisites for sustainability. Walker and Salt used the term, 'slow-key variable' to describe these types of slow changes of system that are not easy to determine.

Social-ecological systems put forward two central themes that support resilience thinking. One theme is the threshold. Social-ecological systems can exist in more than one kind of regime. If a system changes too much, it crosses a threshold into a different regime and begins behaving differently. It is called a 'regime shift'. The other theme is how social-ecological systems change over time. Social-ecological systems usually change through recurring cycles, consisting of four phases: rapid growth, conservation, release, and reorganisation. This is called an 'adaptive cycle'. Early in an adaptive cycle, any system is engaged in rapid growth as species or people exploit new opportunities. In time, the transition to the conservation phase proceeds incrementally, where connections between the actors increase, some of the actors change and new actors are able to be established. At this stage, growth rate slows as connectivity increases, the system becomes more rigid and resilience declines. Eventually, in the release phase, an external disturbance exceeds the system's resilience and breaks its reinforcing interactions apart. Consequently, resources are released, which leads to a phase of reorganisation where new groups may appear and seize control of an organisation. Ultimately, the beginning of a new rapid growth phase is marked by the appearance of a new attractor. However, the order of the adaptive cycle is not always followed to prevent a collapse in the system. The adaptive cycle has two loops: development and a release - reorganisation loop. A development loop is characterised by the accumulation of capital and stability, whereas, a release loop is characterised by uncertainty, novelty, and experimentation. The adaptive cycle is multi-scalar in both time and space and interlinked across scales. This quality of "the cross-scale and dynamic character of interactions between human and natural systems" is named 'panarchy' (Walker and Salt, 2006, pp.11-81).

Researchers and system theorists have pointed out principles, like diversity, redundancy, autonomy, interdependence, flexibility, and compartmentalisation that are necessary to make a system resilient. The presence of more variables in the system increases its ability to absorb various shocks. Thus, 'diversity' relates to flexibility and keeping options open (Walker and Salt, 2006, p.121). Diversity is also complemented by 'redundancy' which means 'multiple copies of one approach'. Redundancy ensures that the system continues to function when one component fails and prevents the whole system from collapsing. 'Autonomous' denotes the capability to operate independently from external control and 'Interdependent' means the ability of components to support each other. Additionally, every system should have 'flexibility and adaptability' to withstand any changes, and 'compartmentalisation' is necessary for any system

that contains various components to continue to function if others fail (Wardekker et al., 2010, p. 994; Godschalk, 2003, p. 139).

Urban Economics

In urban areas, every function tends to locate itself in the most convenient place to enjoy the most considerable advantage of its location. The discipline of 'urban economics' explores the location choices of different functions and their efficiencies in the city. Urban economics is defined by the intersection of geography and economics, where economics explores the choices that people make when resources are limited. According to the theory of urban economics, households make locational choices to maximise their utility, while offices, firms, shops, etc. maximise their profit (O'Sullivan, 2012, p.1). The fundamental argument of location theory asserts that access advantages of location appear as the primary determinant of urban land-use patterns. The basic principle governing the location, size, and shape of the site of economic activities is profit maximisation. The more accessible the site used, the higher the benefits and/or the lower the costs (Goodall, 1972, pp.83-85).

Retail is a significant element of mix and an essential means of attracting various markets. The theory of urban economics has given much importance to the locational aspects of retailing in the city. According to Goodall, the dependence of retail location on consumer access offers to retail the highest prices for sites with the most significant access advantages. Therefore, activities like retail, that demand access to the whole urban population, both as customers and as workers, compete for space in the urban centre. Frequently, retailing as the primary central activity forms a group with department stores, variety chain stores, specialist shops, etc. and occupies the ground floor of the whole district (Goodall, 1972, p.97-133). Moreover, location theory emphasises the clustering of functions in a location because such clustering encourages the growth of other businesses and attracts customers by providing a complete range of goods (Goodall, 1972, pp.82-139; Gehl, 1987; O'Sullivan, 2012, p.45). While explaining the relation of clustering with accessibility, Goodall states that 'the greater the degree of accessibility, the more opportunities for the specialist activities to come together' (Goodall, 1972, p.90).

Chapter-3: Research Methodology

3.1 Introduction

This chapter outlines the strategy and methodology of the research. It is structured into four parts. The first part states the research approach and explains the reasons for using this approach. The second part selects the research method and identifies the case study areas. The third part affirms different scales of the study and various attributes to analyse on each scale. The last part explains the different techniques used for data collection and analysis.

3.2 Research Strategy

This study applies a combination of qualitative and quantitative methods. According to Aliaga and Gunderson (2000), quantitative research involves "explaining phenomena by collecting numerical data that are analysed using mathematically based methods". The quantitative research aims to generalise the results from a large sample (Babbie, 2004). On the other hand, qualitative research focuses on a particular subject in detail (Myers, 2009). The qualitative research involves an interpretive, naturalistic approach to the world where "researchers study things in their natural settings, attempting to make sense of or interpret phenomena in terms of the meanings people bring to them" (Denzin and Lincoln, 2000, p.3). The combination of these two methods allows the researcher to answer qualitative and quantitative questions simultaneously and attempts to consider multiple viewpoints, perspectives, and positions (Opoku et al., 2016, p.35). Hence, this study follows a combination of these methods, as the exploration of the research questions demands the analysis of both numerical and textual data. For empirical investigations of the mix of uses, their associated morphological attributes in urban and building levels and the underlying forces of the growth of mix, the study follows qualitative enquiries involving case studies, a field survey, a photographic survey, and semi-structured interviews. The quantitative study involves the numerical data analysis regarding the number and area of the buildings, plots, urban blocks, and density within each study area to understand the transformation of the functional mix.

3.3 Case Study Research and Study Areas

This research follows 'Case Study' as a methodology. Yin (1984, p.23) defines Case Study Research as an empirical investigation that explores a current phenomenon within its real-life context and where multiple sources of evidence are used. Case Study Research is considered as a robust method when a holistic and in-depth investigation is requisite (Zainal, 2007, p.1). This method is useful, as it allows for both quantitative and qualitative analysis of data. It facilitates the clarification of the process and the result of an event through observation, reconstruction, and analysis of the cases under investigation (Tellis, 1997, p.4). Case Study Research is also essential because it allows generalisation using multiple cases, as the result of findings can lead to some form of replication (Noor, 2008, p.1603). This study intends to explore

the working process of informal mixed-use functions in diverse morphologies, both in urban and building levels. The number of empirical studies focused on this topic is minimal. Hence, the Case Study Research Method is vital to collect in-depth data and have a comprehensive understanding of the issue.

In this study, multiple sites of Dhaka have been chosen as case study areas. At present, Dhaka is dominated by informal economic activities (Rajdhani Unnayan Kartripakkha, 2015, p.38). In Dhaka Metropolitan Development Plan (DMDP) 1995-2015, Dhaka's land-use was identified as 'predominant mixed-use functions' including the mixed-use areas, along with areas with potential for future development as mixed-use (Rajdhani Unnayan Kartripakkha, 1997). However, functional mix has been embedded within the fabric of Dhaka since its inception (Ahsan, 1991, p.397). Over time, it grew informally in terms of the extent and nature of its functional complexity in different areas, including the Planned neighbourhoods. Informal mixes have always existed within the formal framework of the city. These mixes have emerged primarily to meet local demands. However, there are some concerns that the unplanned growth of mixes in residential areas has been affecting the quality of the environment and social life (Nahrin, 2008, p.39; Satu, 2014; Hafiz et al., 2016; Ahamed and Hasan, 2010, p.124). Hence, Dhaka offers a relevant case to study the process of informal mix and its co-existence with the formal system.

The criteria for the selection of the study areas in Dhaka are-

- Various patterns and levels (low-high) of informality
- Development of different historical periods
- Availability of data
- Range of diverse morphologies
- Range of different uses
- Different levels of a mix (low-high)

During the site selection process, a couple of options were considered, but only those sites that satisfy the above-mentioned criteria more fully have been selected for the study. These sites offer case-specific understanding of the interaction of different uses (live/work/visit). All these areas contain physical diversity in terms of the pattern and level of informality, level of mix, grain size and shape, urban interface, street network, and building density. These study areas represent three historical phases (pre-Colonial, Pakistan, Bangladesh) of the urban growth of Dhaka (Fig.3.1). Hence, these areas also provide the opportunity to reveal the morphological transformation process and its various dynamics, along with the development of mixed functions. The historical data necessary to study the physical evolution of these areas is also available from different secondary sources.

Three settlement patterns - informal (historical), a mix of formal/informal and formal layout - are evident in contemporary Dhaka (Nilufar, 2011). Hence, three areas from these patterns have been selected (Fig.3.1) to gain a comprehensive and comparative understanding of the

evolution of the functional mix and its morphology. These three study areas are-

- 1) Historic Core - Part of Islampur (pre-Colonial, i.e., pre-Mughal and Mughal period)
- 2) Semi-planned area - Part of Green Road (Pakistan period)
- 3) Planned area - Part of Sonargaon Janapath and Gareeb-e-Nawaz Avenue, Uttara (Bangladesh period)

The first study area (Fig. 3.1A) - Islampur - is a representative area of the Historic Core. It has been developed since 1600 as a mixed-use neighbourhood. Over time, the area has gradually increased and intensified in the mix. The main road of the area was a bazaar (market) street during the pre-colonial period (Ferdous, 2017, p.85). At present, diverse uses, like residences, retail, wholesale, offices, workshops, go-downs, and light industries, have developed, which offer a scope to understand their synergy. Along with its rich mix of functions, this area has a network of both wide and narrow winding streets, high-density development and a mix of a fine and coarse grain of urban blocks. This area also upholds a formal (building types and age) and social (different rents and incomes) mix.

The second study area (Fig. 3.1B) - Green Road - is an example of a Semi-planned neighbourhood. It has been developed since the 1960s as a middle-income residential area. Since the 1970s, various uses, like shops, workshops, and offices, have developed in this area and over time, it has progressively intensified in the mix. The current morphology features a spontaneously-developed mixed-use function with a combination of a wide and narrow street network and a mix of fine and coarse grain development. Like the Historic Core, this area also supports a formal and social mix.

The third study area (Fig. 3.1C) - Uttara (part of sector 13 and 11) - is a representative area of the Planned neighbourhood, developed recently (during the last quarter of the 20th Century) by the Government. Initially, the area had its regulatory policies and by-laws to control the land-use and density. However, the renewed building regulation¹ has shaped the morphology, in terms of the plot size and density. At present, Uttara is experiencing rapid growth, with a visible transformation from single to an informally developed mix of uses, like shops, cafes, restaurants, and offices. The current morphology demonstrates a rigid grid-iron pattern of street layout, combined with large oblong urban blocks and fine-grain development. This area has similar building types and age. However, it supports a social mix of different income groups.

3.4 Multi-scalar Analysis

Informal mix, as an assemblage and complex adaptive system, works in different scales. Hence, 'multi-scalar analysis' has been applied to comprehend the morphology and working process of the functional mix in different scales. Here, a multi-scalar analysis has been conducted at three scales - macro (city), meso (neighbourhood) and micro (building).

¹ In 2008, Floor Area Ratio (FAR) was first gazetted as a by-law in the renewed building regulation. Before that, the Building Construction Act 1952 and 1996 only provided regulations for building height and plot coverage for building construction.

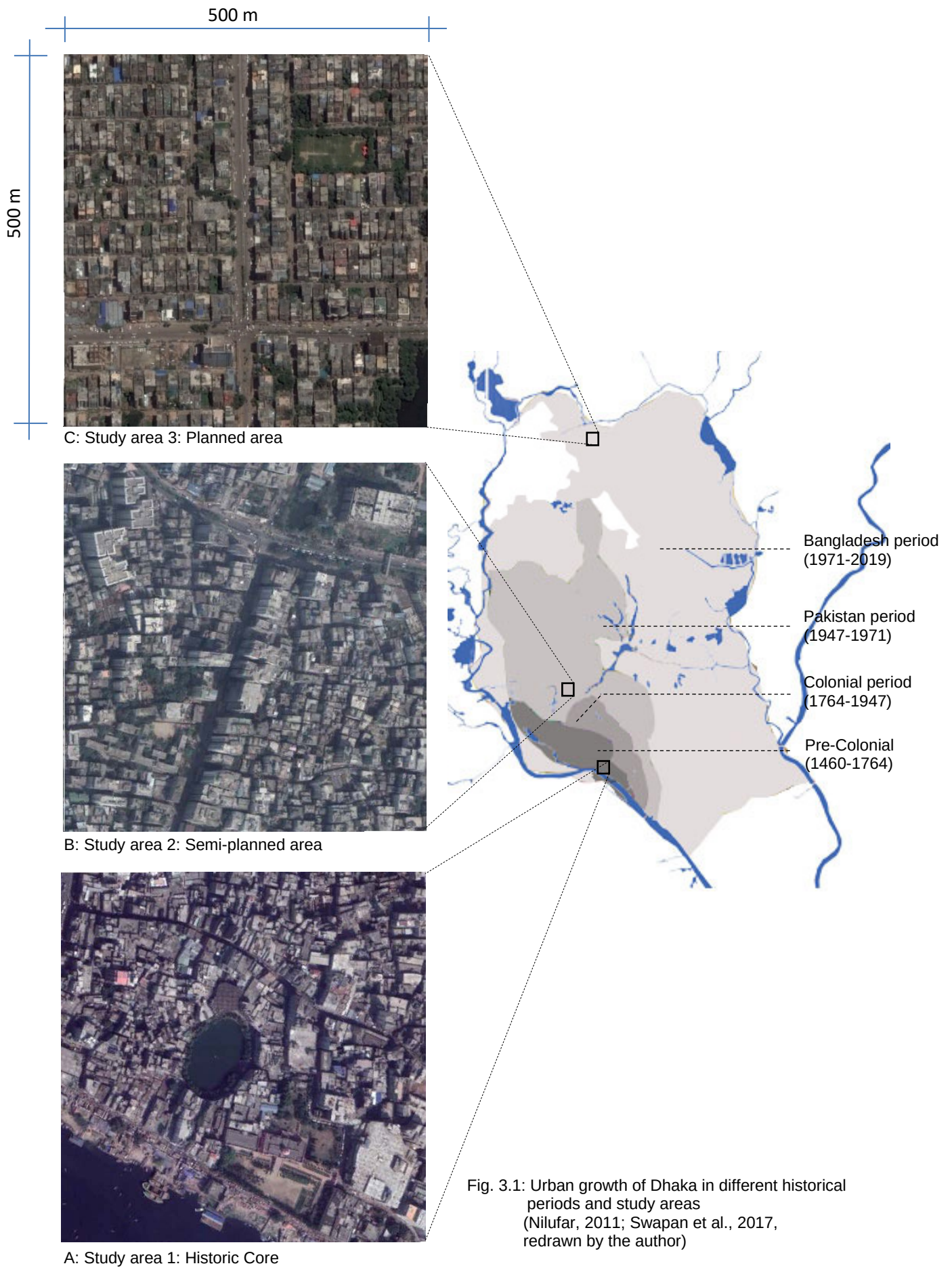


Fig. 3.1: Urban growth of Dhaka in different historical periods and study areas (Nilufar, 2011; Swapan et al., 2017, redrawn by the author)

At the city scale, this study reviews the literature to understand the chronological growth of mix in different historical periods and its governance. However, the empirical study and primary analysis focus on the mix of uses at neighbourhood and building scales.

At the neighbourhood scale, a 25 hectare - 500m x 500m area - has been selected to conduct the study (Fig.3.1). The 500m x 500m scale allows the visibility of individual parcels. Simultaneously, this scale is large enough to identify the general patterns and differences of the functional mix, connectivity, and density. This scale is also suitable for conducting the field survey within the time frame of the research. In this scale, attributes like functional mix, mix of uses at ground level, vertical extension of visit functions, informal street trading, plot size and shape, public-private interface, building entries, public space network, and density (building height, plot coverage and FAR), have been analysed to understand the related morphology and transformation of the functional mix.

At the building scale, 30 individual mixed-use buildings have been surveyed in detail (documentation of plans) to understand their morphology. These samples have been selected according to the different building types in terms of circulation systems from a full range within the three sites. In this scale, attributes like organisation, depth of various functions, and circulation pattern have been studied.

3.5 Data Collection and Analysis Techniques

Literature Review

A theoretical lens has guided the study for understanding the fundamental issues and for the formulation and exploration of the research question. One of the questions investigates the factors influencing the growth of an informal mix in Dhaka, which has been partly extracted from literature. The theoretical lens also focuses on the topics and theories, like functional mix, informality, urban and building morphology, informal mix in South Asian cities, historical development of the functional mix in Dhaka, assemblage theory, resilience, complex adaptive systems, and urban economics, to reveal the working process of the mix of uses.

Archival Research

This research investigates the morphological transformation of the study areas along with the development of the mix of uses. The study of transformation requires historical maps (Pinho and Oliveira, 2009). Hence, archival data sources, like Revenue Survey, Urban Area map and Tax Collection Records, are used to produce the historical base maps of the study areas. These archival sources have been collected from the Department of Land Records and Survey and the Dhaka City Corporation (DCC). Revenue Survey maps were produced during 1966-75 that include the area of the plot and the placement of the building within the plot. The Urban Area map (2003) is a GIS-based map and database containing the area of the plot, placement of the building on the plot and the building height. Tax Collection Records contain detailed information of all buildings in the neighbourhoods of Dhaka since 1988, in terms of their uses, number of

shops, offices, and apartments on each floor and building heights in different construction and extension phases. However, no updated land-use map is available for public use in relevant Government institutions. Hence, updated land-use maps (2003), produced by ARCH VIEW, have been collected from the database of the Department of Urban and Regional Planning (URP), Bangladesh University of Engineering and Technology (BUET).

To study the morphological transformation in the Historic Core and Semi-planned neighbourhood, the historical maps of 1988 and 2003 have been produced to compare with the existing map (2017). For the Planned area, no maps or data are available before 1999. To produce the historical maps of 1988/1999 and 2003, data from the Tax Collection Records has been superimposed with Revenue Survey map (1966-75) and Urban Area map (2003) respectively.

Field Survey

Before the field survey, a pilot survey was undertaken on an urban block (250m x 250m) in the city of Melbourne. The pilot survey was conducted to test the process of field survey and mapping. However, conditions of informality similar to Dhaka could not be tested in Melbourne.

A field survey has been undertaken at the neighbourhood scale (500 m x 500 m) to explore the variety of mix, the co-functioning between the mix of uses and its related morphological attributes in the study areas. This survey has recorded the functional aspects, such as vertical mix, mix at the ground level, vertical extension of visit functions and location of informal street traders. The morphological aspects, like plot size and shape, public-private interface, building entries, public space network and density (building height and plot coverage), have also been recorded. Throughout the fieldwork, the base maps (2003) were edited with the updated data collected from the survey. This survey was conducted between mid-July to November 2017 and was done in office hours (9 am- 5 pm) on weekdays.

Functional Mix Mapping in City Scale

"A map is a graphical representation of the spatial arrangement and distribution of a territory". In the urban study, mapping is used as a means through which researchers and professionals analyse various layers of urban data to get a thorough understanding of how the city works and how it might be transformed through planning and design (Dovey et al, 2017, pp.1-3). In this study, the mixed-use functions have been mapped in the metropolitan scale to comprehend their chronological growth over time in different areas of Dhaka. The information regarding the location of the functional mix in different historical periods (pre-Mughal, Mughal, British, Pakistan, Bangladesh) has been collected from secondary sources (literature and historical maps). The limitation of the historical land-use maps is that until 1995 most of the maps did not show the locations of the functional mix; instead; they identified the locations of retail, wholesale shopping, industries, and residences separately, in different neighbourhoods, along with other information. However, the reference literature has mentioned the locations of mixed-use functions in various historical periods. These locations have been interpreted with the historical

base maps to produce the historical growth maps of the functional mix of Dhaka. Though, these references do not cover the historical background of all areas. In this case, those areas, having no land-use information, are coded as 'no information' on the maps. The locations of the functional mix have been mapped through a coloured graphical representation. Primary road networks in various historical periods have also been indicated in these maps, to understand the linkage of the growth of the mix to the connectivity of the city.

Functional Mix Mapping in Neighbourhood Scale

The mix of uses at building and ground levels has been mapped in all study areas following the live/work/visit (LWV) triangular model developed by Dovey and Pafka (2017). This model offers a basis for a better understanding of different kinds of a mix in all types of urban morphologies. This framework is followed to map mix of uses, as this is more focused on the mix and flows between different urban functions. The live/work/visit framework used here differs from the method used by Dovey and Pafka (2017), in that the mix map focuses on the distinction between singular and mixed functions for each building instead of the particular proportion of mix within a building. In this mapping index, live, work and visit, as the primary urban functions, are presented by three primary colours (red, blue and green) with various forms of mixes between them (L/V-yellow, L/W-magenta, W/V-cyan), fading towards white for the mix of all three functions (Dovey and Pafka, 2017, p.255).

In the process of mapping, the plots containing single and mixed-use functions are coded with the specified colours mentioned above. The number of plots containing live, work, visit, and mixed functions are mathematically analysed, and these data of different historical periods have been compared to understand the transformation of the mix in the study areas. Apart from the mix of uses, other functional aspects, like a vertical extension of visit functions and informal street traders, have also been mapped, considering their intensity and significance in the study areas. Vertical extension of visit functions and informal traders have been mapped through colour graphical representation. All these maps have been produced for the years of 1988/1999, 2003 and 2017.

Morphological Mapping

Apart from the functional mix, other morphological maps that have been produced, based on the historical data and field survey, are plot size, public space network, building height, coverage, and floor area ratio (FAR). These attributes to analyse urban form have been identified from the literature review. All these maps are produced for the years of 1988/1999, 2003 and 2017. Historical data regarding the public-private interfaces and building entries are not available from any source. Hence, these maps are structured only on the field survey data. All these maps have been produced through colour graphical representation with AutoCAD and Photoshop. From these maps, the data regarding the number and area of plots and buildings, urban blocks, building height, coverage, and FAR have been mathematically analysed to understand the current pattern and transformation of the study areas, along with the development of the mix.

The public-private interface has been mapped following the interface categories developed by Dovey and Wood (2015). These categories are - blank/impermeable, direct/opaque, direct/transparent, pedestrian setback and car setback. However, the title of 'car setback' has been edited as 'mixed (car/pedestrian)', since the public-private interfaces which are designed for the access of cars are also used by pedestrians in the study areas.

Along with mapping the public space network, this study has also measured the permeability of the study areas, which is vital for understanding the synergies and alliances between attractions. Better permeability is crucial for maintaining local businesses in urban areas. Several measures have been suggested by researchers like Weicher (1973), Schmidt (1977), Fowler (1987), Stangl (2015), Pont and Haupt (2010), Jacobs (1993), Peponis, Bafna, and Zhang (2008), to measure the permeability. In this study, 'Area weighted average perimeter' (AwaP) has been used for measuring the permeability of all urban blocks. Pafka and Dovey (2017) have suggested this improved metric for measuring the permeability. They have pointed out some shortcomings with using measures based on block area, perimeter, diagonal or numbers of blocks mentioned by other researchers. They have also argued for the limitations of using street length or a number of intersections. 'Area weighted average perimeter' (AwaP) incorporates both street width and block size (Pafka and Dovey, 2017, p.152). In this process, the perimeter of each block is multiplied by its area and the average is then calculated. This method registers the effect of both block area and perimeter, ensuring that the impact of a large impermeable block is not lost in the average. In algebraic terms, the measure of permeability can be represented as follows -

$$\text{AwaP} = \sum_{i=1}^n P_i \times A_i / A_T$$

where n is the number of blocks, P_i and A_i are the perimeter and area of each block 'i', and A_T is the total area of all blocks.

Photographic Survey

Photographic surveys have been carried out to convey information of the diverse mix, location of informal street traders, vertical extension of visit functions, public-private interface, building entries, building height, coverage, and organisation of functions within the mixed-use buildings. 20-76 photographs have been taken in different streets in each case study area, depending on the variety of mixes, their diverse morphologies, and various informal traders. The photographic survey has been implemented in office hours (9 am - 5 pm) on weekdays. Inclement weather such as rain, which is frequent in the study region, has been avoided. The challenge with this survey was that in the Historic Core, some of the inner lanes are very narrow. In such cases, the full height of the buildings often cannot be captured in photographs.

Survey of Mixed-use Buildings and Syntactic Analysis

A detailed survey of 30 buildings (10 from each area) has been conducted through the documentation of building plans during August-November 2017. The objective of the survey

was to collect data regarding the different uses on each floor and the circulation patterns to explore the research question of how different functions are organised in mixed-use buildings. These buildings were selected, depending on the different typologies in terms of circulation systems within the study areas. Prior to the survey, each building owner gave their consent.

The floor plans of the mixed-use buildings were drawn during the field survey. These drawings were later digitised through AutoCAD and Photoshop. These building plans were analysed through syntactic diagrams known as 'justified gamma maps'. A 'justified access graph' or 'justified gamma diagram' is one of the analytical methods of 'Space Syntax' ² analysis developed by Hillier and Hanson (1984) to study the relationships between various spaces in a layout plan. In this process, architecturally-defined spaces are translated into a series of topological diagrams that are mathematically analysed and then interpreted in terms of their architectural, urban, social or spatial characteristics (Ostwald, 2011, p.445).

This study explores the organisation of different uses and the circulation pattern of mixed-use buildings. Hence, it is vital to understand the location of different functions in different depths of buildings. 'Justified gamma diagram' is applied as in this diagram, the major spatial segments of the buildings are organised according to their depth from the street, following the notion of space syntax. Thus, which types of functions are organised at different depths and the way they are organised can be identified from the diagram. It also presents the connection of the different spaces to each other from the street level upwards, from where the circulation pattern (single or mixed circulation) of the building can be identified.

The process of the structuring of gamma diagrams has been briefly illustrated here with a building plan collected from Hillier and Hanson [1984] (Fig 3.2 A). In this process, every space

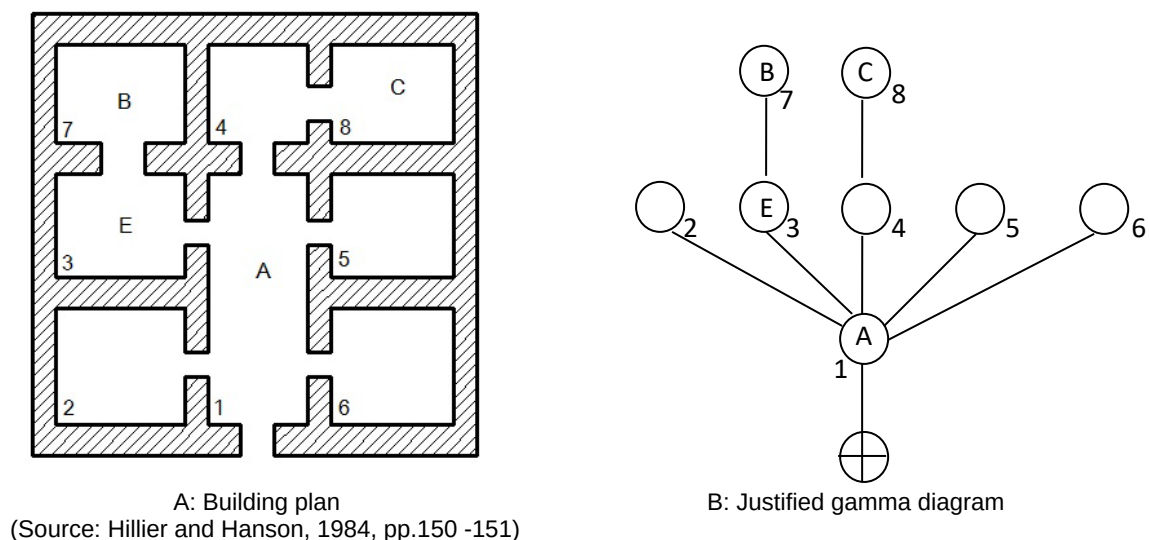


Fig. 3.2. Building plan and justified gamma diagram

² 'Space Syntax' developed in the early 1980s, is the collection of several theories, tools or techniques that depict connections between spatial configurations and social effects (Hillier and Hanson, 1984). This analysis can be done in both the urban and building scale.

in a building is allocated a depth value, according to the minimum number of steps that must be taken to arrive in that space from the street, where a step is defined as a movement from one space to another (Fig 3.2 B). Justified gamma diagrams reduce a set of interconnected rooms to standardised drawings in which different spaces of a floor plan are represented by circles and permeabilities by lines. In these diagrams, all spaces of the same depth are lined up horizontally above the carrier, with the lines representing direct permeabilities between the spaces (Hillier and Hanson, 1984, p.147-149). By justification, it is meant that all points of a certain depth have been positioned on the same horizontal line, with subsequent depth values or lines parallel to the first. In this diagram, the depth of each space is calculated from the street. A gamma diagram does not differentiate between large or small or high or low spaces in a building. It only records the existence of a defined space, called a node. The nature of the link (door/opening) is not recorded on the diagram; only the connections between the different spaces are drawn (Ostwald, 2011, p.450).

The study of the depth of shops is crucial in mixed-use buildings, as commercial functions like shops need to have good accessibility and permeability for their business. Therefore, throughout the structuring of gamma diagrams, each shop of the mixed-use buildings has been identified as a separate space (node). Usually, the residences and offices have several interior divisions. Understanding the syntactic properties of these divisions does not come within the scope of this study. Therefore, each residence and office has been identified as a single node.

In the gamma diagrams, the identification of the number and type of building entries is important, as the diagrams start with the entries. Two types of entries are evident in the mixed-use buildings. Type one is the main entrance to the building that may be mixed (shared) or single-use. Type two is the separate direct entries to the street-side shops and offices. In order to relate the buildings with respective gamma diagrams, both types of entries are demarcated in the building plans.

Supplementary Semi-structured Interview and Content Analysis

An interview is defined "as a conversation with a purpose that allows the researcher to gain insight into the interviewee's account of their experience, perceptions, and circumstances in relation to the specified research questions the interview is addressing" (Opoku et al., 2016, p.43). In this research, a supplementary semi-structured interview has been chosen as the means to explore the queries. Semi-structured interview allows the interviewer to cover a wide range of subject matter using a series of questions, and it can be modified, based on the interviewer's perception of what seems to be appropriate (Hasbollah and Baldry. 2016, p.99).

Supplementary semi-structured interviews have been conducted with 30 participants. 15 were stakeholders, including architects, planners, academicians, urban critics, and people related to city governance (3 from each type). The remaining 15 were local people, including house

owners, shop/office owners, and shop/office workers from the three study areas (5 from each area). Before the interviews with the professionals, academicians, and urban critics, appointments had been fixed to avoid time lags and a plain language statement and interview questions were emailed to them for their preparation. In this case, the selection of each interviewee was pre-determined. The structure of the supplementary interview consisted of several open-ended questions (Appendix A). All professionals and academicians were asked the same questions. They were asked to state their perception regarding the extensive growth of the mix of uses, the advantages and disadvantages of the mix, the forces accountable for the growth of the mix, and the consideration of the mix in the past master plans of Dhaka. These questions aimed to understand the issues related to the growth of the mix of uses, the forces behind the growth, and governance of the informal mix in Dhaka.

For the local people, the strategy was to interview those living and working in the mixed-use buildings selected for the detailed survey. However, a few other locals who agreed to take part were also interviewed. During the interview, these participants were asked about the respective mixed-use buildings, where they reside or work. They were asked about the transformation of the mixed-use building from its previous use, the formal process of change of occupancy, and governance of the mix of uses. The prime intention was to understand the governance of the informal mix in different study areas and the role of the various actors in this process.

All the interviews were audio-recorded, transcribed and conducted at the participant's choice of location and time between August to December 2017. These interviews were mostly conducted in the local language (*Bengali*) and later translated into English for the analysis. The duration of the interviews with the professionals and academicians was from thirty minutes to one hour. Interviews with the local people were from five to fifteen minutes.

The information collected from the interviews has been evaluated through 'content analysis'. Content analysis is a systematic technique to collect valid inferences from written texts and recorded communications into content categories or codes, which can be words, concepts, themes, phrases or sentences. This is useful for data analysis as it facilitates the arrival at a manageable and meaningful set of data (Hasbollah and Baldry, 2016, p.100; Kulatunga, et al., 2007, p.501). In this study, interview typescripts have been assessed through the word-based content analysis to find out the factors influencing the growth of the informal mix. The word-based analysis involves counting the frequency of words in the interview typescripts. This approach has been selected, considering the words mentioned the most indicate important concerns. In this process, the meaning of 'interview texts' is usually condensed into 'categories' or 'codes'. For this study, 'inductive codes' that have emerged from the interview texts themselves are used (Kulatunga, et al., 2007, pp.502-503).

'Nvivo' software has been used to count the frequency of words from the interview typescripts. From the analysis, 12 key categories have been extracted as the factors motivating the growth

of the mix in Dhaka. These categories are 'economic demand', 'land price', 'lack of community facilities', 'proximity to services', 'attitude', 'demographic growth', 'unemployment', 'rise of the middle-class', 'weak administrative and monitoring system', 'frail transportation system', 'political and planning decision', and 'violation of regulations'. These categories have been explained in Chapter 4 to reveal the motivations in detail.

Chapter-4: Dhaka

4.1 Introduction

The focus of this chapter is to understand the functional mix of Dhaka in terms of its chronological development, regulatory framework and the forces influencing its growth in the city. This chapter has been structured into three parts. The first part describes the development of a functional mix over time to reveal its sequential growth pattern in the city. This part also describes the morphological features of different areas (Historic Core, Semi-planned and Planned areas) that contained the functional mix in different historical periods. The second part discusses the regulatory framework. The last part explains the forces that influence the growth of the informal mix in Dhaka. Along with the literature, the information in the second and last parts is also based on supplementary semi-structured interviews.

4.2 Historic Development of Functional Mix

This section discusses the development of the functional mix over time in Dhaka. The information regarding the historical development of mix has been collected from literature and historical maps, as stated in the methodology chapter. In these reference sources, the development of urban functions has been discussed in terms of different historical periods - pre-Mughal, Mughal, East India Company Rules and British, Pakistan and Bangladesh. The same format has been used to discuss the chronological growth of mix.

Pre-Mughal Period (1460-1607) - In the pre-Mughal reign, Dhaka was a small trading centre. Dhaka developed spontaneously on the bank of the Buriganga River and the city was confined between the river and Dulai Khal (Canal). In this period, there was no separately marked land-use pattern as various crafts and trader communities lived in different areas where they worked and sold their products within the same housing unit (Islam and Adnan, 2011, p.278; Karim, 1994, p.74, Hossain, 2013, p.422). Thus, the spontaneous development of mixed-use settlements to the north of the river was evident during this period [Fig. 4.1 A] (Ahsan, 1991, p.397; Chowdhury and Faruqui, 1991, p.45; Khatun, 1991, p.636). The main business areas containing shops and workshops were also established along the south of the city (Ahsan, 1991, p.397). According to Ahsan (1991, p.396), situated on stable soil, above the highest flood levels of the surrounding rivers and commanding ten strategic short-cuts of water routes from the river Brahmaputra to the Ganges, Dhaka has been suitable as a trade centre since the inception.

The morphology of pre-Mughal Dhaka was informal by nature and this still exists. The pattern that persisted in the old city was its winding and intricate street network, with walls defining the houses. The streets were narrow and continuously twisted. However, a few long lines passing through the residential areas were also evident. These were mainly commercial interfaces (bazaar streets). Such areas had no lanes and by-lanes as the accesses were from single

bazaar streets. These streets were defined by closely spaced buildings in contrast to the earlier pattern where buildings were loosely spaced. Thus, two distinct patterns existed in the old city (Nilufar, 2011, p.189).

Mughal Period (1608-1764) - In the Mughal period, Dhaka flourished as an important manufacturing town and rose to prominence, as it became the capital of Mughal Bengal (Ahmed, 1986, p.11; Nilufar, 2011, p.195). In the early stages, a sudden influx of a large number of Mughal soldiers instigated the development of commercial activities in the city (Ahsan, 1991, 398). During this time, Dhaka developed freely with a mixed land-use pattern. The city's economic life was based on handicraft industries that were organised on a household basis. Like the pre-Mughal reign, the similar occupational groups (weaver, bangle maker, carpenter, blacksmith, gold and silversmith, potter, butcher, etc.) used to live in clusters in different *mohallas* (neighbourhoods). The same house was used for the industry and/or a shop as well as the residence (Mohsin, 1991, p.65; Imamuddin, et al. 1989, p.42; Ahsan, 1991, p.398). Later, along with the expansion of the city towards the west, east and north, the mixed-use settlements also extended towards the northern, eastern and north-western parts [Fig. 4.1 B] (Mohsin, 1991, p.65; Ahsan, 1991; Karim, 1991; Chowdhury and Faruqui, 1991; Nilufar, 2011, p.195).

In this period, the Buriganga riverfront areas and the western end of the city were also transformed into commercial areas, containing shops, workshops, and industries (Ahsan, 1991, p.398; Chowdhury and Faruqui, 1991, p.48). Simultaneously, some European trading companies established their factories to the northern outskirts of the city, where there was a sizeable settlement of the local population (Chowdhury and Faruqui, 1991, p.50; Ahmed and Mohaya, 2013, p.307). These factories sustained their existence during the next century also. Throughout the Mughal reign, the similar pattern of pre-Mughal Dhaka continued to the extended parts of the city with the narrow and winding streets, not following any particular plan (Chowdhury and Faruqui, 1991, p.48).

East India Company Rules and British Period (1764-1947) - With the fall of the Mughal reign, Dhaka faced a severe decline in its economy, population, and administrative significance, which caused a subsequent contraction of the urban area. In 1764, an English trading company - the East India Company - attained political domination and took control of the city. The old Mughal city did not expand during this period and in the British reign (1858-1946), it was mostly concentrated as mixed functions, following no definite plan (Nilufar, 2011, p.197). The British laid out the colony formally in confined areas at the outer (northern) fringe of the old city.

At that time, the mixed-use settlements were extended towards the north and north-west of the old city [Fig. 4.1 C] (Ahsan, 1991, pp. 401-402; Ahmed, 1986, p. 115; Hasan, 2008, p.269). Most of the commercial activities, central and provincial offices were carried out near the spatial centre of the city. At the end of this era, these commercial areas were extended towards the

north to serve the British bureaucrats who lived in the new part of Dhaka (Ahsan, 1991, p.402; Nilufar, 2011). In 1885, the grid pattern of roads was first introduced along the east of the old city as planned residential neighbourhoods (Nilufar, 2011).

During this reign, the Colonial building culture did not have a significant impact on the compact and dense urban settlement of the old city. Conversely, a general grid pattern with broad traversing streets and rectangular blocks was evident in the new residential neighbourhoods established by the British. These settlements were characterised by low-density and horizontal development (Nilufar, 1997).

Pakistan (1947-1971) - In 1947, Dhaka attained the status of the provincial capital of East Pakistan and new growth of the city began. During this period, administrative, commercial and residential needs caused an influx of people to Dhaka, which further resulted in immense growth - mainly towards the north (Nilufar, 2011, p.202). No significant development of mixed-use settlements was evident during this period. In 1956, the then government founded the Dacca (previous pronunciation of Dhaka) Improvement Trust (DIT), which planned several single functional areas in the city. Up to 1965, the DIT developed various solely planned residential projects, along with industrial districts and market centres in the west, north-west and north-east parts [Fig. 4.1 D]. These residential areas were planned following the western concept of land-use segregation (Chowdhury and Faruqui, 1991, p.59; Ahmed and Mohuya, 2013, p.307; Nilufar, 2011, p.202). At the end of this period, several residential settlements also developed in the north-eastern and north-western parts, without following any formal planning.

In the 1960s, central business districts (CBD) of new Dhaka, containing diverse shops and offices, were established along the east, but traditional business centres remained closer to the spatial centre of the old city. A typical characteristic of this traditional business centre was the mixing of business and residences in the same place, while the CBD in new Dhaka was totally devoid of residential population [Fig. 4.1 D]. Thus, two commercial centres were developed in the city with distinct characteristics - the indigenous and the modern centre (Ahsan, 1991, p. 402).

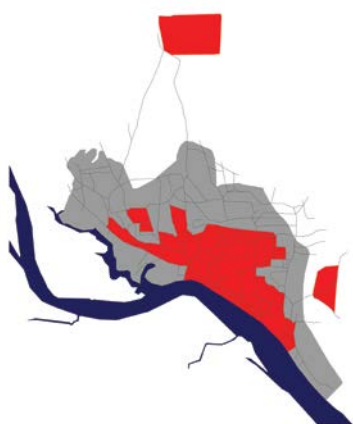
The morphology of the Semi-planned areas of new Dhaka that developed in this period still exists. These areas feature the mixture of winding lanes, by-lanes and cul-de-sacs like the Historic Core. However, the lanes are wider and simpler than in the old city. These areas appear like the representations of traditional urban development with a modern backdrop. However, the primary roads of these areas followed the proposals of the Master Plan of 1959 and hence, appear as longer and wider lines in the urban fabric (Nilufar, 2011, p.192). In contrast, the morphology of the Planned residential areas that developed in this time follows a gridiron pattern of the street layout with a few semicircular arcs. According to Nilufar (2011, p.192), "the high space, service standards and physical designs of these Planned schemes have an aura of Western suburbia, modernity, and status".



A: Pre-Mughal period (1460-1607)



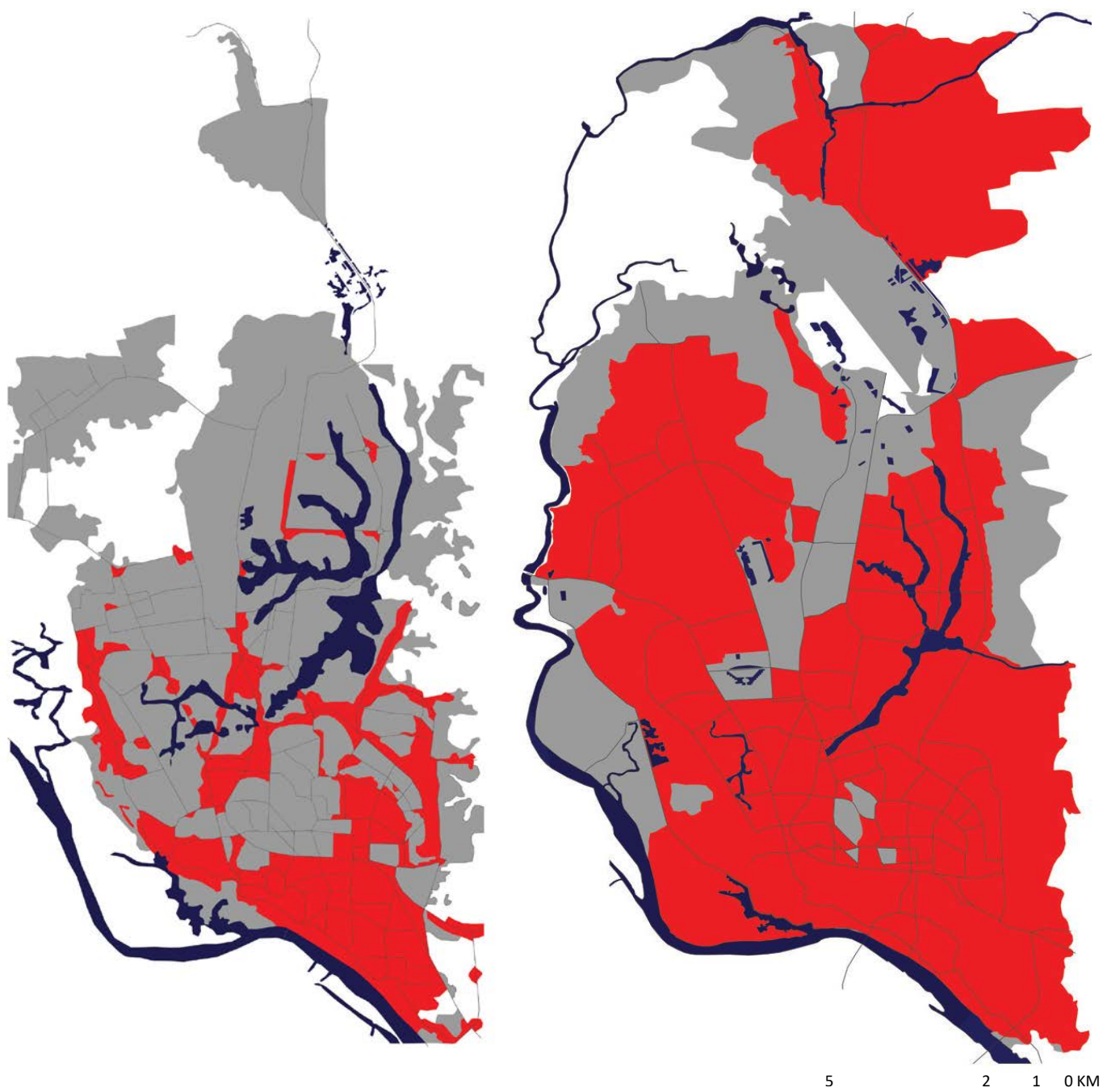
B: Mughal period (1608-1764)



C: East India Company rules and British period (1765-1946)



D: Pakistan period (1947-1970)



E: Bangladesh period (1975)

F: Bangladesh period (1995-2015)

LEGEND

- Mixed-use areas
- Single function areas (live or work or visit)
- Water body (river, lake)
- No information

Fig 4.1: Chronological growth of functional mix in Dhaka

Bangladesh Period (1971-2019) - In 1971, Dhaka became the capital of a new nation, Bangladesh. The city emerged as the most important centre of all national activities including trade and commerce (Hossain, 2014b, p.69). It grew northwards through the expansion of several residential areas, mainly due to rapid population growth (Ahmed and Mohuya, 2013, 309). At this time, the growth of retail was evident in the Unplanned and Semi-planned residential areas towards the strategic centre of the city, and along the east, west, and north [Fig. 4.1 E] (Ahsan, 1991; Nilufar, 2011, p.204). In these areas, shops were growing mainly along the principal nodes and major roads and most buildings were designed to accommodate shops at ground level (Ahsan, 1991, p.407).

During this period, small shops and other facilities also began to grow in the Planned residential neighbourhoods, by influential, business-minded and/or concerned people, to cater for the daily needs of the increasing number of residents (Hafiz et al., 2016, p.54). Thus, the middle and upper-income Planned residential areas located in the north, north-east, and north-west, were turned into mixed-use functions [Fig. 4.1 E]. At this time, individual landowners also exploited their plot-holdings by attracting foreign institutes and private companies on short-term leases (Zaman and Lau, 2000, p.147). Over time, the commercial success of these small-scale endeavours influenced the intrusion of large-scale shopping malls, offices, and factories within these residential neighbourhoods (Islam, 1996, pp.33-36; Hafiz et al., 2016, p.54). Subsequently, informal shops also penetrated the local streets of residential areas, behind the main road front shops (Ahsan, 1991, p.407; Islam and Shafi, 2010, p.85). The lack of supporting community facilities and economic demand influenced spontaneous development of mixed-use functions in these Planned areas (Islam, 1996, p.33; Haque and Asami, 2014, p.63).

In the 1990s, new pockets of government institutions and shopping activities were dispersed from the CBDs towards the north, primarily along the major roads (Ahsan, 1991, p.412; Farida, 2011, p.204). Soon after, the second CBD of new Dhaka was developed, close to the spatial centre of the city. The use of land for offices and factories also increased throughout the city, due to the growth of government offices, NGO, garment industries, private activities, and small and medium-sized enterprises (SMEs) (Ahmed and Mohuya, 2013, p.310). During this time, Dhaka was working like a polycentric city, where economic functions clustered in several interacting centres of activity (Ahsan, 1991, p.413). At the end of the 1990s, the major part of the city was functionally mixed [Fig. 4.1 F]. The 1995-2015 Structural Plan identified the city's land use as 'predominant mixed-use functions' (Rajdhani Unnayan Kartripakkha, 1997).

4.3 Regulatory Framework

The government institutions like the Planning Authority (RAJUK) and Dhaka City Corporation, manage the mixed-use functions in Dhaka. In response to the practice of 'self-regulated development' from residential to mixed-use, since the mid-1990s, the Planning Authority has declared several major roads of the residential areas as 'commercial' and amended the building by-laws several times to accommodate the changes. Official sources claimed that the intention

was to restrict the penetration of the informal mixes into the local streets of the residential neighbourhoods and to 'save' the residential character of these areas (Haque and Asami, 2014, p.63). Interviews with the Planning Authority officials clarified that functions like shops and offices are only allowed with residences along the depth of a single plot on both sides of these 'commercial' roads. However, there are no guidelines provided regarding the vertical extension of the non-residential functions for mixed-use buildings along these roads. The Planning Authority is responsible for collecting the land-use conversion fees of the plots along these 'commercial' roads. The Authority also monitors informal land-use transformations across the city and has the power to demolish any unauthorised construction in the buildings. Dhaka City Corporation governs both the formal (located on 'commercial' declared roads) and an informal mix of uses by collecting a yearly tax from them. However, the majority of these uses are not formally recognised. The City Corporation also has the authority to evict vendors from the streets. Furthermore, in different areas of Dhaka, several informal bodies and local individuals govern the mixed-use functions which have been elaborated in the case study chapters.

Regarding the growth of an informal mix in the residential areas, a criticism of the Planning Authority is that the original plans of the residential projects had drawbacks. There was no provision for supporting neighbourhood facilities, like shops, cafes, and hospitals in these neighbourhoods. Except for schools and mosques, any other non-residential use was officially banned. Also, the housing development in Dhaka often follows an informal 'incremental development' model, where housing, along with supporting facilities is developed in various steps by adding a 'little more' each time. This phenomenon leads to the violation of building by-laws (Swapan et al., 2017).

So far, the disinterest of the Planning Authority in regulating the informal mixes of Dhaka is evident. Until 2008, the authority did not prepare any building policies to regulate different urban functions. The Building Construction Act 1952 and 1996 only provided regulations for building height and plot coverage for building construction. The renewed building regulation (2008) does not have separate policies to regulate mixed-use buildings. The regulation states that in the case of residences mixed with commercial functions (office, shops, market), the FAR and plot coverage of residential uses will be applicable (Rajdhani Unnayan Kartripakkha, 2008, P.48). On the other hand, for the mixes of offices and shops or markets, the FAR and plot coverage of commercial uses will apply. Thus, the renewed building by-law has not offered any extra benefit to the mixes of residential and commercial functions, and in some ways, has discouraged the growth of these mixes in residential areas. However, the building regulations clarify that in the case of any informally transformed land-use and any kind of change in the building from its original plan (submitted for building plan approval), the building construction authorisation will be cancelled or put on hold (Rajdhani Unnayan Kartripakkha, 2008, Clause 29.2.iv, P.22). But the implementation of the building regulation is also criticised for not being strict enough (Zaman and Lau, 2000, p.145)

The violation of the building by-law is common in Dhaka. Nahrin (2008,p.39) noted that the transformations of land-use do not always conform to the obligatory tools prepared by the Planning Authority. Along with the Unplanned and Semi-planned areas, this infringement pattern is also predominant in the Planned residential areas developed by the Planning Authority. Mahmud (2007, p.6) identified that violations of the building codes in Dhaka are conducted mainly into four kinds: 1. land-use, 2. the distance between the building and adjacent road, 3. building height and 4. building setback. Generally, these violations occur at the stage of building construction (Mahmud, 2007, p.6). In the majority of cases, the Planning Authority does not monitor these violations in the field. Consequently, the Authority has failed to stop the informal land-use changes as the concentration of the informal mix is high at present and these functions are useful for the local people. Even the occasional demolition operations in certain areas have had little impact on the process (Islam, 1996, p.37), though, the scale of demolition varies in different areas. Mostly, demolition operations are limited to the unauthorised mixed-use functions on the building setbacks and/or unauthorised shops in public places.

Another problem with the planning and development of Dhaka lies in its institutional structure (Zaman and Lau, 2000, p.150). The involvement of multiple organisations in the urban development process results in overlapping and a lack of coordination in decision-making, planning, and implementation and maintenance activities. Also, urban development organisations are often criticised for being more concerned with administrative interests than with local considerations. These organisations are virtually independent of each other even though they may be under a single ministry. This leads to duplication of efforts and sub-division of responsibilities so no one unit is wholly responsible for any area of development (Jahan, 2011, p.149).

A number of master plans have been proposed for Dhaka since the beginning of the twentieth century. Mixed-use functions have been the norm in the development of Dhaka since its inception. However, the significance of the functional mix was not acknowledged in the master plans until soon after 1995. The first master plan was proposed by Sir Patrick Geddes in 1917. The focus of his plan was on the development of the city transportation system. This plan was never implemented (Jahan, 2011, p.142). The second master plan was proposed in 1959. In this plan, the principle of segregated land-use planning for all new developments was proposed, with the provision of municipal facilities. Two of the critical assumptions on which the Master Plan of 1959 relied heavily were proven to be wrong. First, the population growth rate was assumed to be much lower than it turned out to be. Second, it was assumed that the expansion of the city would take place at the existing densities (of the 1950s), while extreme intensification was evident in the subsequent years. Eventually, the increased population growth, unexpected expansion of the city and changing physical, economic, social and environmental changes made the 1959 Master Plan outdated and ineffective as a tool of development control (Jahan, 2011, p.143). In 1981, the Dhaka Metropolitan Area Integrated Urban Development Plan (DMAIUDP) was proposed. This plan evolved from the severe stormwater drainage and flood

problems of Dhaka and its purpose was to provide a long-term strategy for urban expansion. However, the proposal for this plan could not be implemented because of the consequent lack of commitment (Zaman and Lau, 2000, p.144).

The first gazetted development plan of Dhaka [Dhaka Metropolitan Development Plan (DMDP) 1995-2015] was prepared in 1995. The DMDP consisted of three components - a Structure Plan, an Urban Area Plan and Detailed Area Plans (Zaman and Lau, 2000, p.145). The Structure Plan consisted of a long-term strategy (for 20 years) for the development of metropolitan Dhaka. This plan identified the direction of expected urban growth and formulated a set of policies to achieve the overall plan objectives. The 1995 Urban Area Plan consisted of a mid-term strategy (for 10 years) for the development of urban areas within the Planning Authority's administrative area. This plan involved a concentrated and mixed land-use development strategy. In this Urban Area Plan 1995-2015, the land-use of the whole of Dhaka has been identified as 'predominant mixed-use functions', including existing mixed-use areas, along with areas that have the potential for future development as mixed-use (Appendix B). Finally, Detailed Area Plans referred to more detailed planning proposals for particular sub-areas of the city with a priority because of urgent problems, or in the process of rapid change. A major criticism of DMDP is that its implementation suffered a setback, as the Detailed Area Plan could not be prepared in 12 years after the adoption of the DMDP. This hindered the development strategy of the specific areas of Dhaka as planned by the Planning Authority (Jahan, 2011, p.151).

In recent times, the Dhaka Structural Plan 2016-2035 was proposed by the Planning Authority but it is not gazetted yet. The objective of this plan is to review the DMDP 1995-2015 and propose a revised and updated strategic plan for Dhaka. Interestingly, in this Structural Plan (pp.60-61) (Appendix C), only 0.59% of the area of the city has been identified as mixed-use, which contradicts the DMDP 1995-2015 plan. In the Structural Plan 2016-2035, only the current first CBD and some parts of the Historic Core have been identified as mixed-use areas. In the DMDP 1995-2015, the informal mix was mapped by the Planning Authority, however, perhaps the Authority was apathetic about further acknowledging mixed-use functions for their informal status. Consequently, the locations of the informal mixes were not presented in the Structural Plan 2016-2035. There are other criticisms regarding this new structural plan. During the semi-structured interviews, some planners and architects argued that the nature and quantity of the mix in every mixed-use building of both residential and non-residential (CBDs) areas should be defined in the form of strategy in the Detail Area Plan 2016-2035, which is not developed yet. This will state how much and what type of mixes (compatible) ought to be in the mixed-use buildings of the residential and non-residential areas of the city.

In March 2019, a decision was made by the Planning Authority that there will be no separate residential and commercial zones in Dhaka. Considering the large growth of informal mixed-use functions in the entire city, all of Dhaka will be recognised as mixed-use from now on. However, the location of industries and shopping malls will be specified within designated places in the

city. According to the Planning Authority, they will present the actual land-use of Dhaka in the Detail Area Plan 2016-2035 in the future (Shafiq, 2019).

4.4 Factors Influencing the Growth of Informal Mix

The semi-structured interviews and literature reveal a broad range of factors motivating the growth of an informal mix in Dhaka.

'Economic demand' has been identified as the primary motive for the growth of informal mixes by the majority of interviewees (8 out of 15). For the last few decades, the price of commercial spaces has increased by almost double that of residential spaces in Dhaka (Parvez, 2017). This economic drive has led to the informal conversion of residences into mixed-use functions. Some interviewees also argued that nowadays, new and small entrepreneurs opt for residential buildings to set up the businesses, due to the high rent of commercial spaces in the market centres and central business districts (CBDs).

Some interviewees recognised 'land price' as one of the factors affecting the expansion of informal mixes in residential areas. In Dhaka, the residential neighbourhoods changing into commercial functions (shops and offices) have shown a higher rate of increase in land value than the commercial areas (Hossain, 2014b, p.70). The high land value is directly proportional to land-use changes and/or vice-versa (Kurniati, and Erlambang, 2015, p.312). This high land value motivates people to gain a higher economic return from the piece of land, through the informal conversion of building uses into mixed-use functions.

The urge to live in close 'proximity to services' has been identified as a vital catalyst for the growth of informal mixes. Researchers like Zaman and Lau (2000, p.146) have also noted the preference of Dhaka city dwellers to remain close to their work-places. The interviewees explained that it is a natural human tendency to seek necessities close to their home, and this fundamental need motivates people to develop their essential urban services nearby. The 'lack of community facilities' is considered to be another motivator to increase informal mixes. However, it is related to the former factor of 'proximity to services'. In response to the lack of supporting residential facilities, people choose to develop these facilities close to their living areas. Further, the 'attitude' of local people has been identified by a few interviewees as a basis for the growth of the mix of uses. Historically, local people were accustomed to live in mixed-use communities. The functional mix is beneficial to the locals as it offers their daily necessities, allows them to work close to their home and provides the opportunities of social interactions. In particular, the women of the study region are culturally habituated not to go to the bazaar for their grocery needs. Thus, the attitude and lifestyle of the locals have influenced the increase of mixes in different areas.

'Demographic growth', both by natural increase and migration creates a demand for mixed-use functions to meet growing needs. 'Unemployment' of the growing population has also been

identified as a driving force for the expansion of informal mixes. For the last few decades, the public sector or the formal private sector could not respond adequately to the rising demands of employment in Dhaka. This has a subsequent influence on the rapid growth of the informal sector economic activities (Islam, 1996, p.33; Hossain, 2014b, p.70).

A few interviewees consider that the increase of income and the 'rise of the middle-class' have influenced the development of informal mixes. In the past decades, a significant rise has been evident in the income level (Khan, 2005) and the growth of the middle and higher middle-class population group. Due to their changing lifestyle, socialising and entertaining outside have become a custom of urban life. Consequently, several cafes, restaurants, shops, and shopping malls have emerged in residential areas through private initiatives. These mixed functions, while meeting the needs of the local people and entrepreneurs have persisted in different areas.

The 'frail transportation system' is also recognised by some interviewees as a motivator for the growth of mixed functions in Dhaka. These interviewees argued that the under-developed mass transportation system (Islam and Shafi, 2010, p.76) and the large scale of the city have made the movement difficult to distant places. Further, the common mode of travel - rickshaw - only allows for short distances. These phenomena have influenced the development of mixed-use functions in residential areas to serve local residents.

The 'weak administrative and monitoring system' is often regarded as a significant force for the expansion of mixed functions in the city. Researchers, like Haque and Asami (2014, p.63) and Nahrin (2008.p.39) noted that the lack of a mechanism for the implication of the land-use development in residential neighbourhoods and ineffective implementation of planning controls had paved the way for the unplanned, incompatible and scattered growth of mixes in these areas. The planner and architect interviewees have also criticised the strategic planning system of the Planning Authority. They argued that the authority has not made any realistic future plan until now. The authority tends to address current urban issues with piecemeal solutions in different areas. The lack of comprehensive planning for residential supporting functions has led to the expansion of informal mixes. Some professionals added that disinterest in the development of planning procedure, non-implementation of the procedure and inadequate monitoring, are fueling the tendency of land-use conversions. The lack of robustness in the monitoring system has also aggravated some political group and/or person to endorse an unauthorised mix of uses 'violating the regulations'.

Some interviewees identified the 'political and planning decisions' as a force for the growth of mixed-use functions. As part of the planning control, some of the major roads of the residential areas are declared as 'commercial'. This has influenced the growth of mixed-use functions on other major roads and adjacent areas, with the aspiration of formally transforming them into 'commercial' roads in the future.

4.5 Conclusion

Urban Dhaka initially developed with the spontaneously emerged functional mix. Further, the city expanded in the guise of modernity and segregation of functions but over time, it revived the mix of uses, primarily to meet people's basic needs and economic demands. The related administrative authorities were frequently apathetic in planning and regulating mixed functions. This has led to the intensification of informal mixes in different residential areas. Over the last few years, an informal mix of uses has often been recognised as a crisis. This is the central dilemma around which this study was initiated to investigate: how the informal mix works, and why is it considered a problem. This study intends to explore these through detailed investigations of the mixes and related morphologies that are discussed in the next subsequent chapters.

Chapter-5: Historic Core: Islampur

5.1 Introduction

The focus of this chapter is to understand the co-functioning and transformation of a mix of uses, its related urban morphology and the governance in an area of the Historic Core of Dhaka - Islampur. The morphology and transformation of mixed-use functions have been analysed in terms of co-functioning (mix), connectivity (access), and concentration (density). Through the juxtaposition and comparison of the morphological maps, this chapter also provides an insight into how the interconnections, alliances, and synergies among co-functioning, concentration, and connectivity work. The morphological maps of 1988, 2003 and 2017 have been prepared, based on the empirical survey and archival research. This chapter has been structured into five parts. The first part briefly states the context of the study area. The second, third, and fourth parts describe the co-functioning, connectivity, and concentration respectively. Under each attribute, firstly the transformation and subsequently, its current pattern, have been discussed. The fifth and last part explains the governance process of the functional mix.

5.2 Context

The study area - Islampur - is located at the southern edge of Dhaka along the river Buriganga. The presence of the river has always provided the most significant facility for communication and business. Hence, trade and commerce have flourished in Islampur and surroundings since the Mughal period (1608-1764) (Khan, 2012, p.19). The study area was named 'Islampur', according to the Mughal *Subahdar* (governor) Islam Khan, who was appointed by the Mughal Emperor Jahangir in 1608 (Mamun, 1993, p.47). The study area has two major roads - Islampur Road and the riverside road, called Buckland Embankment Road (Fig. 5.1). Islampur Road, running from the north-west to the south-east and parallel to the river, is one of the primary arterial roads of Old Dhaka. It has divided the study area into north and south divisions. The Islampur area is approached through the Buriganga Second Bridge Road - popularly known as Babubazar Bridge Road (Fig. 5.1). Islampur is also connected to the other parts of the city by the same road. The second major road of the area runs along the river, parallel to Islampur Road. The riverside road has several ghats that establish a significant linkage between the road and the river. At present, this road is mainly used as a service road for transferring different trading products from the river to the city. Islampur is significant, not only because it is the largest cloth market of the country at present, but also because it has a place of historical interest, Ahsan Manzil with Gol Talab, located at the centre of the study area (Fig 5.1). Ahsan Manzil is the Royal Palace of Nawab Ahsanullah, the Nawab (Feudal Lord) of Bengal during the Colonial period. At present, the Palace is a museum. Gol Talab is an oval-shaped pond located to the north-west of Ahsan Manzil Palace. It was built in 1838 by Nawab Khaja Alimullah as a private bathing space for the women of the Nawab family (Ferdous, 2017, p.83). In due course, as the Nawab's family grew, the descendants built all their houses around the pond. The area



Fig 5.1: Study area and surroundings

LEGEND

- Built Space
- Open Space
- Study Area

adjacent to the pond soon became commonplace for the Nawab's relatives, and thus, the private area changed into a public space, where fairs, festivals, and games were organised (Haque, 1990, p.185). Currently, Gol Talab is considered to be one of the culturally significant places in Old Dhaka.

The existence of Islampur Road can be found on the map of Dhaka during the pre-Mughal Period (1460-1607). The maps of pre-Mughal and Mughal Dhaka demonstrate that Islampur Road was one of the few roads of the city which had better connectivity with its surroundings. Islampur Road was a bazaar (market) street during these periods (Ferdous, 2017, p.85). Eventually, in the Company era, the British set up agencies to conduct wholesale clothing businesses in Islampur in 1773. Since the British period, the area has been significant for its wholesale and retail markets. The study area is also historically significant because some parts of the area, like Shankhari Bazar, Tanti Bazar, Kumartuli, etc., (Fig 5.1) had the oldest settlements, where the different occupational groups - *Shankharis*¹, *Tantis* (Weavers), Goldsmiths and Silversmiths used to live in the shop-houses (Mohsin, 1991, p.65). Hence, mixed-use functions emerged in Islampur and its surroundings from the very beginning of the area's development. Until now, the mix is developing and transforming informally.

The current morphology of the Historic Core is the result of multiple overlapping layers of transformation in the built and socio-economic environment. Several researchers have defined the Historic Core as 'organic' by nature (Nilufar, 2011, p.189; Ahmed, et al., 2014, p.1416; Hossain, 2013, p.425), where the different urban spaces have developed spontaneously over time in response to local needs. The organic character of the Historic Core is unique, with densely built-up areas contrasting with the looseness of later developments (Nilufar, 2011, p.189). The study area features a rich mix of functions and activities, which has been explored in detail in the following section. This area also encourages a formal and social mix. According to Dovey (2016, p.30), the formal mix is based on a mix of the different lot/plot sizes, building types, and building age, and the mix of rents and incomes indicates the social mix. The social structure of the Historic Core is heterogeneous, where people of diversified urban occupation, socio-economic status, and religion (Muslim, Hindu, and Christian) live in the same area, forming an indispensable structure of ethnicity and occupation (Nilufar, 1997, p.123).

5.3 Co-functioning

In this part, co-functioning has been discussed in terms of functional mix, mix at ground level, vertical extension of visit functions, plot, interface, and entry.

Functional Mix

Fig. 5.2 maps the transformation of the functional mix. This area was vertically-mixed since early times. These mixes later expanded across the site - significantly, along local streets. Over

¹ *Shankharis* are known to be the oldest residents and professional groups of Dhaka who used to live in the traditional shop-houses in the Shankhari Bazar area. They are famous for their handmade bangles and other ornaments made from the conch shell for the Hindu married women.

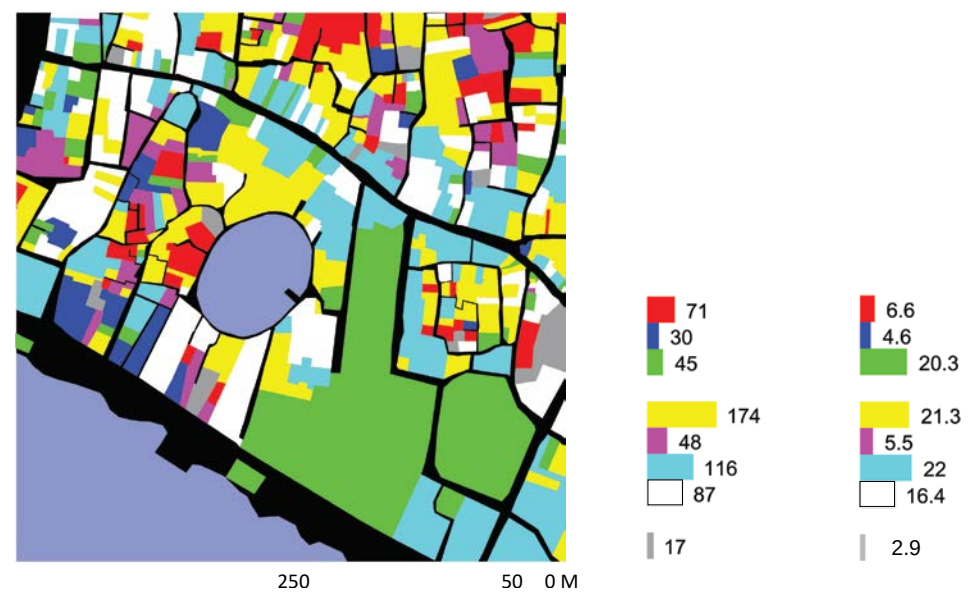
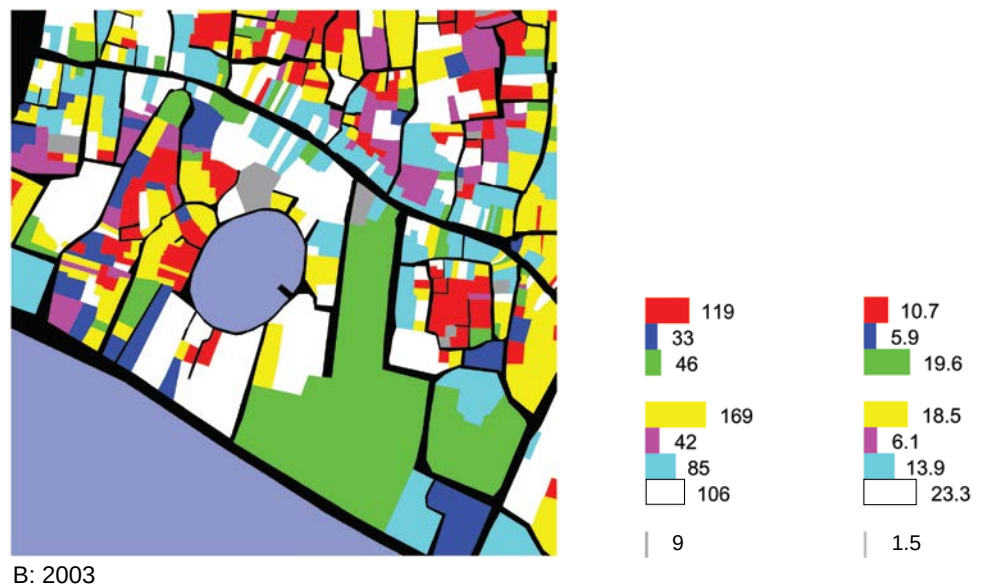
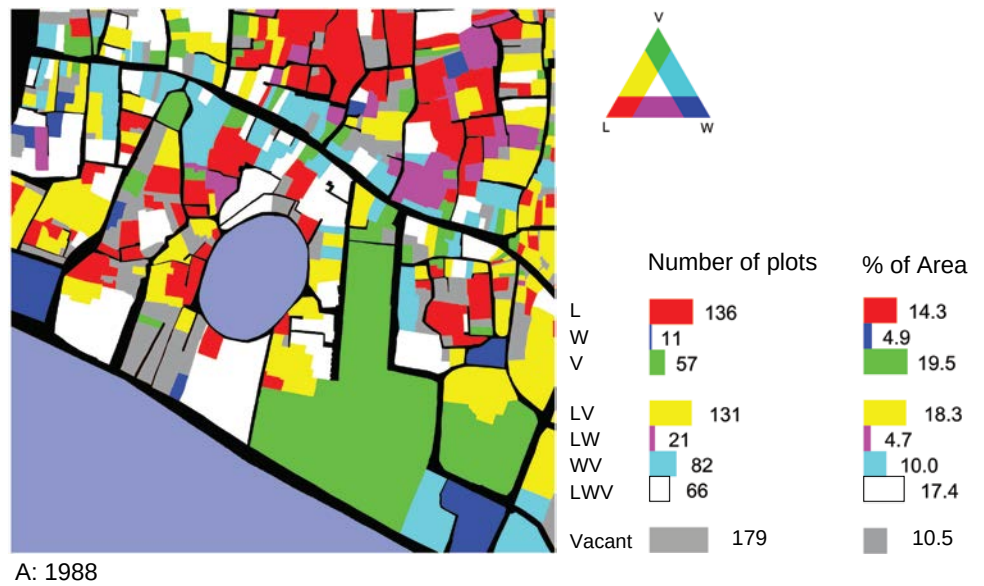


Fig 5.2: Transformation of the vertical mix (1988-2017)

time, work, visit, and their related mixes (blue, green, cyan, white) increased along the main and riverside roads. In contrast, live/visit mixes (yellow) emerged in local streets. Besides, work and live/work mixes (magenta) developed and further intensified in the west and adjacent areas. In the transformation process, many vacant plots in the south-west and east also changed into different single and mixed-use functions. Earlier, live was the dominating use, which has been gradually replaced by a diverse mix of uses. Over time, the locational importance of the area as a traditional business centre and market demand have motivated the growth of mixed-use functions in this area.

Fig. 5.2C maps the current pattern of the functional mix. This map demonstrates that the area is characterised by extensive mixed-use functions (423 plots out of 588). Among all the mixes, live/visit are primary (Fig 5.3A), and these mixes are scattered throughout the site - mainly in local streets. Live/visit mixes in local streets generally contain small-scale shops, which do not seek higher accessibility compared to the other uses along the main roads. Conversely, the main road (Islampur), riverside road, and adjacent areas feature by work, visit, and their related mixes, like wholesale shops, go-downs/storages, banks, and diverse offices (Fig 5.3B). These large-scale functions need good accessibility and connectivity and hence, they are common along the major roads.

Several work and live/work mixes (Fig. 5.3C) are evident along local streets in the north and north-east. However, their concentration is prominent in the south-west, adjacent to the riverside road. The riverside road has several ghats through which fruit and vegetables arrive in the city by boat for wholesale business. The buildings along the riverside road (Fig. 5.3D) are the large go-downs or storages, where the wholesale traders usually store fruits and vegetables and eventually sell them to the retail traders. Go-downs are a significant work function for the area. Other essential work functions are workshops, micro industries, and offices.

Visit functions, like shops, are a significant part of the functional mix. Shops are located everywhere except on the riverside road. High demand for shops along the main road has also placed them at multiple basement levels, although, formally, basements are only allowed for parking. At present, shops containing specialised products are clustered in different streets (Fig. 5.3 E-G). Islampur Road, along with the other local streets in the north-east, appear like bazaar streets, with the tradition of fine craftsmanship in cloth, gold and silver jewellery, ivory carving, etc.. Other clusters of shops, selling medicine, fruit, grocery (rice), paper, stationery, etc., are evident along the north, west, and east sides. These streets for specific trades offer a higher degree of choices for customers. It also creates a street character and image to users. The other types of shops that are scattered throughout the site are barber, laundry, confectionary, cafe, etc.. These shops have mainly developed to cater to the daily needs of residents.

Relatively few residences (71 nos.) are apparent in this area. These live functions and associated live/visit mixes are mostly prevalent in the local streets that run in longitudinal



A: Live/visit mix at a local street



B: Work/visit & Live/work/visit mixes along the main road



C: Live/work mix at a local street



D: Work and live/work mix along the river-side road



E: Specialised shops- banana traders



F: Specialised shops- rice traders

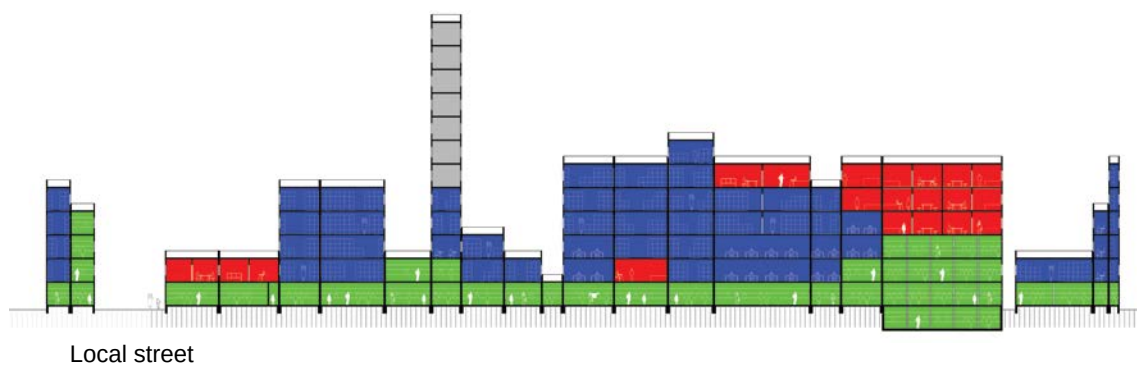


G: Specialised shops- goldsmiths



H: Live/visit mix around the central pond (Gol Talab)

Fig 5.3: Different functions in the study area



A: Section along the main road



B: Section along a local street

Fig 5.4: Sections showing vertical mixes

directions and around the central pond (Fig. 5.3H). The oldest residents comprise the different professional groups and some of the descendants of the Nawab family. In the live/visit mixes along local streets, residential functions are usually placed immediately behind the shops. In these buildings, courtyards play an essential role in the local economy, as they are used for sorting and storing different products and utilitarian items.

In this area, the extent and organisation of different functions in mixed-use buildings vary along main roads and local streets. Fig. 5.4 illustrates the vertical organisation of the functional mix. Mixed-use buildings along the main road contain more visit and work uses compared to live functions. Conversely, a high number of live functions characterise the mixed-use buildings in local streets (Fig 5.4).

Mix at Ground level

Along with the vertical mix, horizontal mixing of uses is also prominent in the study area. To understand this, a lens has been used, where different uses and their mixing are mapped at ground level. This map is also useful to explore the types of functions organised at the ground levels of mixed-use buildings.

Fig. 5.5 maps the transformation of the functional mix at ground level. The urban fabric has been mixed at ground level since early times. These mixes decreased over time, but remain fairly unchanged along local streets. Simultaneously, visit functions emerged significantly at ground level. Earlier, visit uses were prevalent along the main road, which further intensified and expanded into several local streets. In the process of transformation, the growth of work functions was also evident in the north and south-west. The location of the Palace restricted the growth of work and related mixes to the south-west corner of the riverside road and adjacent areas. At the later phase, the riverside road contained several work functions, like go-downs, which were primarily developed to take advantage of the secure transportation of products from the river ghats. Thus, along with the growth of vertical mixes in local streets, the mixes at ground level were gradually replaced by single uses like visit and work, which seek more accessibility and connectivity with public spaces for their business.

Fig.5.5C maps the current pattern of the mix at ground level. This map shows that the majority of the plots (204 out of 683) have visit uses - shops - on the ground level. Visit functions are widespread along the main road and into several local streets in the north and east. These visit functions at street level affect the vitality of the public spaces by attracting people. Apart from visit uses, live, and work functions characterise the local streets, mainly in the north and west. A few mixed-functions are also evident along the riverside road and local streets on the north, west and south-east sides. Informal street trading is a significant part of the functional mix in the Historic Core. Its pattern has been discussed with the connectivity in section 5.4 to comprehend their interrelationships.

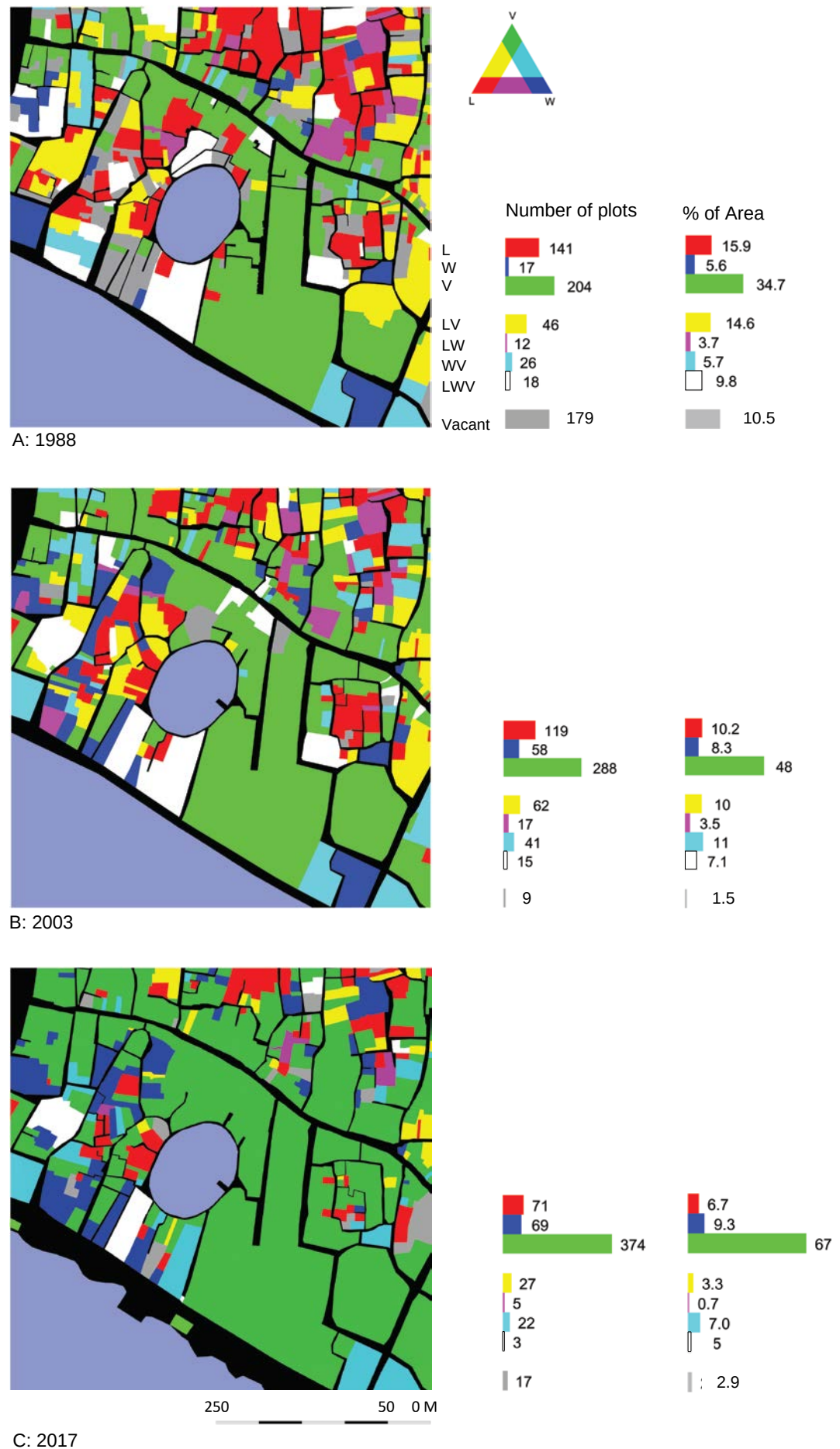


Fig 5.5: Transformation of mix at ground level (1988-2017)

Vertical Extension of Visit Function

Visit functions play a significant part in this study area, where informally-developed shops and showrooms are organised on multiple floors. These visit functions also allow public access to the upper floors in the buildings. Hence, it is crucial to understand the distribution of visit uses within the mixed-use buildings. To comprehend this, a slightly different lens has been applied, where the degree to which visit functions are organised on different floors is mapped (Fig. 5.6).

Fig. 5.6 maps the transformation of the vertical extension of visit functions. In due course, the number of floors containing visit functions has increased. Earlier, the vertical extension of visit functions was prevalent, mainly along the main road. Later, visit functions developed on multiple floors in some local streets - particularly in the east and north-east. Over time, this visit uses further intensified and expanded to adjacent areas. These transformations of visit functions occurred both radically and incrementally. Better accessibility of the main road and locally interconnected nodes has influenced the growth of visit uses on multiple floors.

Fig. 5.6C maps the current pattern of the vertical extension of visit functions. This map shows that the majority of the buildings (75% of all plots) have visit uses confined to the ground level. Visit functions on multiple floors are pronounced, both along the main road and local streets, especially around the central pond and in the north and east. These visit functions are organised up to ninth storeys in buildings. Occasionally, the informally-developed visit functions that are organised at a deeper position and/or the upper floors remain vacant. This affects the local economy to some extent.

Plot

The plot map refers to the way plots with varied sizes are distributed in different locations of the study area. This map is also useful to reveal the relationship between the plot size and the type of use that it contains. Figs. 5.7 and 5.8 illustrate the process of the transformation - amalgamation and subdivision - of plots and alternations in the plot sizes and distribution over time, respectively. It is evident from Fig 5.7 that more plots have amalgamated and/or subdivided in the early time than the subsequent period.

These maps also show that a higher number of plots were subdivided during the early phase compared to the later period. The majority of the subdivisions occurred in local streets, and all sizes of plots (0-2001+ square metres) were subdivided into smaller ones. These subdivided plots mostly characterised live, visit, and related mixes. Empirical investigations indicate that the majority of the subdivisions transpired to distribute the property among the family descendants. Like subdivisions, a higher number of plots were also amalgamated in the early phase than in the subsequent period. Earlier, the amalgamations occurred across the site and were mostly confined to smaller plots (0-1000 square metres). Subsequent amalgamations appeared along local streets, and all sizes of plots (0-2001+square metres) were amalgamated into larger ones. These amalgamated plots along the main road were changed into work, visit, and related mixes.

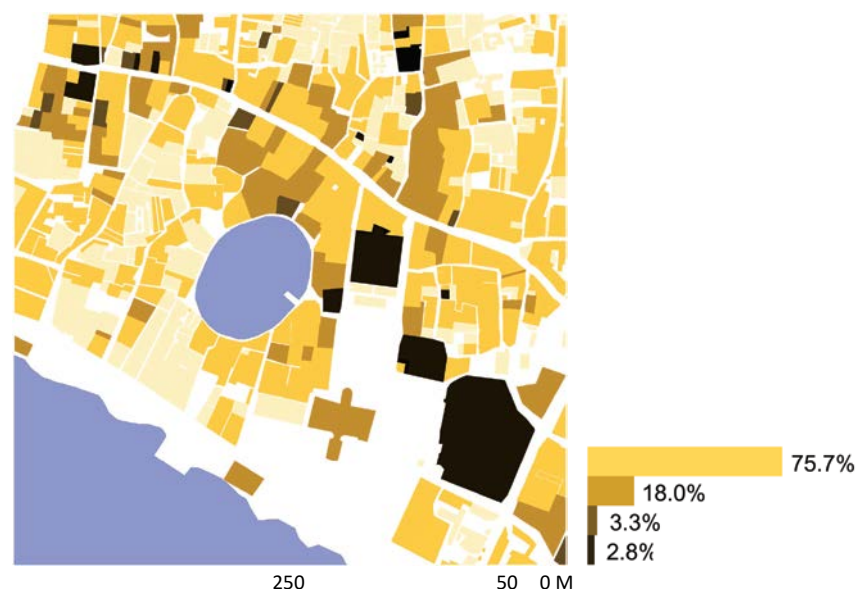
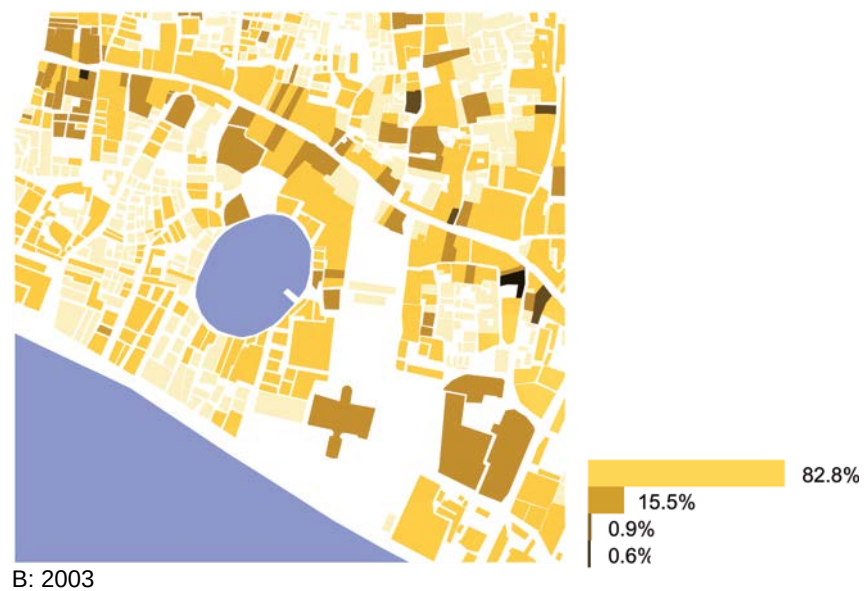
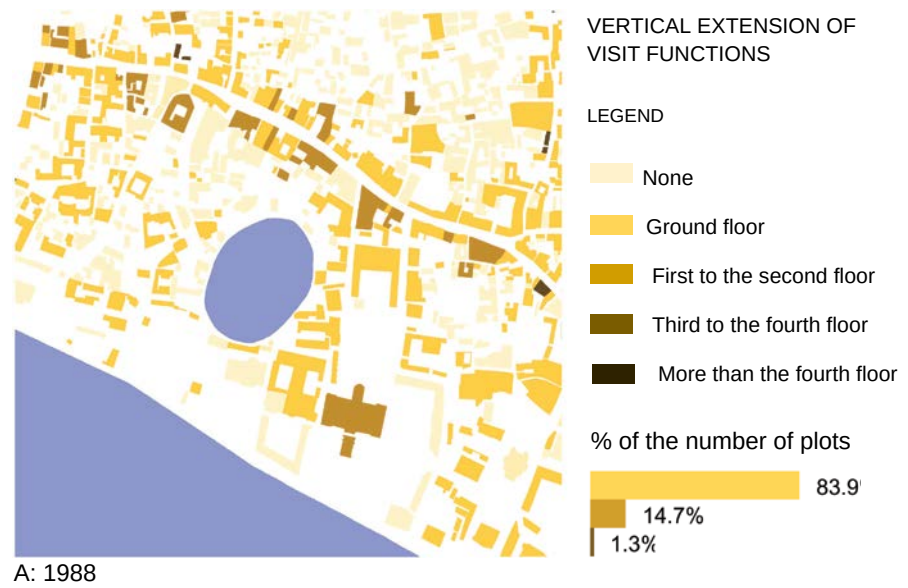


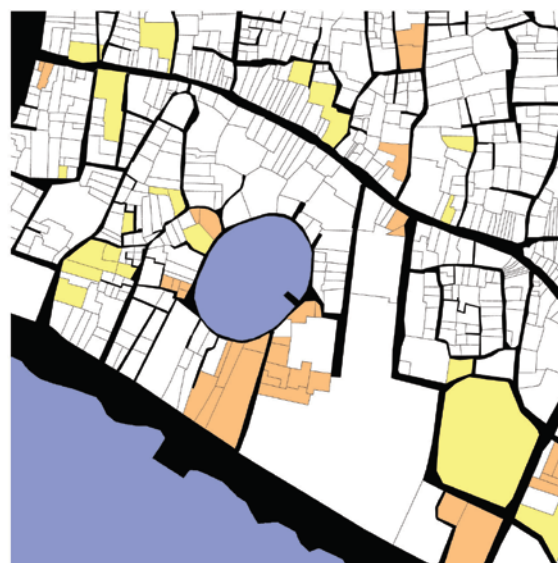
Fig 5.6: Transformation - vertical extension of visit function (1988-2017)



A: 1988



B: 2003



C: 2017

AMALGAMATION AND SUB-DIVISION OF PLOTS

LEGEND

- Sub-divided plots from the immediately previous period
- Amalgamated plots from the immediately previous period

Fig 5.7: Amalgamation and sub-division of plots (1988-2017)

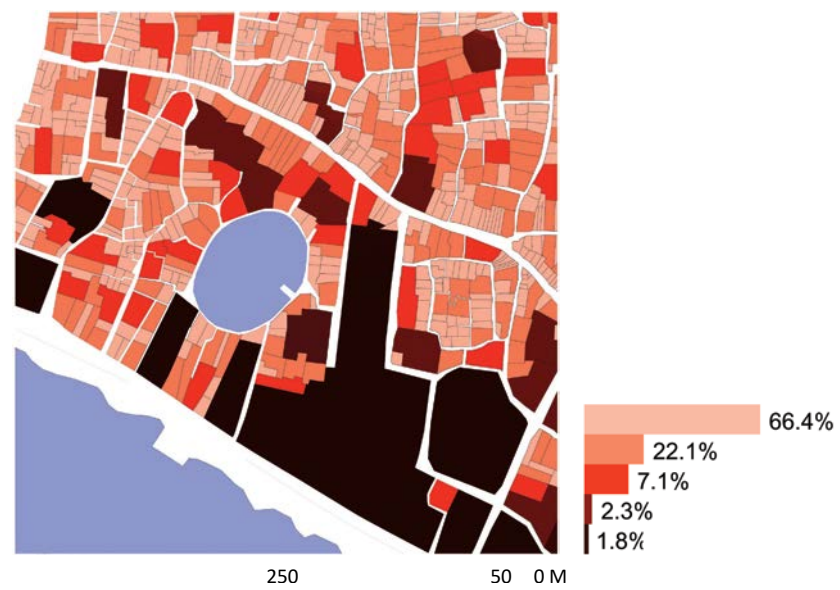
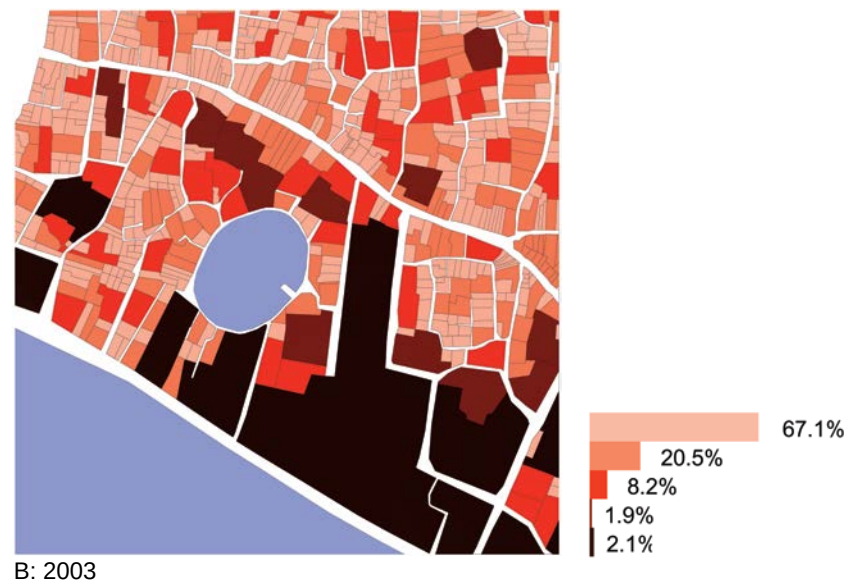
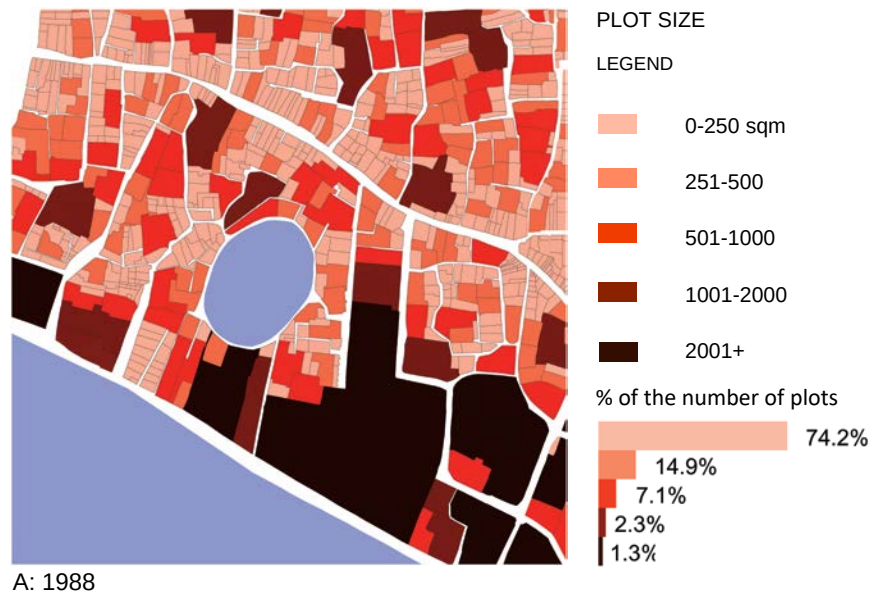


Fig 5.8: Transformation - plot size (1988-2017)

In contrast, the amalgamated plots in local streets were transformed into live, work, and their related mixes.

Fig. 5.8C maps the current pattern of plots. This map demonstrates a mix of different plot sizes of irregular shapes, as the area has been informally developed since its inception. The majority of the plots are small (0-250 square metres), and they are distributed across the site. Larger plots (over 1000 square metres) mostly border the riverside road and the south. A distinct characteristic of plots in this area is that most of the plots along the main road are elongated, with narrow street frontage. This morphology is the resultant effect of the longitudinal subdivision of plots over time to obtain the negotiated street frontage for every single plot for business.

Currently, a higher association between the plot sizes and the types of functions is evident in local streets. The majority of the larger plots (above 1001 sq. metres) along local streets contain work, visit, and related mixes, while the small and medium-sized plots characterise live and related mixes. In contrast, all the plots (both small and large) in the main road have work, visit, and their various mixes. High demand for commercial spaces has led to the development of work and visit functions in small plots along the main road. It also influences the higher-density development on this road by driving more functions into the buildings.

Urban Interface (2017)

Fig. 5.9 maps the current pattern of the public-private interface. This map is useful to explore the diverse interfaces generated by different functions and to assess the compatibility of these interfaces with informally-developed mixes. This map illustrates that the area is dominated by impermeable/blank and direct/transparent interfaces. Impermeable/blank interfaces (Fig. 5.10A) are the solid boundary walls of the buildings, which are common across the site - mainly in local streets. These blank interfaces are occasionally used by informal street traders to display their products for business. Direct/transparent interfaces (Fig. 5.10B) of the shopping strip are also prevalent throughout the site - significantly along the main road. The direct/opaque interfaces (Fig. 5.10C) that indicate the main entrances to the buildings usually controlled by gates are scattered all over the site. Sometimes, the work functions, like the press, workshops, and go-downs, have direct/opaque interfaces, and they are most apparent in local streets. There are a few pedestrian/setback interfaces (Fig. 5.10D) in different locations, primarily concentrated along the south-east, where newly-constructed visit and mixed functions with board setbacks are evident to welcome pedestrians into the buildings. Occasionally, the urban interfaces of the work, visit, and related mixes are kept blank and/or are not transparent enough to see through. The informal land-use practice is perhaps responsible beyond this phenomenon, which creates somewhat of the ambiguity of urban functions.

Building Entries (2017)

Fig.5.11 maps each separate entry to every building in the study area, coded by the colours of the functions to which it gives access. This map primarily identifies different types of entries to



Fig 5.9: Public-private interface types (2017)

LEGEND

- Impermeable/Blank
- Direct/Opaque
- Direct/Transparent
- Pedestrian/Setback



A: Impermeable/blank interface



B: Direct/transparent interface



C: Direct/opaque interface



D: Pedestrian/setback interface

Fig 5.10: Public-private interfaces



Fig 5.11: Building entries (2017)

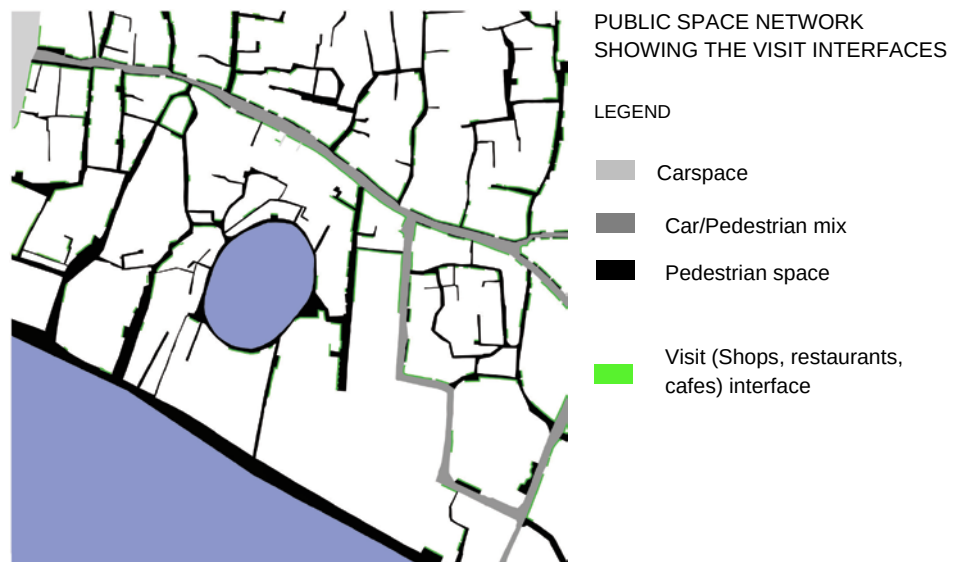
buildings. It is also useful to comprehend the working process of mixed entries. It shows that the area is dominated by visit entries (1565 entries-72%), as the majority of the buildings have shops. Visit entries (green) are pronounced across the site, except in the riverside road, where work (blue) entries are prevalent. Mixed entries are also evident in this area. Diverse mixed entries (work/visit-cyan and live/work/visit-white) characterise the main road, as the concentration of work/visit mix is prominent along this road. Conversely, the live (red), work (blue), and related mixed entries (live/work-magenta and live/visit-yellow) are common in local streets in the west, north, and east, where live, work and their various mixes are evident. These building entries have an association with the plot size. In large plots, the number of entries is typically more because of the high quantity of functions in these plots.

The entry map also demonstrates that in the mixed-use functions, the buildings either have mixed (shared) entries or they have separate entries for different uses. A building with a mixed entry usually has separate entries for street-side shops and a shared entry in the form of a corridor for the rest of the live, work and/or visit functions upstairs. In this area, mixed entry is a characteristic feature of mixed-use buildings. Empirical investigations and interviews reveal that many residential buildings of the study area have informally converted into mixed functions. Hence, separate entries for different uses were not initially designed in these buildings. These mixed entries reportedly create privacy and social problems by allowing visitors and residents through the same accesses.

5.4 Connectivity (Public Space Network)

This section discusses the historical transformation, the existing structure of the public space network and its permeability. The public space network (connectivity) demonstrates the system of interconnecting roads, local streets, and nodes of the study area. This map is useful to explore the relation of connectivity with the functional mix. Besides, the measure of permeability is vital to understand the interconnections between attractions. In the end, this section also compares the visit interfaces, functional mixes, and street trading with the connectivity to reveal their interconnections.

Fig. 5.12 maps the transformation of public space network. These maps demonstrate that the intercity highway (light grey) and main arterial roads (grey) of the area remained unchanged, but some additions and removals of local streets were evident over time. Earlier, a few local streets in the north, east and around the central pond were removed to allow the amalgamation of plots for new developments. This decreased the connectivity of those respective urban blocks with their surroundings. In the subsequent periods, a few local streets were added in the south-east and around the central pond. This enhanced the internal connectivity of those particular urban blocks and also offered a multiplicity of alternative route choices for pedestrian movements. These maps also show the transformation of the visit interfaces. It is evident from these maps, that earlier, visit interfaces were pronounced along the main road and in some local streets,



A: 1988



B: 2003



C: 2017

Fig 5.12: Transformation - public space network (1988-2017)



Fig 5.13: Public space network (2017)

AwaP- 551 m

AwaP- 514 m (considering the
internal corridors as public accesses)

LEGEND

- Carspace
- Car/Pedestrian mix
- Pedestrian space
- Internal corridors
thru. the buildings
- Visit (shops,
restaurants,
cafes) interface
- Informal street
traders

which further intensified and also expanded throughout the site. In the later period, the main road and most of the local streets characterised continuous visit interfaces.

Fig. 5.13 maps the current pattern of the public space network. The public space network, comprising several narrow and wide winding roads and streets, represents a hierarchical layout and divides the area into several small and large blocks. The street network of the area can be categorised into four types: intercity highway, main roads, local streets and internal corridor through the buildings. The Islampur area is approached through an intercity highway (light grey), which is accessible by cars, with pedestrian access on sidewalks. This highway comprises a very small portion of the access network. Next in the hierarchy of the street network are the two long main roads - Islampur Road and the riverside road, which are shared by both cars and pedestrians. The width of Islampur and the riverside roads are 7 and 10 metres respectively. The third tier in the hierarchy of the street network is local streets, which are distributed from the main roads and comprise a significant portion of the access network. The majority of the local streets are narrow (varying from 1 to 5 metres) and shared by pedestrians and non-motorised vehicles (rickshaws and carts), except in the south-east, where local streets are wide enough to be accessed by cars. At the bottom of the hierarchy are the internal building corridors that have connected two streets in this study area. These internal building corridors have increased the permeability of the area by connecting the public spaces bordering with mixed functions and allowing people to travel through long blocks.

The public spaces of this area also serve as interactive and multi-purpose utilitarian spaces. Traditionally the people have the habit of socialising in outdoor spaces. The narrow roads and streets offer an intimate scale to act as civic outdoor spaces. All-day, these streets and nodes remain packed with visitors and residents involved in shopping and various social, cultural, and religious activities. The shops also use adjacent streets as an extension. These activities are an overflow from the building, which creates a sense of territory. These day-long activities, with their variety and diversity, enhance the character of the local area.

The permeability of the access network is also analysed in the present context (Fig. 5.13). A key measurement of permeability is the perimeter of the urban blocks, which vary from 49 metres to 966 metres. The Royal Palace has the most extended block length of 280 metres. Except for this, the most extended block length is 169 metres, which exceeds the prescribed limit of 100 metres by Jane Jacobs (1961) in order to maintain easy pedestrian flow in all directions. The measure of AwaP score at the 500m scale is 551 metres. AwaP score has also been measured considering the internal building corridors of an average of 1.5 metre-wide as the public accesses. This time, the outcome of the AwaP score is 514 m. This indicates that the internal building corridors have increased the permeability of the area. Hence, from the access network, it is apparent that although the area has a few short blocks and dead ends, with many short links, frequent intersections, and rich interconnectivity, the area offers a permeable morphology with multiple choices of public pathways. This type of morphology influences the growth of

movement-seeking functions and also contributes to the synergies of intensive street life and productivity.

Informal practices of urban management affect permeability. In this area, some of the local streets to the central pond have been blocked (Orange spots in Fig. 5.13) by locals in an attempt to restrict the pedestrian flow from the surroundings to maintain the water quality of the pond. This phenomenon has decreased the permeability of the area around the pond and has also restrained further development of visit and mixed functions.

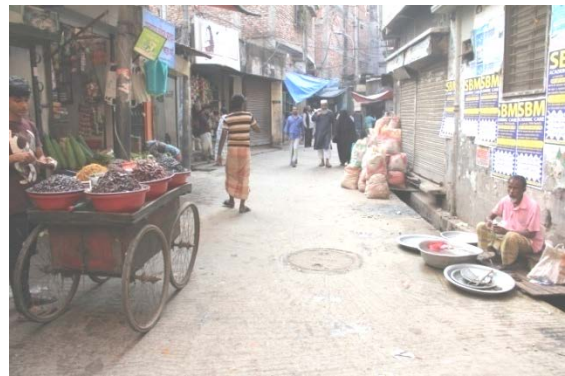
The connectivity has an association with visit interfaces and mixed functions. Fig. 5.13 maps the current visit interfaces, which shows that they are prevalent across the site. Visit interfaces characterise the main road and the majority of local streets - mainly in the north, east, west and around the central pond. This association of well-connected public spaces and visit interfaces especially the retail largely correlates with Hillier's (1996) findings. However, the association of connectivity with the functional mix demonstrates the relation between different types of mixes with various accesses. The main road features work, visit, and related mixes containing large scale shops, showrooms, offices, and go-downs. In contrast, live/work and live/visit mixes containing small shops, workshops, and micro-industries, characterise local streets.

Fig. 5.13 also maps the informal street traders. Informal trading is common across the site - mainly along the main road and around the community nodes, where pedestrians are frequent (Fig. 5.13). However, its concentration is prominent along the south-east of the riverside road and in a north-south running local street at the west of the Royal Place. These street traders sell various products, like fruit, vegetables, flowers, sweets, snacks, pickles, and other local street foods. Different types of street traders are evident in this area. Some are stationary, performing their business at a fixed location every day (Fig. 5.14A). Some are peripatetic, conducting their business in multiple locations each day (Fig. 5.14B). Some are mobile. They always move to different locations, carrying their products on their arms or shoulders (Fig. 5.14C). These informal street traders have an interconnection with the formal trading system. The wholesale shop and small factory owners employ the street traders to sell their products in local streets.

Sometimes street trading conflicts with other functions and traffic. In a local street at the west of the Royal Place, street traders and the shops of mixed-use buildings remain side by side (Fig. 5.13). The street traders have mostly situated themselves along the impermeable/blank interfaces of these mixed-use buildings. A few street traders conflict with the mixed-use functions because they place themselves at the entrance of these buildings, selling similar products like the shops inside the buildings (Fig. 5.14D). However, they share a benign relationship with the shop-owners by negotiating the space, which has been elaborated in the governance section later. The street traders are also in conflict with vehicular and pedestrian traffic. These traders often block the narrow roads and streets with their business products, which impedes the normal traffic and pedestrian flow. However, the concentration of different activities and the crowd that they generate in the public space keep the area vibrant and also give a specific identity to the traditional streets.



A: Stationary street vendors



B: Peripatetic street vendors



C: A mobile street vendor



D: Street traders along the shops of mixed-use buildings

Fig 5.14: Informal street vendors

5.5 Concentration (Density)

In this part, concentration has been discussed in terms of building height, plot coverage, and floor area ratio (FAR).

Building Height

Fig. 5.15 maps the transformation of building height. In due course, the number of higher-storeyed buildings has increased. Earlier, higher-storeyed buildings were concentrated along the main road and adjacent areas. These buildings further developed into some local streets, especially around the central pond and in the north-east and east. They consolidated over time and expanded throughout the site. In the process of transformation, several low-storeyed buildings also increased their height incrementally. Perhaps the key reason for the growth of higher-storeyed buildings is the increased market demand for commercial uses in this study area.

Fig. 5.15C maps the current pattern of the building height. It is evident from the map that the building height ranges from 1 to 14 storeys. However, the majority of the buildings are 1 to 6 storeys tall and they are evident throughout the site. The taller buildings (above 10-storeys) are most apparent along the main road and around the community nodes. Most of the buildings in this area were constructed much before 2008 when the building regulation was revised. This renewed building by-law states that the building heights of different plots can be determined in relation to the respective plot size and adjacent road width. Considering the plot size (22-20862 square metres) and road width (5-10 metres), the estimated building heights along the main road and local streets are supposed to be within 10 and 7 floors respectively. However, some newly-constructed buildings have violated the building height specified by the regulation.

Building height has an association with the type of functions. The majority of the higher-storeyed buildings (above 7 storeys) contain mixed-use functions, while single-use functions characterise lower-storeyed buildings (1 to 6 storeys). No correlation of the building height, functional mix, and plot size has been evident, except at the south-east corner, where some taller mixed-use buildings (above 7 storeys) have recently developed on the larger plots (1000 to 7942 square metres).

Plot Coverage

Fig. 5.16 maps the transformation of plot coverage. These maps show that over time, the number of plots with high coverage has increased significantly. Earlier, the high coverage plots (above 60%) were most evident along the main road and adjacent areas. These plots further developed into several local streets - mainly in the north and east, which intensified over time and expanded across the site. In this area, the sharp growth of coverage has resulted from the growing demand for mixed functions, mainly shops, go-downs, and offices, which is often implemented through the maximum coverage of plots.

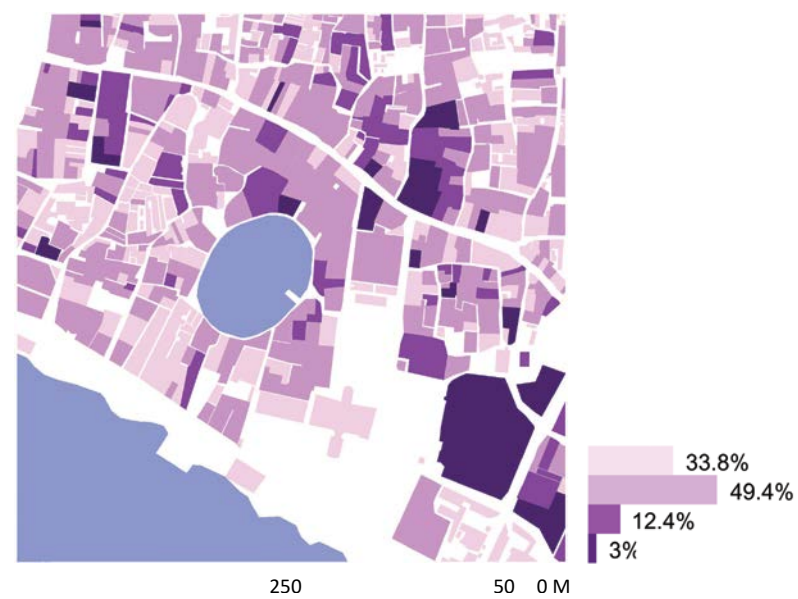
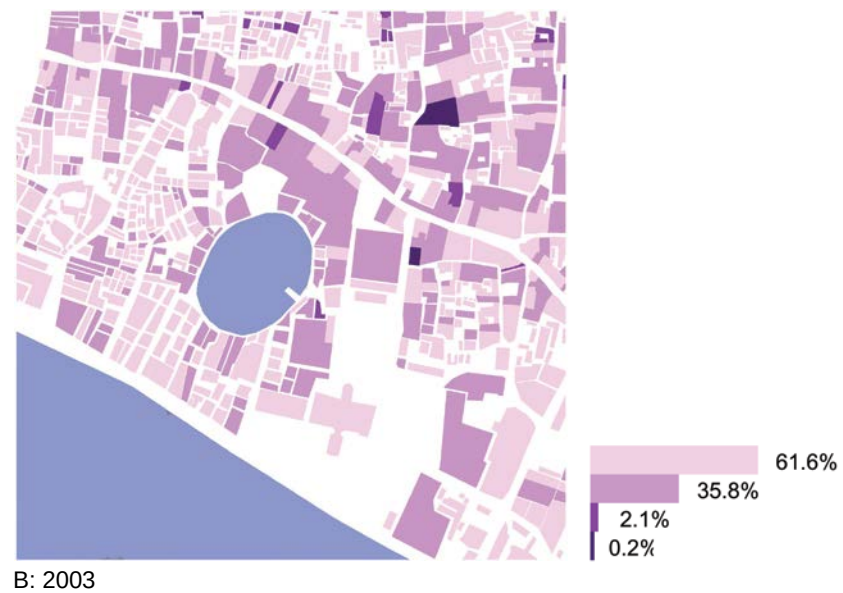
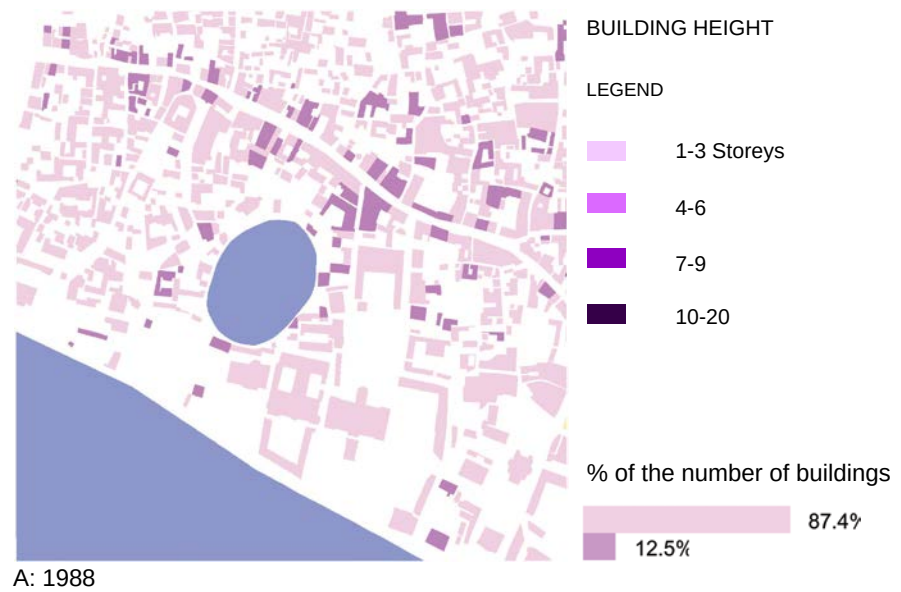
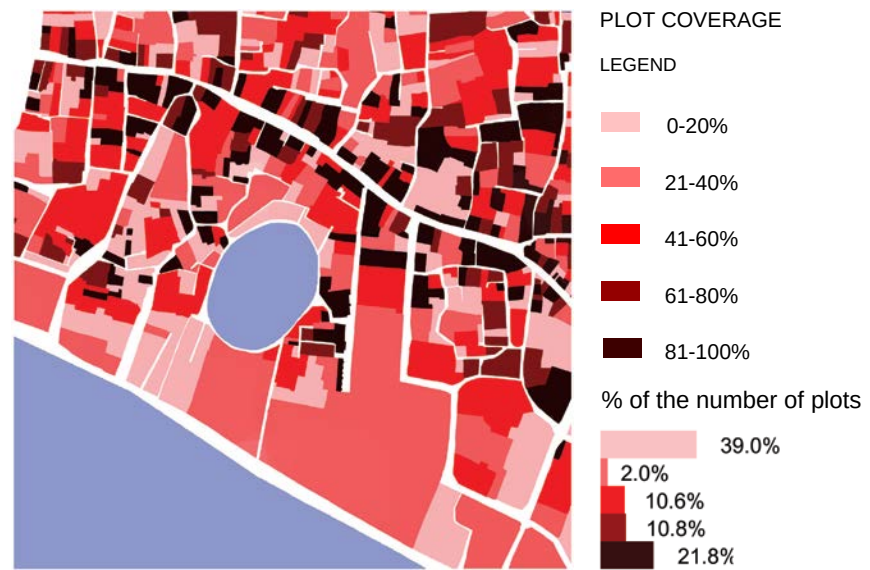
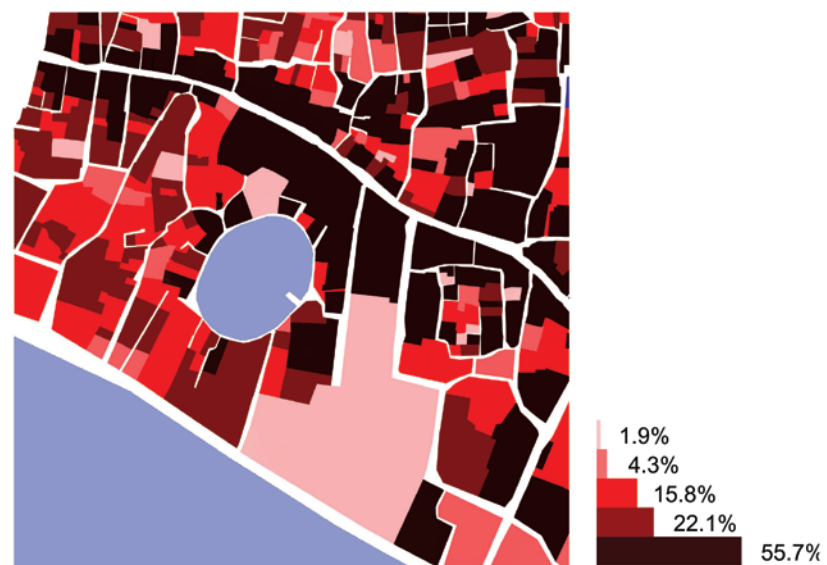


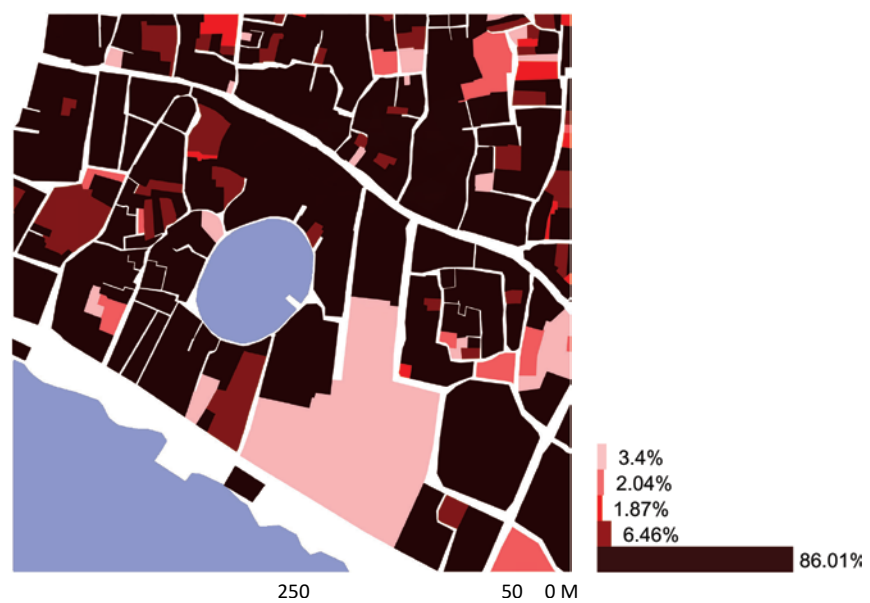
Fig 5.15: Transformation - building height (1988-2017)



A: 1988



B: 2003



C: 2017

Fig 5.16: Transformation - plot coverage (1988-2017)

Fig. 5.16C maps the current plot coverage. This map illustrates that the majority of plots (86% of all plots) have 80% to 100% coverage and these plots are prevalent across the site. The plots with the coverage of 0-20% are mostly vacant, except the plot with the Royal Palace. According to the building regulation (2008), the coverage of different plots of this area ought to be within 50% - 67.5%, depending on the various plot sizes. However, most of the newly-constructed buildings breach this rule. Some of the plots of the Historic Core are too small to make a functional living and/or mixed-use unit. This may be a reason for violating the regulation of plot coverage.

At present, an association between the plot coverage, functional mix, vertical extension of visit function, and building height is evidential. The majority of higher-storeyed mixed-use buildings have higher plot coverage. These buildings also contain visit functions on multiple floors.

Floor Area Ratio (FAR)

Fig. 5.17 maps the transformation of FAR. Over time, the number of plots with higher FAR has gradually increased. At the early time, the plots with higher FAR (above 6) were prevalent along the main road and adjacent areas. Later, a few plots with higher FAR were redeveloped in local streets, mainly in the north. This phenomenon further continued in subsequent periods and the number of plots with higher FAR increased across the site.

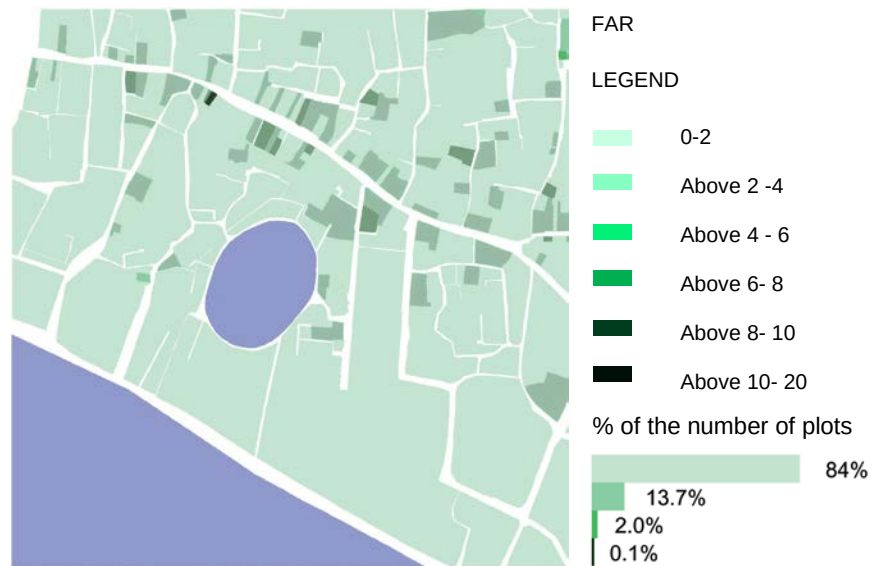
Fig. 5.17C maps the current pattern of FAR. This map demonstrates that the majority of the plots (85%) have FAR between 0-6, and these plots are common all over the site. The average FAR is 4.2. Plots with higher FAR occupy a lower ratio (14%) and are scattered in local streets, mainly in the north, north-west, and east. FAR was first gazetted as a building by-law in 2008 and accordingly, the FAR of this study area ought to be within 3.15-5.25. However, very few newly-constructed buildings have followed this regulation.

Density has an association with the functional mix. The majority of the high coverage and multi-storeyed buildings with higher FAR (above 6) contain visit and mixed-use functions. Comparatively, single-use functions mostly have lower FAR. No correlation of the density and plot has been found in this area, except in the south-east corner, where high-density buildings are developed on the larger plots.

5.6 Governance and Management

Government institutions, autonomous bodies, and local individuals administer the functional mix in this area. The information about the governance and management of mix has been sourced from Dhaka City Corporation, local shop owners, and shop workers, through a semi-structured interview during the field survey in 2017.

Dhaka City Corporation, as a Government institution, plays a role in the governance of the functional mix. At regular intervals, the Tax Collection Officers of Dhaka City Corporation conduct a survey and update their records and tax rates on the number and type of functions of



A: 1988



B: 2003



C: 2017

Fig 5.17: Transformation - FAR (1988-2017)

all buildings. The tax rate increases, along with the increased number and area of shops and offices. Generally, the house owners do not notify the Dhaka City Corporation at once about the changes - new additions of shops and offices - in their buildings. Officers of City Corporation update their records during the survey.

Apart from the Government institutions, other autonomous bodies also work in the management of the mix of uses. In the study area, different types of shops have separate 'Shop Owners Associations' to control them. However, these types of associations are not linked with small shops, like grocery, tailor, barber, etc. that serve the local residents. These associations are more linked with big industries like cloth, gold items, silver items, conch shell items, painting, and printing presses, etc. that mostly sell wholesale products and serve a large population. The most prominent association is the 'Islampur Cloth Businessmen Association', as the cloth is the primary business product of the area. All the shop owners are members of these associations. In the process of governance, the shop owners pay a monthly fee to the respective association and in return, the associations take steps for the welfare of the shop owners. The association helps to maintain a good relationship between house owners, shop owners, and shop workers. In the case of any conflict between the owners and the shop workers, the associations try to solve the issue. Moreover, the associations help the shop owners and shop workers financially in a time of crisis (disaster like fire).

Local individuals, like the house, shop owners, and street traders, also play an important role in the management of the functional mix. For small shops and offices, where there is no association, the shop and office owners pay their monthly rent directly to the house owners. The house owners pay an extra tax for the commercial functions, like shops and offices in their buildings, along with the yearly holding tax, to Dhaka City Corporation. The house owners not only rent the shops but occasionally they lease the shops and offices for specific periods. The street traders negotiate the public spaces with shop owners and street bureaucrats. Street vendors maintain a benign relationship with the shop owners of mixed-use buildings. The stationary vendors pay a monthly rent to the shop owners for using the shopfronts for their business. Further, both stationary and peripatetic vendors pay informal taxes (bribes) to the local police officials and political leaders to run their businesses.

5.7 Conclusion

This chapter reveals how the functional mix works in a traditional settlement. The Historic Core of Dhaka has always been shaped by informal, incremental, and bottom-up practices. Over time, this area has adapted various functional and physical transformations in response to the changing demand of its users and has worked through the interactions of these functional and physical elements of urban form. In this sense, this urban morphology features resilient qualities. The better accessibility of the area has always motivated the rise of mixed functions, which in turn influence the growth of higher-density developments for accommodating more

diverse mixes. Thus, the alliances and synergies of the co-functioning, connectivity, and concentration have shaped the morphology of the area into a vibrant urban development. However, the extensive informal mixes and their building practices have led to incongruous building morphology (incompatible mixes, vertical extension of visit functions, mixed entries, etc.), which presents unique challenges in the community life. Still, it is the mix of uses that has sustained the social diversity and economic opportunity in the Historic Core.

Chapter-6: Semi-planned Area: Green Road

6.1 Introduction

The focus of this chapter is to understand the co-functioning and transformation of the mix of uses, its related urban morphology and the governance process in a semi-planned neighbourhood of Dhaka - Green Road. The morphology and transformation of the mix of uses have been analysed in terms of co-functioning, connectivity, and concentration. This chapter also studies the interconnections, alliances, and synergies among co-functioning, connectivity, and concentration through the juxtaposition and comparison of the morphological maps. The maps of 1988, 2003 and 2017 have been prepared, based on archival research and empirical survey. This chapter has been structured into five parts. The first part briefly states the context of the study area. The second, third and fourth parts describe co-functioning, connectivity, and concentration respectively. Under each aspect, first, the transformation and then, its existing pattern, have been discussed. The fifth part explains the governance of the mixed-use functions.

6.2 Context

The study area - Green Road - is a semi-planned settlement and one of the earliest developed neighbourhoods following the British period (1947). The area stands at the south-western edge of the spatial centre of the city, close to the second CBD. It was named after Dr Green, a Civil Surgeon of Dhaka during the 1850s (Mamun, 1993, p.105). Spatially, it is structured by two major arterial roads - Green Road and Panthapath Road - running from north-east to south-west and east-west respectively (Fig. 6.1). The area is connected with the other parts of the city through the two long north-south arterial roads.

There is little information available about this area in literature. The 1962 Land Use Map of Dhaka indicates Green Road as a middle-class residential neighbourhood (Ahsan, 1991, p.404). Before this, the study area, with adjacent neighbourhoods, was part of a forest. From the 1950s, these areas were used as agricultural lands (Nilufar, 1997, p.125; Chowdhury and Faruqui, 1991, p.59). This neighbourhood was developed in 1960, with roads and plots, probably based on the agricultural fields. However, there is no clear evidence of this in any literature. At the early time, this area developed spontaneously along the longitudinal cardinal road -Green Road- which followed the proposals of the Master Plan (Nilufar, 2011). Panthapath Road - the east-west cardinal road - was once a critical canal. In 1991, it was paved to make a connecting road between the two major arterial roads of the city. The canal was converted to a box-culvert beneath Panthapath Road. The development of Panthapath Road has linked this area with the second CBD and other major connecting roads of Dhaka (Ferdous and Nilufar, 2007). After 2000, the south-eastern edge of Panthapath Road was declared 'commercial'. Since then, the mixed-use buildings located on that part have been formalised.

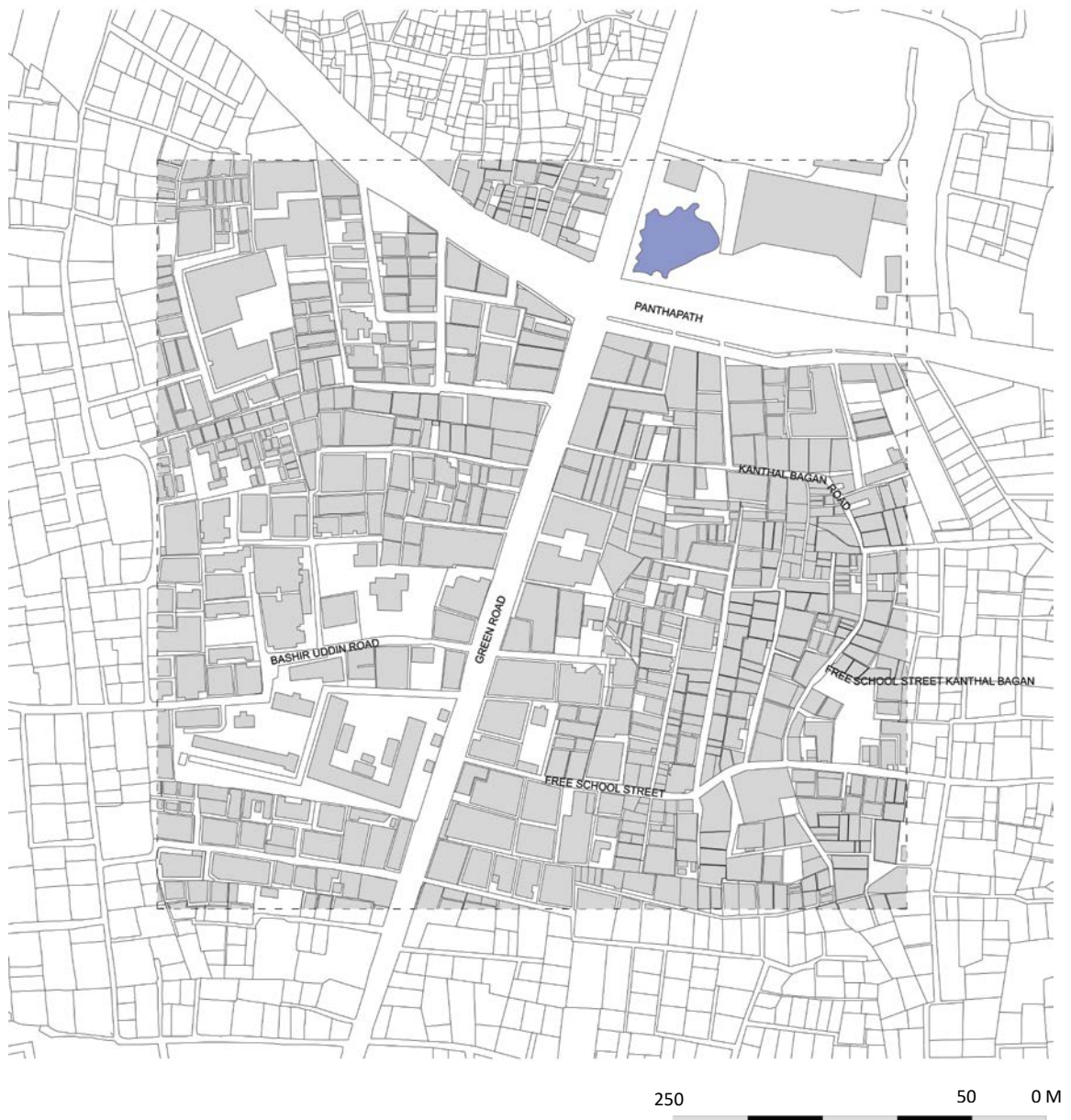


Fig 6.1: Study area and surroundings

LEGEND

- Built space
- Open space
- Study area

Though, visit and work functions, common in the other parts of the area, are still informal. Thus, the study area demonstrates the association of both formal and informal development systems, where the main roads, as part of the formal planning process, indirectly influenced the emergence of informal establishments.

The current morphology of the study area features a combination of the formal and informal layout with a spontaneously-developed mixed-use function, which is detailed in the following sections. In general, the informal character of the area resembles the Historic Core but its streets are wider and less intricate than in the old city. Conversely, the two long, straight, and wide main roads featuring high-density developments manifest the character of new Dhaka. This area also characterises a formal and social mix of different lots/plot sizes, building types, rents, and higher-middle to lower-income groups of people.

6.3 Co-functioning

In this part, co-functioning has been discussed in terms of functional mix, mix at ground level, vertical extension of visit functions, plot, interface, and entry.

Functional Mix

Fig. 6.2 maps the transformation of the mix of uses. This area was mixed, both vertically and horizontally, since its early development. After the canal was filled, this mix along the main road intensified over time, especially around the primary node. It expanded further into some local streets - particularly along the loop on the east. With time, work, visit, and various forms of their mixes (blue, green, cyan, white) increased along the main roads. Simultaneously, live/visit mixes (yellow) emerged in local streets. However, in terms of the concentration of the mix, a significant difference was evident between the east and the west. Over time, mixed functions intensified, primarily in the east. Perhaps, the growth of visit and mixed functions in the west was impeded by the lower permeability of the urban fabric. Live functions (red), from their initial development, were expanded further, primarily along local streets. In the process of transformation, infill areas were occupied by both single and mixed-use functions.

Fig. 6.2C maps the mix of uses in the present context. This map shows that the area is dominated by live functions, as it was primarily developed as a residential neighbourhood. These live uses are common throughout the site - mostly in local streets (Fig. 6.3 A). Among all the mixes, live/visit mix is significant. They are primarily evident along locally interconnected streets (Fig. 6.3 B-C). In contrast, work, visit, and their various mixes are prevalent on the main roads and around the primary node (Fig. 6.3 D-E).

Visit functions, mainly shops, are a significant part of the mix of uses. Different types of shops are evident at various accesses. Shops selling electronic products, furniture, hardware, and food items are prevalent along the main roads, while grocery and stationery shops, barber, pharmacies and so on are typical in local streets. The high market demand for shops has also influenced their development in basements along local streets. Though, formally, basements

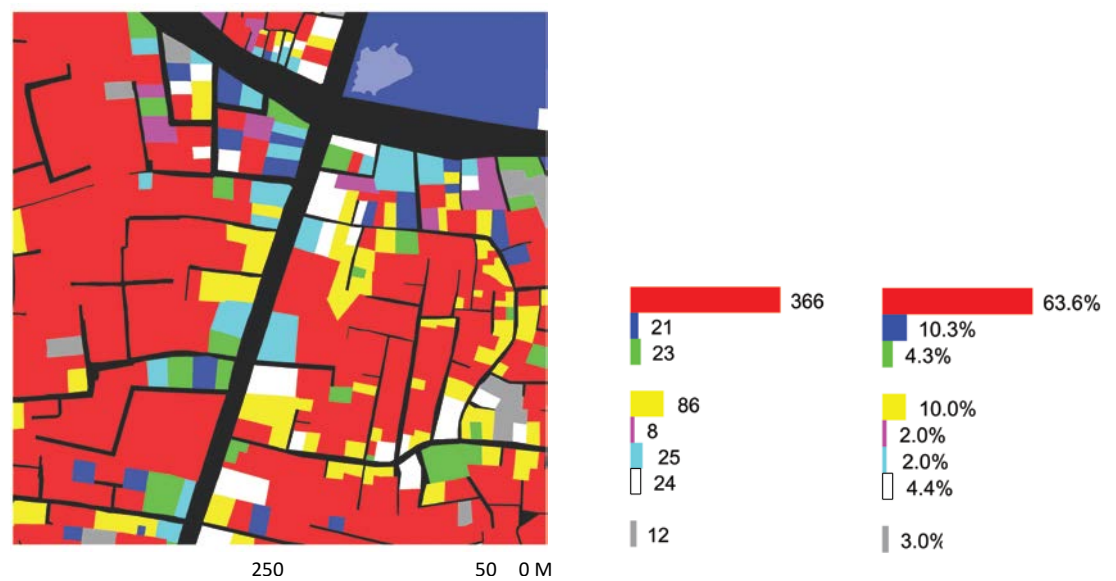
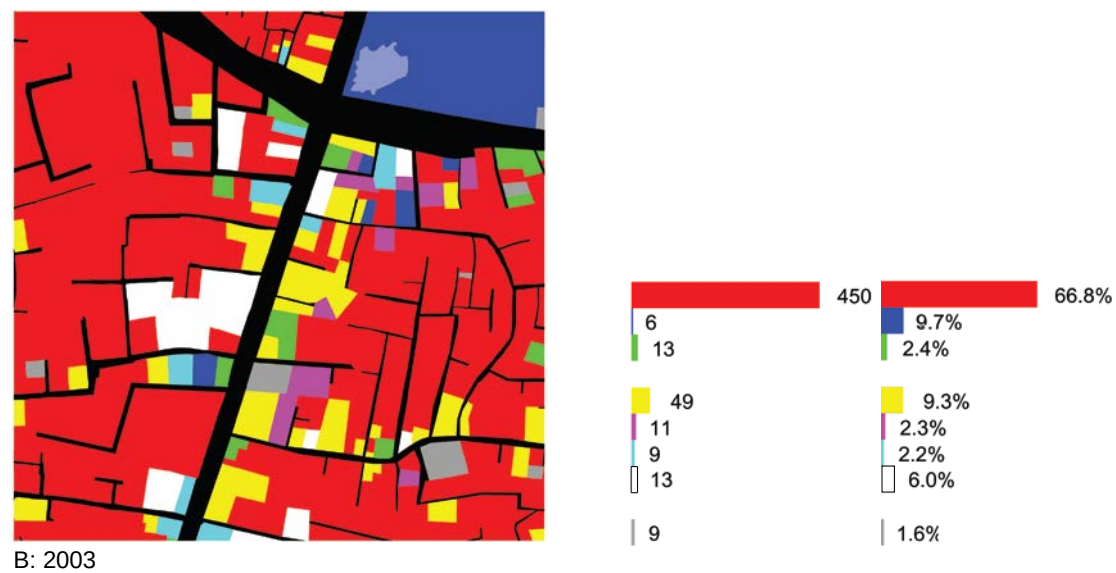
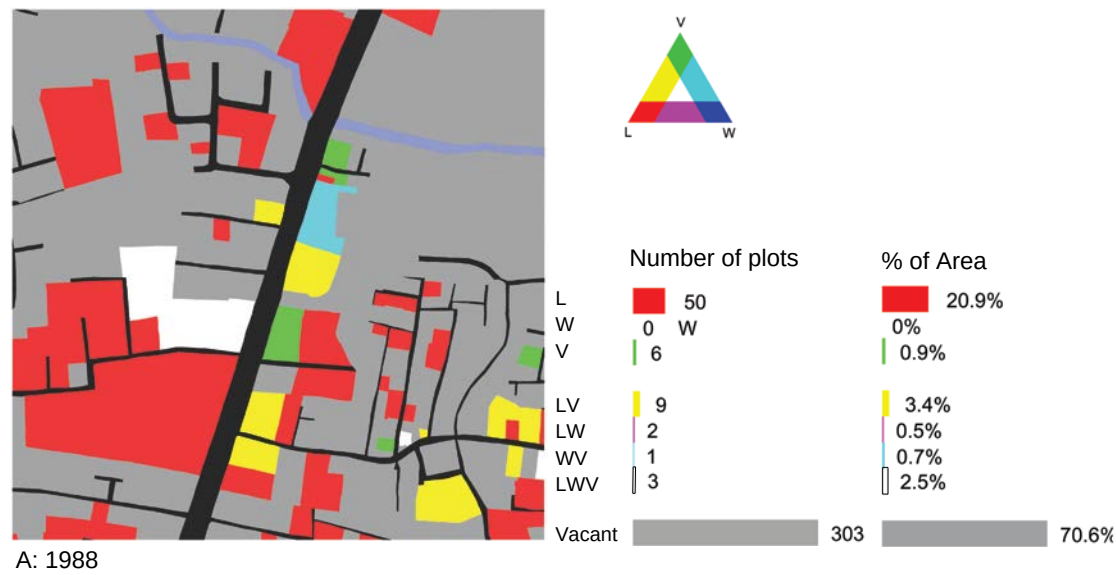


Fig 6.2: Transformation of the functional mix (1988-2017)



A: Live functions along a local street



B: Live/visit mix in a local street



C: Live/visit mix along a local street



D: Visit, work, work/visit and live/work/visit mixes in the main road

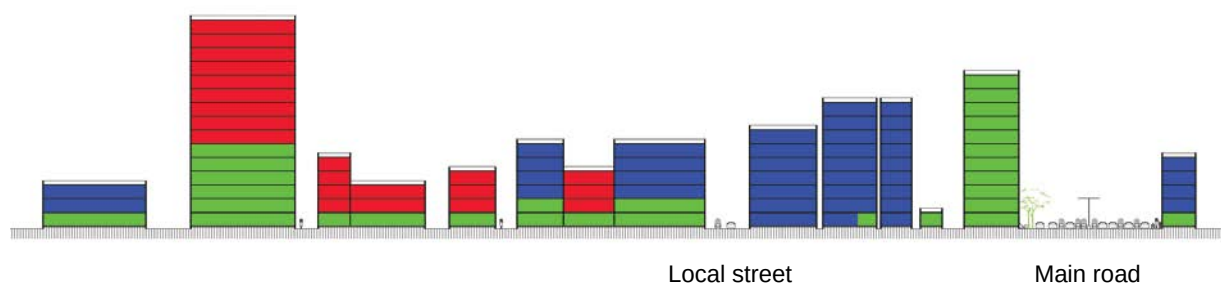


E: Visit, work and work/visit mixes in the main road

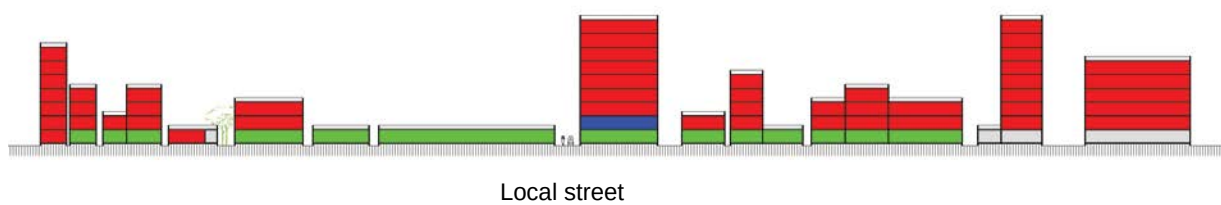


F: Workshops and micro-industries along a local street

Fig 6.3: Different functions in the study area



A: Section along the main road



B: Section along a local street

Fig 6.4: Sections showing vertical mixes

are only allowed for parking. Apart from shops, a good number of visit functions such as hospitals, cafes, and restaurants are widespread on the main roads.

Similar to visit; diverse work functions such as banks, large-scale offices, private universities, and industries are lining the main roads. In contrast, small-scale work functions like workshops, micro-industries, private offices, and educational institutions dominate local streets (Fig. 6.3F). These work functions do not seek a high degree of accessibility and visibility and have developed mainly to serve local residents.

In mixed-use buildings, the quantity and organisation of various functions differ along main roads and local streets. Fig. 6.4 shows the vertical organisation of the mix of uses. Along the main roads and around the primary node, the number of floors containing work and visit use is higher than the live function. In contrast, a high number of live functions dominate the mixed-use buildings in local streets.

Functional Mix at Ground level

Fig. 6.5 maps the transformation of a mix of uses at ground level. These maps illustrate that the ground level of the urban fabric was comprised of mixed functions since early times. These mixed functions on the main road further consolidated over time and expanded into some local streets. In the transformation process, live/visit mixes emerged in the local streets and work, visit, and their diverse mixes primarily increased on the main roads. Better accessibility along the main roads has influenced the growth of work and visit functions. Live functions were common since the earliest phase and expanded further across the site - mainly along local streets. In the past, the ground level was free of parking but introduced later in newly-constructed buildings. The renewed building regulation with particular laws of mandatory parking requirements has enforced these changes.

Fig. 6.5C maps the current pattern of the functional mix at ground level. It is evident from the map that the ground level is dominated by live functions followed by parking and these uses are common across the site, primarily along local streets. Besides, work, visit, and their various mixes characterise the urban fabric of the main roads and the local streets feature live/visit mixes, particularly in the east. Visit functions, like shops at ground level, are useful, as they activate the street frontage. Informal street trading is an integral part of the mix of uses. The pattern of informal street trading has been discussed with the connectivity in section 6.4 to reveal the interrelationship between the two.

Vertical Extension of Visit Functions

Fig. 6.6 maps the transformation of the vertical extension of visit functions. These maps illustrate that in due course, the number of floors containing visit functions has increased. Earlier, the vertical extension of visit functions was not common and visit functions were mostly confined to ground level. Later, the visit functions developed on multiple floors along the main road and intensified over time - especially around the primary node and adjacent areas. They

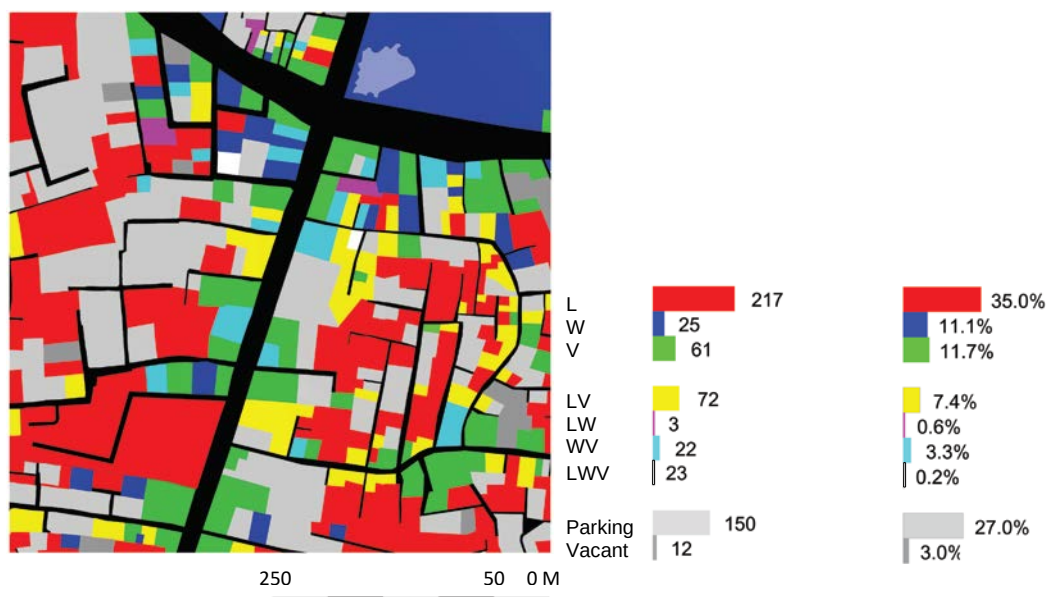
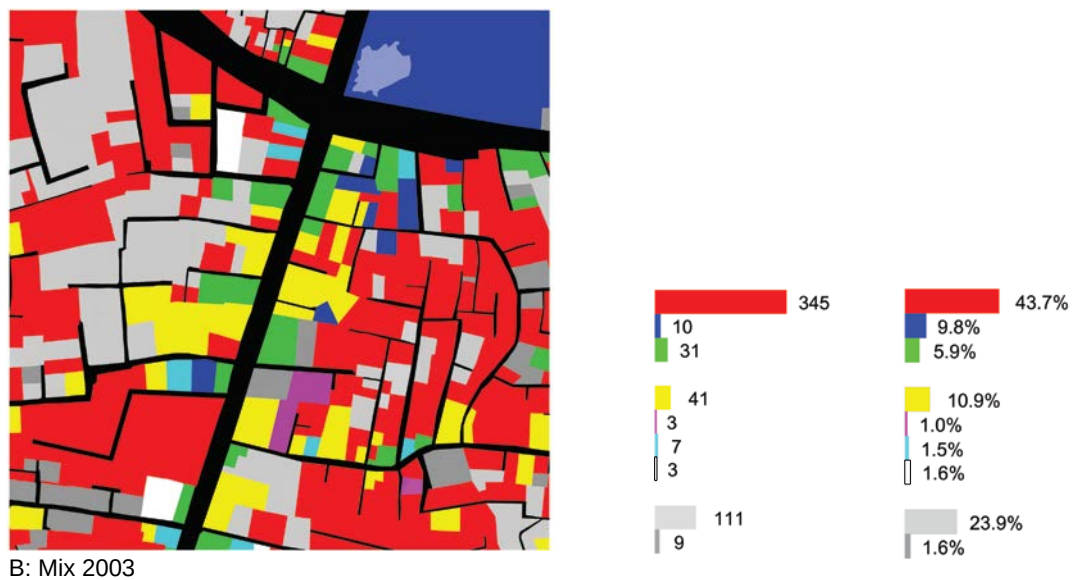
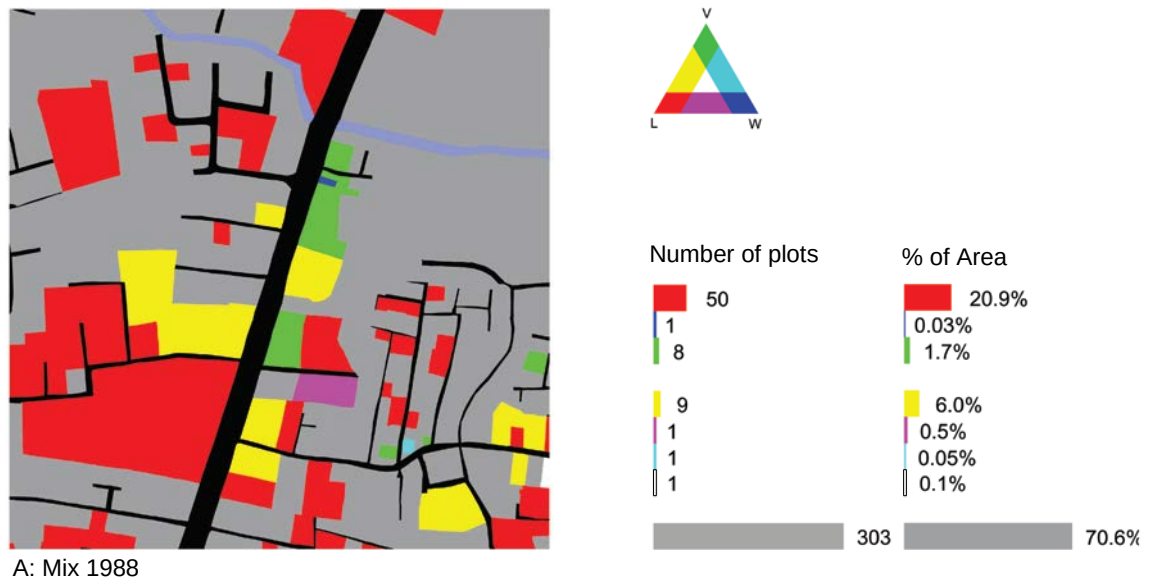


Fig 6.5: Transformation of mix at ground level (1988-2017)

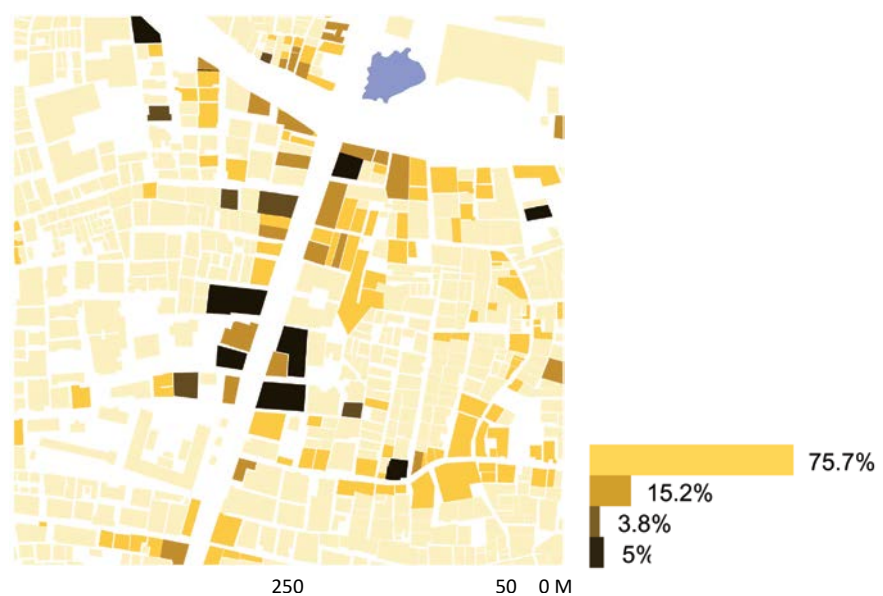
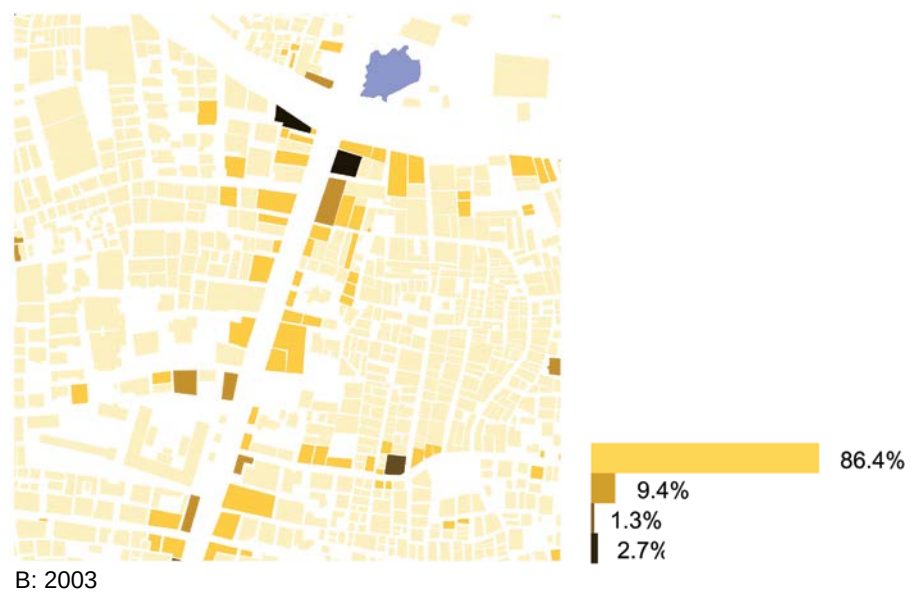
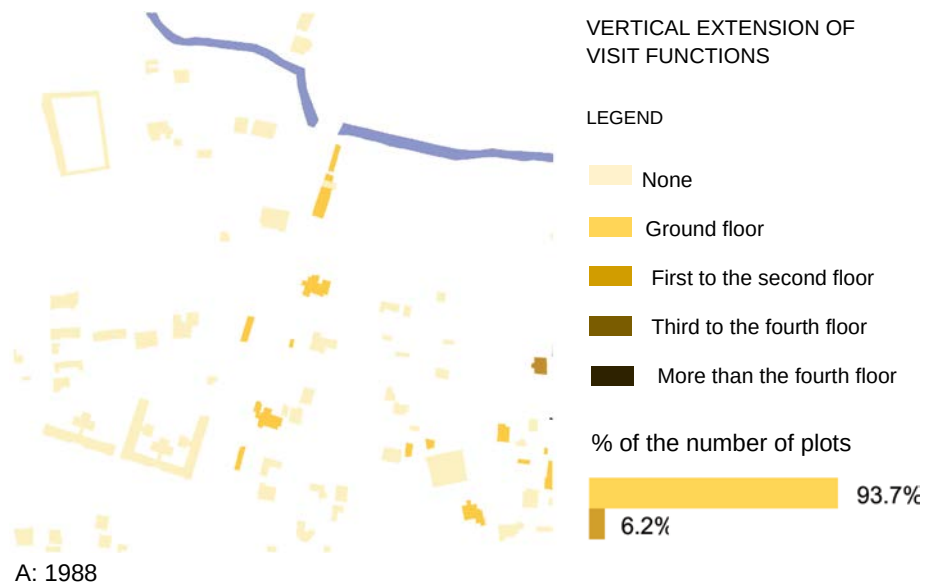


Fig 6.6: Transformation - vertical extension of visit function (1988-2017)

further expanded into a few local streets. Perhaps, the better accessibility of the main roads and the principal node has influenced the extension of visit floors on multiple levels.

Fig. 6.6C maps the current pattern of the vertical extension of visit functions. This map shows that the majority of the buildings contain visit functions confined to the ground floor. Visit functions on the multiple floors are prevalent - primarily on the main road and around the principal node. Though, visit functions on multiple floors are also evident along local streets - particularly on the north and east but at a limited extent. In this area, visit functions are arranged up to ten storeys in buildings.

Plot

Figs. 6.7 and 6.8 maps the transformation of plots and the changes in the plot sizes and distribution over time, respectively. Fig 6.7 shows that in due course, subdivisions of the plots were widespread than amalgamations. These maps also demonstrate that a higher number of plots were subdivided in the earlier phase than the later period. In the early stage, these subdivisions occurred across the site and mostly limited to larger plots (501-2001+ square metres). Subsequent subdivisions appeared primarily in local streets, and all sizes of plots were divided into smaller ones. Over time, the subdivided plots along the main roads were transformed into various single and mixed-use functions, and local streets were changed into live and live/visit mixes. Like subdivisions, a higher number of plots were also amalgamated during the early phase rather than at a later time. However, the majority of these amalgamations occurred in local streets - especially on the north and east and include plots of all sizes. The amalgamated plots mainly featured diverse single and mixed-use functions.

Fig. 6.8C maps the current pattern of plots. This map demonstrates that this area has a mix of different plot sizes of irregular, rectangular or square shapes. The majority of the plots are small (0-250 square metres) and they are distributed throughout the site - primarily in local streets. Larger plots (over 1000 square metres) characterise the main roads and the west.

At present, an association between the plot sizes and the types of functions is evident. The majority of the larger plots contain multi-storeyed live, work, and their various mixes. In contrast, low to mid-rise; single and mixed functions - mainly live/visit mixes - are prevalent in small and medium-sized plots (0-1000 square metres) in close proximity.

Urban Interfaces (2017)

Fig. 6.9 maps the public-private interfaces in the present context. This map shows that the area is characterised by the blank/impermeable (Fig. 6.10A) interface. This type is widespread across the site -, particularly in local streets. The direct/transparent (Fig. 6.10B) and pedestrian/setback (Fig. 10C) interfaces are evident along the main roads and in some of the local streets - especially in the east, where shops are prominent. The direct/opaque (Fig. 6.10D) and mixed (Fig. 6.10E) interfaces are scattered along local streets, wherever live functions are primary. The mixed (car/setback and pedestrian/setback) interface is a parking/garage on the ground floor through which both cars and pedestrians enter the building.



A: 1988



B: 2003



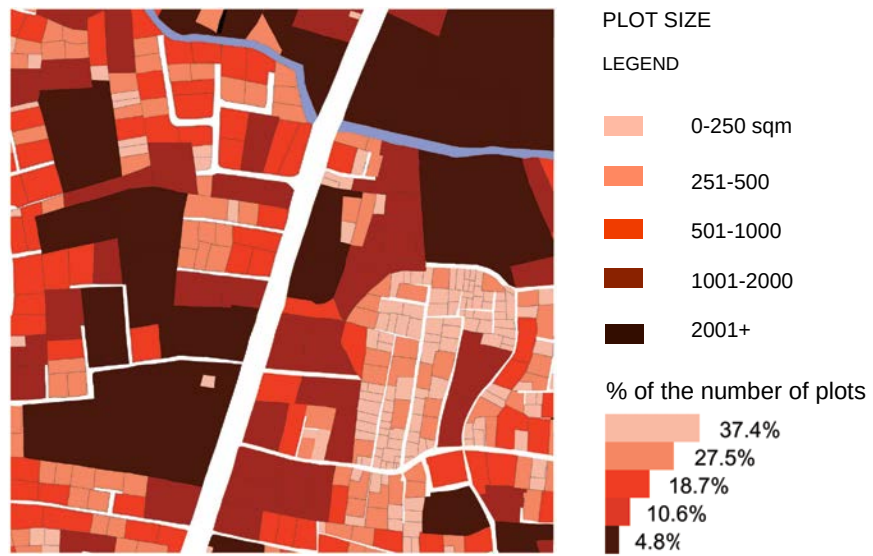
C: 2017

AMALGAMATION AND SUB-DIVISION OF PLOTS

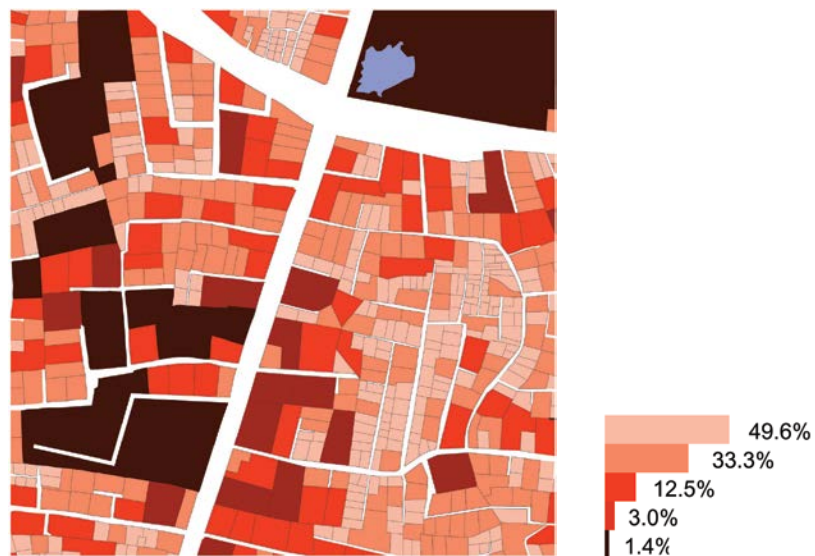
LEGEND

- Sub-divided plots from the immediately previous period
- Amalgamated plots from the immediately previous period

Fig 6.7: Amalgamation and sub-division of plots (1988-2017)



A: 1988



B: 2003



C: 2017

Fig 6.8: Transformation - plot size (1988-2017)



Fig 6.9: Public-private interface types (2017)

LEGEND

- Impermeable/Blank
- Direct/Opaque
- Direct/Transparent
- Pedestrian/Setback
- Mixed-Car/Setback
Pedestrian/Setback



A: Blank / impermeable interface



B: Direct/transparent interface



C: Pedestrian/setback interface



D: Direct/opaque interface



E: Mixed (car/pedestrian) interface

Fig 6.10: Public-private interface types

Building Entries (2017)

Fig.6.11 maps current building entries. This map illustrates that live entries (red) dominate the area as the majority of the buildings have residential functions. These live entries are prevalent in local streets. Visit entries (green) are common along the main roads and at a few local streets - particularly along the loop in the east. Apart from visit entries, diverse mixed entries are also evident adjacent to the main roads and around the principal node, as the concentration of mixed functions is prominent along these areas. In local streets, the number of mixed entries is minimal, as most of the residences and shops are horizontally mixed on the ground level and their entries are separately planned. This organisation of entries provides the scope for the spatial segregation of private (live) and public (visit) spaces while maintaining privacy for the residential functions.

6.4 Connectivity (Public Space Network)

This section discusses the historical transformation, the existing structure of the public space network, and its permeability. It also compares the visit interfaces, functional mixes, and street trading with the connectivity to reveal the interrelations between them.

Fig. 6.12 maps the transformation of public space networks. These maps show that this area was not well connected in the past. The longitudinal arterial road and some local streets formed the early access network. The linkages between the arterial and local streets were loose through a few connections. Most of the local streets were also not well connected internally due to a higher number of dead ends. Eventually, the development of the east-west arterial road led to significant changes to the overall connectivity. The access network became internally connected with the development of several local streets on the east and west. A higher number of connections also improved the linkages between the main roads and local streets. However, in the last decade, no significant changes are evident except for a few additions (to gain access to the residential buildings) and removals (to allow the amalgamation of plots for new development) of local service streets. These maps also show the transformation of the visit interfaces. At the early development, the area had visit interfaces along the longitudinal arterial road and in a few local streets. Over time, visit interfaces developed on the east-west arterial road and further intensified - mainly around the principal node. They also expanded into some local streets - particularly on the east.

Fig. 6.13 maps the current pattern of the public space network. The public space network represents a hierarchical layout containing roads and streets of varying widths and can be categorised into two types. The first, in the hierarchy - are the two long arterial roads. The width of these roads varies from 20 to 27 metres. Both of these roads are accessible by cars and slow-moving vehicles (*rickshaws*) and have sidewalks for pedestrians. Next, in the hierarchy - are local streets. These streets comprise a significant portion of the access network. The width of these streets varies from 2 to 7 metres. The majority of the local streets are accessed by cars, slow-moving vehicles, and pedestrians and these streets do not have any separate

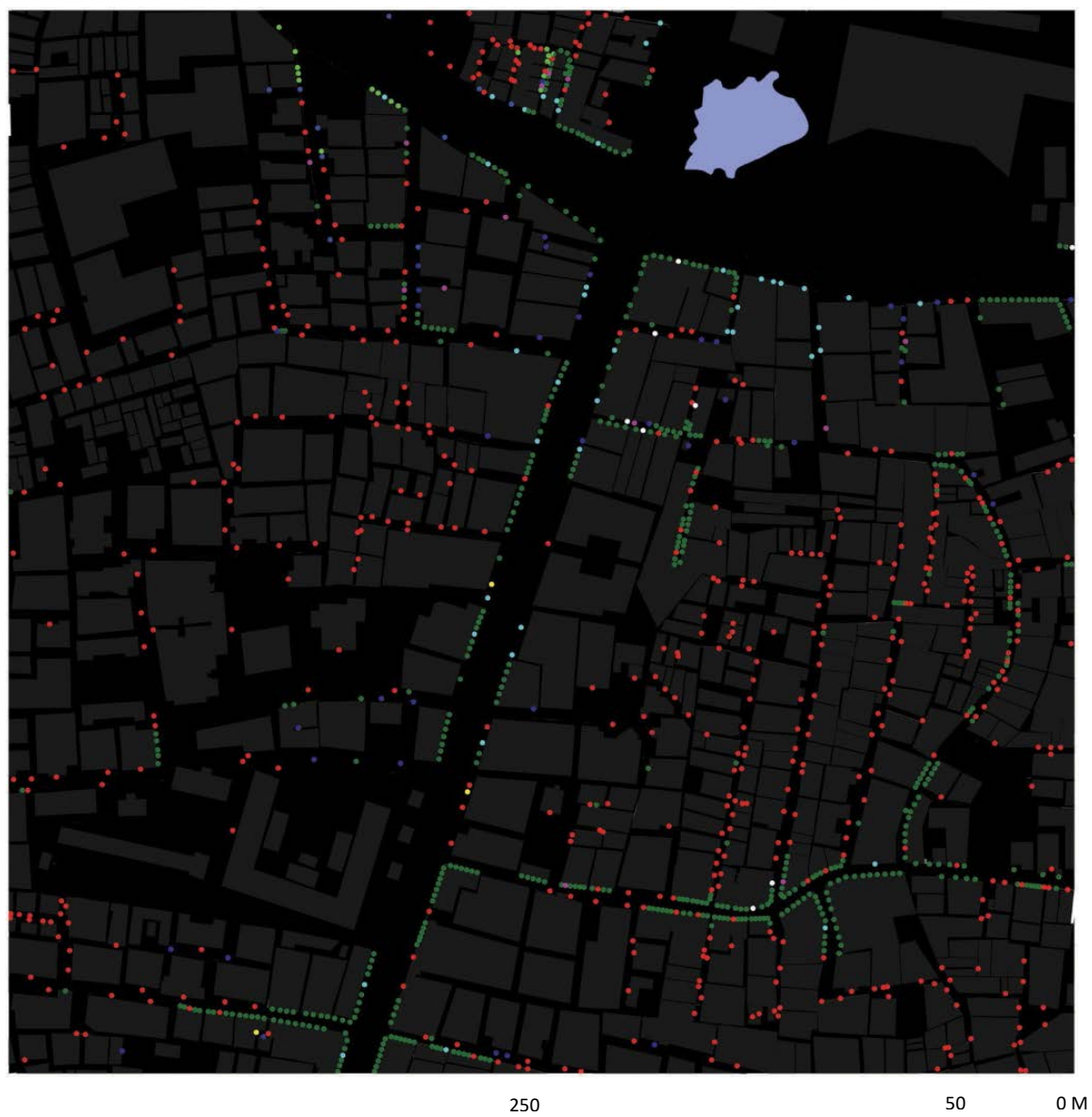
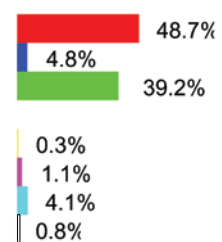
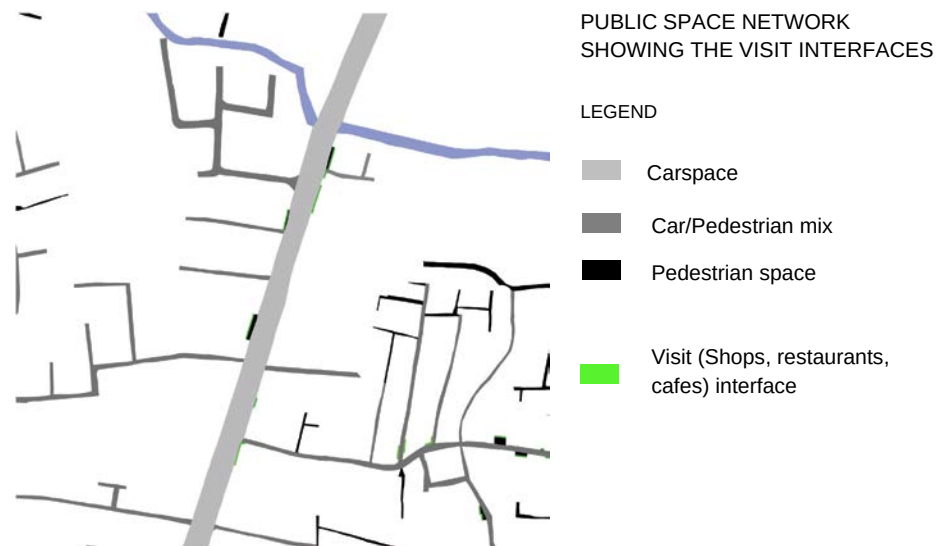


Fig 6.11: Building entries (2017)



% of the number of entry





A: 1988



B: 2003



C: 2017

Fig 6.12: Transformation - public space network (1988-2017)



Fig 6.13: Public space network (2017)

AwaP- 897 m

LEGEND

- Carspace
- Car/Pedestrian mix
- Pedestrian space
- Visit (shops, restaurants, cafes) interface
- Informal street traders



A: A Stationary street trader along the arterial road



B: A Stationary street trader with a temporary shed



C: Peripatetic street traders at a local street



D: A mobile street trader on a local street



E: A stationary street trader on a Pedestrian way



F: Peripatetic street traders along a local street

Fig 6.14: Informal street vendors

pedestrian walkways. A few local streets on the east are very narrow and are only accessible by pedestrians.

This study also analyses the permeability of the access network in the present context (Fig. 6.13). The perimeter of the urban blocks - an essential measurement of permeability- varies from 77 to 1675 metres. The most extended block length is 215 metres that exceeds the maximum block length of 100 metres, suggested by Jacobs (1961) for easy pedestrian flow in all directions. The AwaP score at the 500m scale is 897 metres. All these measures indicate reduced permeability of the access network in the study area. The majority of local streets have dead ends, and some of the blocks are too long, which impede normal traffic flow and thus, restrict the possibilities of developing movement-seeking functions. A few of the blocks are also extremely short. They allow traffic movement but restraint prospects for the activation of all frontages.

In this area, informal practices of urban management affect permeability. Informal practices influence people to manage public spaces according to their way to fulfil their needs. One of the local thoroughfares on the west has been blocked (Orange Spot in Fig. 6.13) in an attempt to restrict the traffic flow from the longitudinal arterial road. This phenomenon has resulted in lower permeability and has also constrained the development of diverse functions.

The connectivity has a link with visit interfaces and functional mixes. Fig. 6.13 maps the current visit interfaces. This map illustrates that visit interfaces dominate the main roads, the principal node, and a few local streets - especially the loop in the east. All these public spaces are well connected. This association of connectivity and visit interfaces supports Hillier's (1996) findings. The relation of connectivity with different functions shows that work, visit, and related mixes characterise the main roads, while live and live/visit mixes are prevalent along the locally interconnected streets.

Fig. 6.13 also maps the informal street traders. It illustrates that street traders are frequent throughout the site - particularly along the main roads and in a few local streets on the east. The street traders remain close to the other visit functions of mixed-use buildings. They usually do not conflict, except for a few locations on the local streets as observed. All types of traders - stationary, peripatetic, and mobile - are evident in this area (Fig. 6.14 A-D). The street traders sell various fresh produce such as fruit, vegetables, poultry, fish, snacks, and kids' toys. These traders take up most of the pedestrian ways (Fig. 6.14E) and impede normal pedestrian flow. However, their existence makes the public spaces active by attracting visitors, which also creates an opportunity for social interactions (Fig. 6.14F).

6.5 Concentration (density)

In this part, concentration has been discussed regarding building height, plot coverage, and floor area ratio (FAR).

Building Height

Fig. 6.15 maps the transformation of the building height. From these maps, it is evident that over time, the number of higher-storeyed buildings has increased following the process of both incremental and radical transformation. The early mid-rise buildings (up to 6 storeys) have incrementally transformed to high-rise buildings (10 storeys and over) by adding new floors. Again, the older low-rise buildings were entirely replaced by new developments of taller mixed-use buildings. These higher-storeyed buildings concentrated along the main roads further consolidated over time and also expanded into a few local streets. The increased market demand for commercial uses like shops and offices has led to the growth of high-storeyed mixed functions on the main roads and around the principal node.

Fig. 6.15C maps the existing building height. This map illustrates that the building height ranges from 1 to 16 storeys. However, the area is dominated by buildings with 1 to 6 storeys, which characterise the local streets. Buildings above 10 storeys are mostly concentrated on the main roads and around the principal node. The majority of the buildings of this area were constructed before 2008 when the new building by-law was amended. However, the renewed building regulation has allowed the construction of taller buildings by setting new height limits. The building regulation suggests that building heights can be measured about the respective plot size and adjacent road width. Considering the plot size and road width ranging from 29-12726 square metres and 2-27 metres; the estimated building heights along the main roads and the local streets are supposed to be within 13 and 7 storeys respectively. However, some newly-constructed mixed-use buildings are evident across the site, which violates the specified height limit set by the building regulation.

At present, an association between building height, type of use, and vertical extension of visit function is evident. The majority of the higher-storeyed buildings (above 7 storeys) along the main roads have work, visit, and mixed-use functions and some of these buildings also have multiple floors with visit uses. In contrast, most of the taller buildings along the local streets have residential uses.

Plot Coverage

Fig. 6.16 maps the transformation of plot coverage. These maps illustrate that over time, the number of plots with high coverage has increased. Earlier, the area was thinly dispersed with predominantly lower coverage (0-20%) plots and vacant land. A few high coverage plots dotted the site - mostly along local streets. Eventually, high coverage plots (over 60%) were developed throughout the site and intensified over time. These plots further expanded adjacent to the main roads and in the east. With time, few government residential quarters and makeshift structures have covered the large plots leaving ample open spaces, resulting in overall lower plot coverage in the west compared to the east.

Fig. 6.16C maps the plot coverage in the present context. This map demonstrates that the majority of the plots have higher coverage (over 80%). These high coverage plots characterise

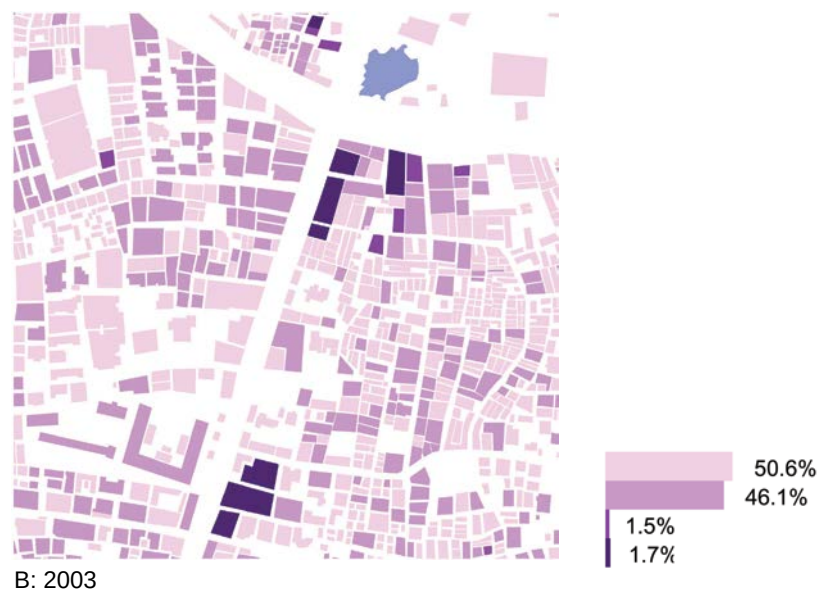
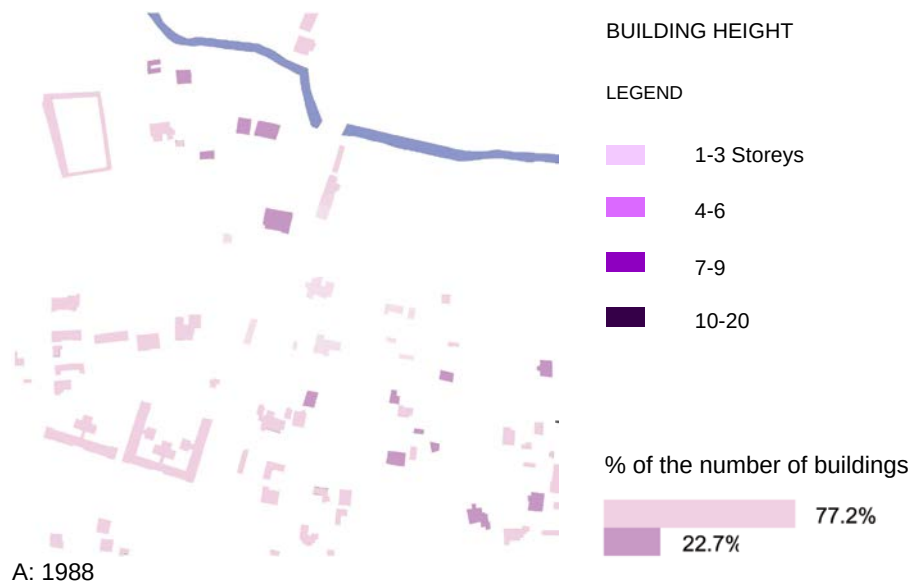


Fig 6.15: Transformation - building height (1988-2017)

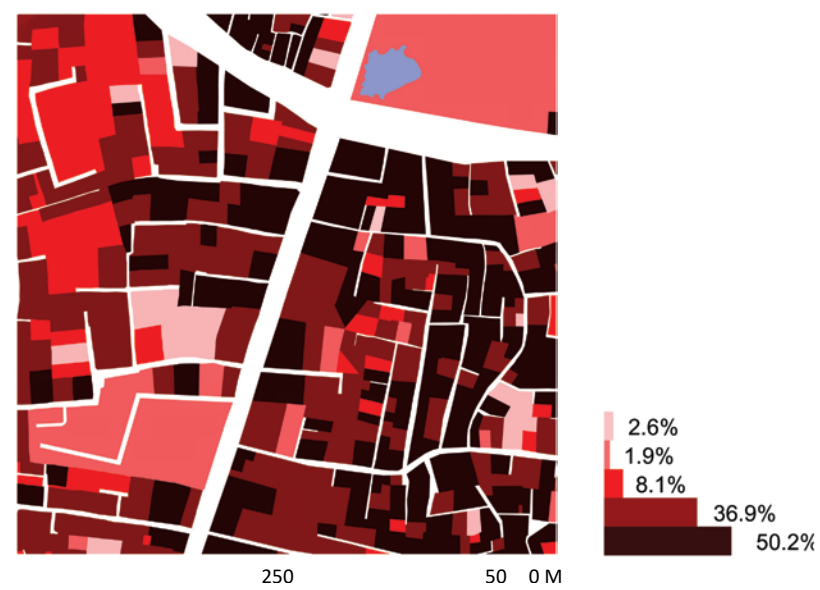
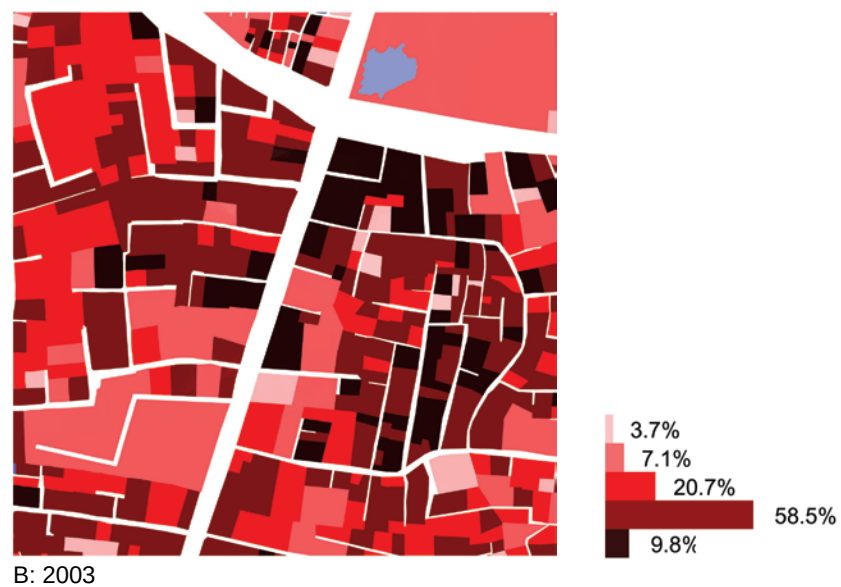
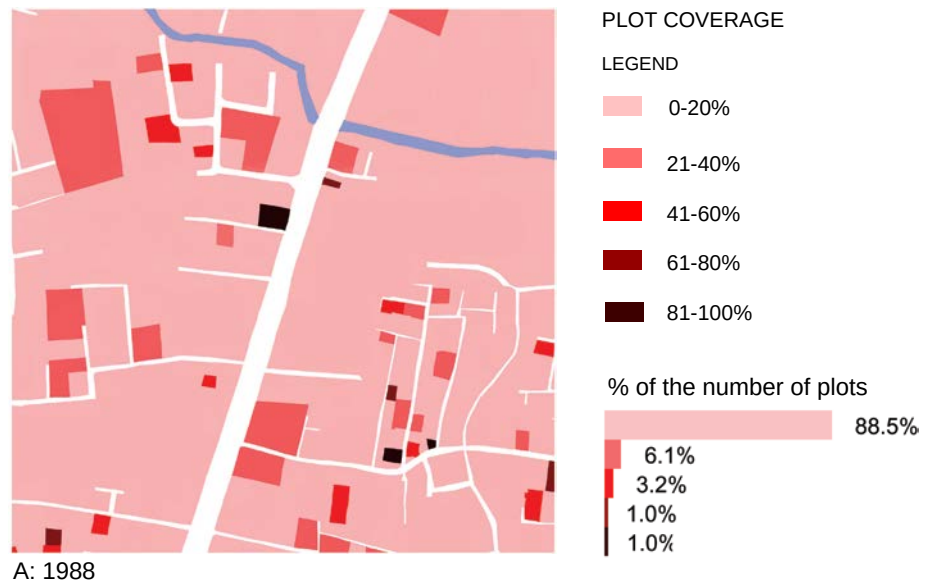


Fig 6.16: Transformation - plot coverage (1988-2017)

the main roads and local streets - primarily on the east. The number of lower coverage plots (0-40%) is few and they are mostly apparent in local streets. The newly-constructed buildings on the larger plots feature coverage between 41% - 80%. In these plots, the buildings cover the major part, leaving minimum setbacks. Conversely, in smaller plots, buildings cover the entire plot, with the intention to make a functional mixed-use and/or living unit. According to the renewed building by-laws (2008), the plot coverage ought to be within 50% - 67.5%, depending on the various plot sizes. However, some newly-constructed buildings violate this regulation.

At present, an association between the plot coverage, functional mix, and vertical extension of visit functions is evident. Most of the mixed-use buildings have mid to high (61%-100%) coverage and the majority of these buildings also contain visit functions on multiple floors.

Floor Area Ratio (FAR)

Fig. 6.17 maps the transformation of Floor Area Ratio (FAR). These maps show that at the early development, this area had predominantly lower FAR (0-2). A few plots with FAR 2.1-4 were scattered throughout the site - mainly in local streets. Eventually, the plots with higher FAR (over 6) developed along the main roads and intensified over time - especially around the principal node and adjacent areas. These higher FAR plots further expanded into some local streets.

Fig. 6.17C maps the current FAR. This map illustrates that the majority of the plots have lower FAR (0-6), and these plots are common along local streets. Conversely, high-density (6 +) developments dominate the main roads and the east. High-density buildings in the east have possibly resulted due to their early establishment compared to the west and their intensification over time. The average FAR is 3.6. According to the renewed building by-laws (2008), the FAR of this area ought to be within 3.15-6.5. Very few newly-constructed buildings follow this regulation.

Currently, an association between the FAR, functional mix, building height, and plot coverage is evidential. The majority of mixed-use buildings have mid to high FAR. These buildings also have higher floors and/or coverage as FAR is related to building height and plot coverage.

6.6 Governance and Management

Government institutions and local individuals govern the mix of uses in this area. The information regarding the governance and management of a mix of uses has been sourced from the Planning Authority, Dhaka City Corporation, local shop owners, and shop workers through a semi-structured interview during the field survey in 2017.

As a Government institution, Dhaka City Corporation (DCC) plays a role in the governance of mixed functions. At regular intervals, the Tax Collection Officers of DCC investigate to revise their records and tax rates about the type and number of functions of all buildings. The tax rate

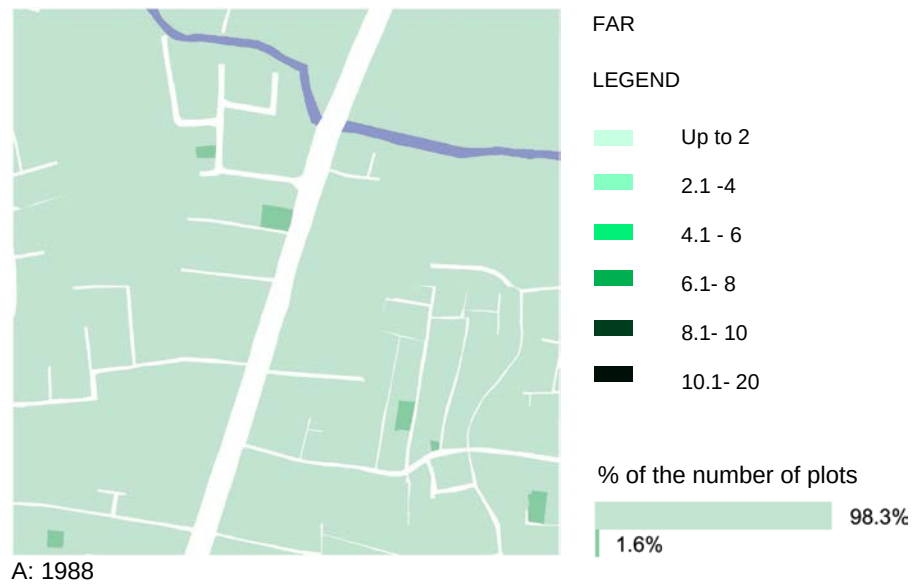


Fig 6.17: Transformation - FAR (1988-2017)

increases along with the increased area and number of shops and offices.

The Planning and Development Authority (RAJUK), as a Government institution, also plays a vital role in the management of the mix. In this area, the Planning Authority has declared a part of the east-west arterial road as 'commercial'. This indicates that work and visit use like shops, restaurants, cafes, and offices can develop on this 'commercial' road, along with residences with the condition that the plot owners have paid the 'commercial fee' to transform the building use. The responsibility of the Planning Authority is to monitor whether the non-residential uses along the commercial road have paid the fee to convert the building uses or not.

Local individuals like the house, shop owners, and street traders perform a role in the management of mixed functions. At present, 'small groups' - formed by the shop and office owners of different buildings administer functional mixes that work in different building levels. In this process, the shop owners pay the monthly rent to the house owners, and they negotiate with the house owners for their rights and security. The house owners pay an extra tax for the shops and offices in their buildings, along with the yearly holding tax, to DCC. The house owners not only rent the shops, but they also lease the shops and offices for a specific period. The informal street traders negotiate the public spaces with the local street bureaucrats. These traders pay informal taxes (bribes) to police officials and political leaders to conduct their business.

6.7 Conclusion

Green Road has mostly been shaped following bottom-up practices. Though, the city's formal structure had influenced its initial development. Over time, this area has emerged as an adaptive and responsive urban form by accommodating various functional and physical changes. The lack of mixed functions had influenced the incremental development of informal mixes in this area. In the process of transformation, the increased accessibility and connectivity has resulted in the densification and intensification of diverse mixes along the major routes and locally interconnected streets. The highly mixed major roads and local streets with predominant residential functions have made a balance between the demand and supply of supportive community functions. Thus, the interconnections of the co-functioning, connectivity, and concentration have shaped the morphology of the area into a productive and lively urban setting.

Chapter-7: Planned Area: Uttara

7.1 Introduction

The focus of this chapter is to understand the co-functioning and transformation of the mix of uses, its related urban morphology and the governance in a Planned area of Dhaka - Uttara. The morphology and transformation of mixed-use functions have been analysed regarding co-functioning, connectivity, and concentration. Through the juxtaposition and comparison of the morphological maps, this research also studies the interconnections, alliances, and synergies between co-functioning, connectivity, and concentration. The maps of 1999, 2003 and 2017 have been prepared, based on the archival research and empirical survey. This chapter has been structured into five parts. The first part briefly states the context of the study area. The second, third, and fourth parts respectively describe the co-functioning, connectivity, and concentration. Under each attribute, firstly the transformation and subsequently, its existing pattern has been discussed. The last part describes the governance of the functional mix.

7.2 Context

The study area - Uttara - is located at the northern periphery of Dhaka. It is connected with the other parts of the city through a highway. In 1965, the Planning and Development Authority (RAJUK), initiated the 'North Satellite Township' project following the western model of suburban development, which was later renamed as 'Uttara Model Town' during the 1980s (Haque and Aktar, 2016, p.33; Rashid, 2002, p.6; Ullah, 1987, p.40). The name is derived from the Bengali word '*Uttar*' meaning 'north'. The development of the area has been planned in different phases, and the expansion process is still going on. At present, Uttara is divided into 14 sectors. The study area extends over parts of sectors 11 and 13 (Fig. 7.1). The development of these sectors began in 1988 (Haque and Aktar, 2016, p.35). The study area has two main roads - Sonargaon Janapath and Gareeb-e-Nawaz Avenue (Fig. 7.1). These two roads, running east-west and north-south respectively, have divided the area into four divisions. The area includes a very small part of 'Uttara Lake' along its south-east corner. Also, it has three open spaces on the north-east, south-east and south-west sides. The open spaces on the north-east and south-east are neighbourhood parks, and the open space on the south-west is mainly used for cultural activities and recreation.

During the early 1960s, the Planning Authority of Dhaka considered it necessary to build new residential communities to meet the demands of the growing population and to reduce the pressure of high population density in the city (Ullah, 1987, pp.28-34). With these objectives, the respective authority set up this residential neighbourhood in the periphery of the city under the 'site and service scheme' (Haque and Aktar, 2016, p.33). Initially, this housing project was intended to provide housing services to 'all income groups', with special emphasis on those with lower and middle-incomes. Under the 'site and service scheme', the Planning Authority was the leading developer of the land, which they leased to private individuals. During the development



Fig 7.1: Study area and surroundings

LEGEND

- Built space
- Open space
- Study area

process, the authority took cost-recovery into consideration and eventually, the residential plots were distributed among the higher-income population group (Haque and Aktar, 2016, p.31). Initially, various spaces were allocated for necessary community facilities in this residential project, which were developed much later in different phases. Although Uttara was initially planned as a residential neighbourhood, for the last few years the Planning Authority has amended the building by-laws to formally recognise the mixed-use functions that have already been developed there. Under this process, they have declared a few major roads as 'commercial'. In this study area, the east-west running arterial road was declared as 'commercial' during the 1990s. Hence the mixed-use buildings located on this road are currently recognised as authorised. According to the Planning Authority, the functional mix of the north-south running arterial road is also in the process of gaining authorisation in the future. However, the visit and work functions that are evident along local streets are still unauthorised.

Generally, the study area demonstrates a formal framework with spontaneously-developed mixed-use functions, which has been explored in detail in the following sections. This area also features a formal mix of different lot/plot sizes and a social mix of different rents and middle to upper-income groups of residents (Mridha, 2015, p.667).

7.3 Co-functioning

In this part, co-functioning has been discussed in terms of functional mix, mix at ground level, vertical extension of visit functions, plot, interface, and entry.

Functional Mix

Fig. 7.2 maps the transformation of the functional mix. This area was not mixed in earlier times. Later, functional mixes emerged in a dispersed manner across the site. They consolidated over time, especially along the main roads, and expanded into several local streets. In due course, work, visit, and their various mixes (blue, green, cyan, white) increased along the main roads, while live/visit mixes (yellow) emerged in local streets. The good access and large-sized plots have permitted the development of large scale work and visit functions along the main roads. Live functions (red), from their early development, increased further - mainly in local streets. In the transformation process, many vacant plots were altered into diverse single and mixed-use functions. The lack of community facilities during the initial development phase and weak monitoring by the formal authority might have influenced the growth of informal mixes in this Planned neighbourhood.

Fig. 7.2C maps the current pattern of the functional mix. This map shows that the area, being planned as a residential neighbourhood, is dominated by live functions. These live uses are widespread in local streets (Fig. 7.3A). Among all the mixes, live/visit are significant and these mixes are standard across the site - mainly along local streets (Fig. 7.3B). In contrast, the main roads and the principal node are characterised by work, visit, and their related mixes (Fig. 7.3C-E). Several vacant plots are also evident, spread throughout the site, primarily in local streets.

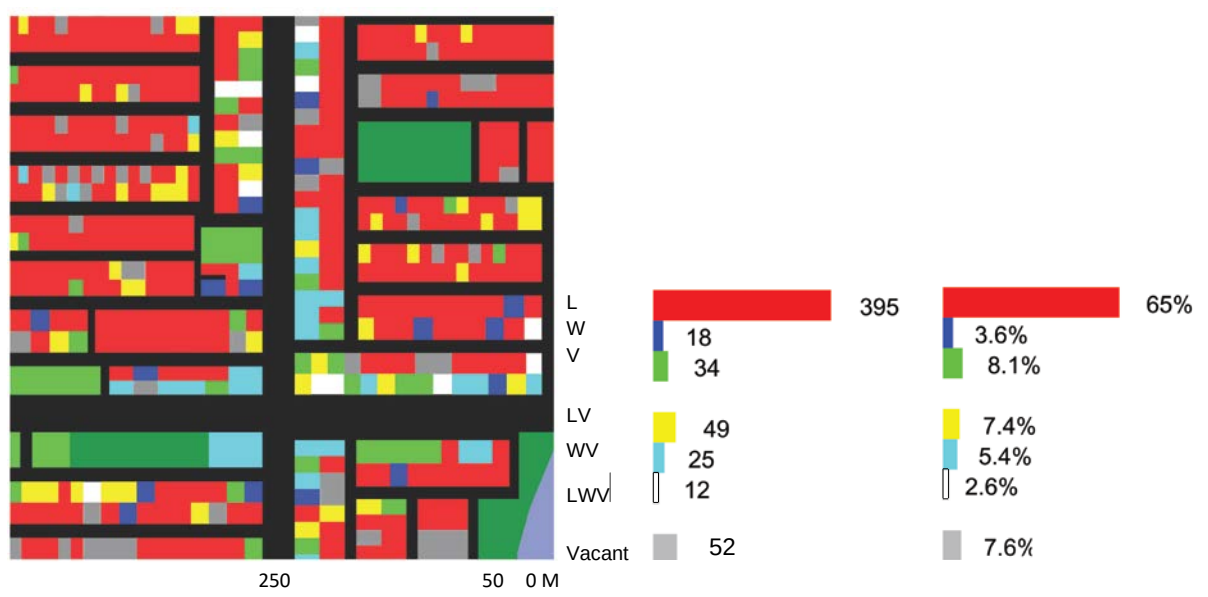
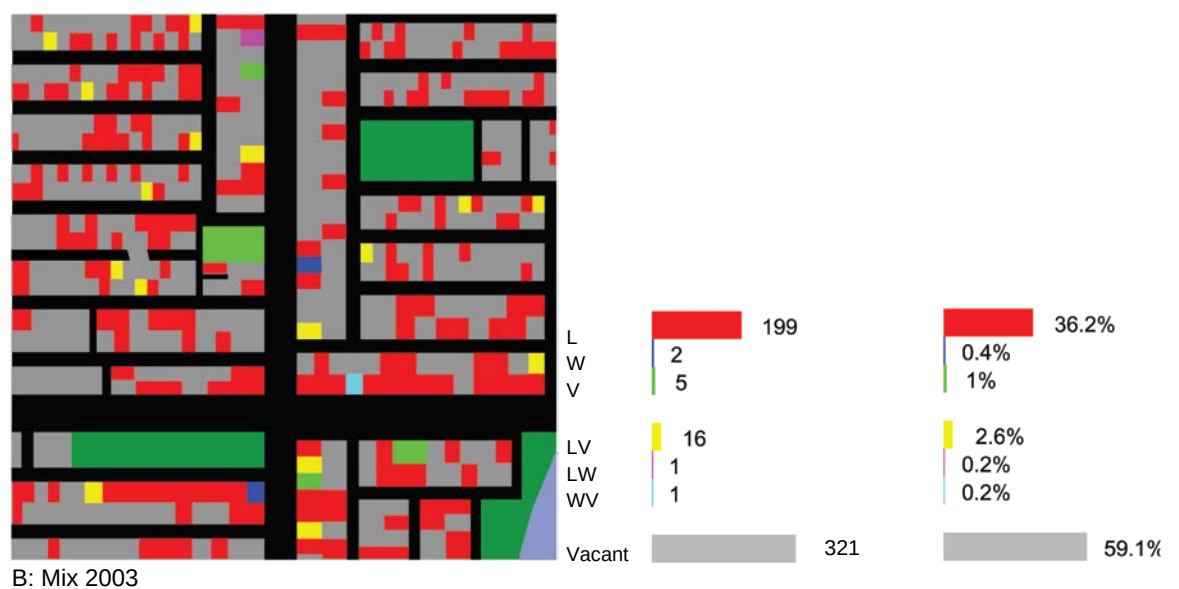
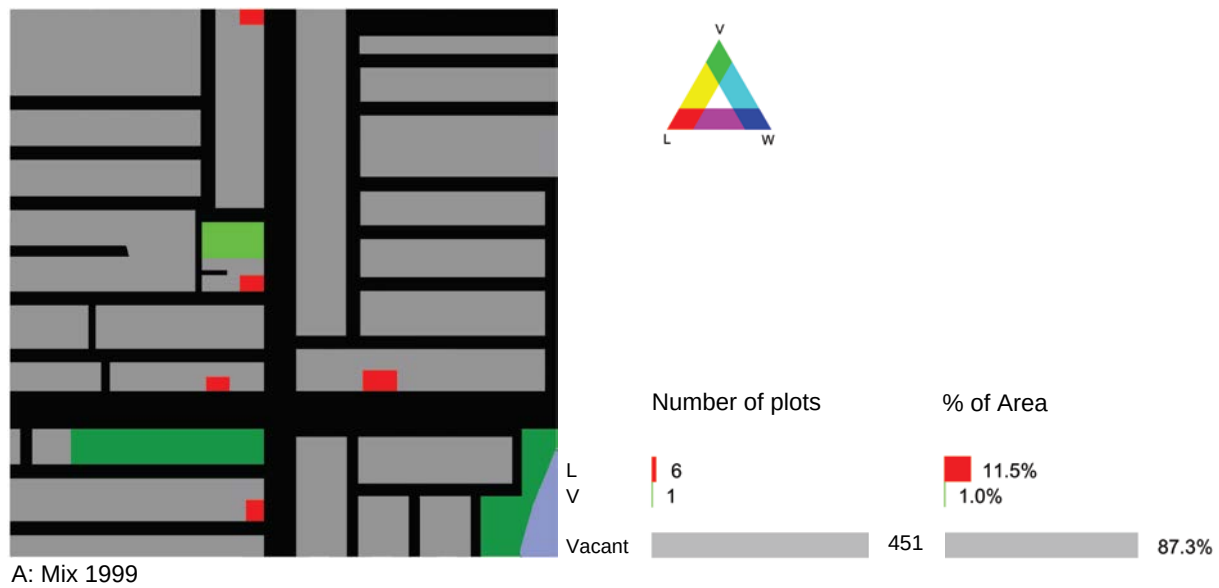


Fig 7.2: Transformation of the functional mix (1999-2017)



A: Live functions along a local street



B: Live/Visit mix in a local street



C: Visit and work/visit mixes along the east-west running arterial road



D: Visit, work/visit and live/work/visit mixes in the north-south running arterial road



E: Concentration of mix around the principal node



F: Visit function (wet market) along the main road



G: A work/visit mix (private school and shop) in a local street

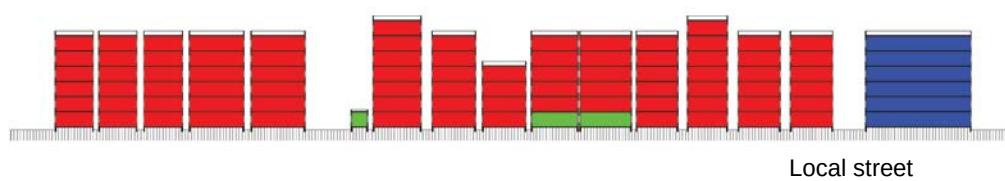


H: A work function (car repair garage) in a local street

Fig 7.3: Different functions in the study area



A: Section along the main road



B: Section along a local street

Fig 7.4: Sections showing vertical mixes

Visit functions are a significant part of the functional mix. In this area, the primary visit functions along the main roads are vegetable and wet markets (Fig.7.3F), shopping complexes, supermarkets, showrooms, restaurants, and cafes. Conversely, the visit uses in local streets are mainly shops, such as grocery, stationery, barber, laundry, and pharmacy, and these shops are primarily developed to fulfil the daily necessities of local residents. Visit functions, coded by the deep green colours, are open spaces.

This area also demonstrates the existence of diverse work functions, and they are most apparent in local streets. These work functions are schools, small-scale private offices, and car repair garages (Fig.7.3 G-H). They do not seek a high degree of accessibility and visibility compared to the other work functions along the main roads. The work uses in the main roads are banks, various government, and large-scale private organisations.

In this area, the degree and organisation of various functions differ in mixed-use buildings along main roads and local streets. Fig. 7.4 shows the vertical organisation of the functional mix. A high number of work and visit functions characterise mixed-use buildings along the main roads. In contrast, the buildings in local streets have more live uses.

Functional Mix at Ground level

Fig. 7.5 maps the transformation of the functional mix at ground level. The ground level of the urban fabric was not mixed since early times. Functional mixes later developed in a few locations, which increased in number over time and scattered across the site. Simultaneously, visit functions significantly emerged at ground level. Earlier, some visit uses to spread throughout the site, which further intensified - especially along the main roads and over time, expanded into several local streets. The demand for good accessibility and connectivity has driven the higher growth of visit uses on the ground level in the major roads. The growth of other single-use functions - live and work - was also evident into some local streets. In the process of transformation, the number of parking was increased at ground level. The renewed building regulation with compulsory parking requirements has catalysed these changes.

Fig. 7.5C maps the current pattern of the functional mix at ground level. It is evident from this map that most of the plots have parking on the ground level. Particularly in local streets, the urban fabric is characterised by these ground-level parking. Visit functions are also prominent, mostly prevalent along the main roads and around the principal node. These visit functions on the street level make urban interfaces lively by offering diverse products and activities and attracting larger crowds. Some live and work functions are scattered across the site, primarily in local streets. Besides, a few mixed-use functions are apparent both along the main roads and the local streets. Informal street trading is an integral part of the functional mix in this Planned area. It has been discussed with the connectivity in section 7.4 to understand their interrelationships.

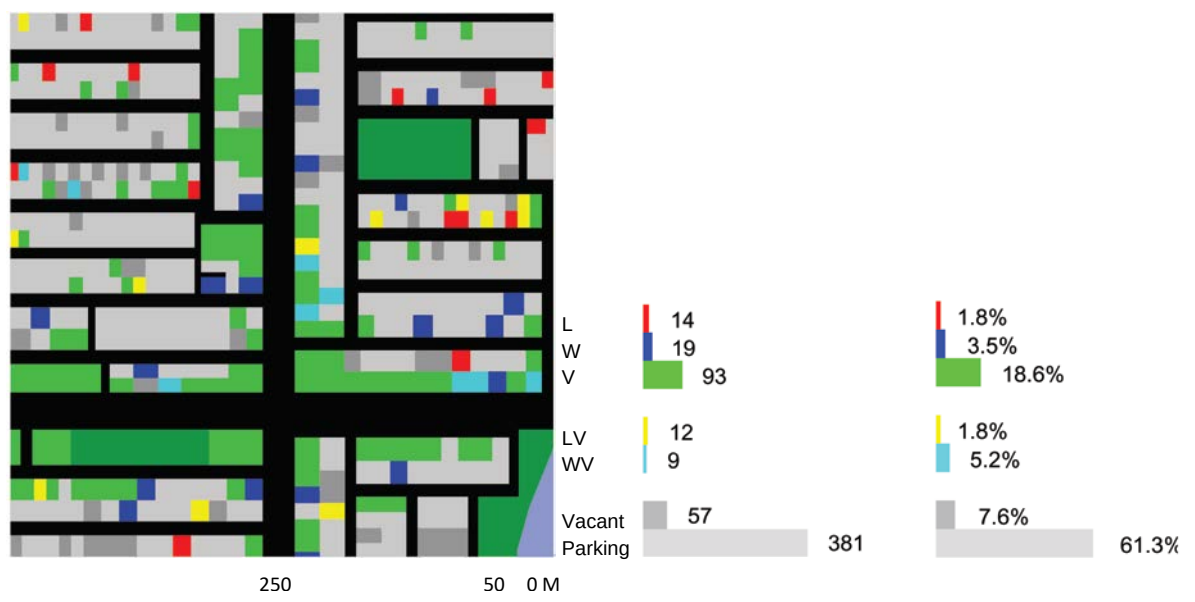
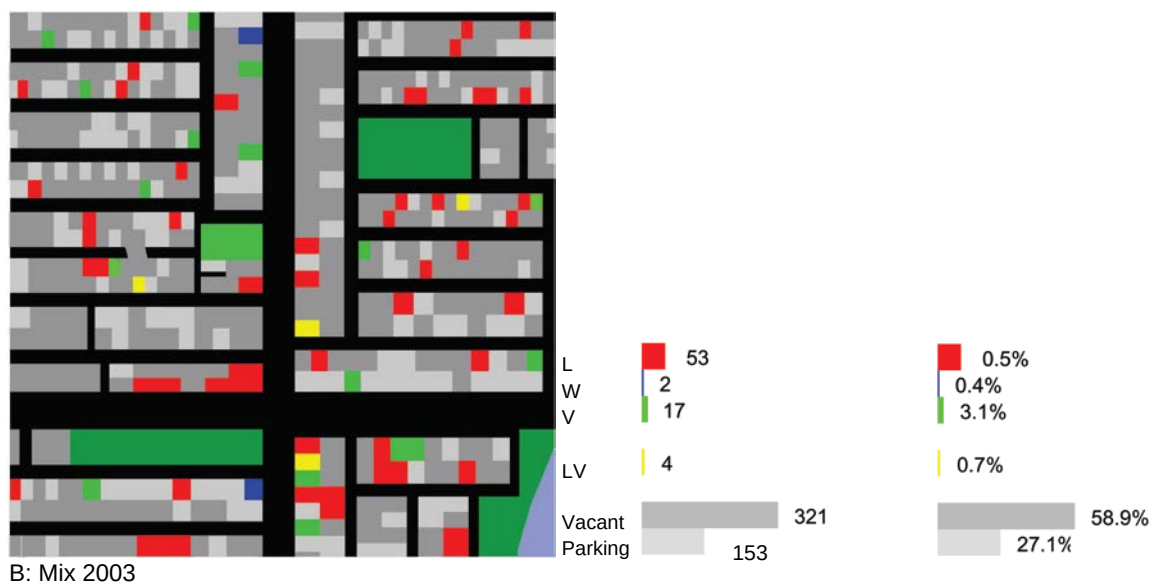
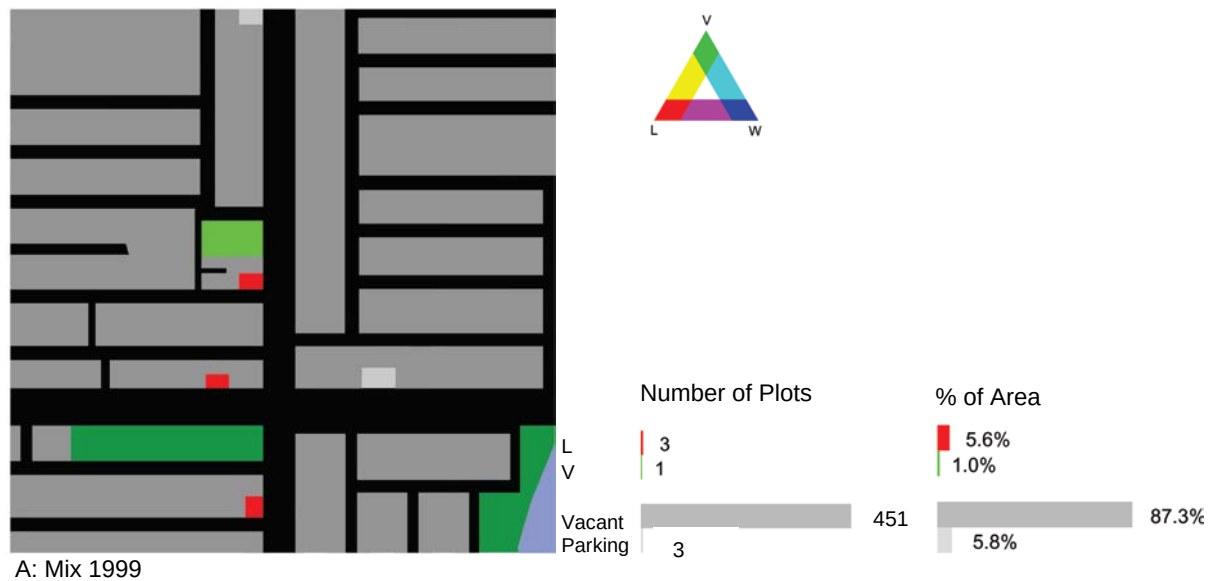


Fig 7.5: Transformation of mix at ground level (1999-2017)

Vertical Extension of Visit Function

Fig. 7.6 maps the transformation of the vertical extension of visit functions. These maps demonstrate that in the course of time, the number of floors containing visit functions has increased. Earlier, most of the visit uses were confined to ground level, and visit functions on multiple floors were evident in a few buildings along the main roads. Further, visit functions intensified over time, primarily in the main roads, and expanded into a few local streets. The good accessibility and connectivity of the main roads have led to the development of more visit functions on the upper floors of the buildings.

Fig. 7.6C maps the current pattern of the vertical extension of visit functions. The majority of the visit functions are confined to the ground floor, especially in local streets. Visit functions on the upper floors are prevalent along the main roads and around the principal node, where visit uses are extended up to fourteen storeys.

Plot

Figs. 7.7 and 7.8 maps the transformation of plots and the alterations in plot sizes and distribution over time, respectively. Fig 7.7 demonstrates that in due course, subdivisions of the plots were more prominent than amalgamations, which started in the later period. These maps also show that a higher number of plots were subdivided in the early phase in comparison to the subsequent period. Most of these subdivisions appeared in local streets - mainly on the north-west and primarily included mid-large sized plots (251-2001+ square metres). Earlier, these subdivided plots were mostly developed into live, visit, and related mixes; while in the later period, they were developed into live, work, visit, and their various mixes. These subdivisions were conducted by the Planning Authority to distribute the lands among the plot owners. During the subsequent period, some plots were amalgamated, mostly along the main roads. These amalgamations were confined to small-sized plots (0-500 square metres). The amalgamated plots along the main roads were transformed into high-density visit and work/visit mixes. Conversely, the amalgamated plots in local streets were altered into multi-storeyed apartment buildings.

Fig. 7.8C maps the current pattern of plots. It is evident from the map that this area has two dominant plot sizes of 335 and 210 square metres of regular shapes. The majority of the plots are small (0-250 square metres), and they are typical - primarily along local streets. The larger plots (250-500 square metres) are prevalent adjacent to the main roads and along the south-east, beside the lake. Perhaps the majority of the larger plots were strategically planned along the main roads to encourage high-density developments. A few large-size plots (501+square metres) are evident, scattered across the site. These plots are the amalgamated plots from the preceding years and/or plots used as community facilities.

In this study area, plot size has a higher association with the type of function. Work, visit, and their various mixes are more pronounced in the larger plots (335 square metres) along the main roads. Conversely, the live and live/visit mixes are prominent in smaller plots in local streets.

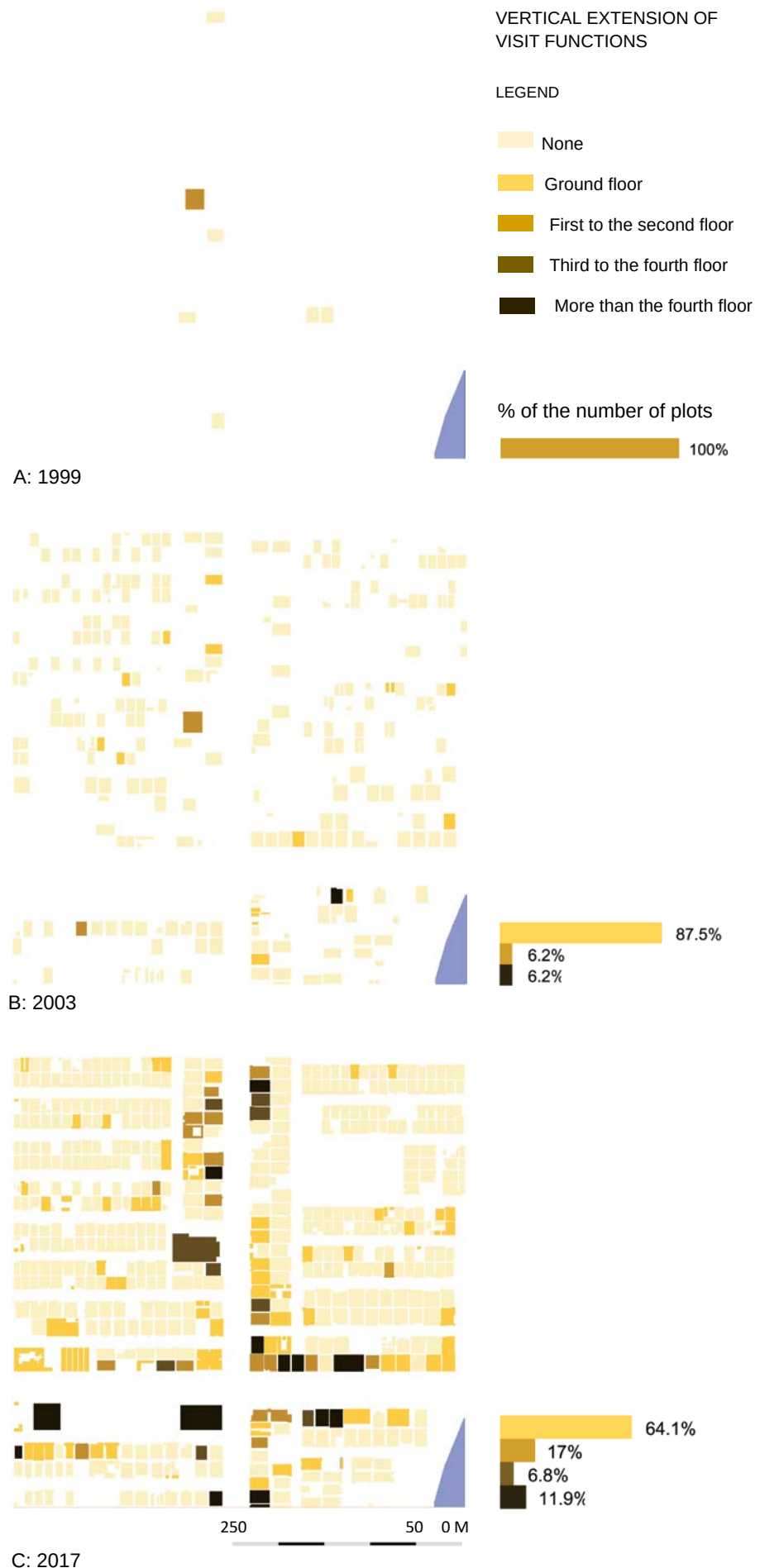
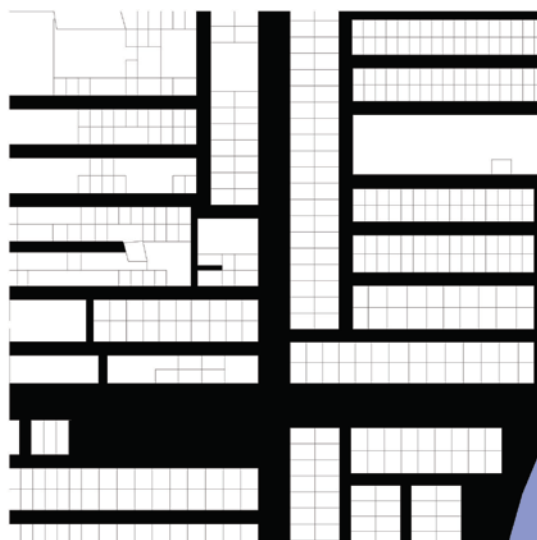
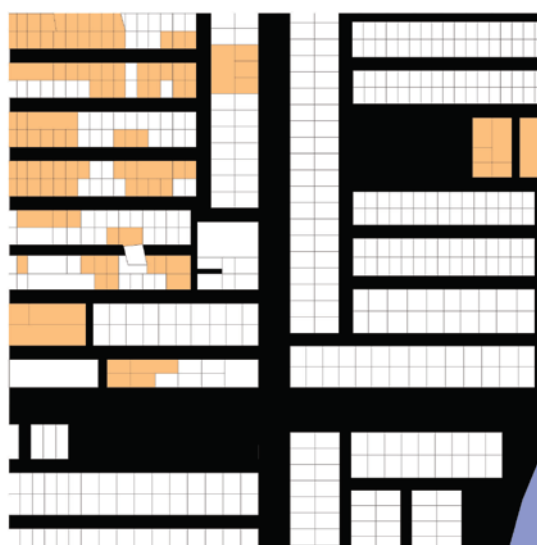


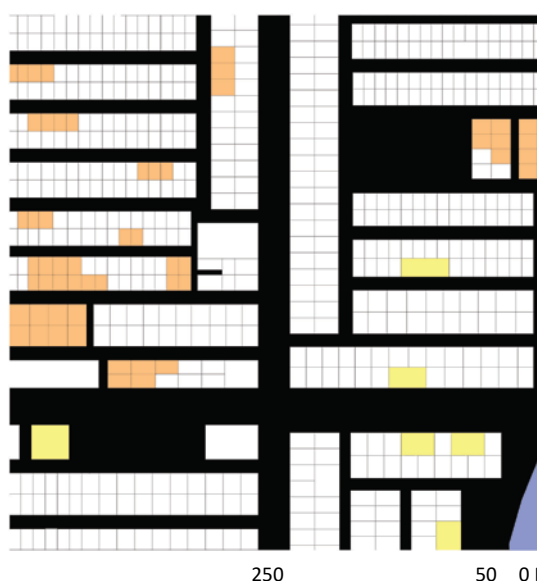
Fig 7.6: Transformation - vertical extension of visit function (1999-2017)



A: 1999



B: 2003



C: 2017

AMALGAMATION AND SUB-DIVISION OF PLOTS

LEGEND

- Sub-divided plots from the immediately previous period
- Amalgamated plots from the immediately previous period

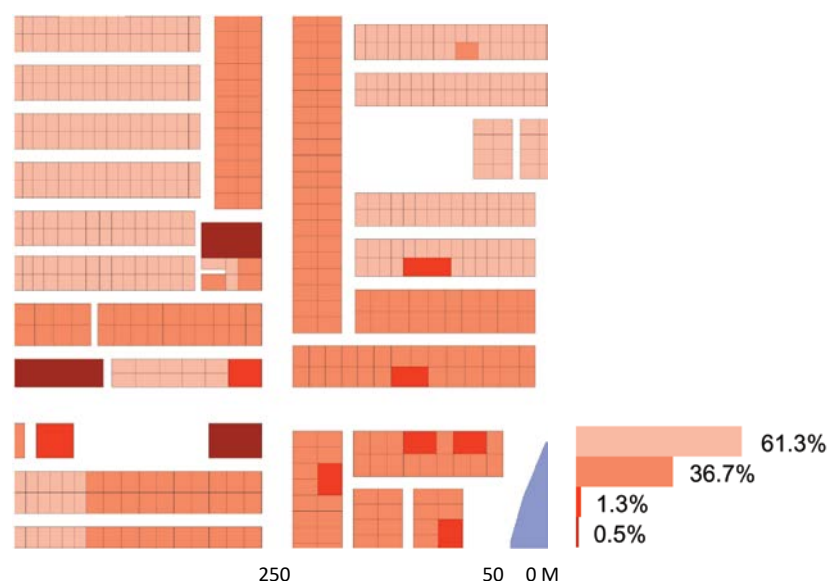
Fig 7.7: Amalgamation and sub-division of plots (1999-2017)



A: 1999



B: 2003



C: 2017

Fig 7.8: Transformation - plot size (1999-2017)

Large scale work and visit functions are primarily developed on the larger plots to achieve high-densities.

Urban Interfaces (2017)

Fig. 7.9 maps the current pattern of the public-private interface. It is evident from the map that this area is dominated by mixed (car/setback and pedestrian/setback) (Fig.7.10A) and impermeable/blank interfaces (Fig.7.10B). The main roads are characterised by pedestrian/setback (Fig.7.10C) and direct/transparent interfaces of shopping strips (Fig. 7.10D). Direct/transparent interfaces are also apparent in local streets, where shops are evident. Direct/opaque interfaces (Fig.7.10E) featuring the live and live/visit mixes are spread across the site. In a few cases, inconsistency persists between the building interfaces and the functions inside. For instance, visit functions, such as beauty parlours, barbershop, etc. in local streets do not have direct/transparent interfaces. The informal practice of land-use conversions primarily leads to such mismatch in urban interfaces.

Building Entries (2017)

Fig.7.11 maps the existing building entries. This map shows that the area is dominated by live (red) entries, as the majority of the buildings are residences. These live entries are widespread in local streets. The main roads are characterised by visit, work, and mixed entries because of the higher concentration of mixed functions along these roads. Most of the buildings along the main roads have informally converted into functional mixes. As a result, building entries here are predominantly mixed type, as there were no provisions for separate entries when these buildings were first constructed. Conversely, in local streets, the number of mixed entries is minimal, as different functions are horizontally mixed and they have separate entries from the street.

7.4 Connectivity (Public Space Network)

This section discusses the transformation, the existing structure of the public space network and its permeability in the study area. It also confers the relation of connectivity to visit interfaces, functional mixes, and street trading.

Fig. 7.12 maps the transformation of public space networks. No significant change has been revealed, except for the incremental addition of a few local streets. Earlier, there were no local streets in the north-west corner and a part of north-east, as these areas were under-developed. Later, with the construction of some local streets, the connectivity of urban blocks has increased. In the past, this area had no separate pedestrian ways; these began to develop along the main roads. These maps also show the transformation of visit interfaces. In the earlier stage of development, visit interfaces were not significant and were dotted across the site. In the following periods, along with the growth of mixed functions, visit interfaces increased all over the site and were concentrated primarily along the main roads.

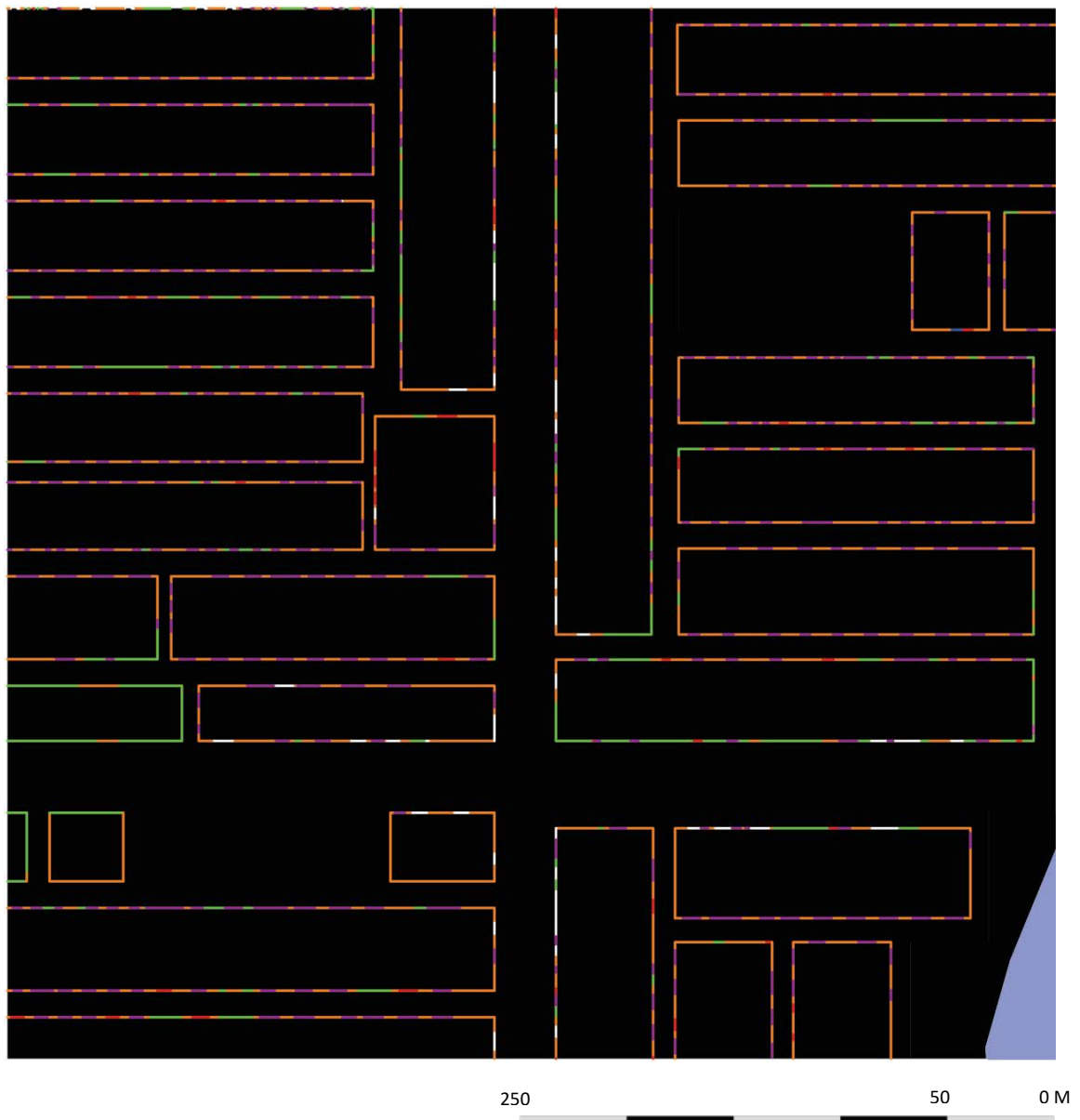


Fig 7.9: Public-private interface types (2017)

LEGEND

- Impermeable/Blank
- Direct/Opaque
- Direct/Transparent
- Pedestrian/Setback
- Mixed-Car/Setback
Pedestrian/Setback



A: Mixed (car/ pedestrian setback) interface



B: Impermeable/blank interface



C: Pedestrian/setback interface



D: Direct/transparent interfaces



E: Direct /opaque interface

Fig 7.10: Public-private interface types

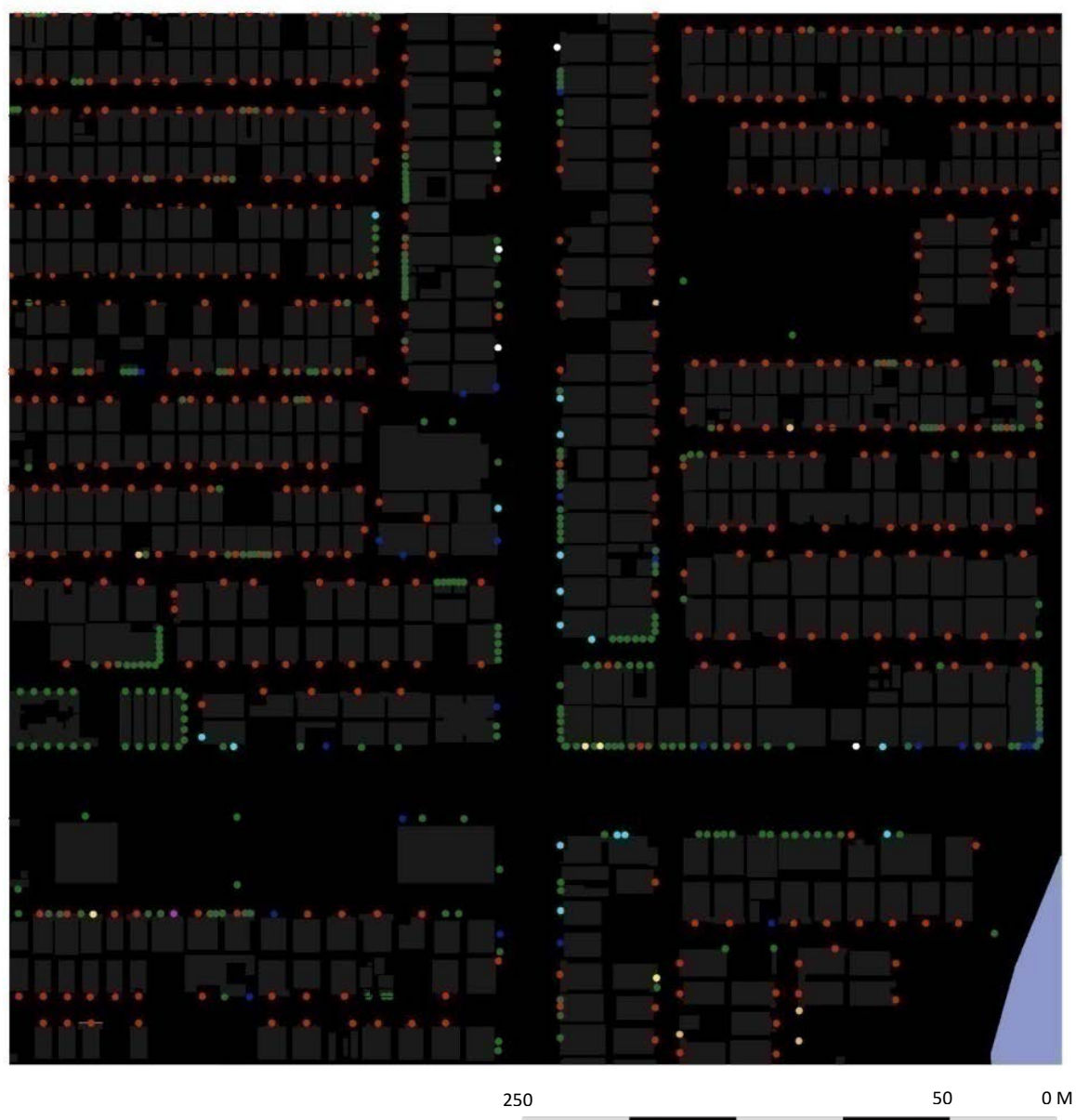
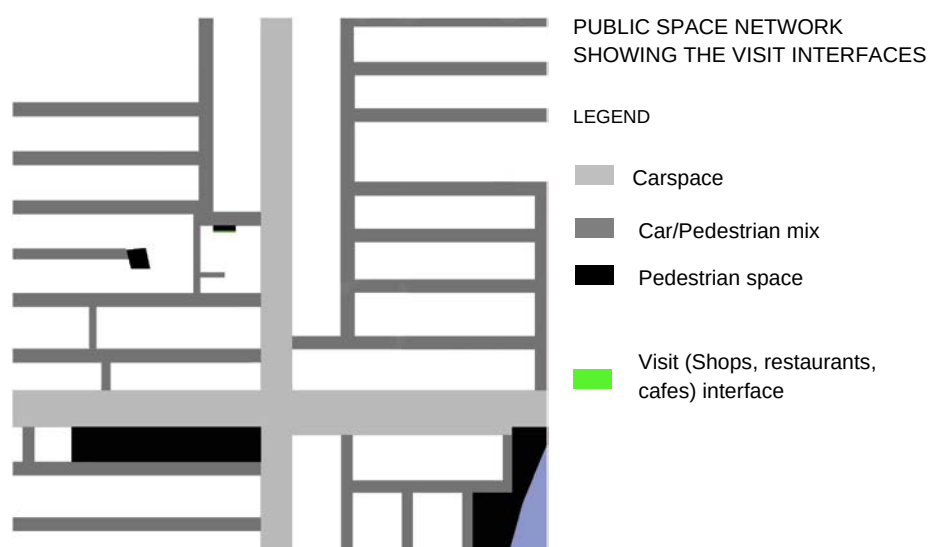
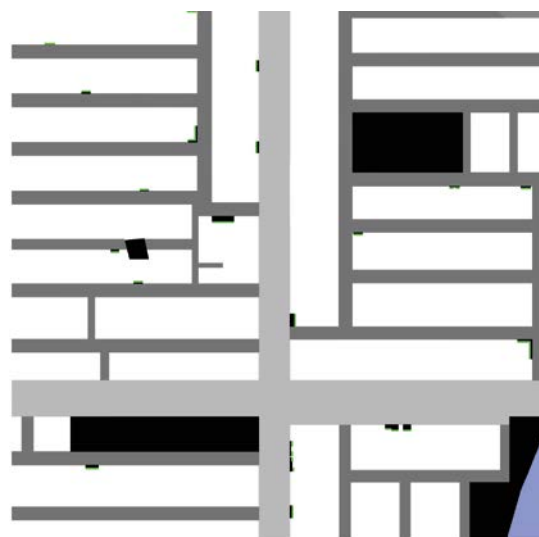


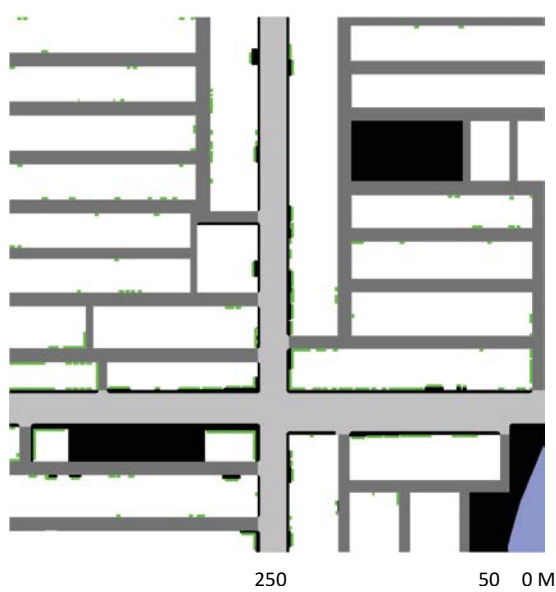
Fig 7.11: Building entries (2017)



A: 1999



B: 2003



C: 2017

Fig 7.12: Transformation - public space network (1999-2017)

Fig. 7.13 maps the existing public space network. The public space network, containing roads and streets of varying widths, represents a hierarchical layout in a grid-iron pattern and divides the area into several rectangular blocks. The street network can be categorised into two types. The first in the hierarchy, are the two long arterial roads. The width of these roads varies from 25 to 30 metres. They are accessible by both cars and pedestrians. Next in the hierarchy, are local streets, which are distributed from the main roads in both north-south and east-west directions. In this area, local streets comprise a significant portion of the access network. The width of these streets varies from 5 to 6.5 metres, and both are accessible by cars and pedestrians. However, these streets have no separate walkways.

The permeability of the public space network is analysed at present context to examine its effect on the development of movement-seeking functions. An important measurement of permeability is the perimeter of the urban blocks, which vary from 172 metres to 641 metres. The most extended block length is 277 metres, and the average block length is 136 metres, which exceed the highest block length of 100 metres, suggested by Jacobs (1961) to maintain easy pedestrian flow in all directions. The score of AwaP at the 500m scale is 522 metres. The majority of the blocks are long (exceed 100 metres). This provides pedestrians with minimal choice of public pathways and does not allow them opportunities to pass through the long blocks. Hence, the access network of this area has lower permeability. This type of morphology restrains the development of mixed functions and does not successfully contribute to the synergies of intensive street life.

In this area, the connectivity has an association with visit interfaces and mixed-use functions. Fig. 7.13 maps the existing visit interfaces, which shows that these interfaces are apparent across the site, mainly along the main roads and around the principal node. The relationship of connectivity with the functional mix demonstrates that significant scale work, visit functions, and their related mixes are widespread on the main roads, and live/visit mixes are standard along local streets.

Fig. 7.13 also maps the informal street traders. Street traders are present throughout the site - primarily along the main roads and around the community nodes (Fig. 7.14A). Three types of street traders - stationary, peripatetic, and mobile - are pronounced here. Stationary traders are frequently seen with temporary sheds on public-private interfaces (Fig. 7.14 B-E). These street traders sell products like fruit, vegetables, fish, local street food, utilitarian items - shoes, clothes, household products - and so on. In this area, the street traders and the shops in the mixed-use buildings do not usually conflict, except for a few exceptions, for instance, in the locations along the main roads. Informal traders selling similar or different products are evident in front of the mixed-use buildings with shops at ground level. Sometimes, street trading also conflicts with the regular traffic and pedestrian flow, as it occupies a significant portion of the pedestrian ways and streets (Fig. 7.14 F-G). However, various activities and the crowds that they generate around them make the public spaces vibrant (Fig. 7.14H).



Fig 7.13: Public space network (2017)

AwaP- 522 m



A: A group of street traders around a community node



B: Stationary street traders in the main road



C: A stationary street trader with temporary shed along the main road



D: Peripatetic street traders in a local street



E: A mobile street trader along a local street



F: Peripatetic street traders occupying a part of the main road and adjacent pedestrian way



G: Stationary street traders occupying a part of the pedestrian way along the main road



H: Public gathering around the peripatetic street traders in a local street

Fig 7.14: Informal street vendors

7.5 Concentration (density)

In this part, concentration has been discussed regarding building height, plot coverage, and floor area ratio (FAR).

Building Height

Fig. 7.15 maps the transformation of the building height. These maps demonstrate that, over time, higher-storeyed buildings have increased. Earlier, only a few tall buildings were evident along the main roads. The number of these buildings increased in the subsequent period and spread across the site. This phenomenon continued in later periods, and the tallest buildings (10-20 storeys) were developed along the main roads. The possible driver for the growth of high-storeyed buildings is the increased market demand for commercial uses along these roads. The new policy has also fuelled this change. Before 2008, only 6-storeyed buildings were allowed. Eventually, with the amendment of the building regulations, permission for building construction was extended up to 9 storeys.

Fig. 7.15C maps the existing building height that ranges from 1 to 14 storeys. However, the majority of the buildings are 4 to 6 storeys tall. Buildings of 1-9 storeys are apparent throughout the site, while, buildings with more than 10 storeys characterise the main roads and the principal node. At present, buildings up to 9-storeys are allowed; however, some newly-constructed buildings are evident which violate this rule.

Currently, an association between building height, type of use, vertical extension of visit function, and the plot is evident. All the tallest buildings (10 to 14 storeys) along the main roads contain mixed-functions. All of these buildings are on larger plots (335 square metres) and some of them also contain visit functions on multiple floors. In contrast, most of the taller buildings in local streets have live functions.

Plot Coverage

Fig. 7.16 maps the transformation of the plot coverage. These maps show that, over time, the number of high coverage plots has increased. In the past, the area was dominated by vacant land. A few large coverage plots were dispersed along the main roads. Later, these plots were developed, consolidated over time, and expanded across the site. The increasing demand for work and visit functions and the lack of monitoring by the Planning Authority have been the possible reasons for the growth of large coverage plots in this area.

Fig. 7.16C maps the plot coverage in the present context. The majority of the plots have 61% to 80% coverage. The mid-high coverage plots (61-100%) are prevalent across the site. Plots with the coverage of 0-20% are mostly vacant and are evident in local streets. According to the renewed building by-laws (2008), the coverage of different plots of this area ought to be within 50 - 67.5%, depending on the various plot sizes. However, several newly-constructed buildings breach this regulation.

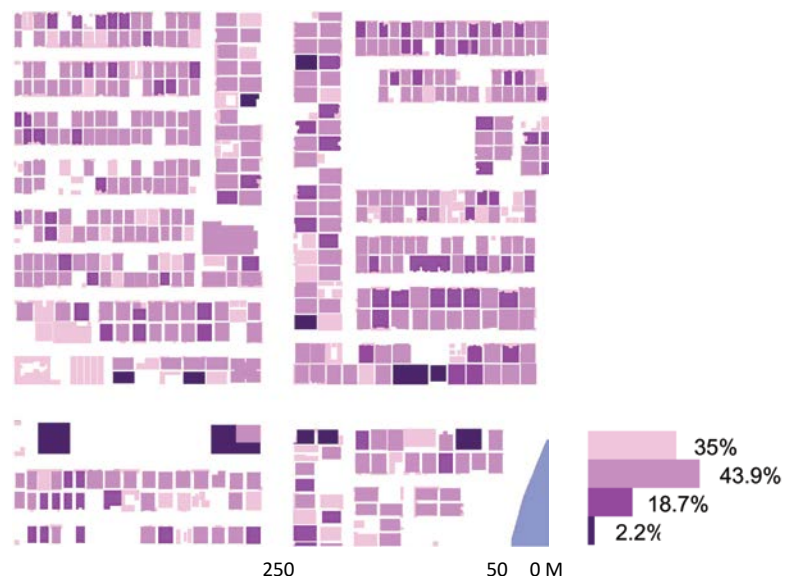
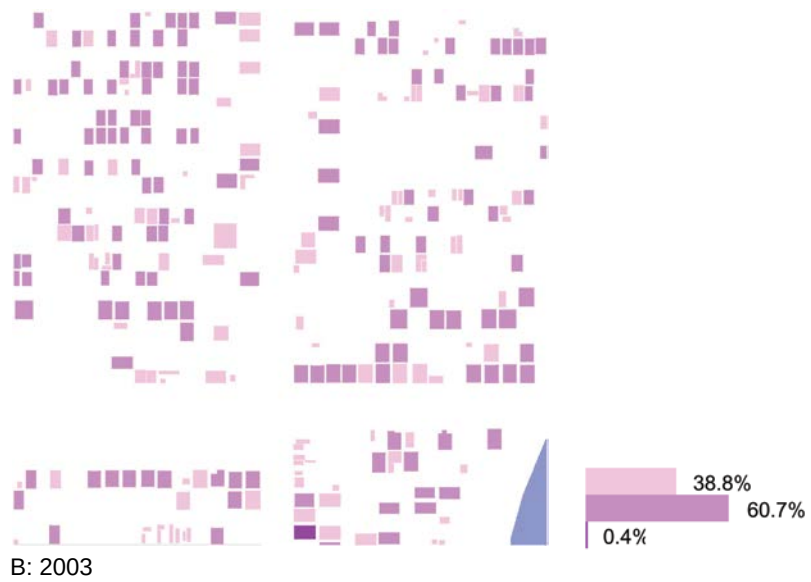
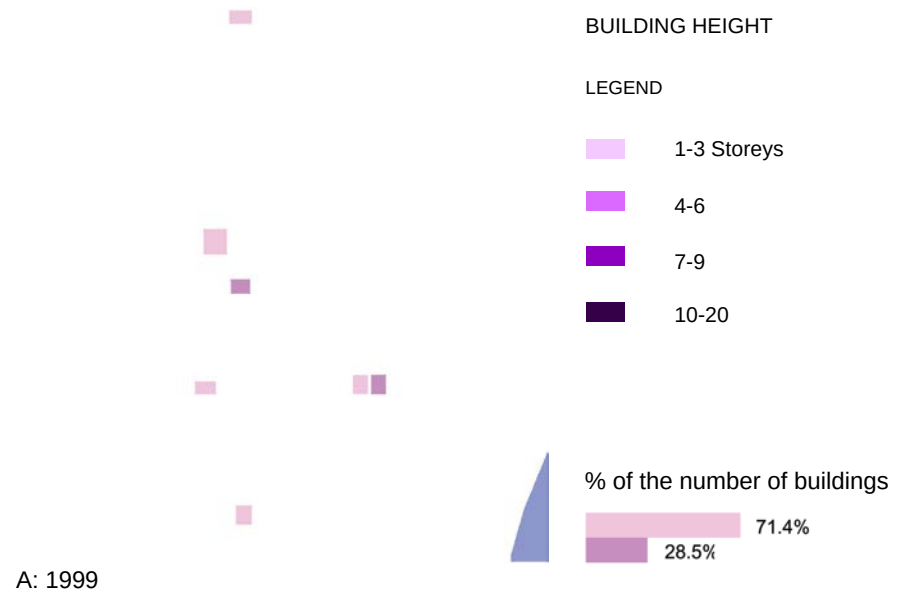
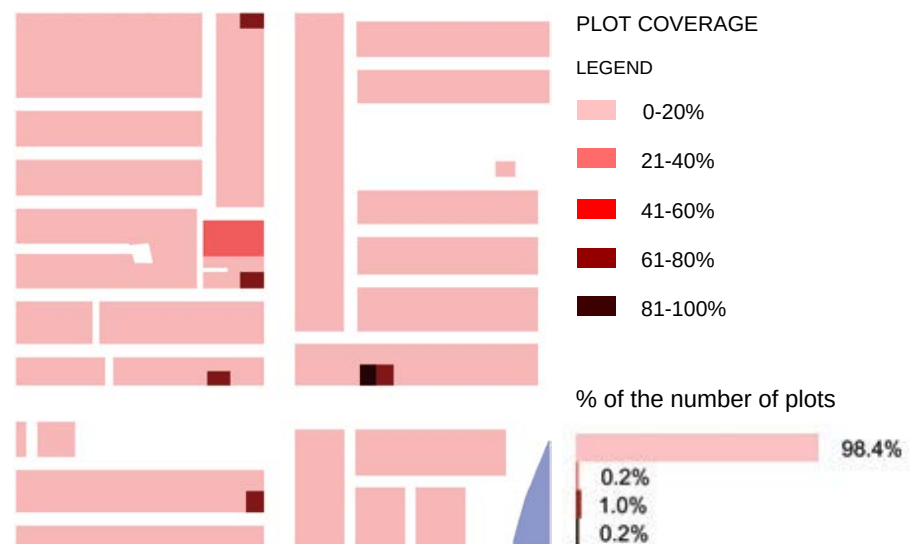
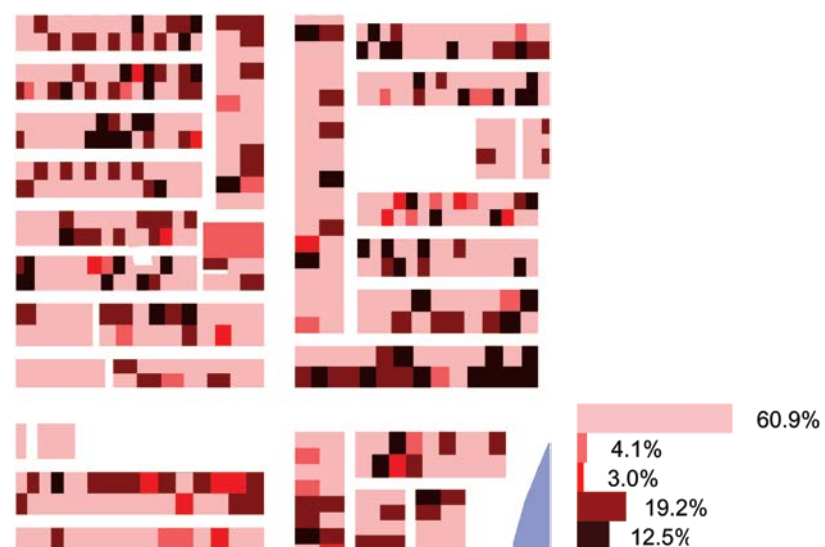


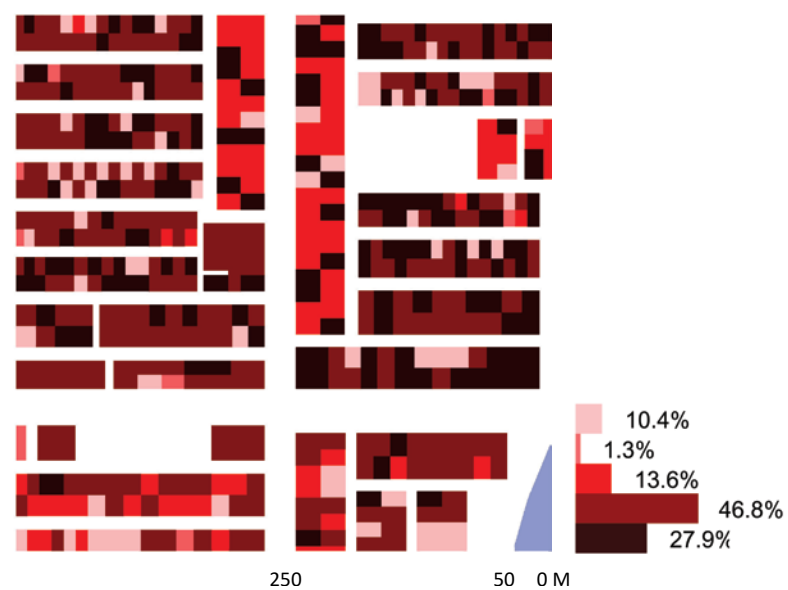
Fig 7.15: Transformation - building height (1999-2017)



A: 1999



B: 2003



C: 2017

Fig 7.16: Transformation - plot coverage (1999-2017)

Plot coverage has an association with the functional mix and vertical extension of visit functions. The majority of the work, visit, and various mixes have mid-high plot coverage. In some of these buildings, visit functions also extend on multiple floors.

Floor Area Ratio (FAR)

Fig. 7.17 maps the transformation of the FAR. These maps show that the number of plots with higher FAR has increased over time. Earlier, the area was characterised by lower FAR, and only a few plots with mid-FAR were apparent on the main roads. Later, plots with mid-FAR were developed and increased over time, particularly in the north, and expanded all over the site. In the subsequent period, the development of higher FAR (over 6) plots was evident, mainly along the main roads. In the process of transformation, several lower FAR buildings were gradually replaced by the multi-storeyed high coverage developments.

Fig. 7.17C maps the current pattern of FAR. This map shows that the majority of the plots have low-mid FAR (0-6) and these plots are prevalent throughout the site. The average FAR is 3.5. The plots with high FAR (over 6) are most evident along the main roads. However, some mixed-use buildings along the main roads are above the FAR limit of 3.5-6.5, as specified by renewed building by-laws. Weak monitoring and the high market demand for work and visit functions are the possible causes for the increase of FAR along these roads.

At present, density has an association with the functional mix, vertical extension of visit function, plot size, and building height. The majority of the high-density buildings feature mixed-use functions that extend vertically. All these buildings have developed on the larger plots and have visit functions on multiple floors.

7.6 Governance and Management

Government institutions, autonomous bodies, and local individuals are involved in the management of the mix of uses in this study area. The information regarding the governance and management of the mix has been sourced from the Planning Authority, Dhaka City Corporation, local shop owners, and shop workers through a semi-structured interview during the field survey in 2017.

As a Government institution, Dhaka City Corporation (DCC) plays a role in the governance of the functional mix. At regular intervals, the Tax Collection Officers of DCC conduct a survey and update their records and tax rates concerning the number and type of functions of all buildings. The tax rate increases along with the increased area and number of commercial functions, like shops and offices in the plot.

The Planning and Development Authority (RAJUK), as a Government institution, also plays a crucial role in the governance of the mix of uses. In this area, the Planning Authority has declared the east-west running arterial road as 'commercial'. This means that work and visit uses can develop on this 'commercial' road, along with live functions, with the condition that the plot owners of this road have paid the 'commercial fee' to transform the building use. The

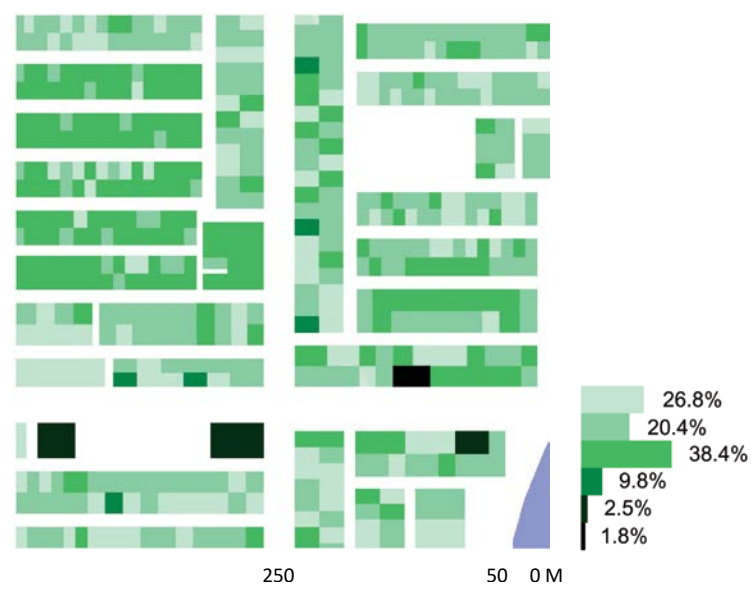


Fig 7.17: Transformation - FAR (1999-2017)

responsibility of the Planning Authority is to monitor whether the non-residential uses along the commercial road have paid the fee to convert the building uses or not. This authority also has the power to evict any unauthorised use from this area, including the 'commercial' road.

Besides the formal institutions, autonomous bodies - 'Local Welfare Associations' - developed informally by the residents, also work in the management of the functional mix. These 'Local Welfare Associations' work in different sector levels. All the house owners are members of these associations. They provide 24/7 security to all buildings, including shops and offices. The Association is responsible for the preservation of the rights and privacy of the building owners and helps to maintain a good relationship between house and shop owners. The Association also performs a role in the management of street traders. The management of street vendors is diverse in different sectors of Uttara. In the study area, the Association has authorised some street vendors at several designated locations. The association has also provided a fixed dress code for street traders. The intention is to keep the number of street vendors minimal and under control. However, along with the authorised street vendors, other unauthorised vendors also operate their businesses side by side in different streets. These unauthorised vendors often face eviction by the security officers of the Association and by the police.

Individuals, like the house, shop owners, and street traders, also perform a role in the management of the functional mix. In the process of management, house and shop owners pay a monthly fee to the Local Welfare Associations. Along with paying the yearly holding tax and extra tax for the commercial functions (shops and offices) to Dhaka City Corporation, house owners also pay a fixed amount of money to the Planning Authority (RAJUK) to convert their plot into a commercial function. The house owners not only rent but also lease the shops and offices for a specified period. The informal street traders negotiate public spaces with the Local Welfare Association and street bureaucrats. The authorised vendors pay a monthly rent to the Association, which is sometimes higher than the monthly rent paid by the shop owners of mixed-use buildings. Unauthorised street vendors pay informal taxes (bribes) to the local police officials to conduct their business.

7.7 Conclusion

Uttara was developed following the top-down planning (land zoning) in its early stage, but eventually, the development has been shaped by the incremental and bottom-up practices of the locals. Initially, the shortage of services had influenced the development of non-residential uses. Over time, the growing concentration of mixed-functions and better connectivity have increased functional diversity and building density along the major roads. Therefore, the interconnections of co-functioning, connectivity, and concentration have enhanced the functionality of the area. Through the adaptation of diverse functional and physical elements, the 'informal' has developed an intricate relationship with the 'formal' system here. The functional mix has also generated a socio-economic diversity, which the formal system failed to offer.

Chapter-8: Mixed-use Buildings

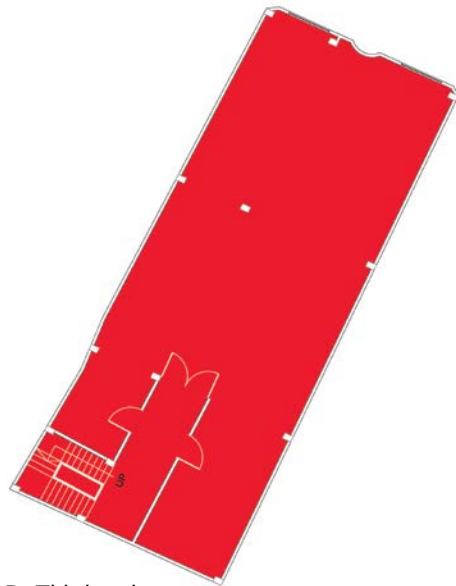
8.1 Introduction

This chapter analyses the vertical mix of buildings to understand functional mix on a smaller scale. The primary objective is to study the mixing of different functions and circulation patterns within the buildings. 30 sample buildings, 10 from each of the three study areas, were surveyed during August-November 2017. These buildings were selected according to the different types of circulation systems from a full range within the study areas. In this chapter, the floor plans and the syntactic structures of all the sample mixed-use buildings are presented. This chapter has been structured into five sections. The first section explains the detailed method of generating syntactic diagrams to analyse the morphological features of mixed-use buildings. The second, third, and fourth sections respectively describe the mixed-use buildings of the Historic Core, Semi-planned, and Planned areas. In these sections, the buildings are correspondingly labelled as HC, SP, and PL according to three study areas. The last section generalises the standard building types and depth of different functions.

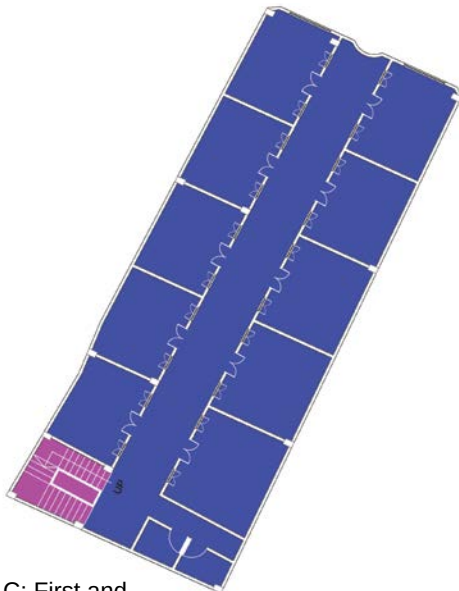
8.2 Detail Method

The 'syntactic structures' (gamma diagrams), derived from space syntax methods (Hillier and Hanson, 1984), are produced to reveal the depth of different functions and the circulation patterns of mixed-use buildings. In these diagrams, the major spatial segments are structured according to their depths from the street in a number of spatial segments. Thus, these diagrams show the position of different functions and their mixes at various depths of the buildings. In the syntactic structures, the representation of mix follows the live/work/visit triangular model used throughout this thesis. The circles outlined with thick lines represent the main circulation spine of each building. Clusters of segments with similar functions are represented with elongated boxes instead of dots. The number in this box is indicative of the total number of segments in a cluster. The circulation lines are coded by the functions to which they give access. In this chapter, the spatial syntax of each of the 30 buildings will be diagrammed according to this method. These results will then be summarised through a further set of diagrammatic types in section 8.6.

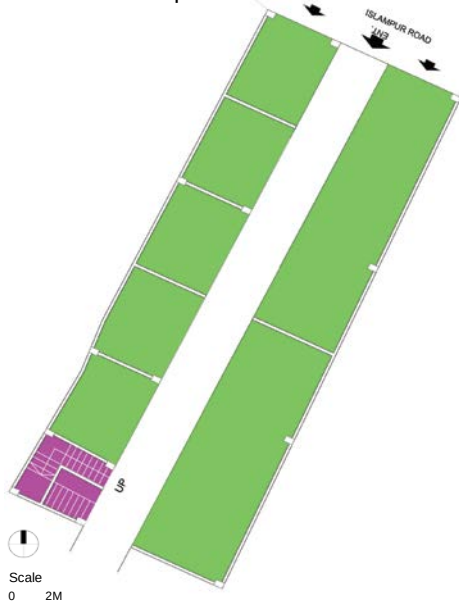
8.3 Mixed-use Buildings - Historic Core HC - 1



D: Third and fourth floor plan

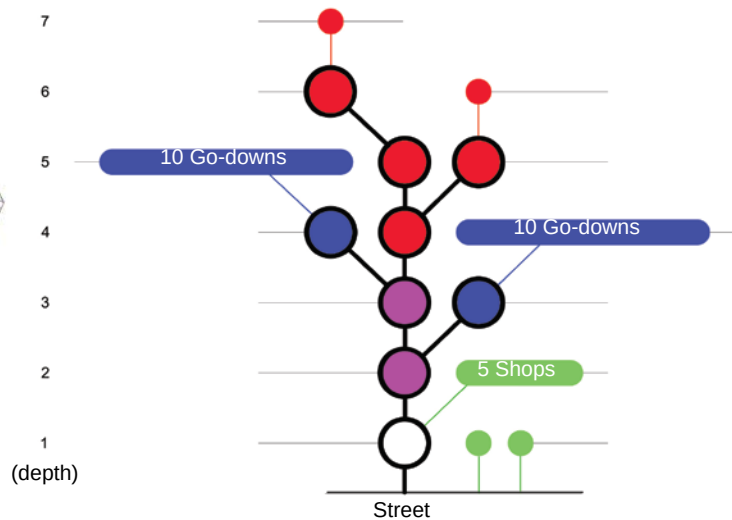


C: First and second floor plan

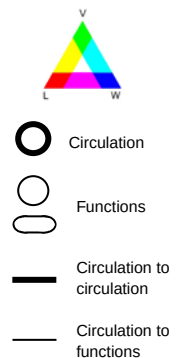


B: Ground floor plan

This building shows a tree-like structure comprising visit, work, and living at progressive depths (Fig. A). It has several shops and go-downs branched up to the depth of 2 and 5 segments, while residences extend 7 segments deep. The shops are accessed both from the street and the mixed entry. The building plans and diagram show that the functional mix is confined to the first three floors. The main circulation spine (stair) becomes progressively mono-functional from the triple (live/work/visit) and double (live/work) mixes, as it penetrates deeper.



A: Syntactic structure

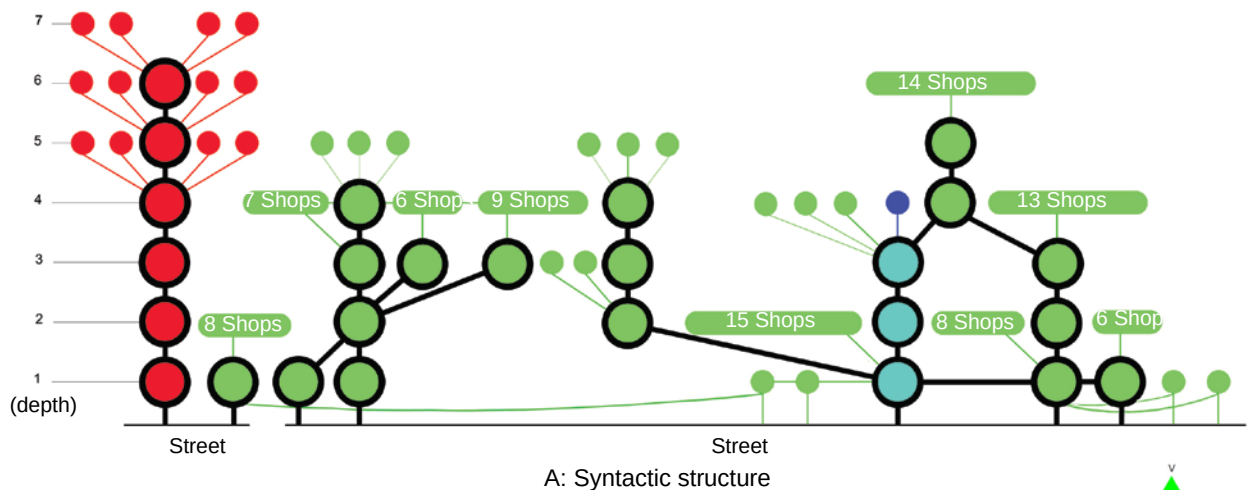


E: 22, Islampur Road, Old Dhaka

Fig. 8.1: Building 1

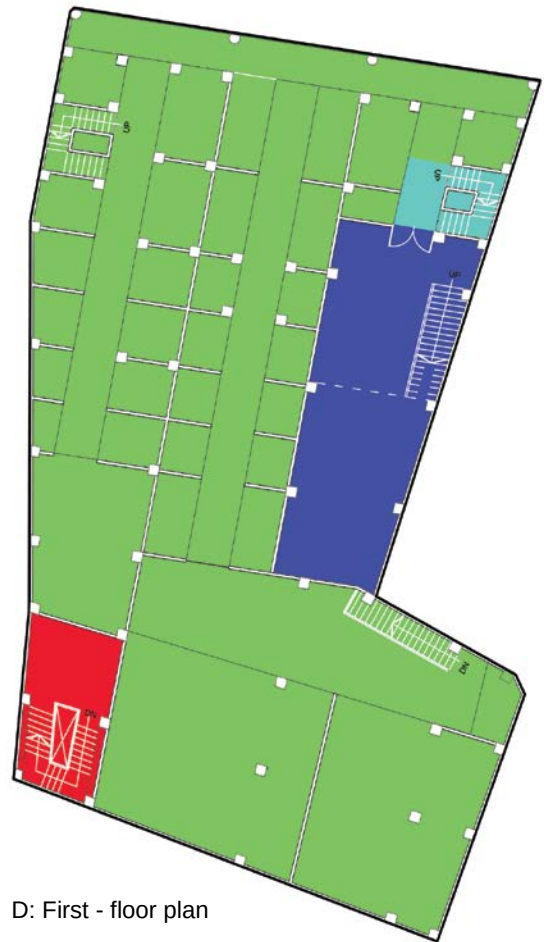
HC - 2

This building has a network of shops, which penetrate 6 segments deep from the street. These large numbers of shops (94 nos.) are connected through multiple interconnecting corridors (Fig. B). This building has a bank, which occupies a part of the first floor and the full portion of the second floor. Among the multiple internal corridors, only a part of two corridors is mixed (visit/work), which progressively becomes mono-functional (visit) as it penetrates deeper. The diagram demonstrates that it also has a residential tree-like structure, which extends up to a depth of 7. These residences are accessed through a separate stair from the street.





E: Third-fifth floor plan



D: First - floor plan



F: 38-39, Islampur Road, Old Dhaka

Fig. 8.2: Building 2

HC - 3

This building characterises residential function, with a live/work mix at its lower depth (Fig. A). It has a shop and a workshop along the street, which penetrate 1 segment deep. On the first floor, it has a madrasa¹, designed initially as a residence. The other residential units occupy the upper floors and extend up to a depth of 6.

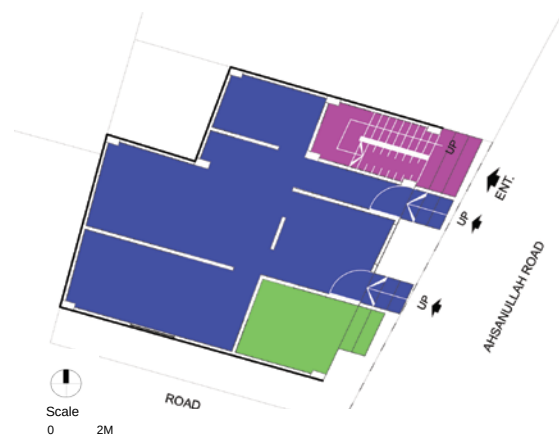
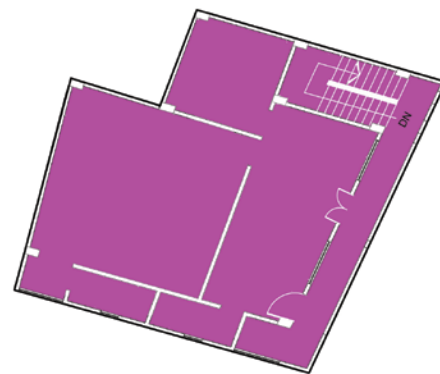
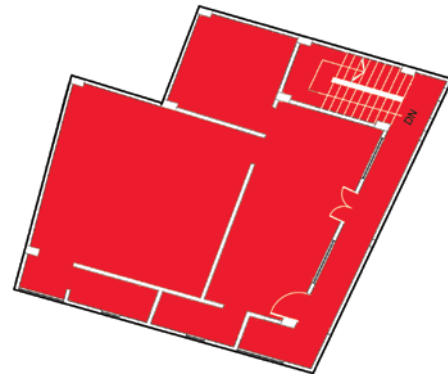
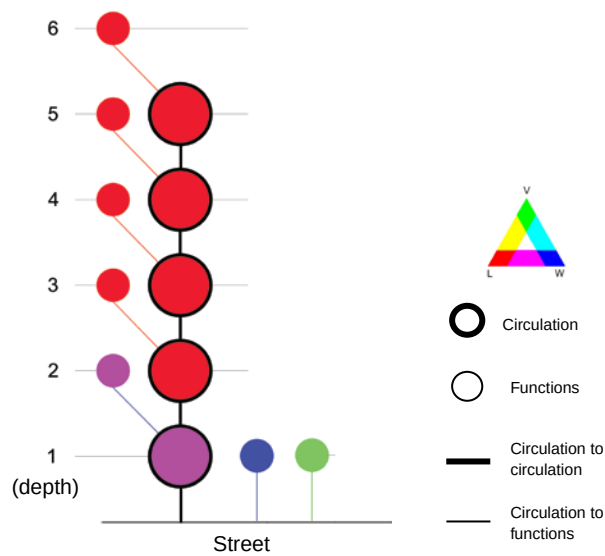
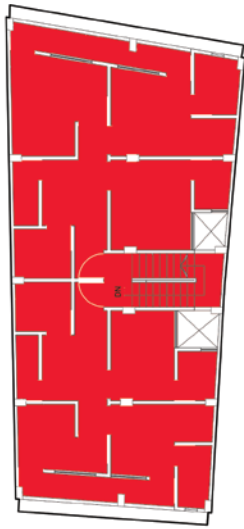


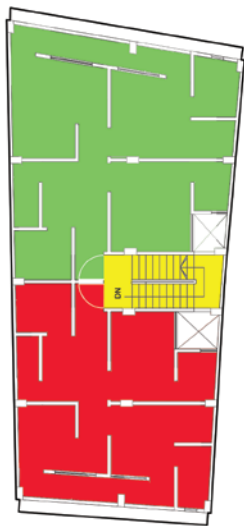
Fig. 8.3: Building 3

1. Locally madrasa means the school for Islamic Instruction, where children study and live in the same place

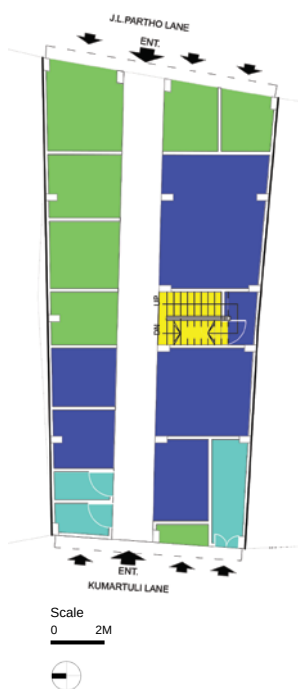
HC - 4



D: Second-fifth floor plan

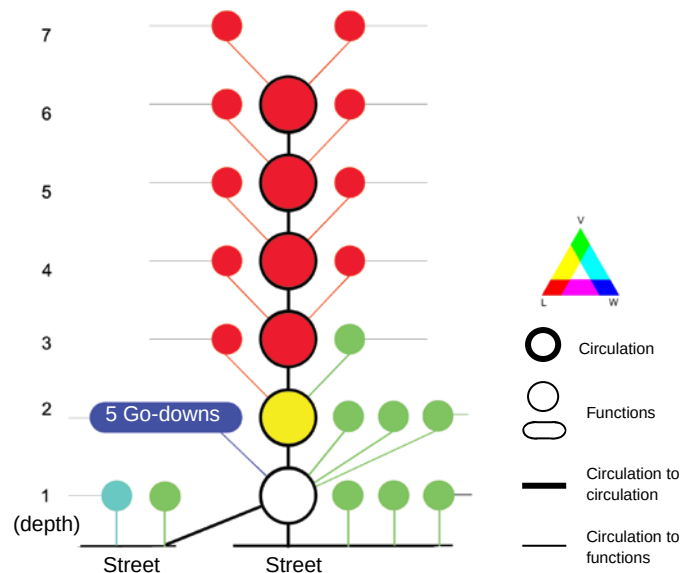


C: First - floor plan



B: Ground floor plan

This building shows a red tree-like structure in the deeper levels, with a triple and live/visit mixes at its lower depths (Fig. A). It has several shops and go-downs on the ground floor, which penetrate 2 segments deep. These shops are accessed both from the street and the mixed entry. The beauty parlour located on the first floor penetrated 3 segments deep and was initially designed as a residence. The other residential units are organised upstairs, which extend up to a depth of 7.



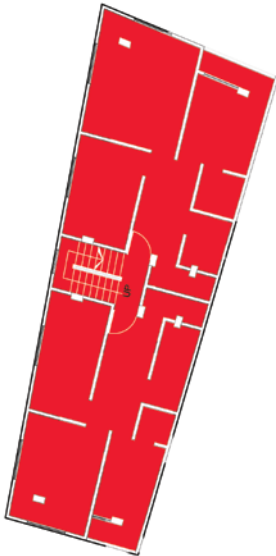
A: Syntactic structure



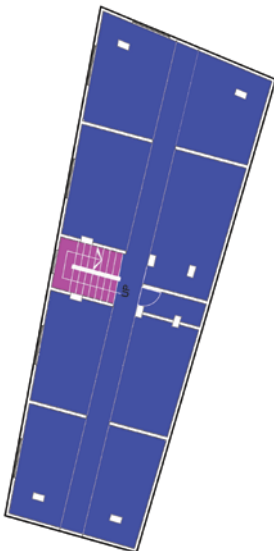
E: 5/1, J.L. Partho Lane, Old Dhaka

Fig. 8.4: Building 4

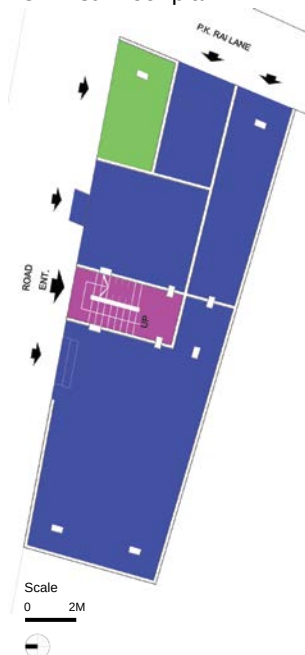
HC - 5



D: Second-fifth floor plan

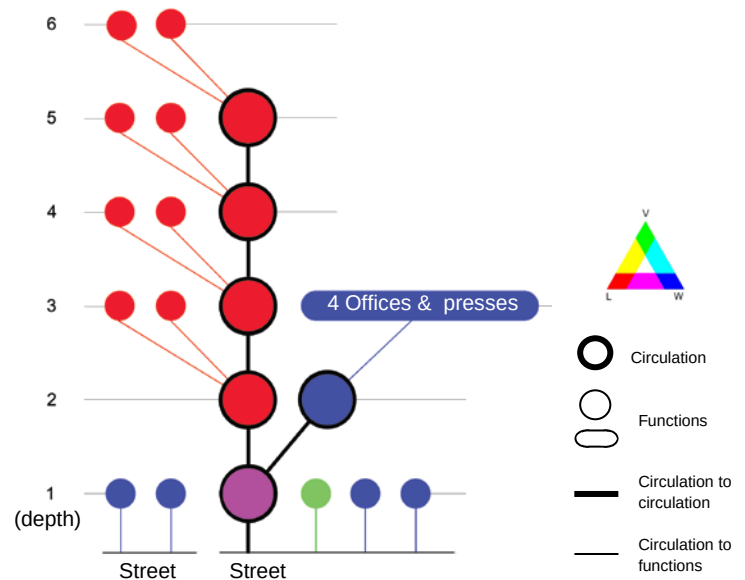


C: First - floor plan



B: Ground floor plan

This building primarily has a residential tree-like structure. It has a shop and some presses along the streets, which penetrate 1 segment deep (Fig. B). On the first floor, it has several offices and presses, which extend 3 segments deep. The residential units occupy the second to the fifth floors and extend up to a depth of 6. The functional mix is confined to the first two floors. The central circulation spine begins with a live/work mix and progressively becomes mono-functional (live), as it penetrates deeper.



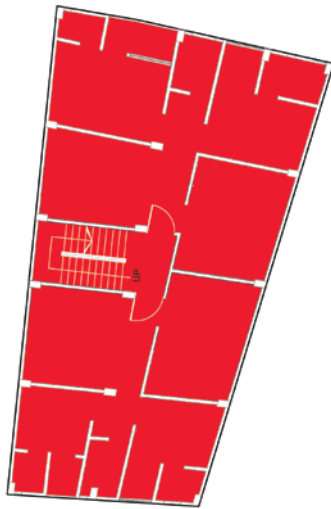
A: Syntactic structure



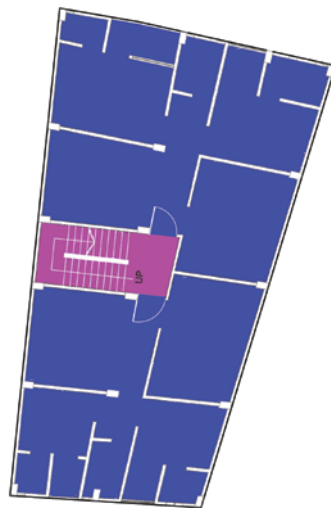
E: 8, P.K. Roy Lane, Old Dhaka

Fig. 8.5: Building 5

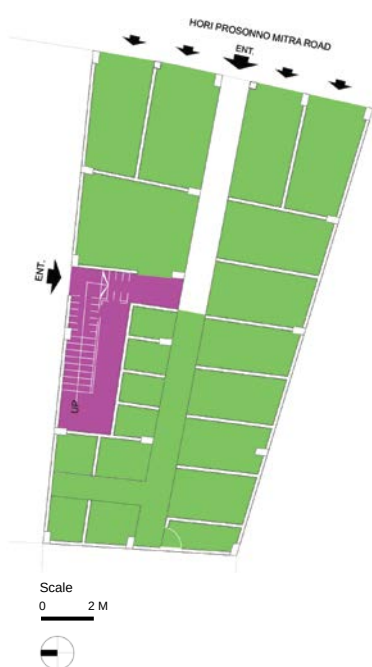
HC - 6



D: Second-fifth floor plan

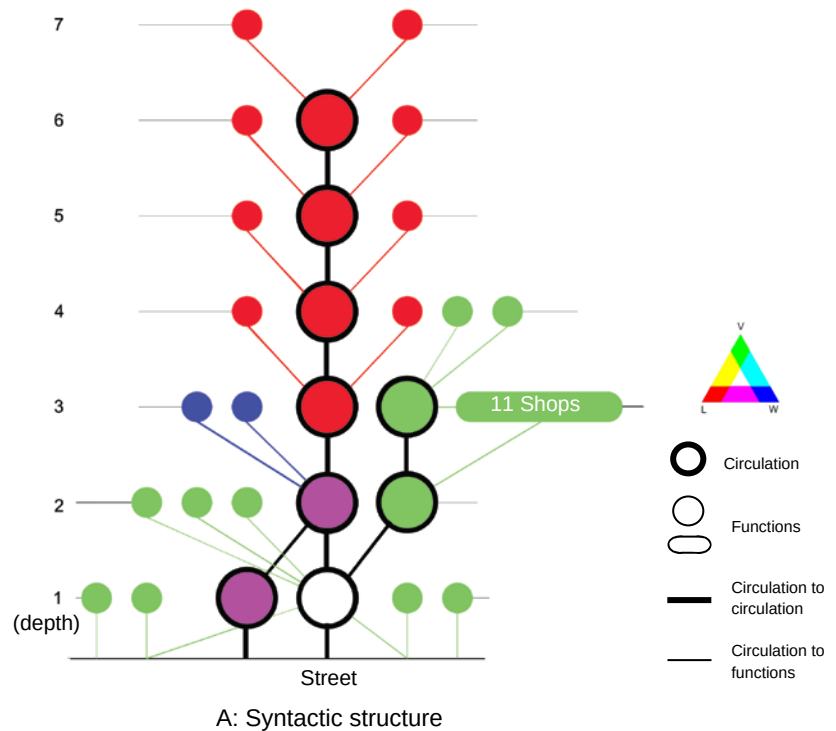


C: First - floor plan



B: Ground floor plan

This building combines visit, work, and living at progressive levels. It has two ways of access: one from the street on the east and the other from an internal corridor that is shared with the adjacent north building (Fig. B). It has shops and offices on the ground and first floors and these functions penetrate 4 segments deep from the street. The residences are organised upstairs and extend up to a depth of 7. The mixed circulation penetrates 2 segments deep and eventually becomes mono-functional (live), moving from a triple mix to live/work and then purely residential.



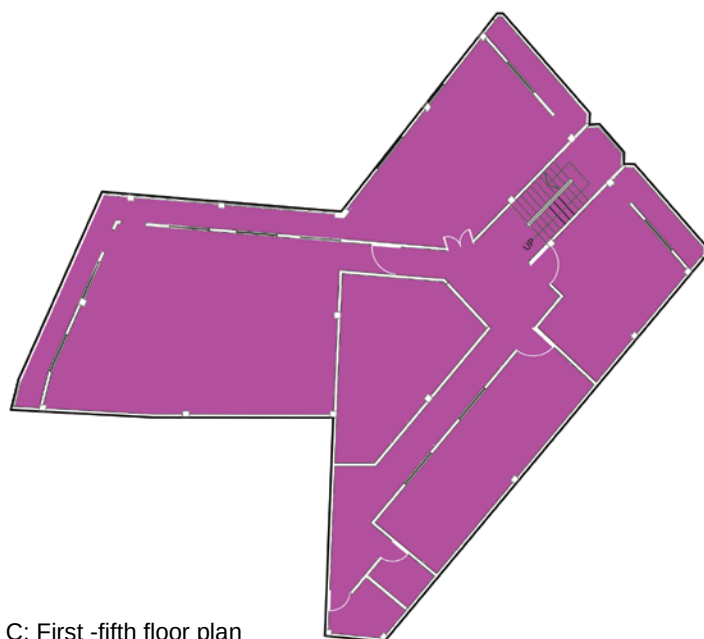
A: Syntactic structure



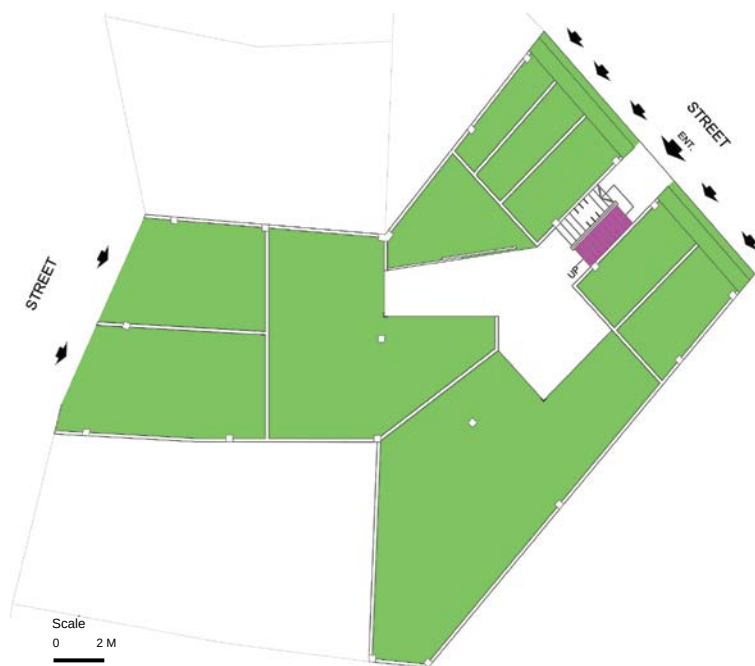
E: 27/1, Hori Prosonno Mitra Road, Old Dhaka

Fig. 8.6: Building 6

HC - 7

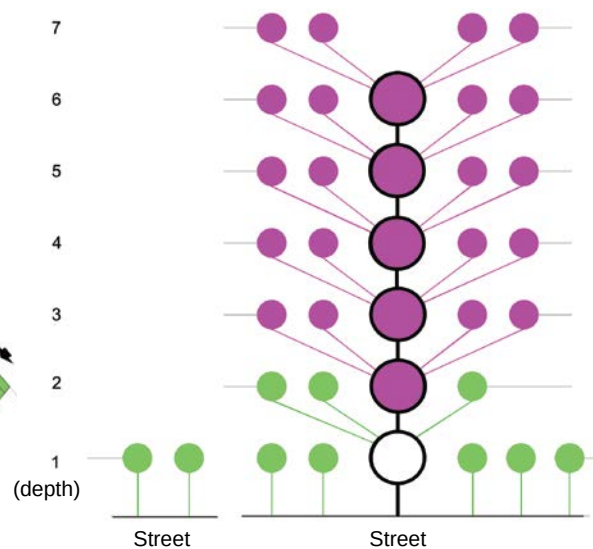


C: First -fifth floor plan



B: Ground floor plan

This building demonstrates a different pattern of live/work mix tree-like structure, comprising a triple mix at its lower depth. It has several shops on the ground floor that penetrate 2 segments deep. These shops are accessed both from the street and the mixed entry. The mix of uses occupies the first to the fifth floors and extends up to a depth of 7. These mixes consist of workshops that also function as living and cooking areas at night.



A: Syntactic structure



○ Circulation

○ Functions

— Circulation to circulation

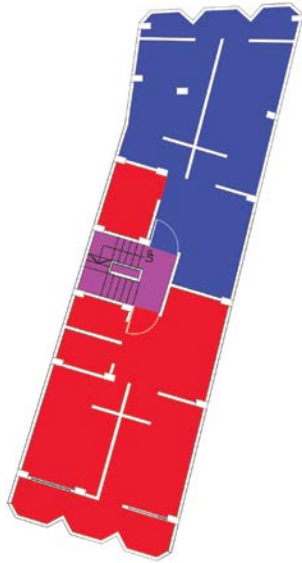
— Circulation to functions



D: 53,54, Loeal Street, Old Dhaka

Fig. 8.7: Building 7

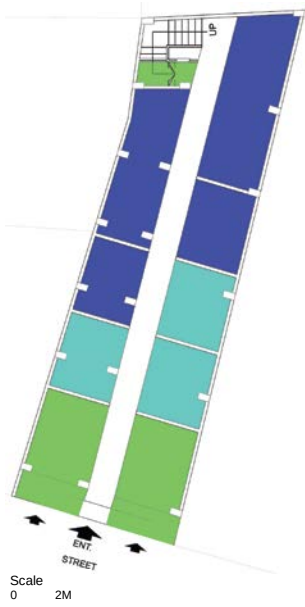
HC - 8



D: Second -fourth floor plan

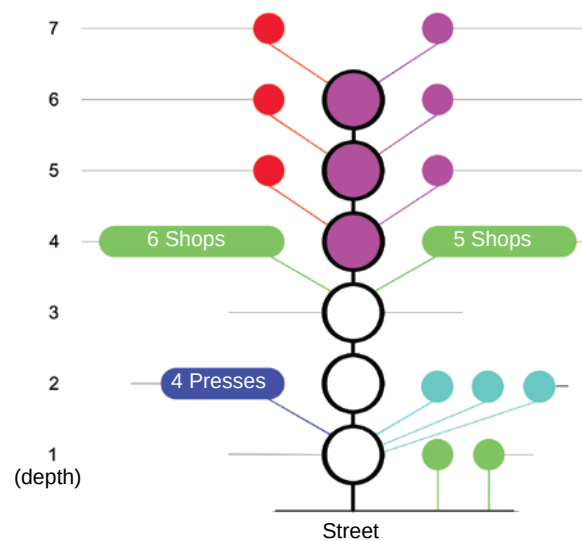


C: First - floor plan

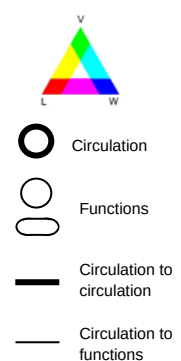


B: Ground floor plan

This building characterises mixed functions (Fig. A). It has triple mixes at lower depths, which are reduced to double mixes (live/work) on the upper floors. It has shops, presses, and mix of uses, like book-binding shops, on the ground and first floors, which penetrate 4 segments deep. The rest of the building has residential units and go-downs (stores) on each floor. The go-down acts as a mixed-function because a room of it works as the kitchen for the adjacent residence. The diagram shows that the mixed circulation spine extends up to a depth of 7.



A: Syntactic structure

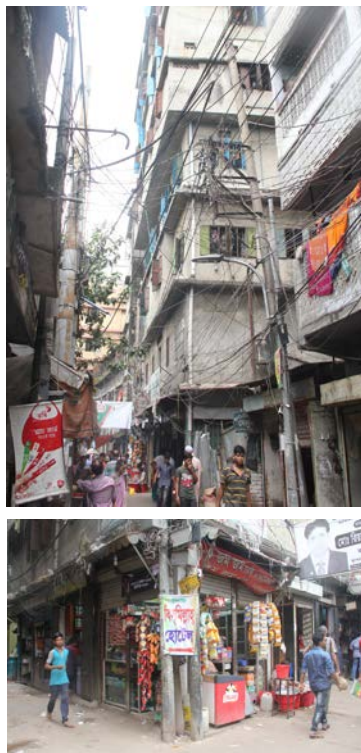
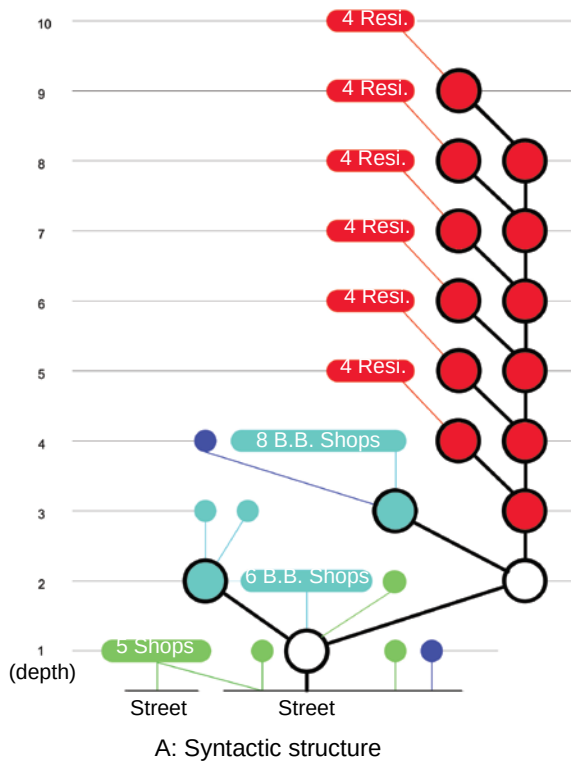


E: House-19-29/B, Syed Hassan Ali Road,

Fig. 8.8: Building 8

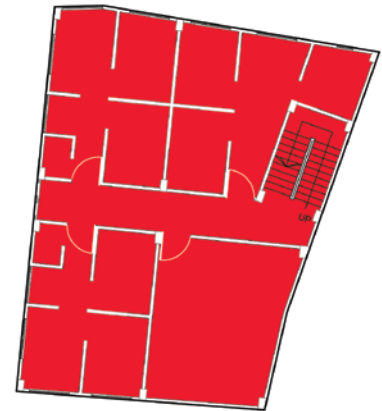
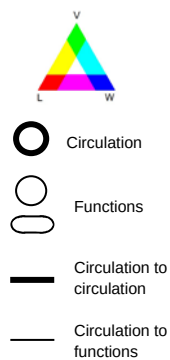
HC - 9

This building demonstrates a red tree-like structure, comprising live/work/visit and work/visit mixes at its lower depths (Fig. A). It has shops, offices, and mixed functions, like book-binding shops, on the ground and first floors, which penetrate 4 segments deep. These functions are accessed both from the street and the central circulation spine that is mixed. Residential units occupy the second to the seventh floors and extend up to a depth of 10.

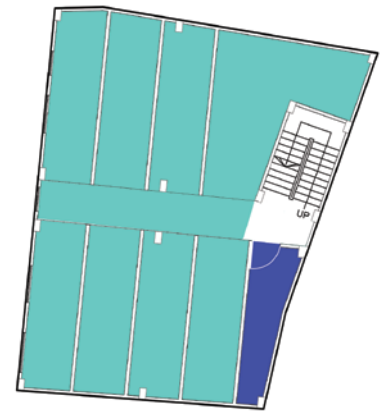


E: 48, Zindabahr First Lane, Old Dhaka

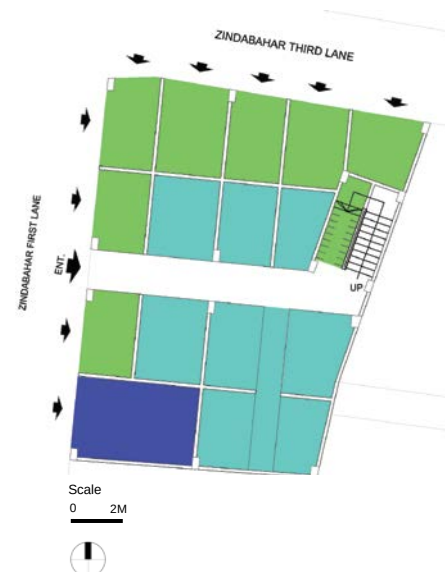
Fig. 8.9: Building 9



D: Second -seventh floor plan



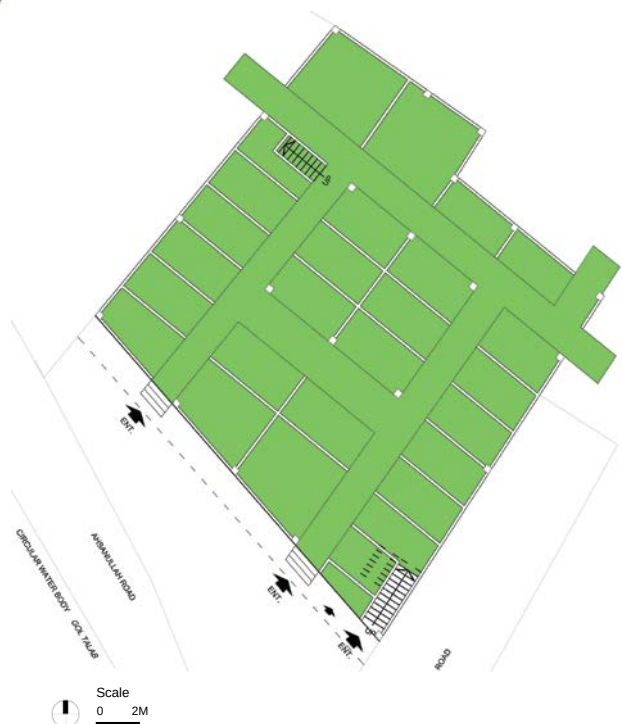
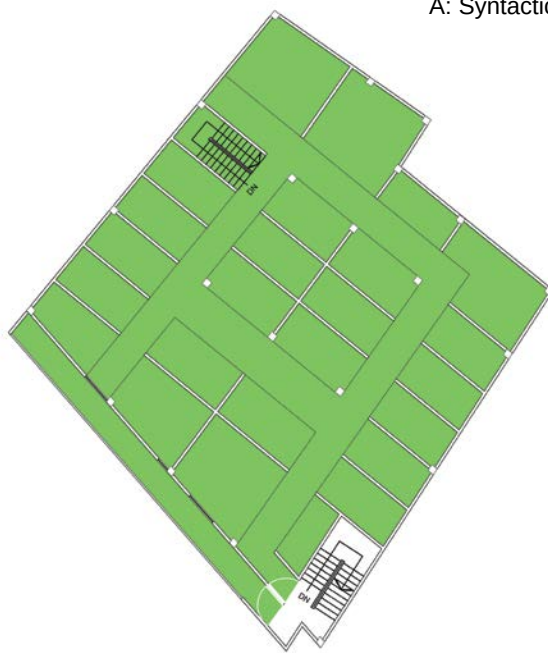
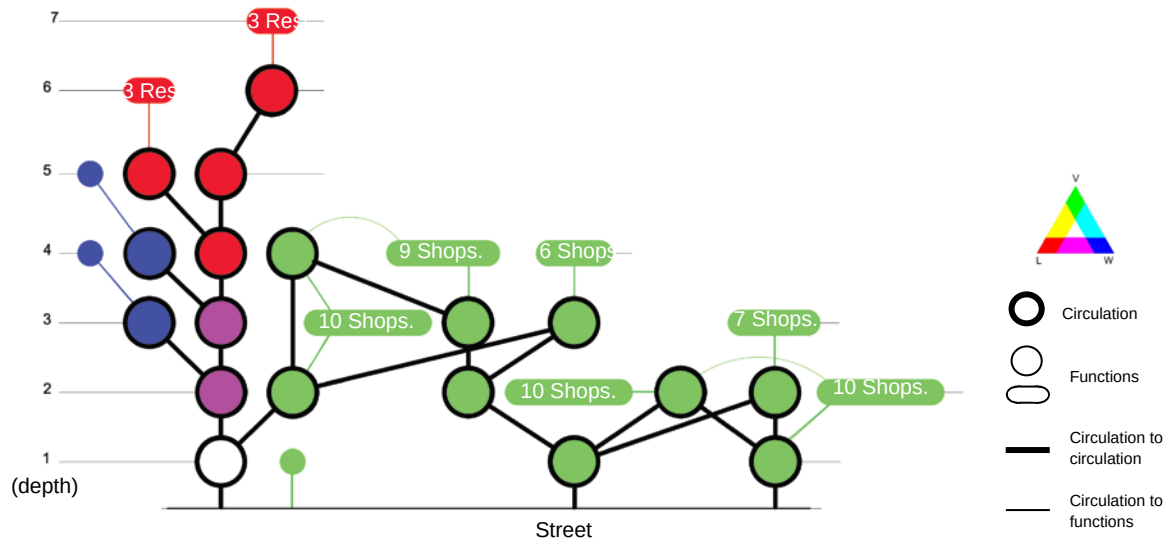
C: First - floor plan

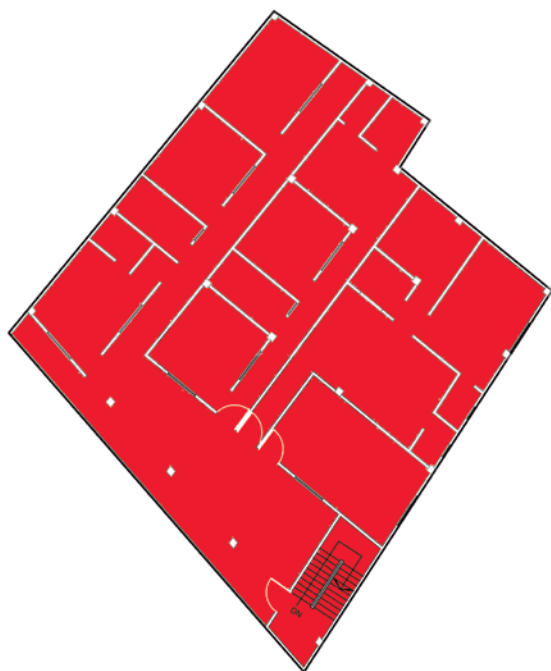


B: Ground floor plan

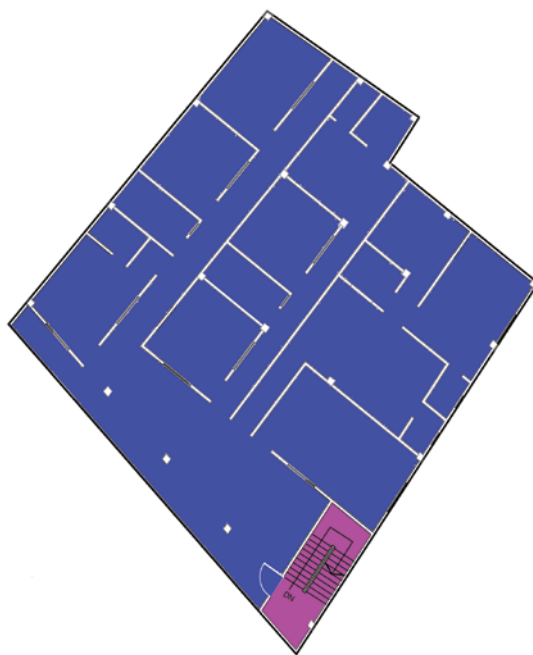
HC - 10

This building has a visit, work, and living at progressive depths. It has a network of a large number of shops (53 nos.) distributed on the ground and first floors, which penetrate 4 segments deep. These shops are associated through multiple interconnecting corridors (Figs. A, B). The spatial structure demonstrates that it also has a residential tree-like structure containing triple and live/work mixes at its lower depths. It has several go-downs and residential units, which respectively extend up to the depth of 5 and 7 segments. These functions are accessed through a separate mixed circulation spine from the street.





E: Fourth-fifth floor plan



D: Second-third floor plan



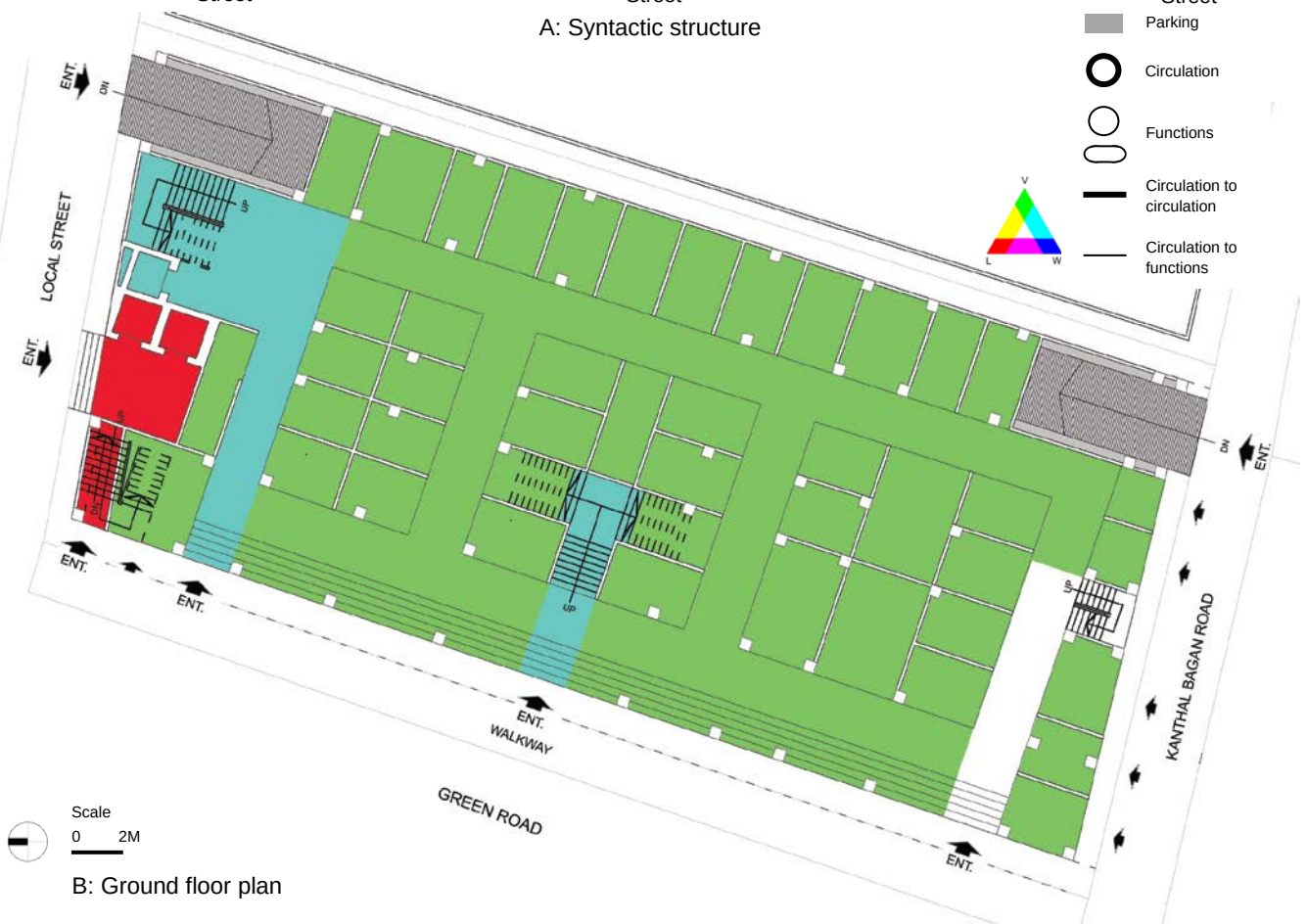
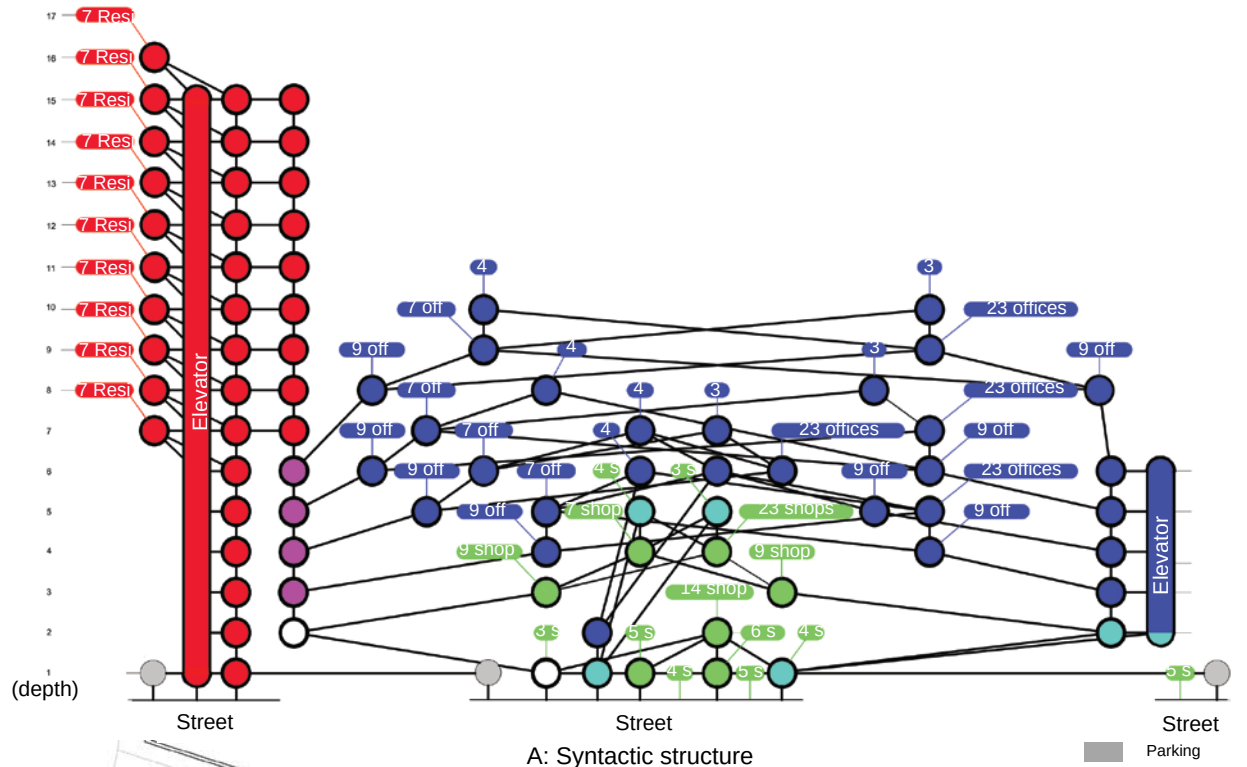
F: 40/5, Ahsanullah Road, Old Dhaka

Fig. 8.10: Building 10

8.4 Mixed-use Buildings - Semi-planned Area

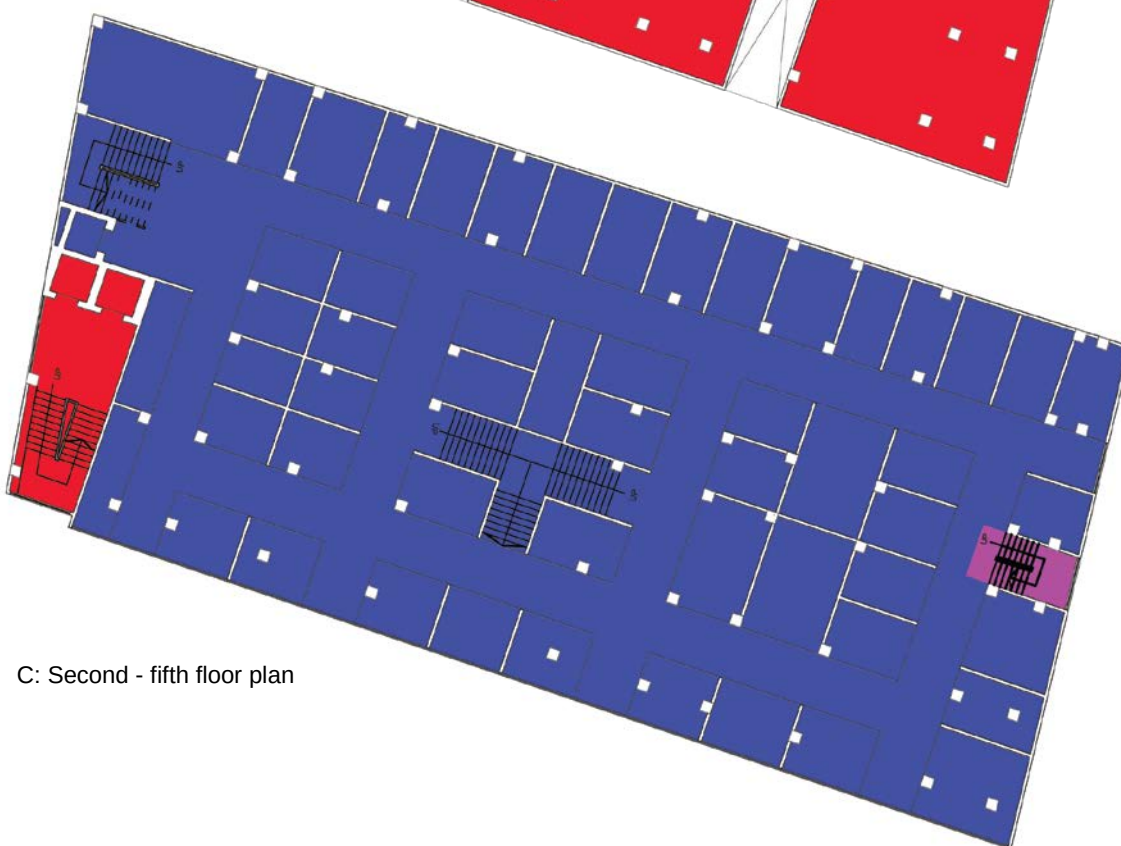
SP - 1

This building contains a complex network of shops and offices, organised from the ground to the fifth floors (Fig. A). These large numbers of shops (99 nos.) and offices (216 nos.) are linked through multiple interconnecting corridors and are accessed through mixed circulation spines. It also contains a separate residential tree-like structure with triple and double (live/work) mixes at its lower depths. In this building, residential units occupy the sixth to the fifteenth floors, which extend up to a depth of 17. These residences are separately accessed through elevators and stairs.





D: Sixth -fifteenth floor plan



C: Second - fifth floor plan

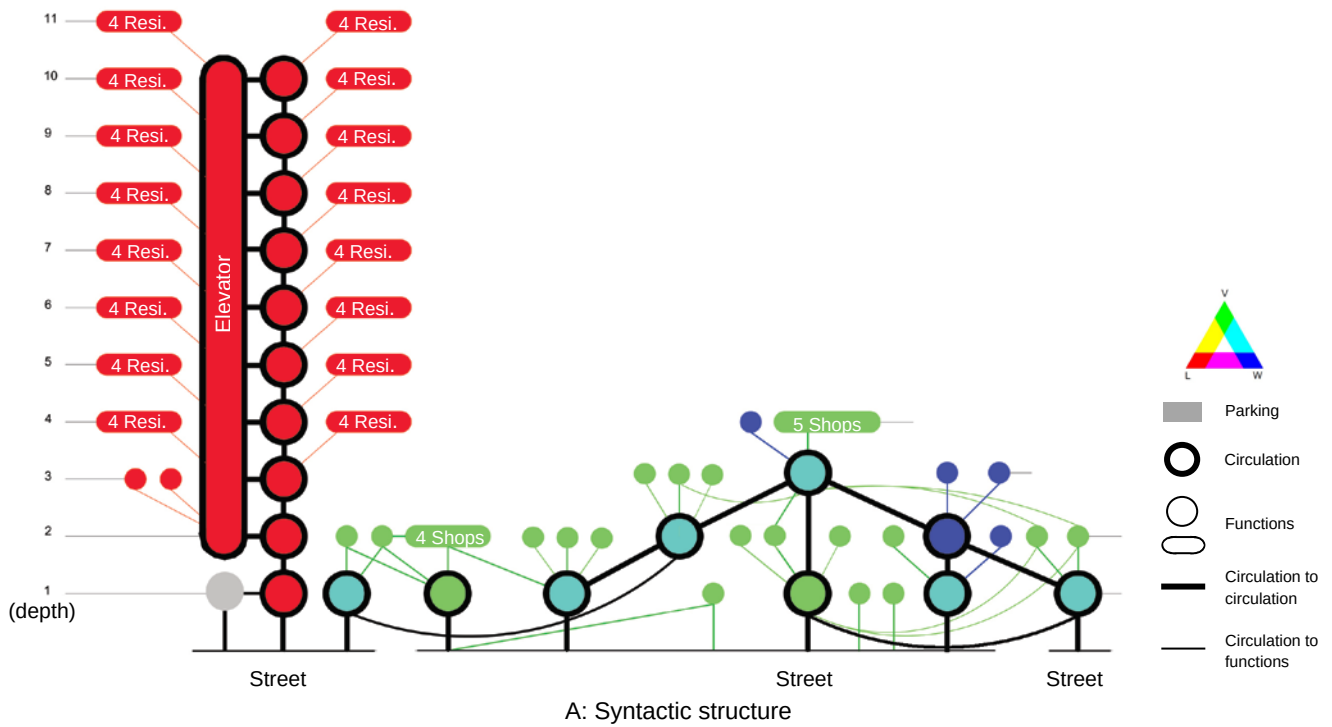


E: 68, 68/1, 68/1/A, 68/3, Green Road Fig.

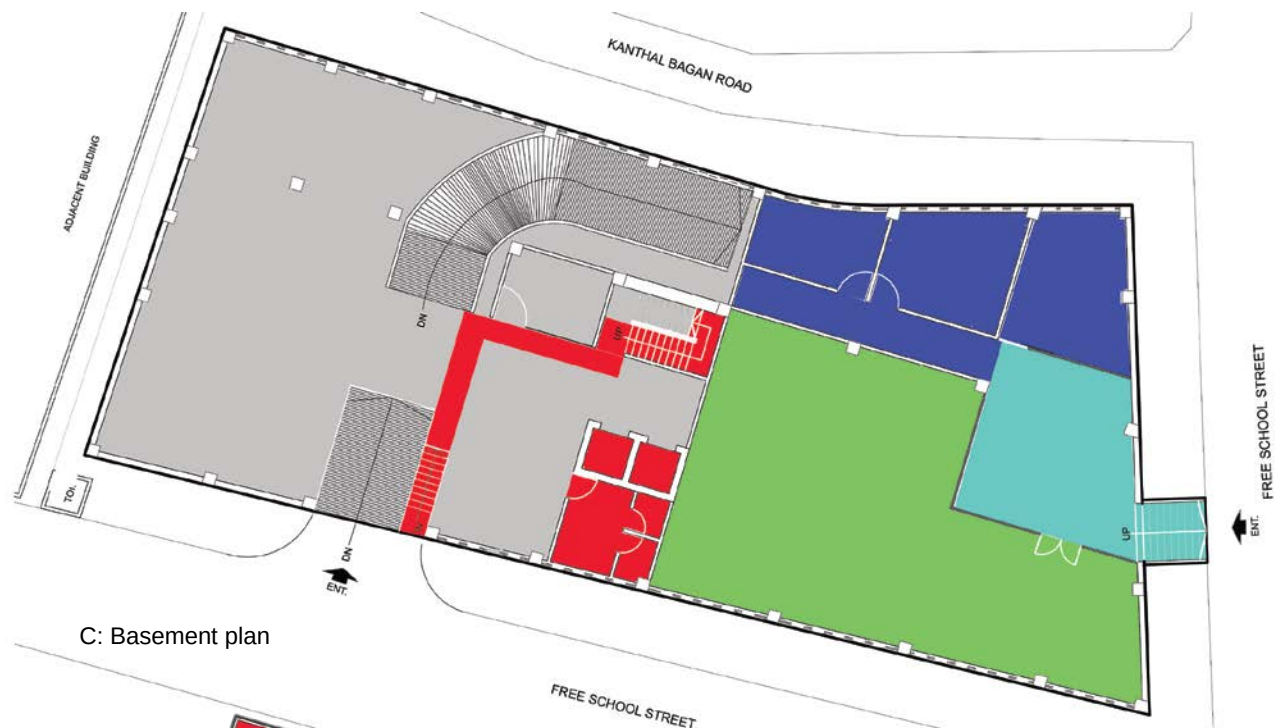
Fig. 8.11: Building 11

SP - 2

This building contains a network of work and visit functions that extends up to a depth of 4 (Fig. A). Like the previous example, the large numbers of shops on the ground floor are linked through multiple interconnecting corridors. The functional mix is confined to the ground and basement and up to a depth of 3. The spatial structure also shows that it has a residential tree-like structure, which penetrates 11 segments deep. These residences are accessed through a separate mono-functional circulation spine from the street.



B: Ground floor plan



C: Basement plan

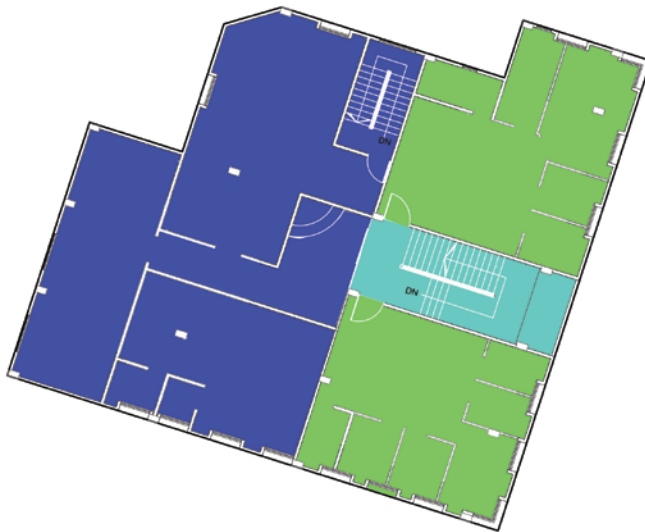


D: First-Ninth floor plan



E: 88, Free School Street, Green Road
Fig. 8.12: Building 12

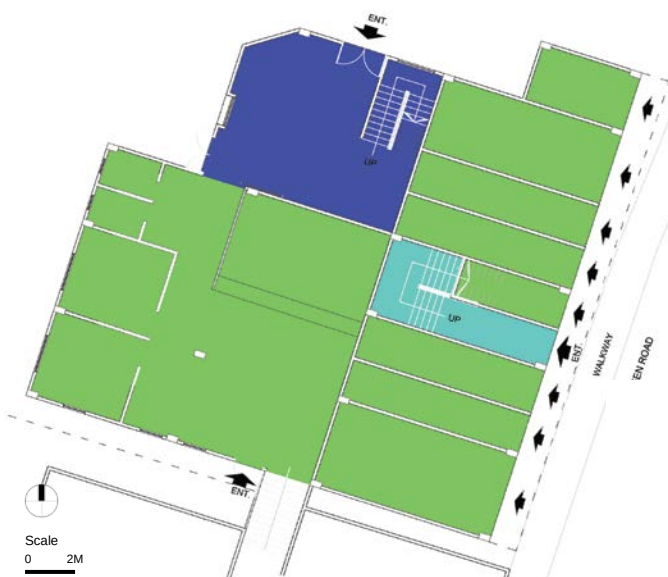
SP - 3



D: Second - floor plan

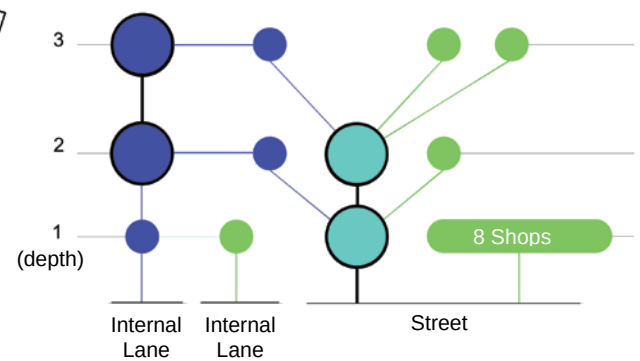


C: First - floor plan



B: Ground floor plan

This is a small building, containing work and visit functions at different levels (Fig. A-D). The building plans show that, apart from a range of street entries at ground floor, it also has two other accesses. One leads to work functions upstairs and the other ends in a visit use at ground floor. It has several shops and a hospital on the ground floor. This hospital is a part of the large hospital on the adjacent plot. The upper floors contain work and visit functions, like a bank, several offices, and doctor's chambers, that extend up to a depth of 3. The functional mix is limited to the main stair and penetrates 2 segments deep.



A: Syntactic structure

○ Circulation

○ Functions

○ Functions

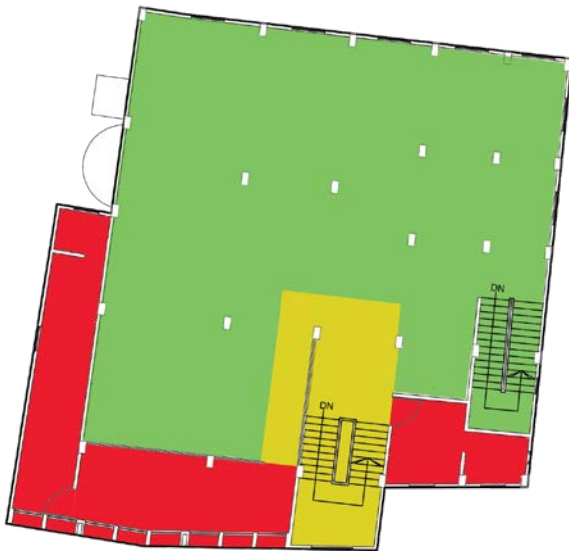
— Circulation to circulation

— Circulation to functions



E: 167, 167/A Green Road
Fig. 8.13: Building 13

SP - 4



D: Second-fifth floor plan

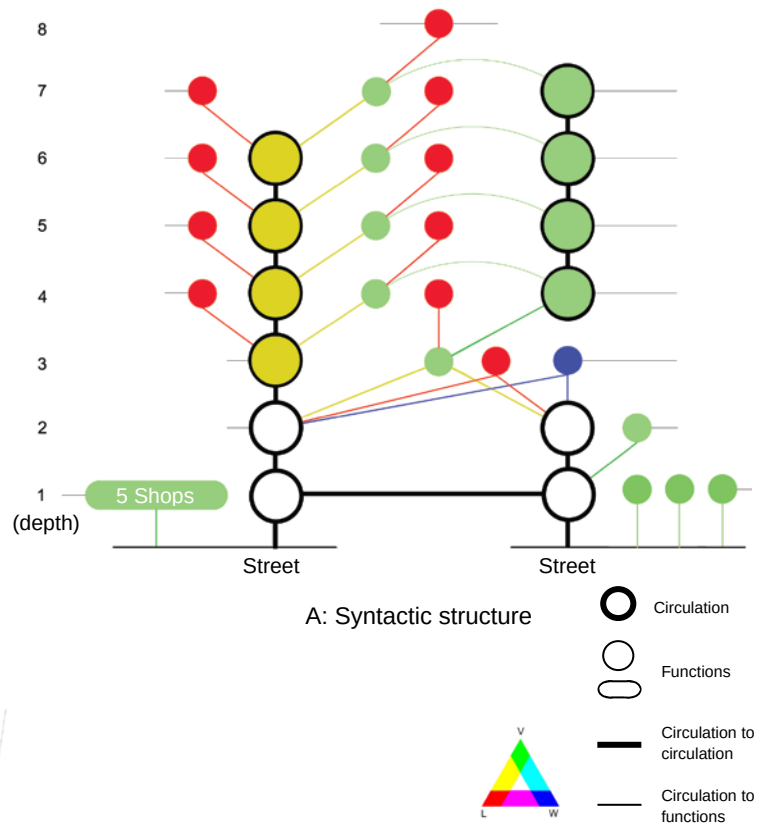


C: First-floor plan



B: Ground floor plan

This building has two main circulation spines (Fig. A). One extends for 6 segments and begins as a triple mix that is reduced to a live/visit mix. The other is a triple mix that extends for only 2 segments. However, a third circulation spine, geared to visit functions, emerges at a deeper section of the building and it penetrates up to a depth of 7. This building was originally designed as a Mosque and several shops and bachelor's quarters, have developed incrementally to generate income for its maintenance. The shops are located along the street, and upstairs contain bachelor's quarters, along with prayer halls. These functions are accessed through mixed circulation spines.



A: Syntactic structure

○ Circulation

○ Functions

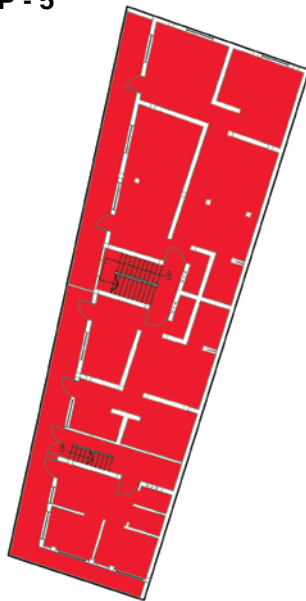
— Circulation to circulation

— Circulation to functions

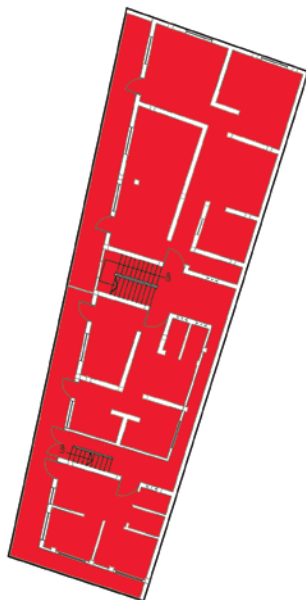


E: 176, 176/5, Free School Street, Green Road

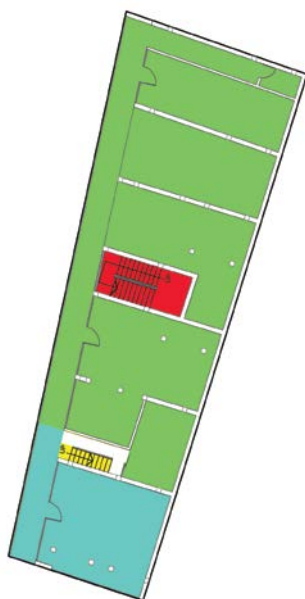
Fig. 8.14: Building 14



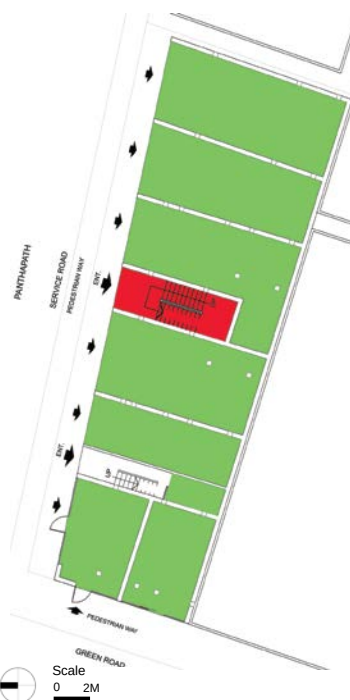
E: Fourth-fifth floor plan



D: Third - floor plan

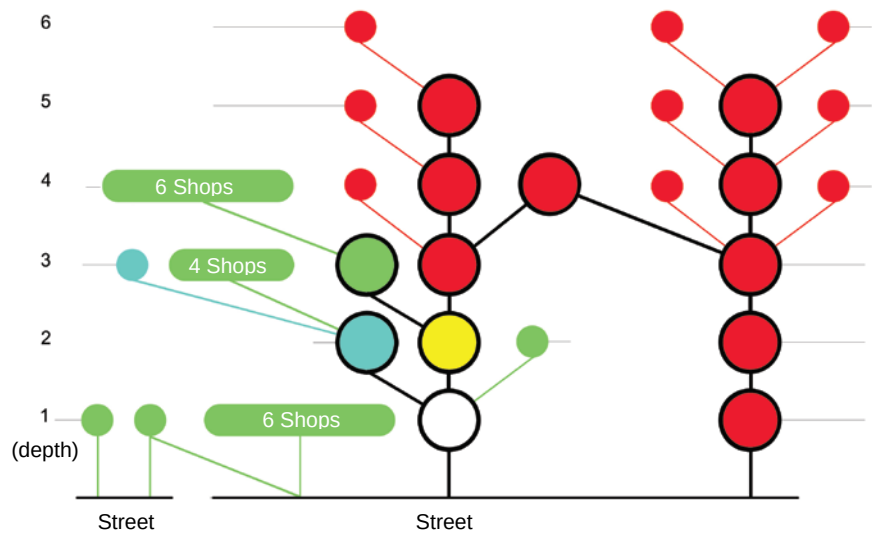


C: First - floor plan

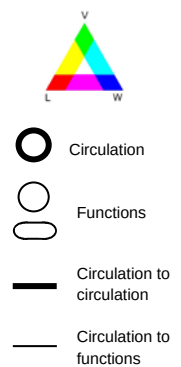


B: Ground floor plan

This building has effectively two separate spatial structures, which adjoin at a depth of 4 (Fig. A). Among these spatial structures, one is residential and the other is mixed-use. This mix is primarily shops and residential. This building has several shops and a work/visit mix, like a photo-studio, from the ground to the second floors, which penetrate 4 segments deep from the street. The upper floors contain residential units that extend up to a depth of 6.



A: Syntactic structure

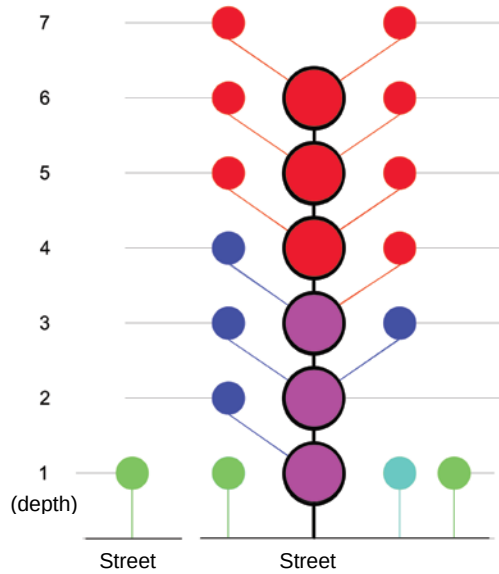


F: 70/A, Green Road

Fig. 8.15: Building 15

SP - 6

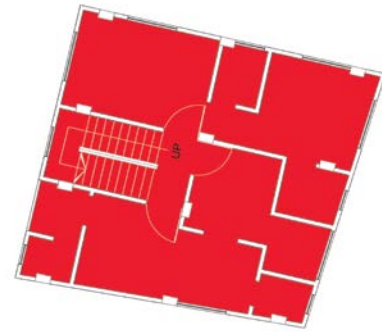
This building is primarily a live/work mix with main circulation spine mixed up to 3 segments deep from the street (Fig. A). It has a restaurant, few shops and a mixed-function, like a photo-studio, along the street. Several offices, designed initially as residences, are organised from the ground to the second floors and penetrate 4 segments deep. The residential units occupy part of the second to the fifth floors, which extend up to a depth of 7.



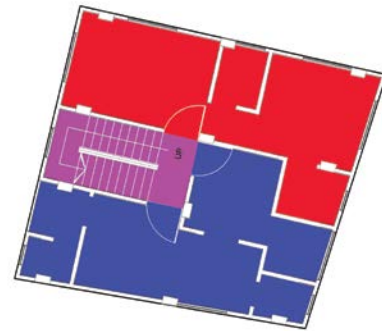
A: Syntactic structure



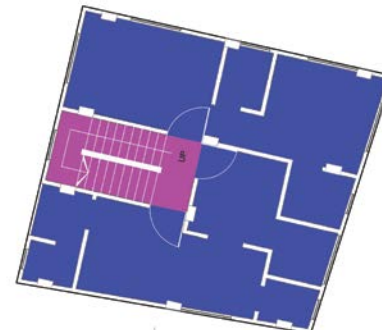
F: 57/11, East Rajabazar, Green Road
Fig. 8.16: Building 16



E: Third-fifth floor plan



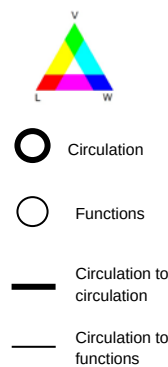
D: Second floor plan



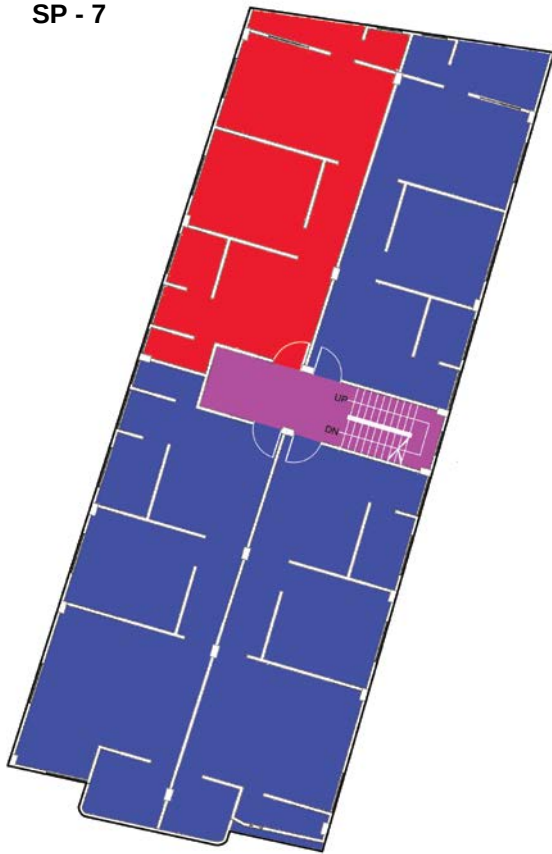
C: First floor plan



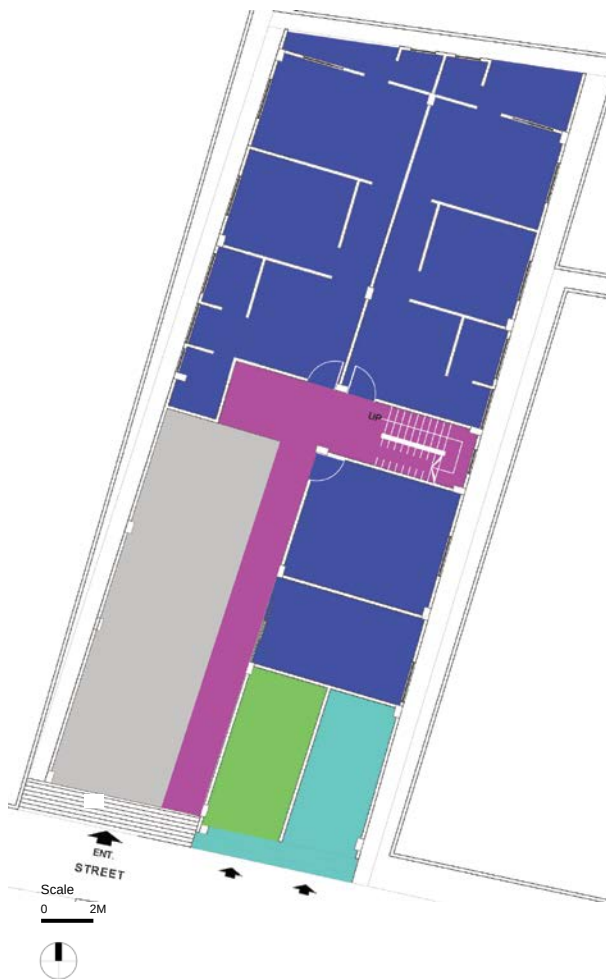
B: Ground floor plan



SP - 7

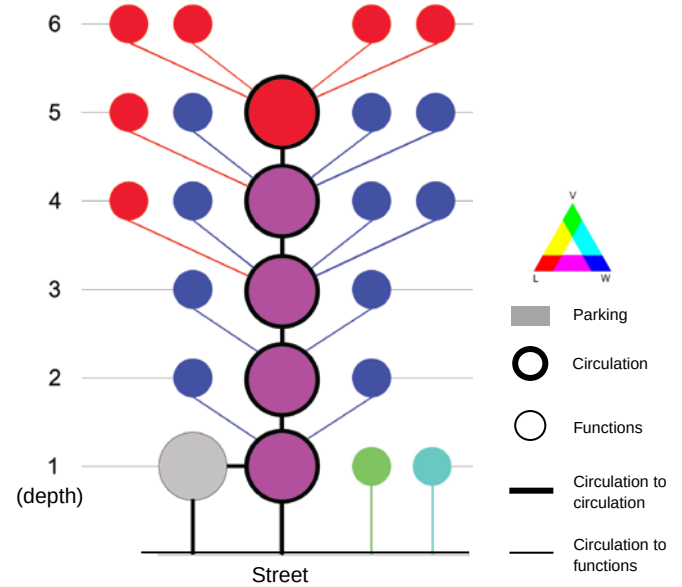


C: First and second floor plan



B: Ground floor plan

This building demonstrates a live/work mix tree-like structure, crowned with residences (Fig. A). It has a customer care centre and a mixed-function (photo-studio) along the street. Several offices and residential units occupy the ground to the third floors and respectively penetrate 5 and 6 segments deep from the street. It has a mixed (live/work) circulation spine that extends up to a depth of 4.



A: Syntactic structure

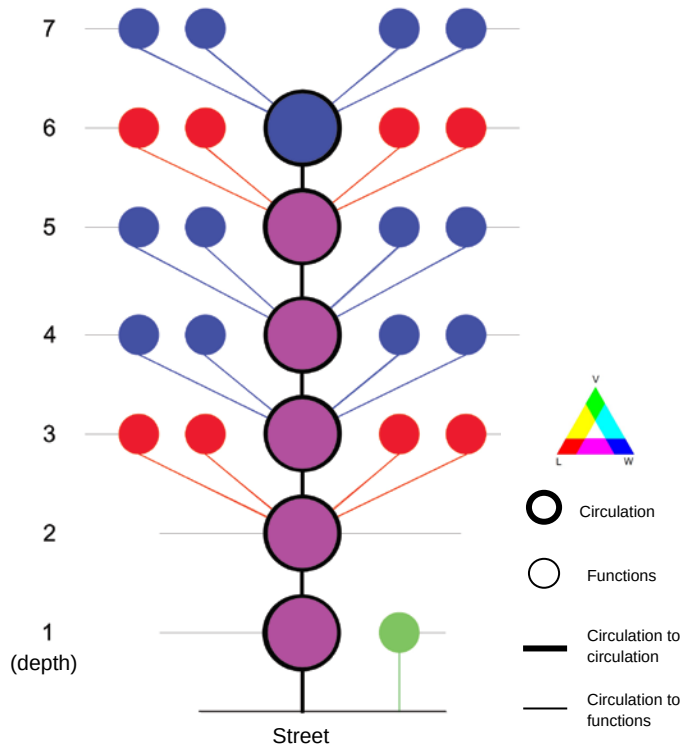


D: 68/4, Green Road

Fig. 8.17: Building 17

SP - 8

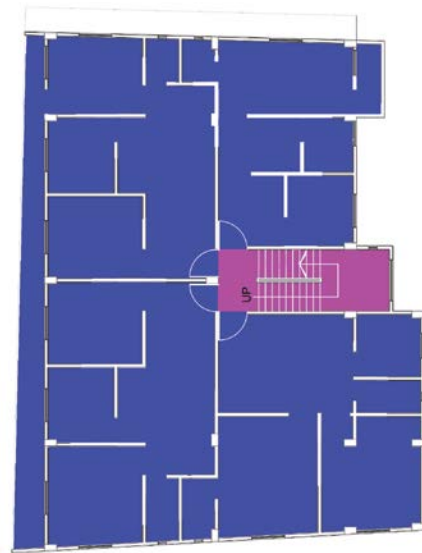
Like the previous examples, this building is mostly a live/work mix tree-like structure; however, each floor is functionally segregated (Fig. A). It has a shop along the street. The work functions - offices, designed initially as residences - penetrate up to the highest 7 segments deep from the street. The central circulation spine is mixed (live/work) that extends up to the 5th floor, eventually becomes mono-functional (work).



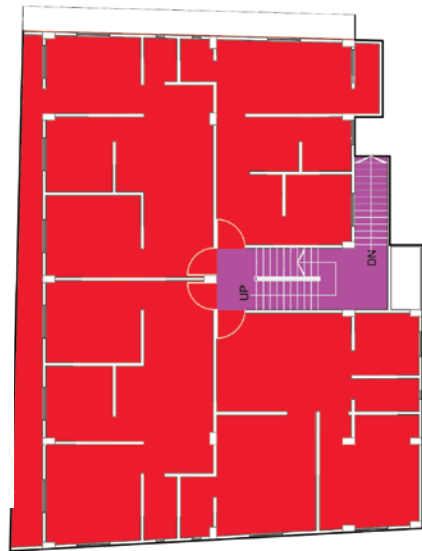
A: Syntactic structure



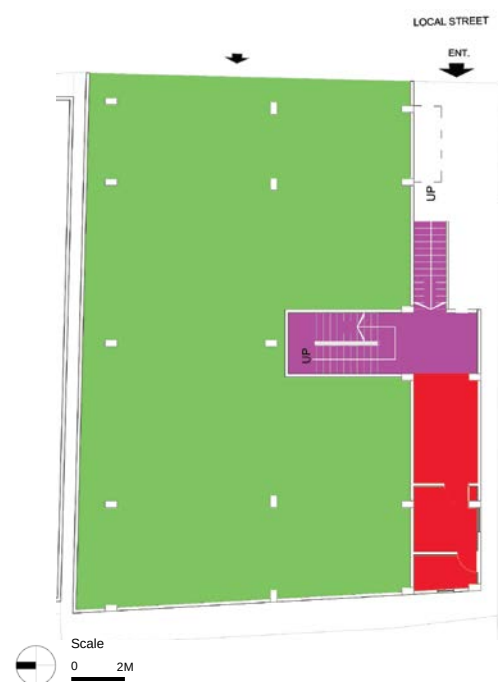
E: 152/2/M, Green Road
Fig. 8.18: Building 18



D: Second, third and fifth floor plan

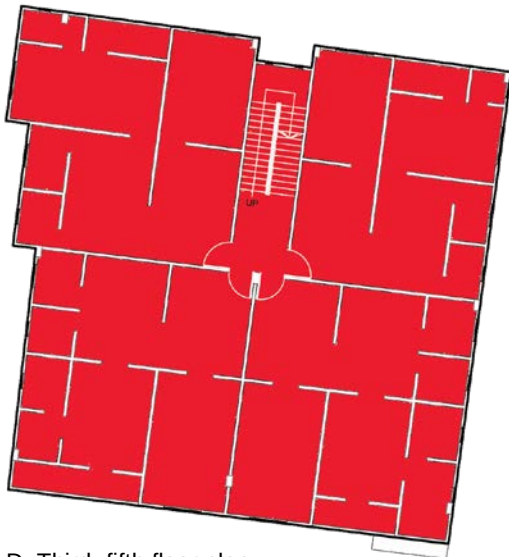


C: First and fourth floor plan

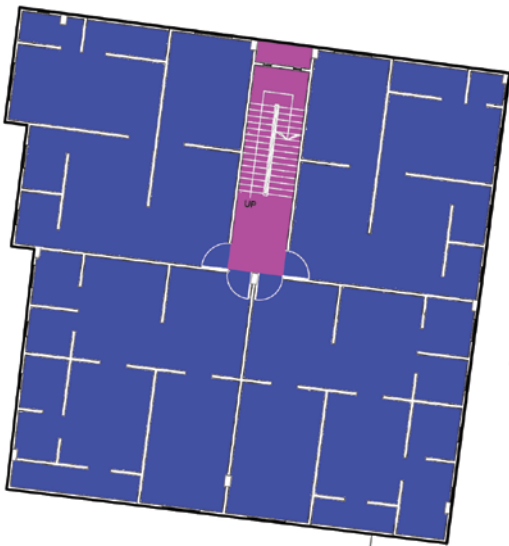


B: Ground floor plan

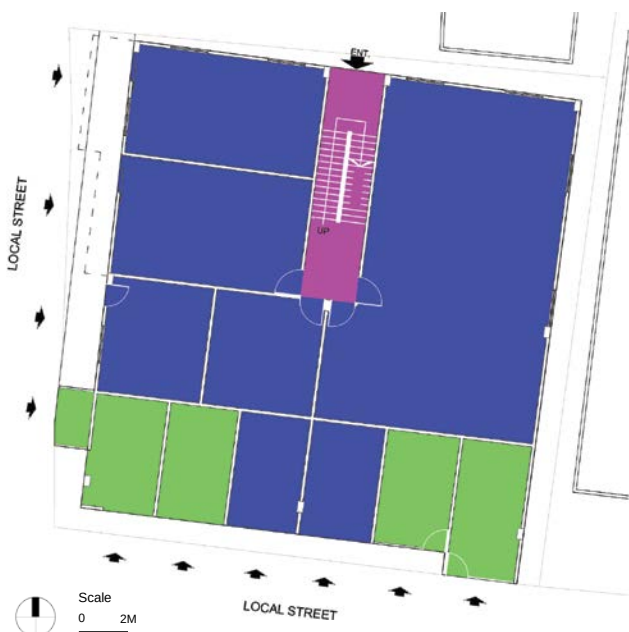
SP - 9



D: Third - fifth floor plan

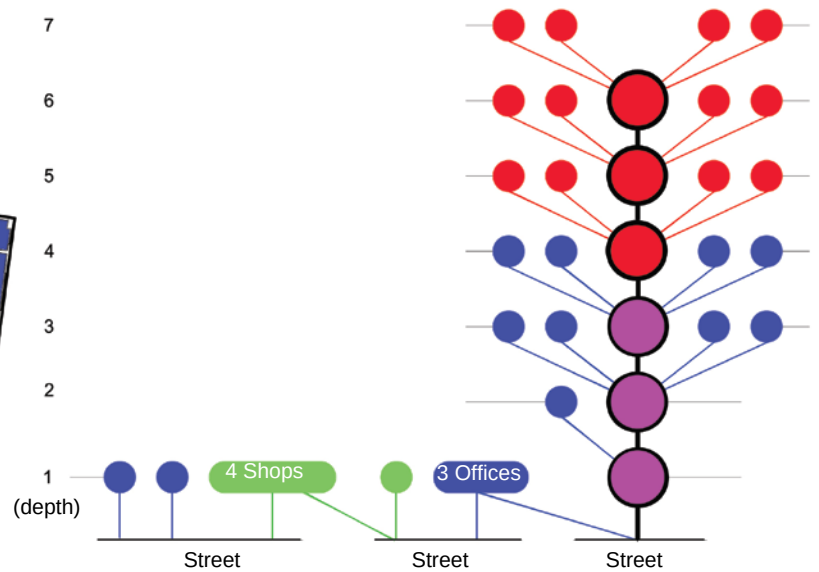


C: First - second floor plan



B: Ground floor plan

This building is effectively a progressive mix of work and then live with mixed access to about half the depth of 7 segments (Fig. A). Several shops, offices, and go-downs are organised from the ground to the second floors, which penetrate 4 segments deep. Among these functions, a few shops and offices are separately accessed from the street. The residential units occupy upstairs and extend 7 segments deep.

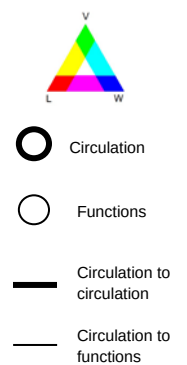


A: Syntactic structure

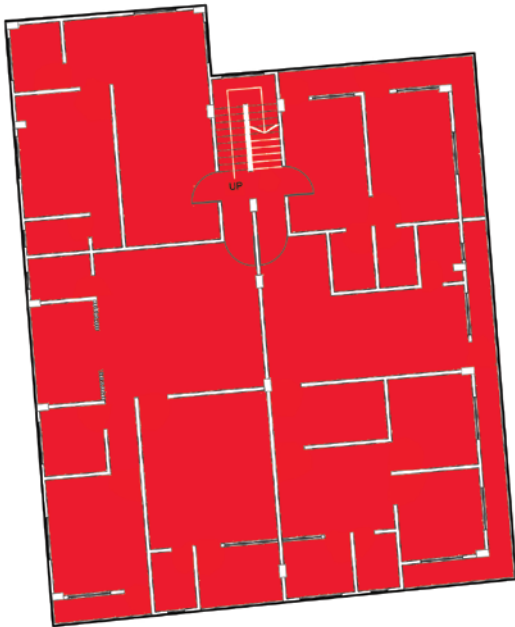


E: 152/2, Green Road

Fig. 8.19: Building 19



SP - 10



C: First -third floor plan



B: Ground floor Plan

This building has a mono-functional residential tree-like structure with the ground floor interface utilised for direct access shopping (Fig A). These shops and residential units respectively penetrate 1 and 5 segments deep into the building. As the residences and shops are horizontally mixed, they have separate accesses from the street.

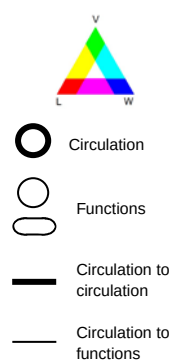


A: Syntactic structure



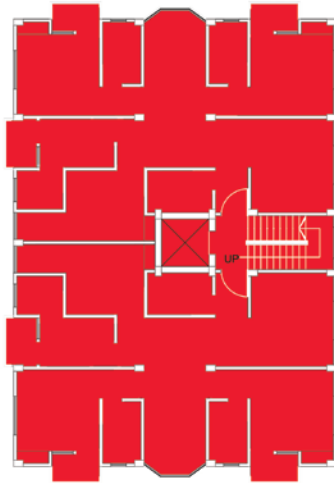
D: 174, Green Road

Fig. 8.20: Building 20

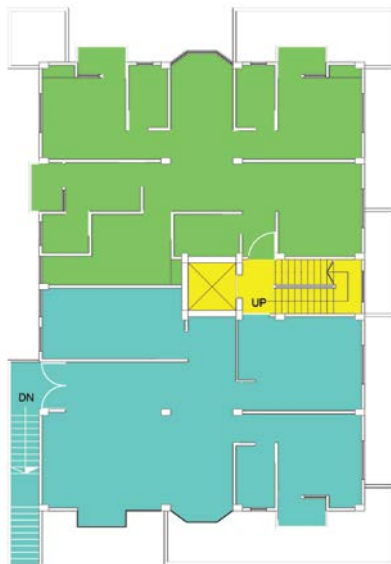


8.5 Mixed-use Buildings - Planned Area

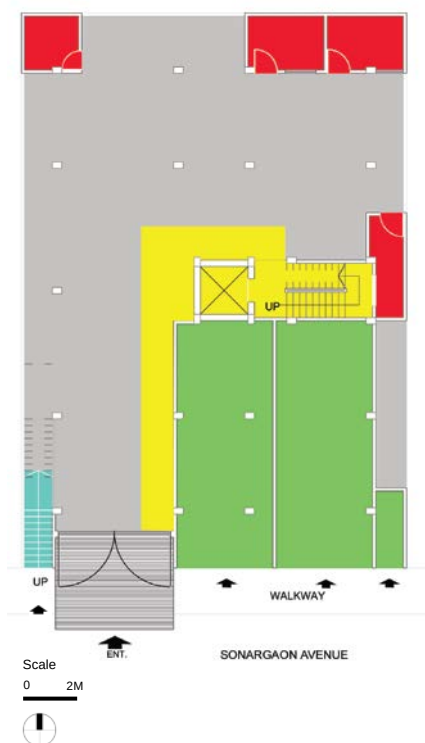
PL - 1



D: Second-fifth floor plan

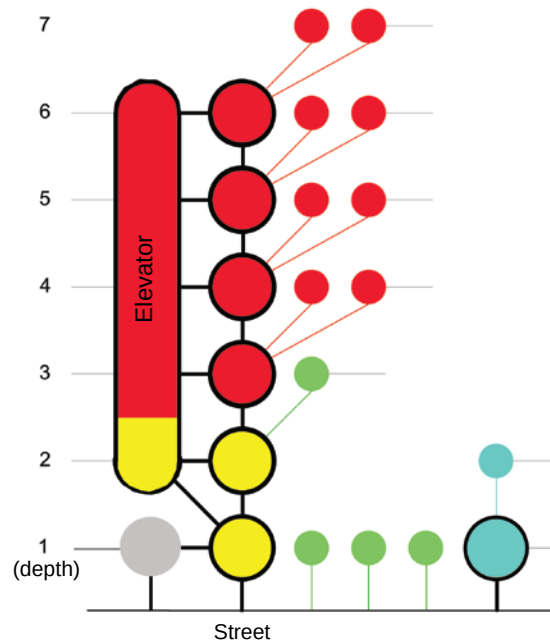


C: First - floor plan



B: Ground floor plan

This building primarily demonstrates a residential tree-like structure comprising live/visit mixes at its lower depths (Fig. A). It has some shops along the street. On the first floor, it has a mixed-function (photo-studio) and a doctor's chamber, originally converted from residences, which respectively penetrate 2 and 3 segments deep from the street. This photo-studio has direct access from the street, while the doctor's chamber is accessed from the mixed (live/visit) circulation spine of the building. Other residences are organised upstairs and extend up to a depth of 7.

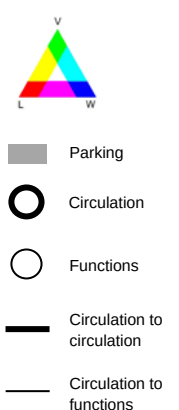


A: Syntactic structure



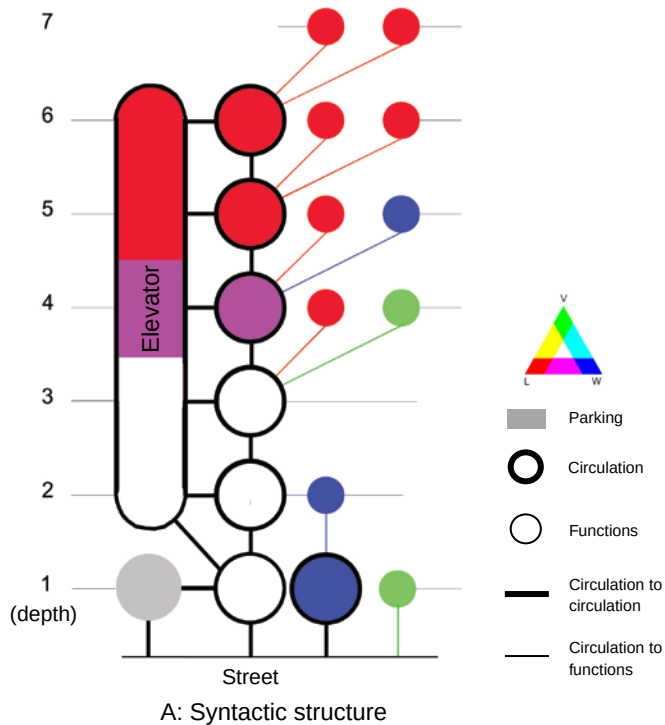
E: House-26, Sonargaon Avenue, Uttara

Fig. 8.21: Building 21

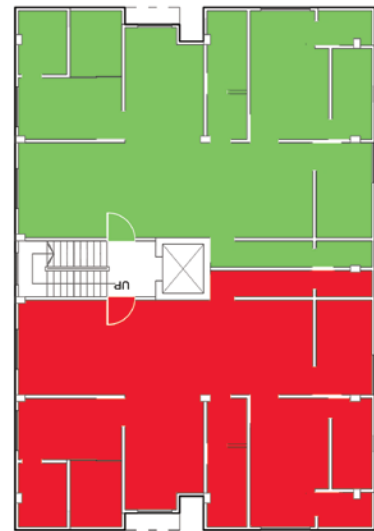


PL- 2

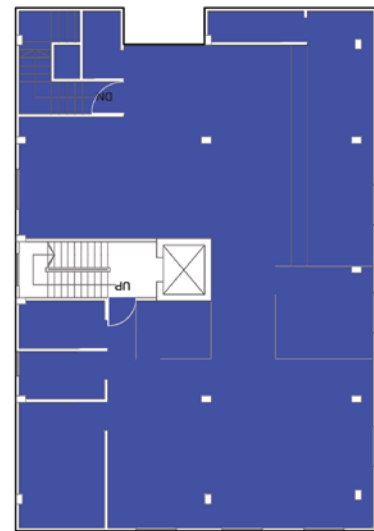
This building shows a residential tree-like structure with mixes at its lower and intermediate depths (Fig. A). It has an ATM and a bank on the ground and first floors, which are directly accessed from the street. This building has a dental clinic and a private office on its second and third floors, and these functions respectively penetrate 4 and 5 segments deep. Residences occupy the second to the fifth floors and extend up to a depth of 7. This building was initially designed as a residence and later transformed into a mix of uses. The central circulation spine starts with a triple mix, which gradually becomes live/work and then solely residential, as it penetrates deeper into the building.



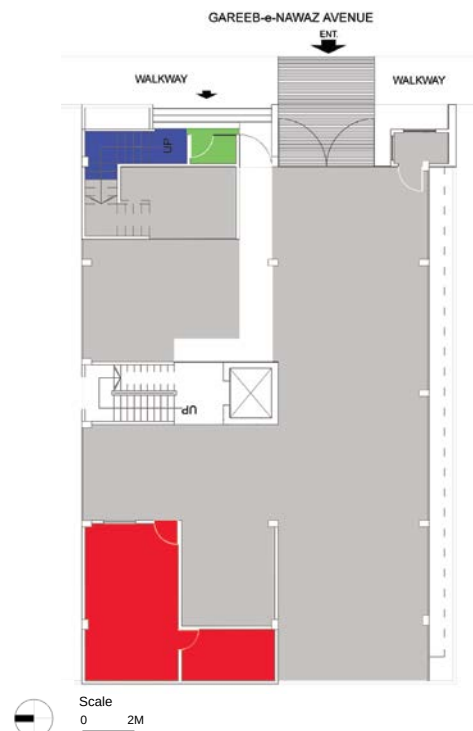
E: House-15, Gareeb-e-Nawaz Avenue, Uttara



D: Second - floor plan



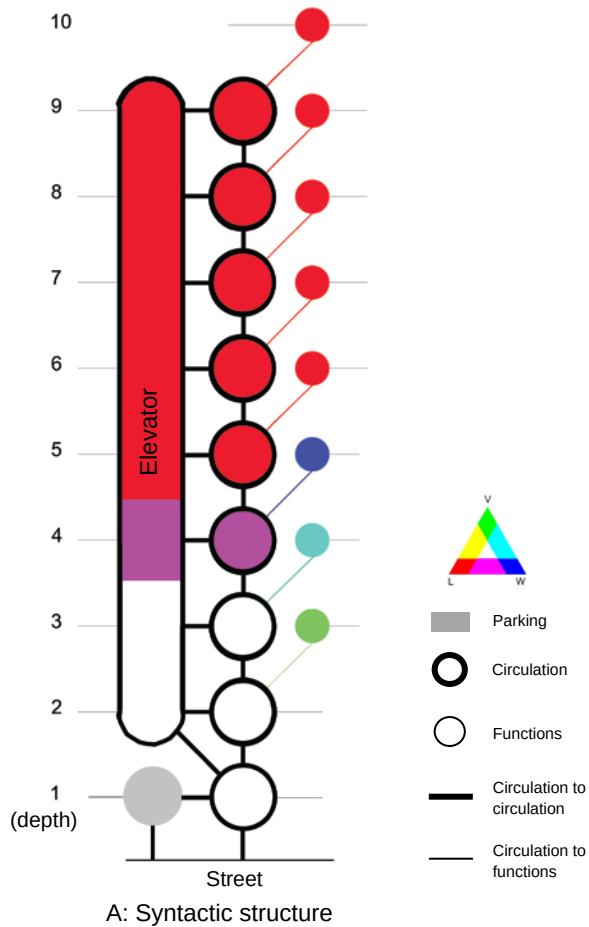
C: First - floor plan



B: Ground floor plan

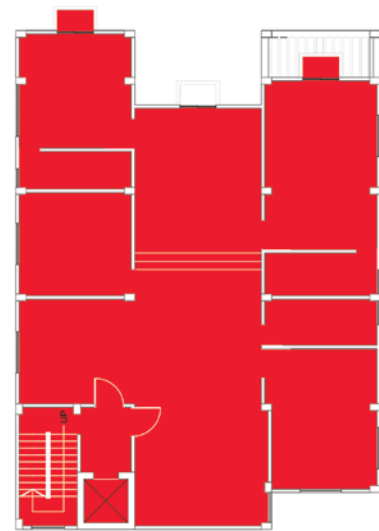
PL - 3

This building integrates visit, work, and living at its progressive depths. It has parking on the ground floor. A beauty parlour, a rehabilitation centre, and a private office are organised on first, second, and third floors, which respectively penetrate 3, 4 and 5 segments deep from the street (Fig. A). Residential units occupy upstairs and extend up to a depth of 10. The central circulation spine begins with a triple mix, which later becomes double mix (live/work) and then residential, as it penetrates deeper.



E: House-3, Gareeb-e-Nawaz Avenue, Uttara

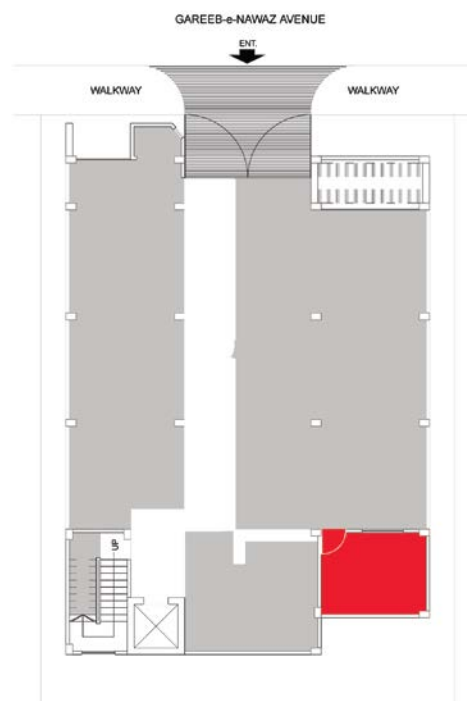
Fig. 8.23: Building 23



D: Fourth-eighth floor plan

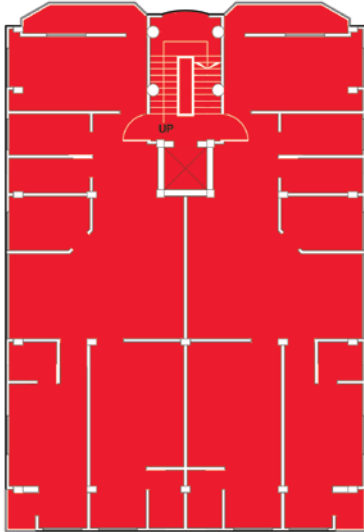


C: First - floor plan

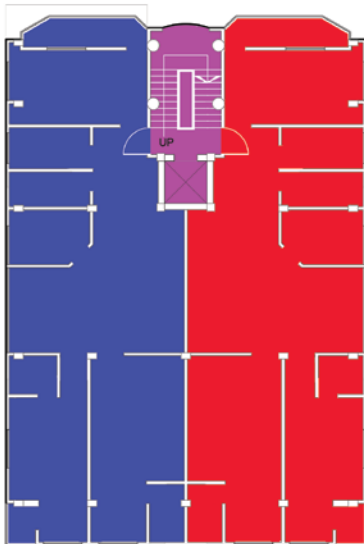


B: Ground floor plan

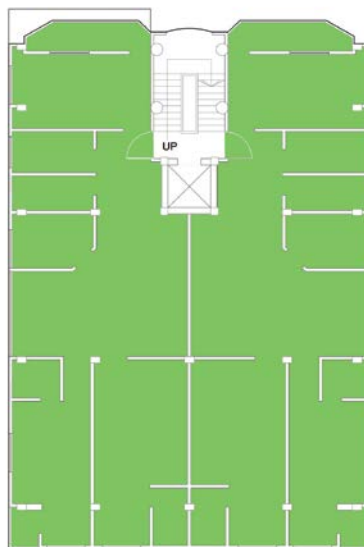
PL - 4



E: Third-fifth floor plan

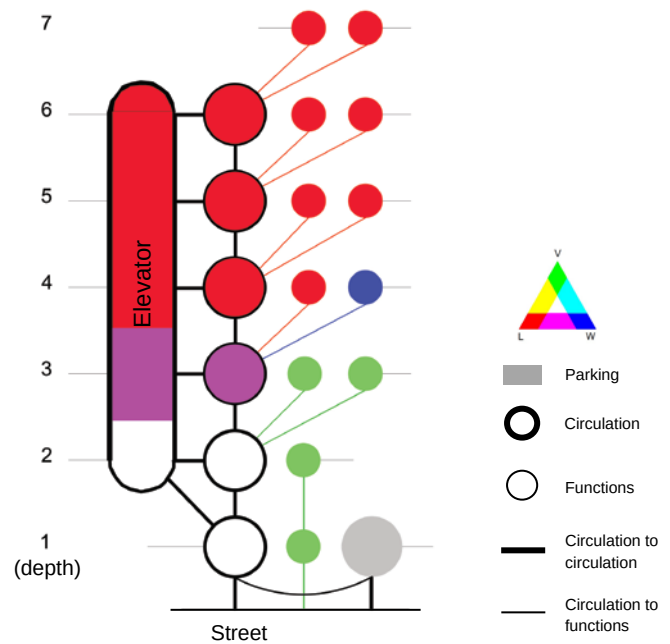


D: Second - floor plan

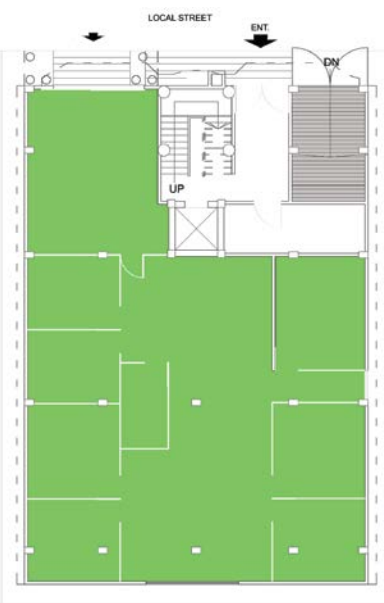


C: First - floor plan

This building demonstrates a residential tree-like structure containing triple and double (live/work) mixes at its lower depths (Fig. A). It has a pharmacy and an eye-clinic on the ground and first floors, originally converted from residences. On the second floor, it has a private office that penetrates 4 segments deep from the street. Residential units are organised from the second to the fifth floors, which extend up to a depth of 7.



A: Syntactic structure



Scale
0 2M



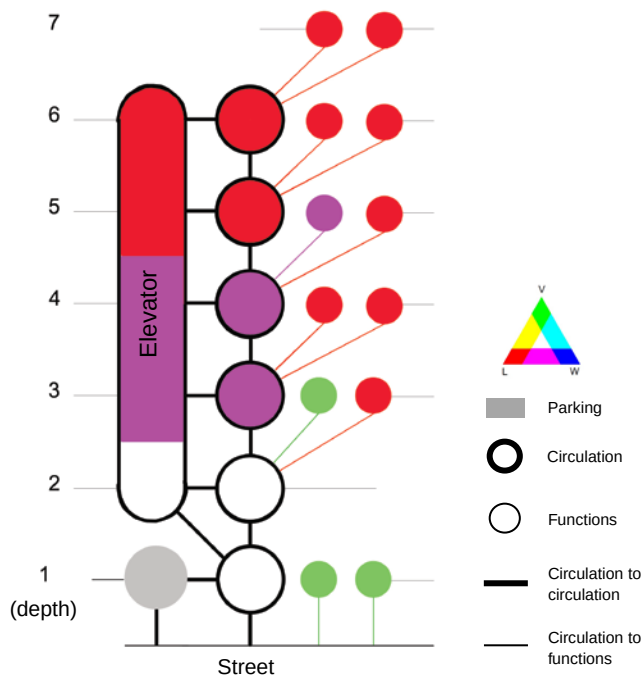
B: Ground floor plan



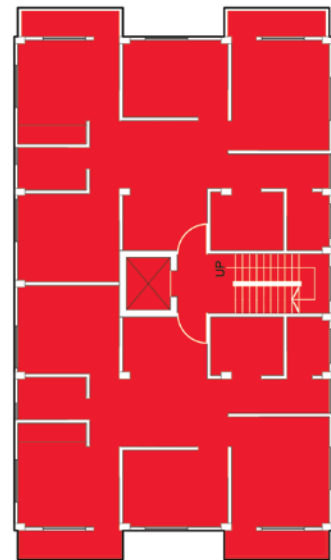
F: House-19, Road-14, Sector-13, Uttara
Fig. 8.24: Building 24

PL - 5

Similar to the previous examples, this building also contains triple and double (live/work) mixes at its lower and intermediate depths (Fig. A). It has visit functions, like shops, along the street and a beauty parlour on half part of the first floor, which penetrate 3 segments deep from the street. It has a madrasa on the third floor. The residential units occupy the first to the fifth floors and extend up to a depth of 7. This building was originally designed as a residence, which later transformed into a functional mix.



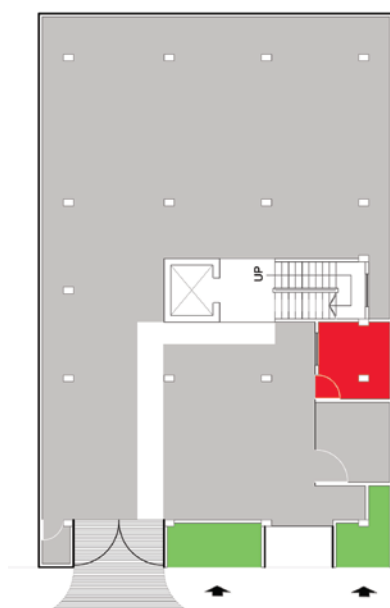
A: Syntactic structure



E: Second, fourth and fifth floor plan



D: Third - floor plan

F: House-16, Road-10,
Sector-11, Uttara

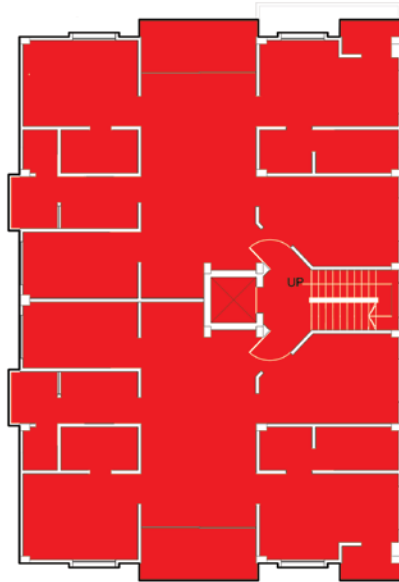
B: Ground floor plan



C: First - floor plan

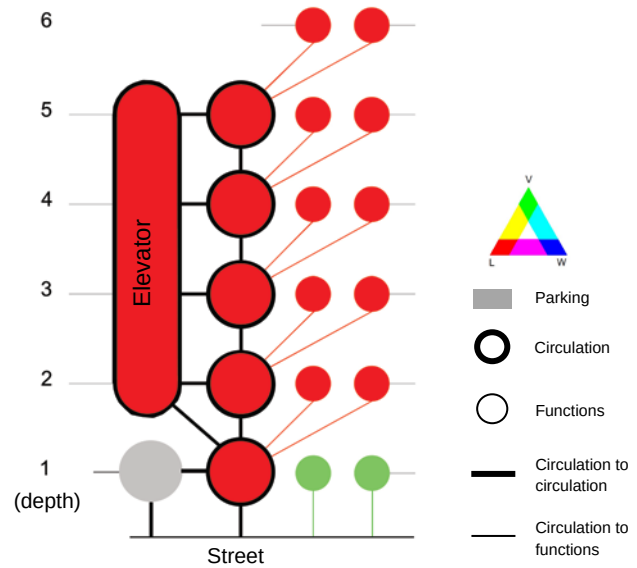
Fig. 8.25: Building 25

PL - 6



C: First-fifth floor plan

This building characterises residential functions with a few shops at its ground level (Fig. B, C). These shops penetrate 1 segment deep and are accessed from the street. The residential units extend up to a depth of 6 and have separate access from the street.



A: Syntactic structure



B: Ground floor plan

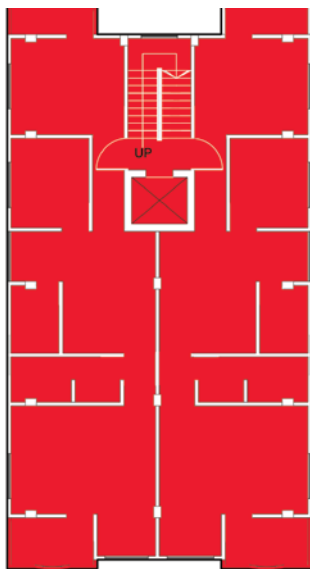


D: House-17, Road-14, Sector-11, Uttara

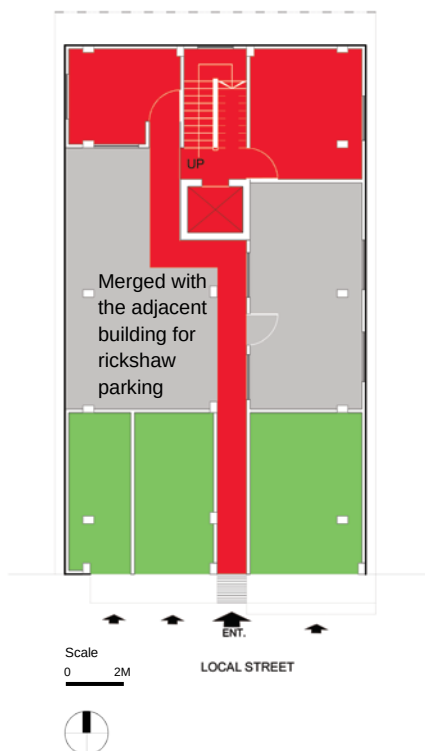
Fig. 8.26: Building 26

PL - 7

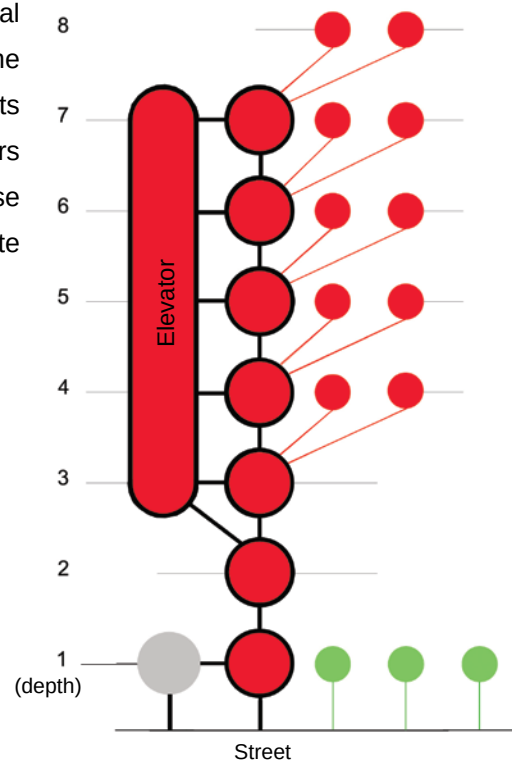
This building demonstrates a residential tree-like structure (Fig. A). It has some shops along the street. The residential units are organised from the first to the fifth floors and extend up to a depth of 8. These residences are accessed by a separate mono-functional (live) circulation spine.



C: First-fifth floor plan



B: Ground floor plan



A: Syntactic structure



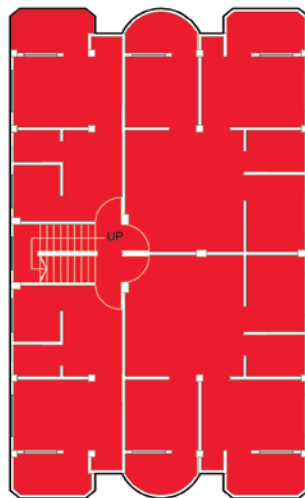
- Parking
- Circulation
- Functions
- Circulation to circulation
- Circulation to functions

D: House-18, Road-19, Sector-11, Uttara

Fig.8. 27: Building 27

PL - 8

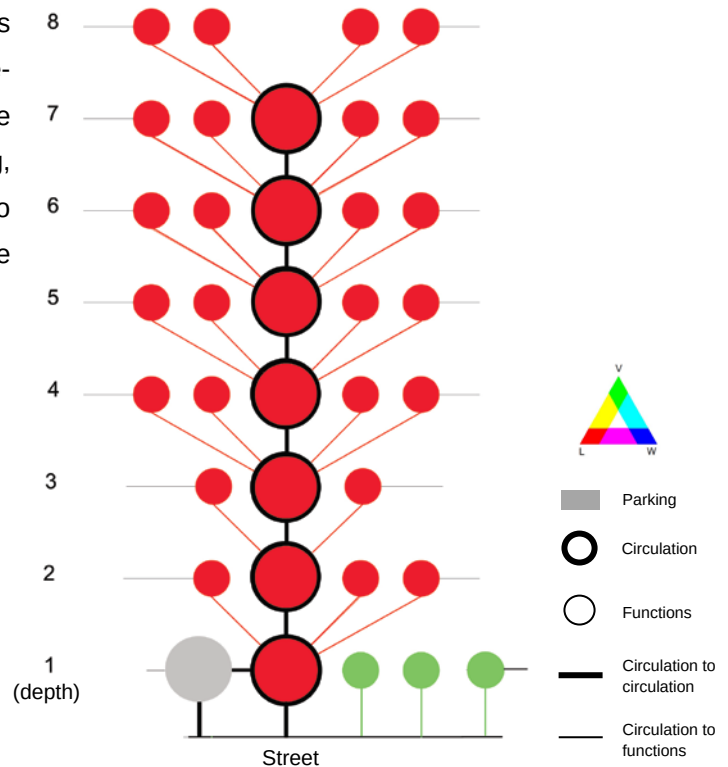
Similar to the previous examples, this building also shows a residential tree-like structure containing shops at the ground level (Fig. A). In this building, residential units occupy the ground to the fifth floors and have a separate live circulation spine from the street.



C: First-fifth floor plan



B: Ground floor plan



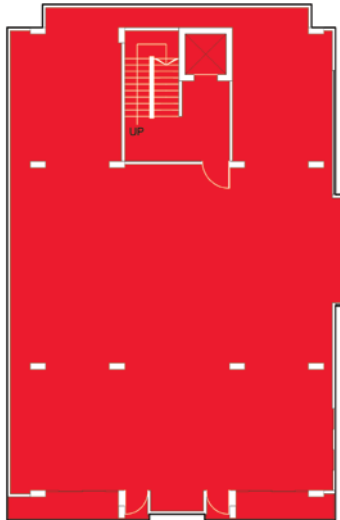
A: Syntactic structure



D: House-16, Road-19, Sector-11, Uttara

Fig. 8.28: Building 28

PL - 9



D: Second-fifth floor plan

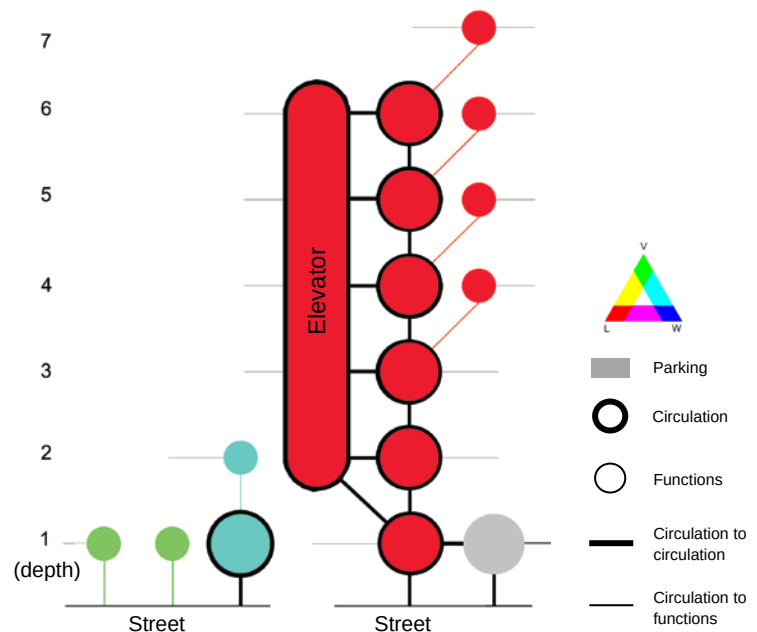


C: First - floor plan



B: Ground floor plan

This building shows a residential tree-like structure (Fig. A). It has a few shops along the street and a work/visit mix on the first floor, which penetrate 2 segments deep. These functions are accessed from the street. The residential units occupy the first to the fifth floors and extend up to a depth of 7. A separate live circulation spine accesses them from the street.



A: Syntactic structure

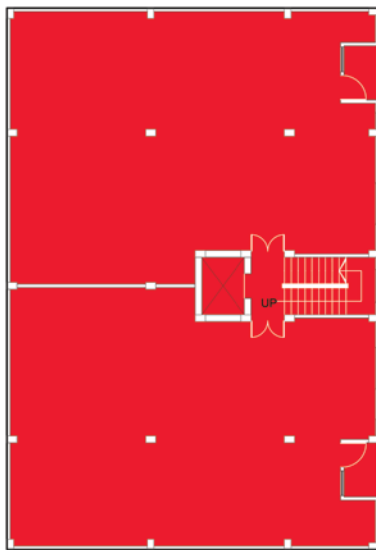


E: House-2, Road-2, Sector-11, Uttara

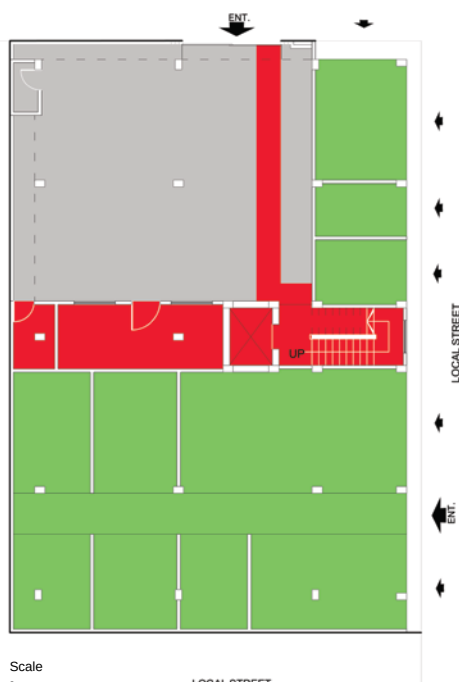
Fig. 8.29: Building 29

PL - 10

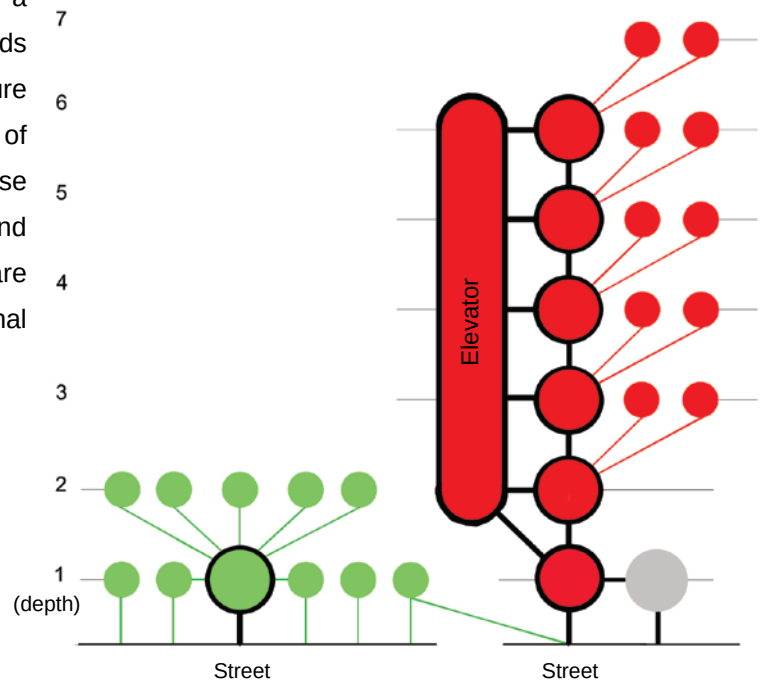
This building primarily demonstrates a residential tree-like structure, which extends up to a depth of 7. The syntactic structure shows that it also has a small network of shops that penetrate 2 segments deep. These shops are accessed both from the street and the visit circulation spine. The residences are accessed by a separate mono-functional circulation spine from the street.



C: First-fifth floor plan



B: Ground floor plan



A: Syntactic structure



- Parking
- Circulation
- Functions
- Circulation to circulation
- Circulation to functions



D: House-1, Road-2, Sector-11, Uttara

Fig. 8.30: Building 30

8.6 Common Building Types and Depth of Functions

This section generalises the common building types and depth of mixed-use functions.

Common Building Types

Mixed-use buildings can be broadly categorised into following 5 types according to different circulation systems-

Type-1 : Live + Visit (Red + Green)

Type-2 : Live + Work/Visit Complex (Red + Blue/Green Complex)

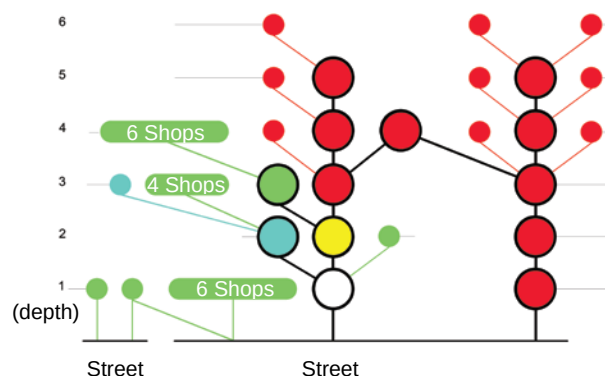
Type-3 : Live/Work/Visit > Live/Work (White > Purple)

Type-4 : Live/Work > Live (Purple > Red)

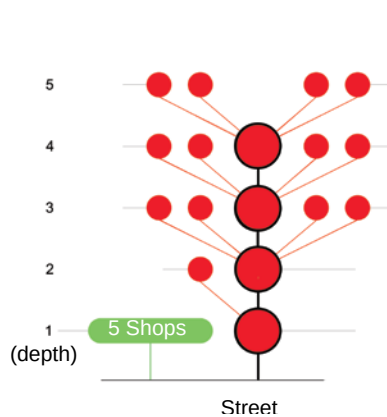
Type-5 : Live/Work/Visit > Live/Work > Live (White > Purple > Red)

In mixed-use buildings, circulation systems are vital as the mixing of different functions primarily takes place in the circulation spines. This building typology represents the typical patterns of vertical mix with circulations that are identifiable within the 30 cases. These building types are derived by grouping the syntactic structures of sample mixed-use buildings according to their different circulation patterns (Fig. 8.31-8.35). The patterns of these types are described alongside the building type diagrams. While other types are evident, they are singular rather than typical examples and have been omitted here for the sake of clarity. In the diagrams of the common building types, different functions and circulations are denoted by boxes and lines respectively, and the functions are organised according to the hierarchy from the street upwards/to the deepest positions of buildings. In these diagrams, the representation of different functions and their mixes follows the live/work/visit triangular model used throughout the study. The main circulation spines are represented by thick lines. The lines labelled with the primary colours (blue, green, red) indicate the single type circulations/accesses. The type which contains a mixed circulation is represented either through a line with mixed colour or multiple colours, representing the different types of mixed access at various depths of the building.

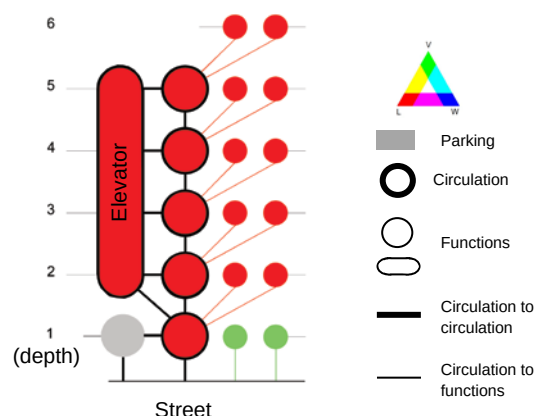
Figures 8.31-8.35 show that types 1 and 5 are commonly evident in the majority of buildings. These two types are the least and most mixed categories, whereas other types have evolved due to various combinations and intensities of different functions at various depths. Type-1 is the mix of live and visit functions and it is the only category, where functions and entries are both segregated. Hence, this type maintains the privacy of residences and simultaneously allows diverse businesses at the ground level without any conflict. In contrast, type-5 contains the combination of all three functions (live/work/visit) and a triple mixed entry, which gradually becomes double mixed and then to residential in the upper floors. Types 2 and 4 are also evident in several buildings, where work and visit functions or work/visit networks remain at lower depths and live/work mixes and live functions occupy the higher depths. In these types, the functions at lower depths are accessed directly from the street or by mixed (work/visit) accesses, while the other functions at the higher depths are accessed by separate monofunctional (live) or mixed (live/work) entries. Type 3 is evident in a few buildings, where



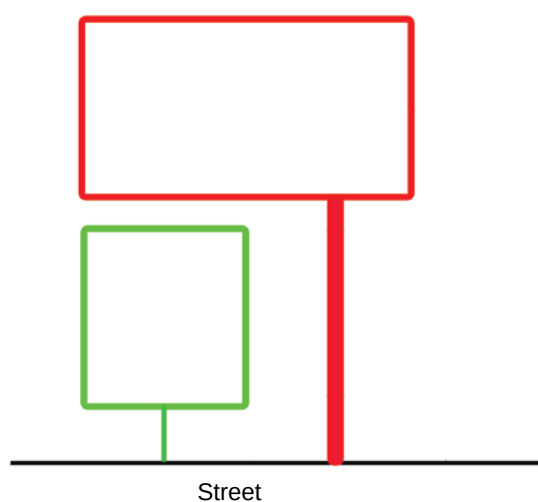
A: Syntactic structure- SP 5



B: Syntactic structure- SP 10



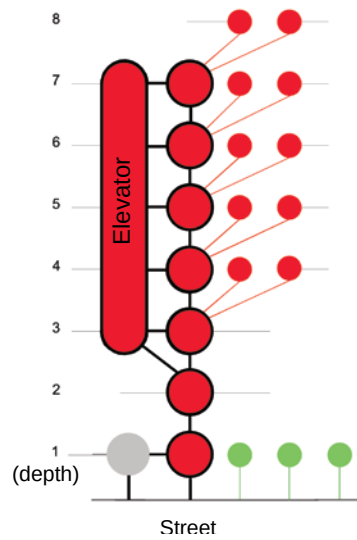
C: Syntactic structure- PL 6



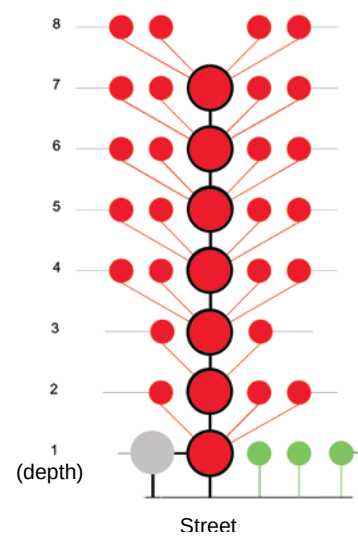
i: Generic building type-1
L+V
(Red + Green)

Pattern-
This type is a mix of live and visit functions but both the functions and entries are clearly segregated. Occasionally, it has work/visit mixes at lower depths.

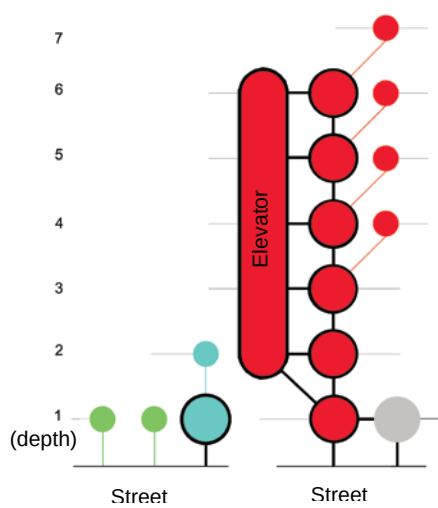
Fig. 8.31: Syntactic structures of sample buildings (A-G) and generic building type-1



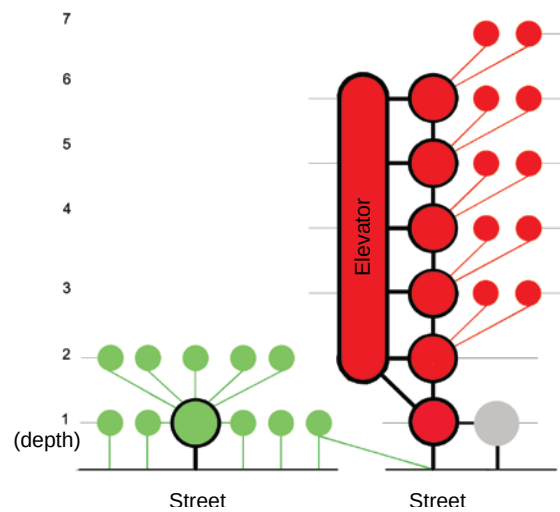
D: Syntactic structure- PL 7



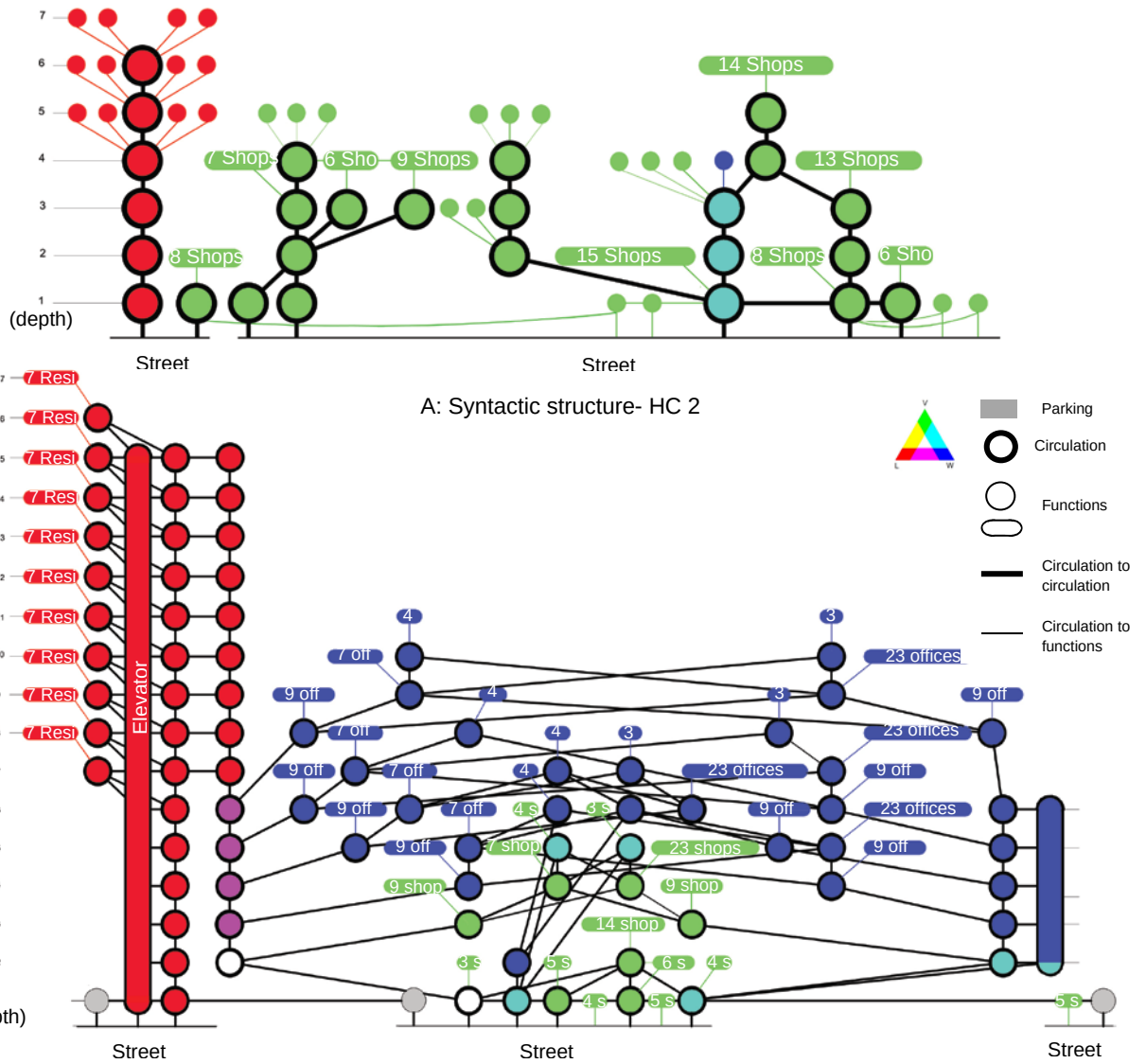
E: Syntactic structure- PL 8



F: Syntactic structure- PL 9



G: Syntactic structure- PL 10



B: Syntactic structure- SP 1

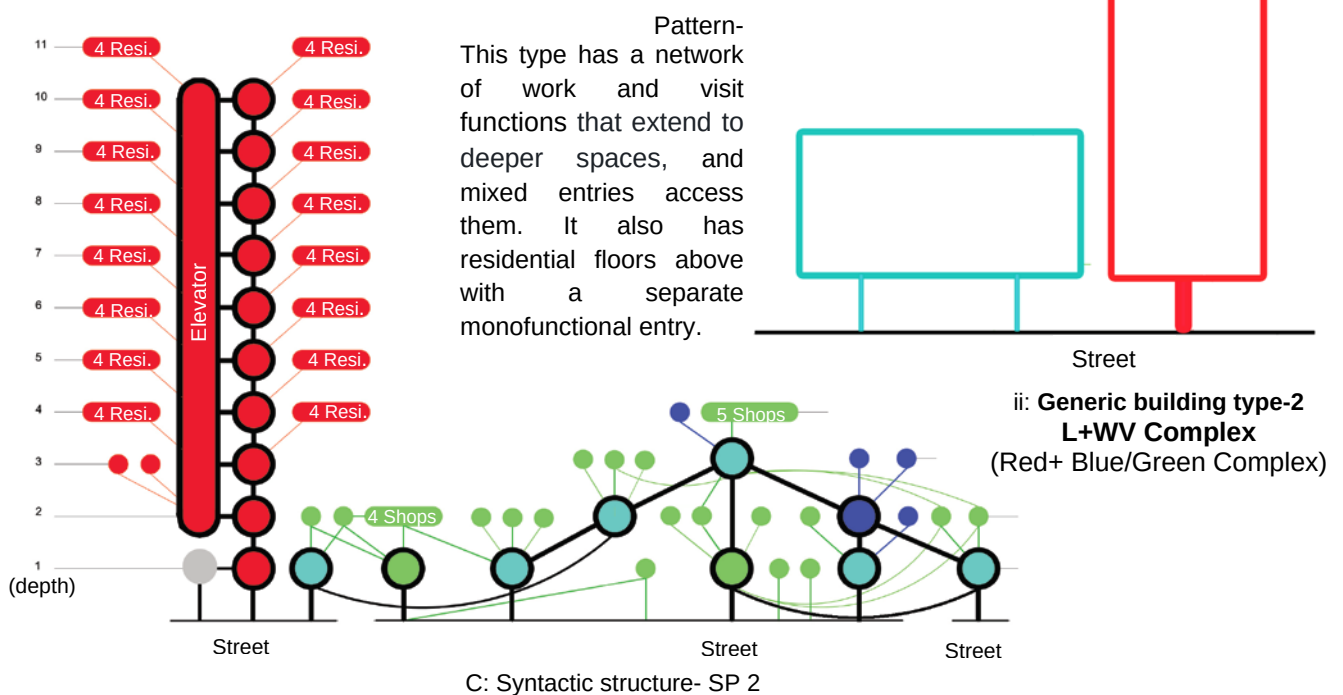


Fig. 8.32: Syntactic structures of sample buildings (A-C) and generic building type-2

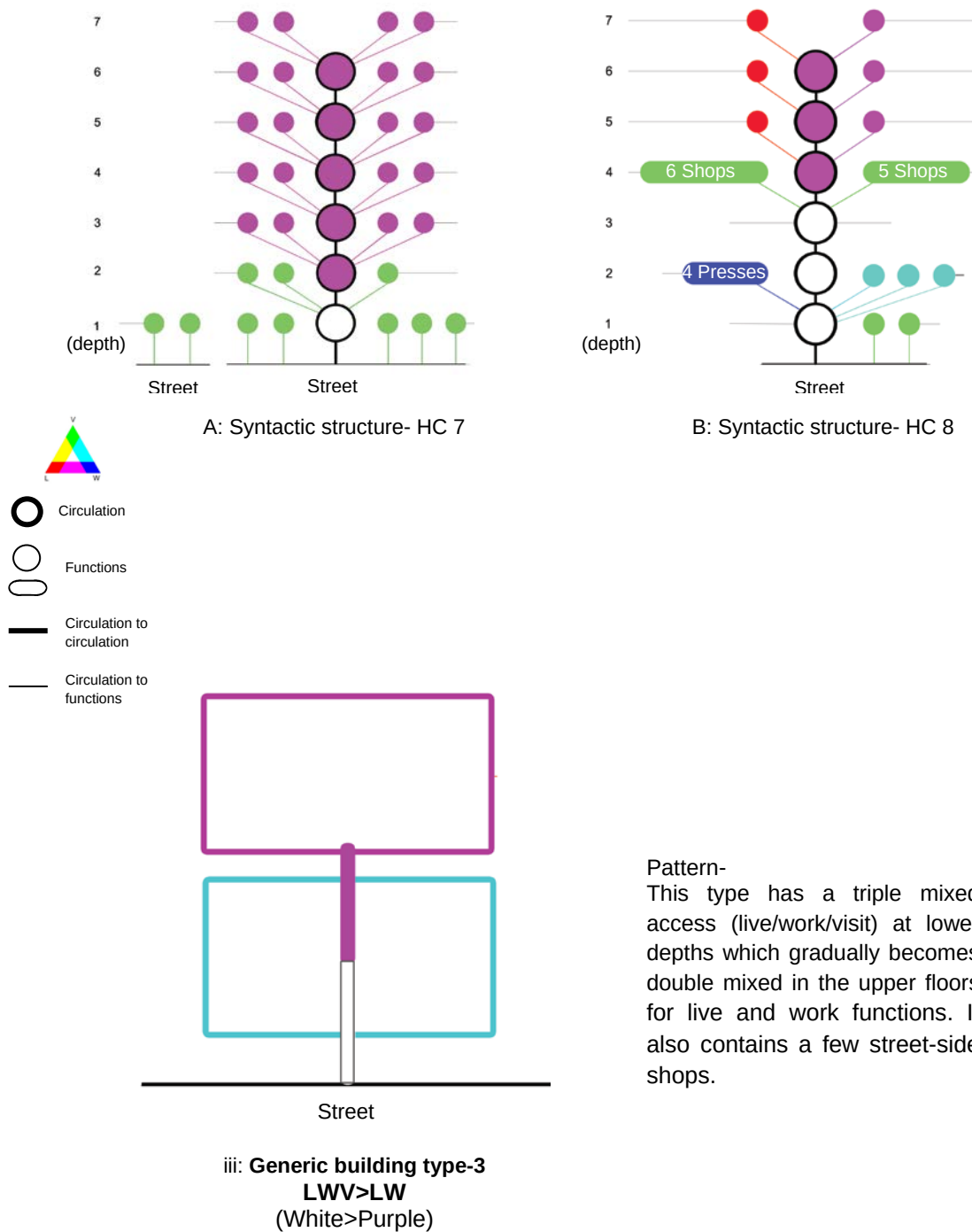
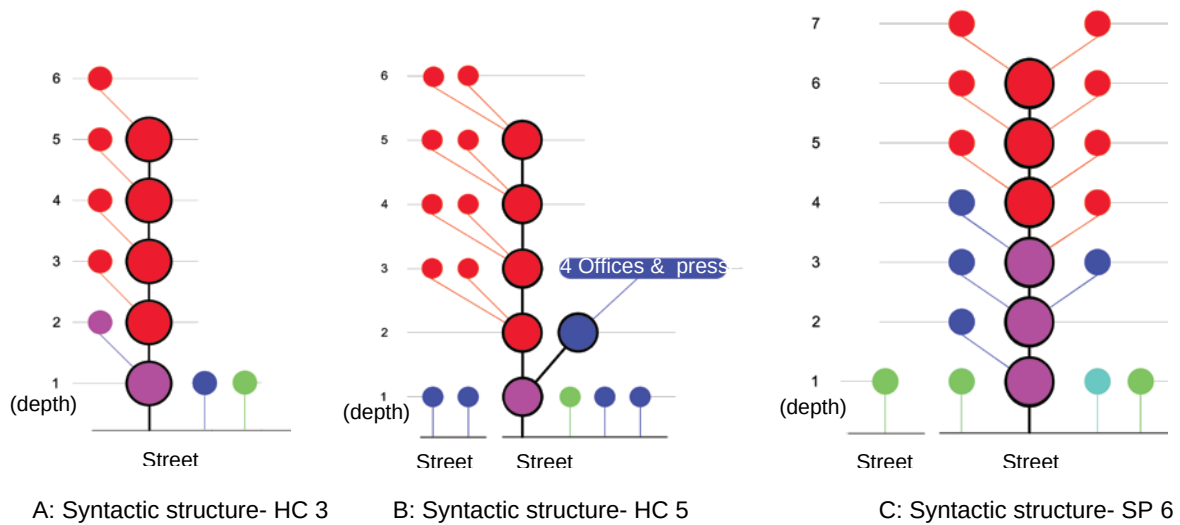


Fig. 8.33: Syntactic structures of sample buildings (A-B) and generic building type-3



Pattern-

This type has mixed access for live and work functions in the deeper spaces and this access become mono-functional in the residential upper floors. It also has some street-sides shops and work functions.

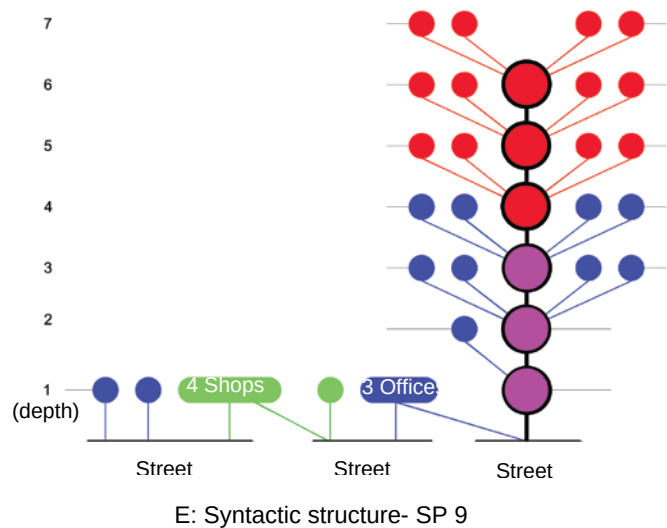
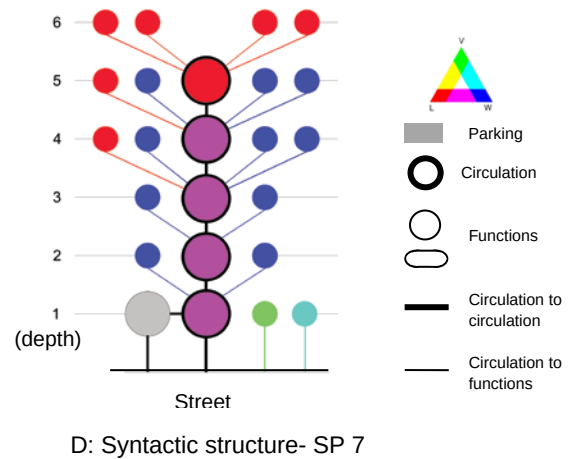
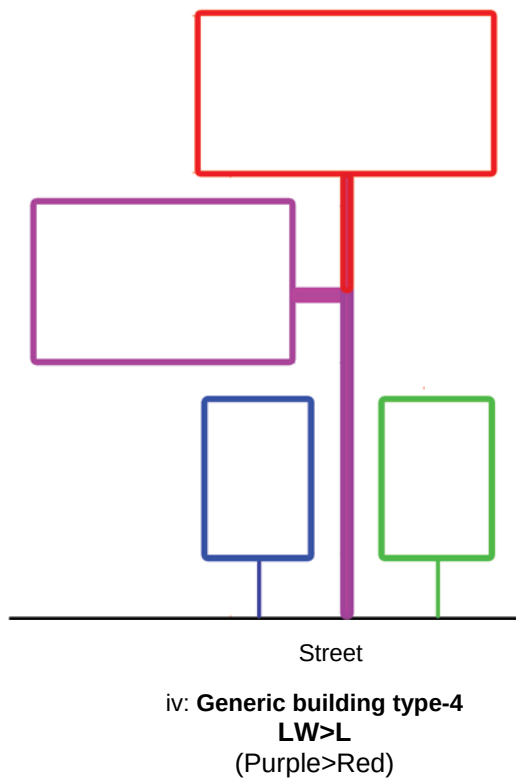


Fig. 8.34: Syntactic structures of sample buildings (A-E) and generic building type-4

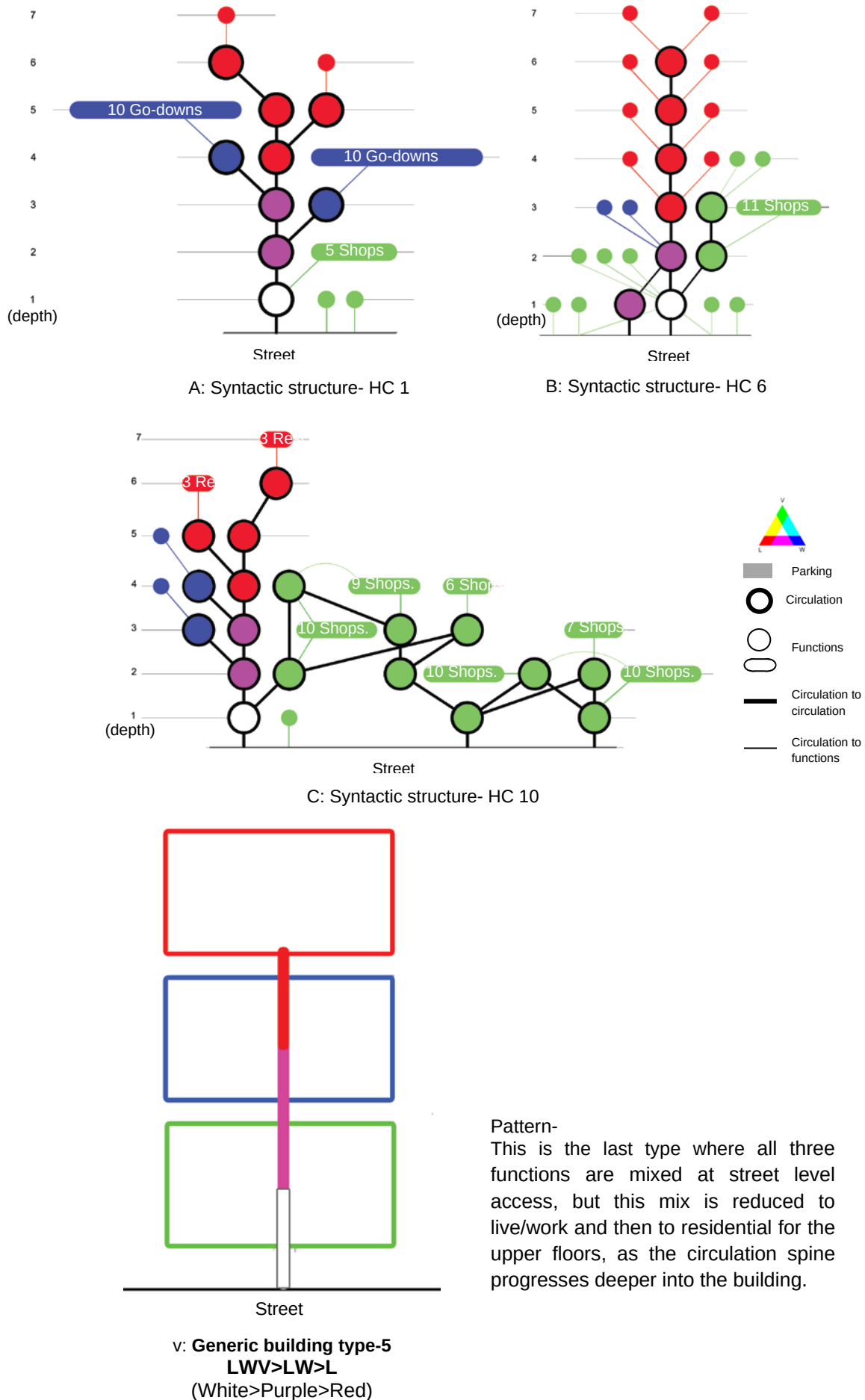
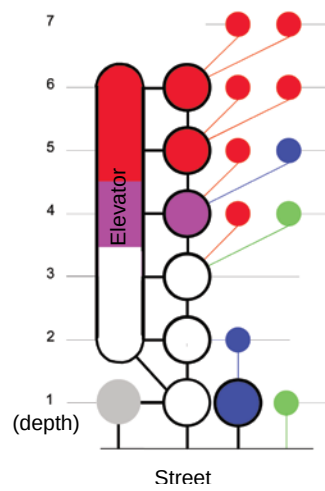
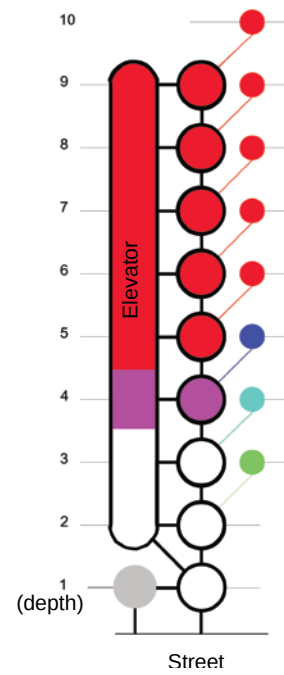


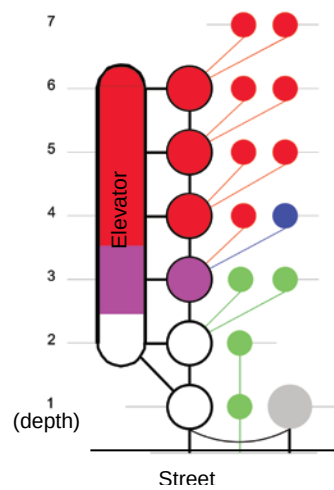
Fig. 8.35: Syntactic structures of sample buildings (A-G) and generic building type-5



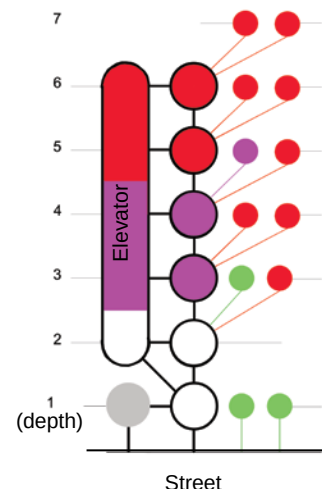
D: Syntactic structure- PL 2



E: Syntactic structure- PL 3



F: Syntactic structure- PL 4



G: Syntactic structure- PL 5

various mixed functions remain at different depths and are accessed by a triple mixed entry, which becomes double mixed in the upper floors.

Depth of Functions

The syntactic structures (gamma diagrams) demonstrate that live, work, visit, and their related mixes have particular depths in mixed-use buildings. The depths of visit functions vary from 1 to 6. Visit uses typically remain at the shallowest position, as they seek good accessibility with the adjoining street for their business. The depths increase in some cases, where the number of shops is higher, and they are organised along the deeper spaces of the buildings. Considering the depth, the work functions posit next to the visit. However, in a few buildings, work functions, like workshops and offices, are arranged on the ground floor, adjacent to the street. Thus, the depth of work functions ranges from 1 to 11. Lastly, the residences are organised from the shallowest to the deepest positions, and their depth varies between 2 to 17. In the buildings where the numbers of work and visit functions are higher, residences are organised from the mid-depth to the deepest spaces. In contrast, where the number of work and visit functions is less, the depth of residences is lower. Residences usually remain in the deepest positions and on the upper floors, as they seek privacy from the streets. In the case of mixed functions, they are mostly confined within the first four floors. However, in a few cases, live/work mixes extend up to the deepest position of the building.

8.7 Conclusion

In mixed-use buildings, visit, work, and live functions generally remain in a progressive depth. Each of these functions has distinct characteristics; however, their activities overlap and interact at different spatial levels. Visit uses are organised from the shallowest to the intermediate depths, and work functions mostly remain on intermediate floors. Both of these uses characterise single or mixed circulation patterns. Live functions usually remain in the deepest positions and represent a single circulation pattern. Visit, work, and live functions can be organised in different combinations in mixed-use buildings. Informal adaptation of various functions in these buildings further led to their diverse organisations and mixed circulation patterns. Informal adaptation of functions can also result in an incompatible mix of uses. These incompatible uses and mixed entries may conflict with residential functions, but this is the way these mixed-use buildings work and sustain in informal contexts.

Chapter-9: Discussion and Conclusion

9.1 Introduction

This thesis takes an analytical approach to reveal the co-functioning, related urban and building morphology and transformation process of the functional mix in the context of Dhaka. It also explores the factors influencing the growth of the informal mix and its governance process. This concluding chapter presents the significant findings of the study and related discussions to explain how functional mix works in Dhaka. It has been structured into seven parts. The first, five parts answer the following key questions: How does the functional mix vary in different areas of Dhaka and how has the mix transformed over time? Which factors have motivated the growth of the informal mix? How does the mix of uses co-function? How is the informal mix regulated? How do mixed functions work at the building scale? Finally, the sixth part synthesises the working process of the informal mix through the lens of urban assemblage, complex adaptive systems, resilience, and urban economics. The last part provides a brief direction for further research.

9.2 Morphology and Transformation of Functional Mix in Dhaka

Functional mixes are largely informal in Dhaka and these mixes are integrated within the formal framework of the city at different spatial levels. Informal functions are evident in the mixed-use buildings and in the form of street trading. The vital morphological attributes of mixes and their transformation in different areas are discussed in terms of vertical mix, street trading, vertical extension of visit functions, entries, connectivity, and density as follows.

Vertical Mix



Fig. 9.1 compares the maps of the vertical mixes in the study areas. The functional mix is extensive in the Historic Core, while live functions dominate the Semi-planned and Planned areas. The intensification of the functional mix in the Historic Core is a result of its origin as a trading town, with spontaneously developed mixed-use functions. In contrast, live uses characterise the Semi-planned

and Planned areas, as these are the new settlements and were initially developed as residential neighbourhoods. These maps also illustrate a typical pattern of the distribution of functions in the study areas. Work, visit, and their related mixes are widespread along the main roads, while live-related mixes - mainly live/visit mixes - are common along the local streets. Better accessibility has fostered a high demand for spaces for shops, restaurants, and offices, along the main roads.

A diverse organisation of visit functions, like shops, is evident in different areas. In the Historic Core, rows of shops containing specialised products are grouped along different streets, while various types of shops are clustered in the Semi-planned and Planned areas. Historically, in Old Dhaka, particular traders' communities used to live in groups in shop-houses on different streets. A similar trend of specialised grouping shops has been followed until now. This arrangement of co-locating shops facilitates customers choosing desired items out of a broader range of products.

A varied organisation of work functions is also apparent on local streets of the study areas. Like the visit uses, similar work functions are grouped along different streets in the Historic Core. Conversely, in the Semi-planned and Planned areas, there are comparatively fewer work functions and diverse work functions are concentrated at different locations. In the Historic Core, these work functions are mostly micro-industries, workshops, and wholesale storages (go-downs), which operate as the service functions of shops and occasionally remain separate. In other areas, the work functions are mostly private offices and educational institutions. These work functions do not seek a high degree of accessibility and visibility, and they are primarily developed to serve residents.

The various uses of the mixed-use neighbourhoods are interdependent and they co-function for their endurance. Visit uses, like shops, restaurants, and cafes, serving local residents and people working in nearby offices. Notably, the wholesale shops of the Historic Core have a larger pool of users (factory owners and retail businessmen) across Dhaka. In study areas, the shop owners usually locate their workshops and wholesale storages close to their shops for easy transportation of products. Different types of work functions like banks, government, private offices, and educational institutions, develop in the residential areas so that people do not need to travel too far to avail these services.

The study of the transformation over time (since 1988) shows that in the study areas, mixed-use functions have increased. Earlier, mixes were prevalent along the main roads, and they further expanded in local streets. Over time, in response to a lack of employment in the formal sector for the growing population, various self-employment processes have gradually developed and increased across Dhaka. Among these self-employment schemes, the growth of small and medium-sized enterprises (SMEs), export-oriented garment manufacturing industries, and private offices have been significant. Residential areas have adapted these non-residential uses, as they have fulfilled the local demand and have also provided employment opportunities for local people. The study of the transformation also demonstrates that the change of functions in the Semi-planned and Planned

areas were dispersed throughout the site, while in the Historic Core, the changes were only apparent in local streets. Perhaps in the long (over 400 years) process of transformation of the Historic Core, the type of uses along the main roads has been saturated with the specific mixes (visit, work/visit and live/work/visit), while the functions only on the local streets are currently transforming. On the other hand, in the Semi-planned and Planned areas, the mixes have begun to emerge from the main roads to local streets a few decades ago. Hence, at present, all parts of these areas are going through the process of transformation.

The mixed-use functions of Dhaka have emerged from privately-initiated informal practices to cater to the needs of the local people. These types of bottom-up, self-organising processes can generate a lively and diverse environment - a quality that is often lacking in the Planned areas. However, extensive mixed-use functions have drawbacks too. The higher informal mixes invite higher visitors, which can compromise the privacy of the residents. Informal mixes can also contain noxious or dangerous functions, like storages of flammable chemicals, which can be harmful to residences and other work functions.

Street Trading

In many parts of Dhaka, informal street traders are a significant part of the functional mix. They are evident, either in clusters or individually, selling various products in public spaces - primarily on the main roads and around the nodes, where pedestrian movement is frequent. They usually remain close to other visit functions to get a higher customer flow, and often illegally occupy public spaces - streets and sidewalks. They negotiate these public spaces with related administrative and political powers to conduct their business.

Different types of street traders - stationary, peripatetic, and mobile - serve the various needs of the city and also complement the formal trading. Stationary traders fulfil the everyday needs of the neighbourhood by selling fruits and vegetables. Peripatetic (semi-fixed) traders meet periodic needs by selling toys and particular food items for school and office-going pedestrians. Mobile traders usually sell household items and seasonal foods to fulfil specialised needs. These street traders have an association with the formal trading system. In the Historic Core, wholesale traders and factory owners usually employ peripatetic and mobile vendors to sell their products in local areas. However, this association is not evident in the Semi-planned and Planned areas.

By vending different products door-to-door and in local areas, street traders meet socio-cultural demands, as the people of the study region are culturally habituated to buy daily necessities close to their homes. Street traders contribute to the local economy and employment. These traders, along with the other mixed-use functions, also make public spaces vibrant. In this sense, street traders are useful and play an essential role by filling the gaps produced by top-down planning. However, informal trading has drawbacks too. Street vendors occupy many sidewalks and parts of the main roads, impeding regular traffic and pedestrian flow.

Vertical Extension of Visit Functions

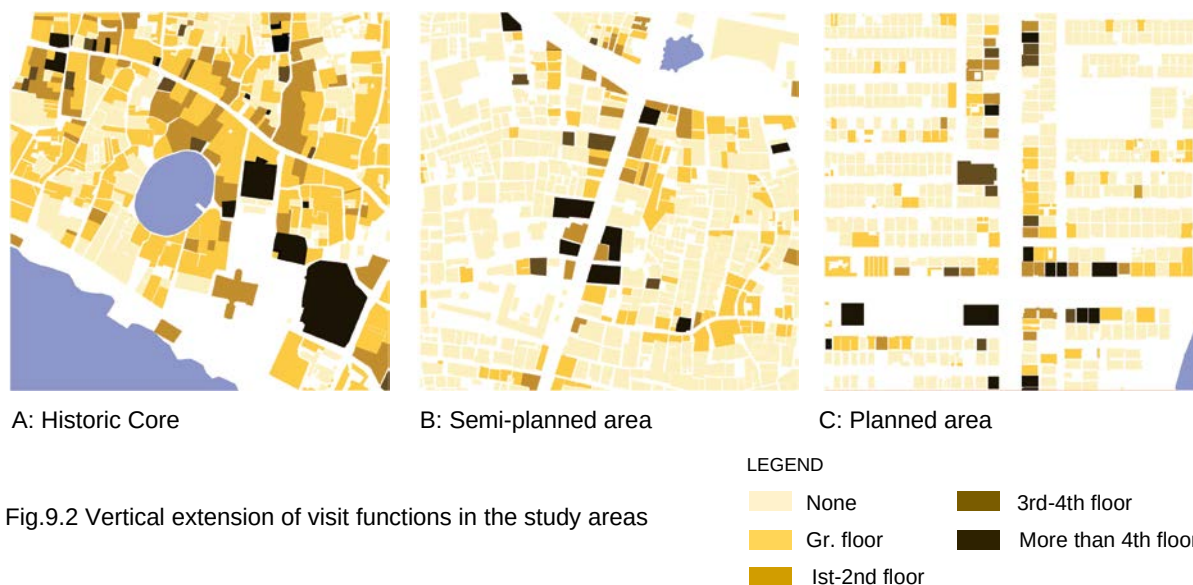


Fig.9.2 Vertical extension of visit functions in the study areas

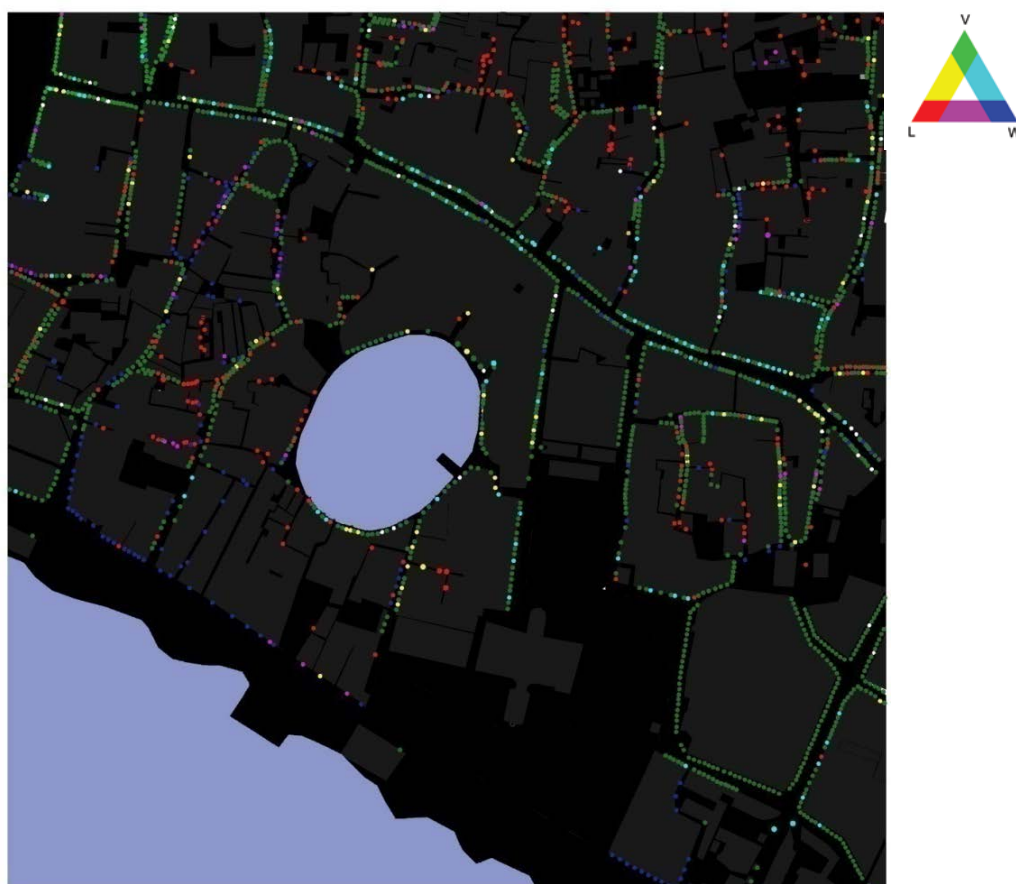
Fig. 9.2 compares the maps of the vertical extension of visit functions in the study areas. The highest floors containing visit uses are shown in the dark brown colour. Visit functions on multiple floors are clearly more pronounced in the Historic Core than in the other areas. In the Historic Core, visit functions on multiple floors are prevalent throughout the site, but in the Semi-planned and Planned areas, they are primarily concentrated adjacent to the main roads.

The study of the transformation shows that the growth of visit uses on multiple floors has increased over time in some areas of Dhaka. Earlier, the vertical extension of visit functions was confined to the main roads. Later it expanded across the site - mainly in the Historic Core. The compound effect of land scarcity and rising demand for visit functions by the growing population is the possible cause of the incremental development of visit uses on multiple floors of the buildings.

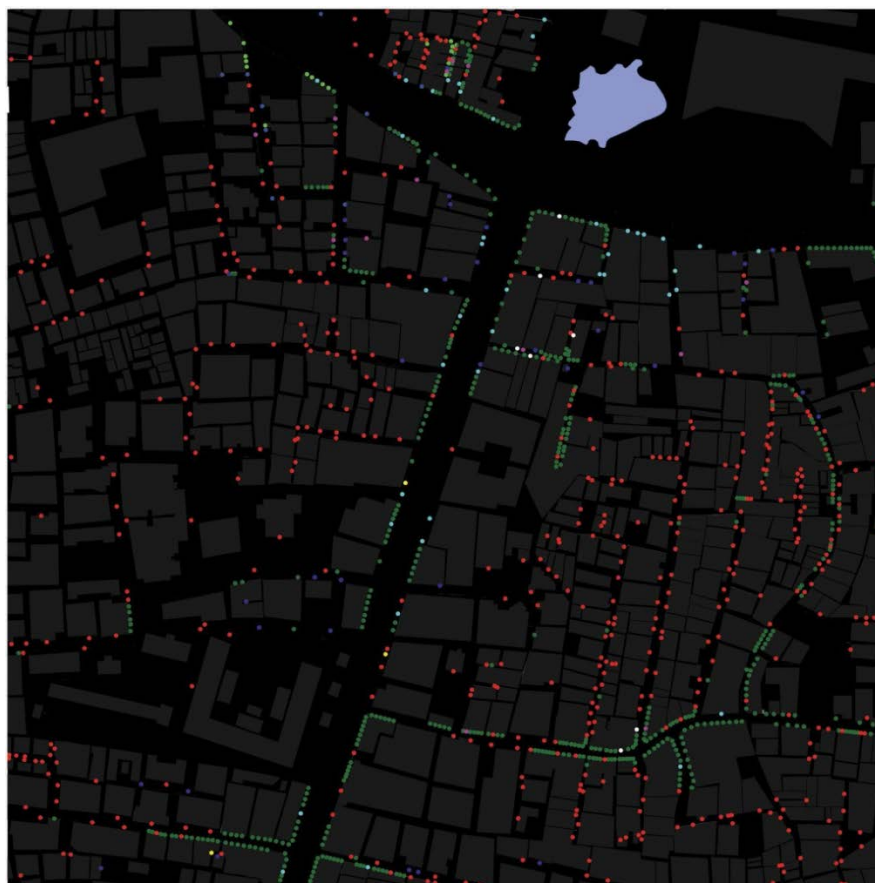
However, such vertical growth of visit functions is not always effective, due to misgauged demand and ill-conceived marketing strategies. Empirical investigations have explored (in chapter-5) that the visit functions organised on the upper floors sometimes remain inactive and/or vacant. Thus, unplanned and informally developed mixed-use functions often contradict the notion of efficient use of land. These vacant shops further provide the opportunity for the informal adaptation of service functions (barber shops, laundry, etc.) and private offices that do not seek good accessibility and visibility for their endurance.

Building Entries

Fig. 9.3 compares the maps of the building entries in the study areas. The Historic Core is characterised by mixed and visit entries, whereas live entries dominate the Semi-planned and Planned areas. In all the study areas, work, visit, and mixed entries are prevalent along the main roads compared to local streets, as the concentration of mixed functions is widespread on the main roads.



A: Historic Core



B: Semi-planned area



C: Planned area

Fig.9.3 Building entries in the study areas

A high number of mixed entries is evident in the Historic Core in comparison to the other areas. Over time, the transformation of building from mono-function to mixed-use has led to an incremental increase in mixed entries in this area. Also, some of the plots of the Historic Core are too small for the provision of multiple entries. Interviews suggest that the people of the Historic Core are less accustomed to seeking professional advice from architects, who are trained to design separate functions. Most of the people are dependent on the local builders (master mason) for design and construction of the buildings, which led to more mixed entries in this area. However, mixed entries have drawbacks too. Mixed entries that have common or shared circulation systems for visitors and residents are problematic, as they compromise the required privacy of live functions.

Access/Permeability

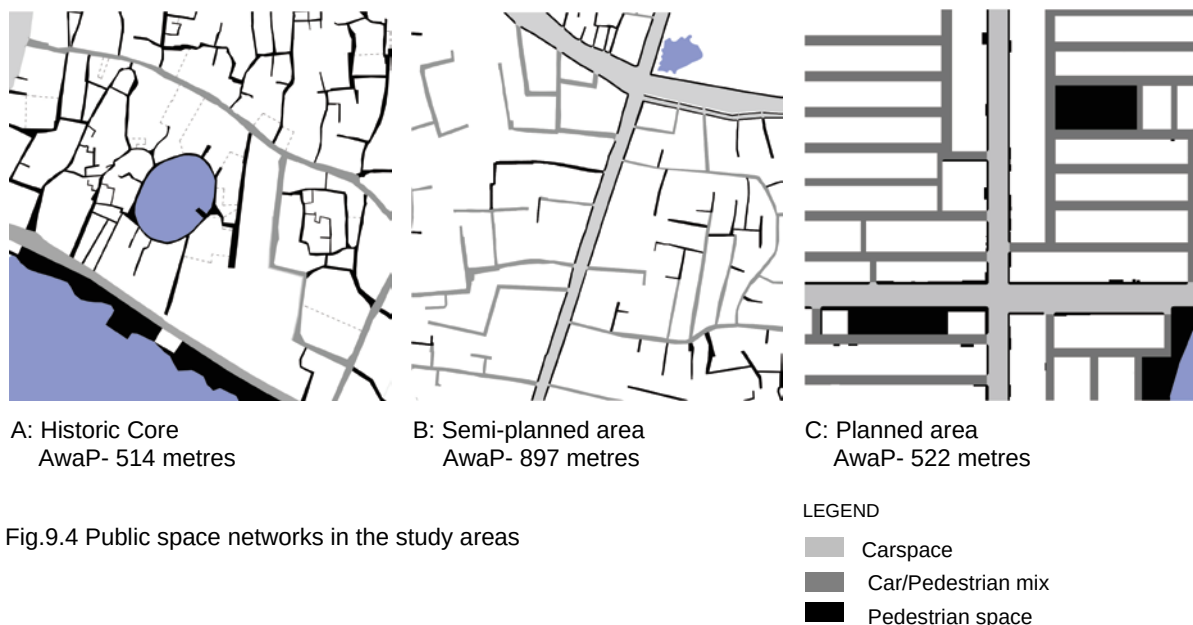


Fig.9.4 Public space networks in the study areas

Fig. 9.4 compares the maps of the public space networks. The study areas feature three distinct public space networks - informal, mixed (formal/informal) and formal. The street pattern of the Historic Core is informal. Hence, it is narrow, winding and intricate. The access network of the Semi-planned area is a mixture of formal/informal layout. The local streets are similar to the old city, but they are broader and less intricate. The main arterial roads have followed the proposals of the Master Plan hence, they are longer and broader. Lastly, the access network of the Planned area follows a rigid grid pattern, where the streets are more extended and broader. Based on the spatial structure (wide/narrow) and traffic volume, public space networks of the study areas are organised in hierarchical layouts - mostly from main roads to local streets. The significant land uses follow the hierarchy of these access networks, with the main shopping activities and offices on the main roads and small shops, workshops, micro-industries, and residences in local streets.

This study of the access network also compares the AwaP scores (area-weighted average perimeter of urban blocks) to investigate the permeability of the study areas concerning each other. Fig. 9.4 demonstrates that the Historic Core offers the most permeable access network of all the areas, as it

has several short links, frequent intersections, and better interconnectivity. The use of the internal building corridors as public accesses has also increased its permeability, which is not common in other study areas. These internal building corridors have improved the connectivity between the public spaces having attractors. Thus, the morphology of the access network of this area influences the growth of movement-seeking functions with its good accessibility and permeability. Comparatively, the Planned and Semi-planned areas have lower permeability. Both of these areas have long blocks and the Semi-planned neighbourhood has many dead ends. These types of urban morphologies provide pedestrians with very minimal of public access and consequently do not allow the development of more attractors.

The study areas also differ in terms of pedestrian and car permeability. The public spaces of the Historic Core are pedestrianised mainly. The Planned area is more car-dominated, while the Semi-planned area is mixed, in the sense that the major roads are prevailed by cars and local streets are characterised by pedestrians.

In the process of transformation, some local streets have been removed in the Historic Core and Semi-planned area to allow for the amalgamation of plots for new developments. This has decreased the permeability of these areas to some extent. However, over time, local streets have also been added to provide access to various functions in deeper urban blocks. The addition of these streets has made these areas more internally connected, enabling the development of diverse functions.

Building Density (Floor Area Ratio-FAR)



Fig.9.5 Building density in the study areas

Fig. 9.5 compares the maps of the building densities. The high-density buildings are shown in dark green colour. The mid-high density ($FAR > 4$) developments are present in all study areas. However, the higher-density ($FAR > 6$) buildings are more apparent in the Historic Core than in the other areas. In the Historic Core, high-density buildings are typical across the site. Conversely, the Semi-planned and Planned neighbourhoods have a density concentration primarily along the main roads.

Over time, the density of the study areas has increased. In the past, the higher-density buildings were most prevalent along the main access roads. These buildings further expanded throughout the site in the Historic Core, but in the Semi-planned area, high-density buildings primarily remained close to the main roads. The Planned area demonstrated a slightly different pattern with predominant mid-density buildings, until recently. However, subsequent high-density development mostly followed the main roads. Also, density has an association with a mix. This association can be well revealed from the historical transformation of building density and functional mix. Over time, density and mix have increased in parallel, and that increased density also enabled the increased mix.

High-density developments have both advantages and drawbacks. One of the noted advantages of high-density mixed-use development is that it can ensure the efficient use of land. However, high-density buildings with high plot coverage are often criticised for hurting the urban environment and quality of life by reducing the area of open spaces.

Comparison of the Study Areas

The morphological attributes of the functional mix are summarised in table 9.1 to enable a comprehensive understanding of the linkage of the informal mix with its diverse morphologies. The three study areas and their associated morphological attributes of the mix are compared, depending upon their highest to lowest percentages, averages, and values.

The comparison demonstrates that most of the attributes - informality, vertical mix, mixed entries, permeability, plot coverage, and density (FAR) - are high in the Historic Core. Conversely, the vertical extension of visit function and the average building height are high in the Planned Area.

Table 9.1: Morphological attributes of functional mixes in three study areas

	Attributes	Historic Core	Semi-planned Area	Planned Area
Co-functioning (mix)	Informality (% of area of Informal functions)	90.1%	30.9%	25.8%
	Vertical mix (% of the area)	65.2%	18.4%	15.4%
	Vertical extension of visit uses (% of bldgs.)	24.2%	24.1%	35.8%
	Mixed entries (number)	12.3%	6.3%	3.1%
Connectivity (access)	Permeability (AwaP)	514 m	897 m	522 m
Concentration (density)	Building Height (average)	4.6	4.8	5.0
	Plot coverage (61-100%) (% of bldgs.)	92.4%	87.1%	86.8%
	FAR (average)	4.2	3.6	3.5

Low  High

In the Historic Core, the past or traditional practice of mixing diverse functions, locational importance as bazaar streets, and less monitoring, have been identified as crucial factors for the increase of informal mixes. The informal use and building practices have led to an increase of vertical mixes and the number of mixed entries. The growth of mix has also abetted high plot coverage and the resultant building density by consolidating more uses in the buildings and/or vice-versa. The street network has played a role in the integration of various uses across the site by offering good permeability. Hence, the synergy between the mix, access, and density has given rise to the extensive mixed-use functions in the Historic Core.

In the Planned area, wider roads and plot sizes have provided the scope to build taller buildings within the regulations. Also, the lack of mix at the initial stage of development has led to the conversion of building uses into diverse functions on multiple floors of the tall buildings. However, possibly the higher control of the Planning Authority has restricted the extensive growth of mixed-functions along local streets. On the other hand, in the Semi-planned neighbourhood, less control by the Planning Authority might have led to an increase of the informal mix and density, while remaining lower than in the Historic Core.

9.3 Factors Influencing the Growth of Informal Mix

The factors identified through the interviews as motivating the growth of the informal mix in Dhaka are 'economic demand', 'land price', 'lack of community facilities', 'proximity to services', 'attitude', 'demographic growth', 'unemployment', 'rise of the middle-class', 'weak administrative and monitoring system', 'frail transportation system', 'political and planning decision', and 'violation of regulations'. All these factors generally come under the broader categories of 'market demand' and 'weak governance'.

These factors are identified separately from interviews and literature, but some of these are interrelated and can work simultaneously for a productive outcome. 'Lack of community services', 'demographic growth', and 'unemployment' can work together for the development of the functional mix in an area. Primarily, the lack of supporting residential functions, like shops, cafes, schools, health facilities, etc., motivates people to develop these uses to fulfil their daily needs informally. Demographic growth and unemployment in the formal sector further create the demand for mixed functions and street trading to meet the growing needs of the people. Again, the preference to live 'close to urban services' and the 'attitude' of local people to live in mixed-use neighbourhoods together can contribute to the increase of informal functions. Simultaneously, 'weak administrative and monitoring system' encourages people to 'violate the building regulation', which further influences the growth of informal mixes.

9.4 Co-functioning of Mix of Uses

The co-functioning (mix) of the mix of uses with connectivity (access) and concentration (density) is evident in the study areas.

The concentration of work and visit related mixes along the main roads with better accessibility demonstrates the association of mix with connectivity. In the Historic Core and Semi-planned area, live/visit mixes are prevalent in local thoroughfares and around community nodes, where connectivity is relatively good. These associations increase the possibilities for the higher use of urban functions. However, in the Planned area, live/visit mixes do not follow any particular pattern of development. In some cases, they have popped up into the middle of long oblong urban blocks, leaving the corner plots, where the accessibility and visibility are better.

Again, the study areas demonstrate the interconnection of the functional mix, plot size, and connectivity. In all study areas, the small plots in local streets mostly contain live/visit mixes. In contrast, work and visit related mixes are prevalent on the large plots along the major roads in the Historic Core and Planned area. However, this relationship is not apparent in the Semi-planned neighbourhood, where the large plots contain live and work functions along the major roads.

All the study areas also show the higher association of the mix and density. The majority of the mixed-use buildings have mid to high FAR, upper plot coverage and/or higher floors. Mixed-use buildings usually need higher-density to accommodate various functions, separate accesses, and supporting service facilities. These high-density developments bring diverse mixes together and thus, contribute to the activation of the urban spaces.

Lastly, an interrelationship between connectivity and density is apparent in the Semi-planned and Planned areas. In these areas, mixed-use buildings with higher floors and upper FAR are mostly evident along the main accesses. However, this association is not apparent in the Historic Core, where high-density buildings are primarily concentrated in local streets. The Historic Core has the highest connectivity and permeability of all the study areas. Hence, the high-density mixed-use buildings are typically situated on locally interconnected streets, where pedestrian and vehicular movements are frequent. They do not only depend on the accessibility of the main roads.

However, there are a few disassociations, but typically, the mixing of diverse function, access, and density has allowed them to work in synergy for the generation of various urban activities, movements, and vibrant urban spaces. Thus, these associations of the mix, access, and density have sustained the functionality and productivity of these study areas.

9.5 Governance

The governance of the functional mix in Dhaka involves various actors, across multiple scales. In the macro (city) scale, formal (Government) institutions like the Planning Authority (RAJUK) and Dhaka City Corporation administer mixed functions. In the meso (neighbourhood) scale, autonomous institutions govern informal mixes. In the micro (building) scale, local individuals - house owners and shop owners - manage informal functions. In the Historic Core and Planned areas, government, autonomous institutions, and local individuals work in the management of the mix, while in the Semi-planned neighbourhood, government institutions control the mix, along with local individuals.

Considering the widespread development of informal mixes across the city, this multi-scalar governance approach is useful to manage mixes in all scales that the formal system cannot offer.

The functional mix of Dhaka has largely been self-governed. In Dhaka, the policies to regulate the urban functions surfaced much later. The renewed building regulation (2008), first provided the rules to regulate different types of functions (residential, commercial, institutional, industrial, health care, etc.), but it has not offered exclusive regulations for mixed-use buildings. Further, these regulations do not specify the types of uses that mixed-use buildings should accommodate in different residential and non-residential areas. Hence, the lack of effective policies to regulate the mix has motivated its self-governance in different areas until now. The benefit of such self-governance is that the local areas can fulfil their daily needs with various functions. However, the risk of incompatible mixes presents a major challenge, as the prime focus of autonomous organisations and local individuals is to meet the market demand, instead of considering community wellbeing issues.

It is known from the interviews that the violation of building regulations by mixed-use buildings is prevalent across the city. There are rules and penalties to prevent violations, but the Government's monitoring system is inadequate. The violations are rarely recorded as attempts to breach the law. This has caused the continuing malpractice of land-use and building density. There is a grey area in the monitoring and management system, within which people often seek to adapt to the necessary services as the formal sector cannot afford it.

Interviews also reveal that there is an association of informal mixes with the formal institution in Dhaka. Informal mixes are linked with formal institutions for tax payment and land-use approval. Street vendors also pay informal taxes (bribes) to street bureaucrats (police and powerful local entities) to conduct their business. Similarly, the formal institutions benefit from the taxes collected from the mixed-use functions. Hence, it is the negotiation between the formal and informal systems that helps the informal mix to work in the city.

9.6 Mixed-use Buildings

This section compares the three study areas concerning the detailed findings on sample mixed-use buildings. Broadly five types of mixed-use buildings are categorised based on their circulation systems. It is evident from table 9.2 that in the Historic Core, types 2-5 are apparent, which contain the combination of live, work, and visit functions and mixed accesses. These mixed accesses extend up to the intermediate/highest depths of the buildings. In this area, type 5 is dominant, where all three functions (live/work/visit) are mixed at street level access and this mix is reduced to work/live and then

Table 9.2: Number of mixed-use buildings according to building types in three study areas

	Type-1 L+V	Type-2 L+WV Complex	Type-3 LWV>LW	Type-4 LW>L	Type-5 LWV>LW>L
Historic Core	-	1	2	2	3
Semi-planned area	2	2	-	3	-
Planned area	5	-	-	-	4

to residential only in the upper floors, as one progresses deeper into the building. This type is commonly evident in the Historic Core, as most of the buildings generally characterise higher mixes and this type is the most intensively mixed category. Comparatively, in the Semi-planned area, types 1, 2 and 4 are apparent, which contain work, visit, and/or work/visit mixes at lower depths and live/work mixes and live functions at higher depths. In these types, triple (live/work/visit) and double (live/work and work/visit) mixed accesses are prominent but several buildings also have separate accesses for residential and non-residential functions. In this area, type 4 is dominant, which characterises live and work mix and contains a mixed access for live and work functions in the deeper spaces which becomes mono-functional (residential) in the upper floors. This type is usually found in the Semi-planned area, as the majority of the buildings have private offices, which occupy the different depths with other functions. Lastly, in the Planned area, types 1 and 5 are evident, while type-1 is the major, which is a mix of live and visit with clear separation of both entries and functions. This type is most evident in the Planned area, as this area is comparatively a new development and functional mix is not extensive here. The comparison of the study areas also demonstrates that the shift from the traditional (Historic Core) to planned settlement shows a higher degree of the segregation of residential and non-residential functions and entries. The sense of privacy is more evidential in the Planned areas of Dhaka, which may lead to higher functional segregation here.

The study areas also differ concerning the number and depth of different functions in mixed-use buildings. The majority of buildings in the Historic Core and Semi-planned area contain a higher number of visit, work, and their mixes, which remain organised along the full depth on multiple floors. Conversely, the buildings in the Planned area have a comparatively lower number of visit and work functions, facing the street front. The Historic Core is a traditional business centre and the Semi-planned area, being close to the second CBD, has an economic significance. Possibly, the high demand for non-residential uses has led to an increase in these functions in these areas. Consequently, the depths of these non-residential functions have also increased in the buildings of these areas compared to the Planned neighbourhood. The higher depth of work and visit functions allows public accesses deeper into the buildings, which may be conflicting with the residences. Simultaneously, it may also be a drawback for those respective non-residential uses, as they seek a closer position to public spaces for their business.

9.7 Informal Functional Mixes and Interconnected Theoretical Frameworks

The theoretical framework of this study is focused on functional mix, informality, complexity, adaptation, resilience, and urban economics. Considering these theoretical understandings, this section critically discusses how functional mixes work in informal cities, with a particular focus on Dhaka.

The post-modernist scholars and contemporary urban theories, like new urbanism and neo-traditionalism, advocate the notion of 'mixed-use function' considering its socio-economic significance and its contribution in creating a lively urban environment. However, the functional mix in the informal cities of the global South, particularly in Dhaka, manifests a distinct character. Along with many

positive aspects, it also brings some challenges to the urban environment and social life, primarily because of its extensive growth, unplanned development, and informal building practices. Informal mixes invite more visitors and vehicles in different areas, which can affect the privacy of residents, create a sense of insecurity, and increase noise and pollution. Informal mixes may also cause an incompatible mix of functions and lead to extremely higher-density (higher-storeyed with high plot coverage) developments.

These informal mixes have emerged spontaneously through the process of self-organisation to cater to the needs of the community people. Self-organisation occurs through the cycles of interactions between different urban functions and associated morphological elements across a range of different scales of space and time. This self-organisation process also involves the competition and negotiation of different functions between themselves and with other formal/informal actors.

These cities with functional mixes work as assemblages and complex systems. They contain many heterogeneous components, and actors from different domains of built-environment, socio-economic structure, and governance. These components and actors interact in different domains across multiple scales and thus involve complex interrelationships. These informal cities are flexible and adaptive. The urban forms and mixed-use buildings of these cities can adapt to various functional and physical changes. In this sense, these settlements also exhibit certain levels of resilient qualities. Resilience also offers an understanding of the 'key slow variables' that can push the system into a new identity. In South-Asian informal cities, particularly in Dhaka, such key slow variables may be economic demand, land value, demography, building density, political will, and the demolition process. The mixed-use settlements can adapt to these incremental changes.

Economic and geographic theory, like urban economics, provides a useful lens to relate the spatial distribution of various functions in informal settlements, based on their economic preferences and interests. In mixed-use settlements, various economic functions, like retail, wholesale shops, large scale firms, and street trading, usually develop along the most accessible and strategic locations to ensure maximum economic benefits. Different types of retail shops mostly remain in clusters, so that they can offer competitive prices and a complete range of products to customers. Residential functions develop at those locations, where they can get the maximum services nearby. All these spatial conditions of various functions in the cities are relative to the notion of location theory of urban economics.

9.8 Conclusion and Direction for Future Research

This research investigates the informal functional mix and related morphologies at multiple scales, taking Dhaka as a case study. First-hand information is collected and mapped to achieve a comprehensive understanding of the working process of the informal mix in Dhaka. This section makes some concluding remarks and propositions regarding the current status and future development of mix, followed by directions towards further research in the broader context of informal global South.

The research argument stems from two contradictory views of the functional mix: that is the mix of uses has been advocated by many scholars, while in many cities of the global South, the mix of uses appears as a challenge, rather than an advantage. Historically, the mix has been the norm of developing Asian cities, but at present, these cities are confronted by the informally developed mix of uses. From time to time, several residential development models of segregated land-uses have been borrowed, following the process of modernisation, and applied in these informally-developed cities in an attempt to replace mixes. However, these attempts failed, as these models were implemented without assessing their sustainability outcome in local settings (Yigitcanlar, et al., 2015, p.2573; Lai and Han, 2012, p.374).

This research deems that the functional mix has a two-sided impact in informal cities. It has both advantages and challenges. This is the way functional mixes work in informal contexts. An informal mix is typical in Asian cities. It serves city dwellers by filling the gaps between demand and available services; so it contributes to the local economy. It generates lively urban environments by integrating diverse functions, activities, and people altogether. Hence, this research argues that neither the functional mix nor its informality is always problematic, but its informal building practices (mixing of incompatible uses, vertical growth and integration of visit and work functions with residences, inconsistent urban interface, mixed entry with incompatible uses, violation of building height and encroachment of setbacks), in informal Asian cities, is at stake. The extensive growth of informal mixes in residential areas can also be problematic for the people and their social environment. But the spontaneous mix is so integrated into the Asian urban morphology that it cannot be disregarded simply by considering its challenges in urban life.

Particularly in Dhaka, the informal mix is considered as a challenge, for its incompatible mix of uses and uncontrolled growth in residential neighbourhoods. The several incidents of fire in the Historic Core of Dhaka in the last few years are the resultant impacts of the incompatible mix of chemical warehouses and factories with residential and other uses.

From the above discussions, some propositions can be made for the future development of the informal mix in Dhaka. The most vital issue is to acknowledge the informal mix within a formal planning system, considering its intensification in the city, and adapt it with the urban morphology. Simultaneously, it is necessary to identify the different issues related to informal land-use conversions, both in urban and building levels and address those issues to achieve the benefits of the mix of uses in the community life. The potential of the functional mix can be capitalised if compatible uses are integrated to work as an efficient whole. Due considerations need to be made to strengthen the monitoring and controlling system to minimise the incompatible mixing of uses. Consideration of the issue of mixed entry is also essential, as it affects the privacy and safety of the building residents. In mixed-use buildings, usually, residential uses require privacy, while non-residential functions necessitate more public accesses for the business. Mixed entries and circulations for both residents and visitors can create conflict between the demands of residential and non-residential uses. Hence, separate entries may be preferable for residential and non-residential functions in mixed-use buildings. For the effective management of informal mix, participatory governance may be useful,

where the formal authority will deal with the local autonomous organisations and community in the decision-making, implementation, and operational management of mixes. In many areas of Dhaka, autonomous organisations informally participate in the management of mix, but they have no link with formal governance. An association between the formal and informal (autonomous organisations) may be useful through which both the demand of the community people for diverse functions and the control of the incompatible mixing of uses can be achieved.

Not much empirical study has been conducted on informal mixes in other cities of the global South. Hence, future studies need to be carried out on the morphologies of informal mixes in the global South, to have a comparable understanding of the working process of the mix in these cities. There is also a better scope for the future study to explore the ways - how an informal mix can be adapted within the current morphology of informal Asian cities.

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To stakeholders

(Architects, planners, academicians, urban critics, and people related to city governance)

Questions-

1. What do you think about the extensive growth of mix of uses in Dhaka?
2. What are the advantages and disadvantages of functional mix?
3. What are the forces that have influenced the growth and transformation of the functional mix for the last few decades?
4. Has planning authority considered 'mix of uses' in the different structural plans of the city?

To local people

(house owners, shop/business owners, and shop/office workers)

To house owners

1. Has this building always been mixed-use? How it has changed?
2. What is the formal process for a change of occupancy?
3. How have mixed-use functions (shops/offices) been governed?

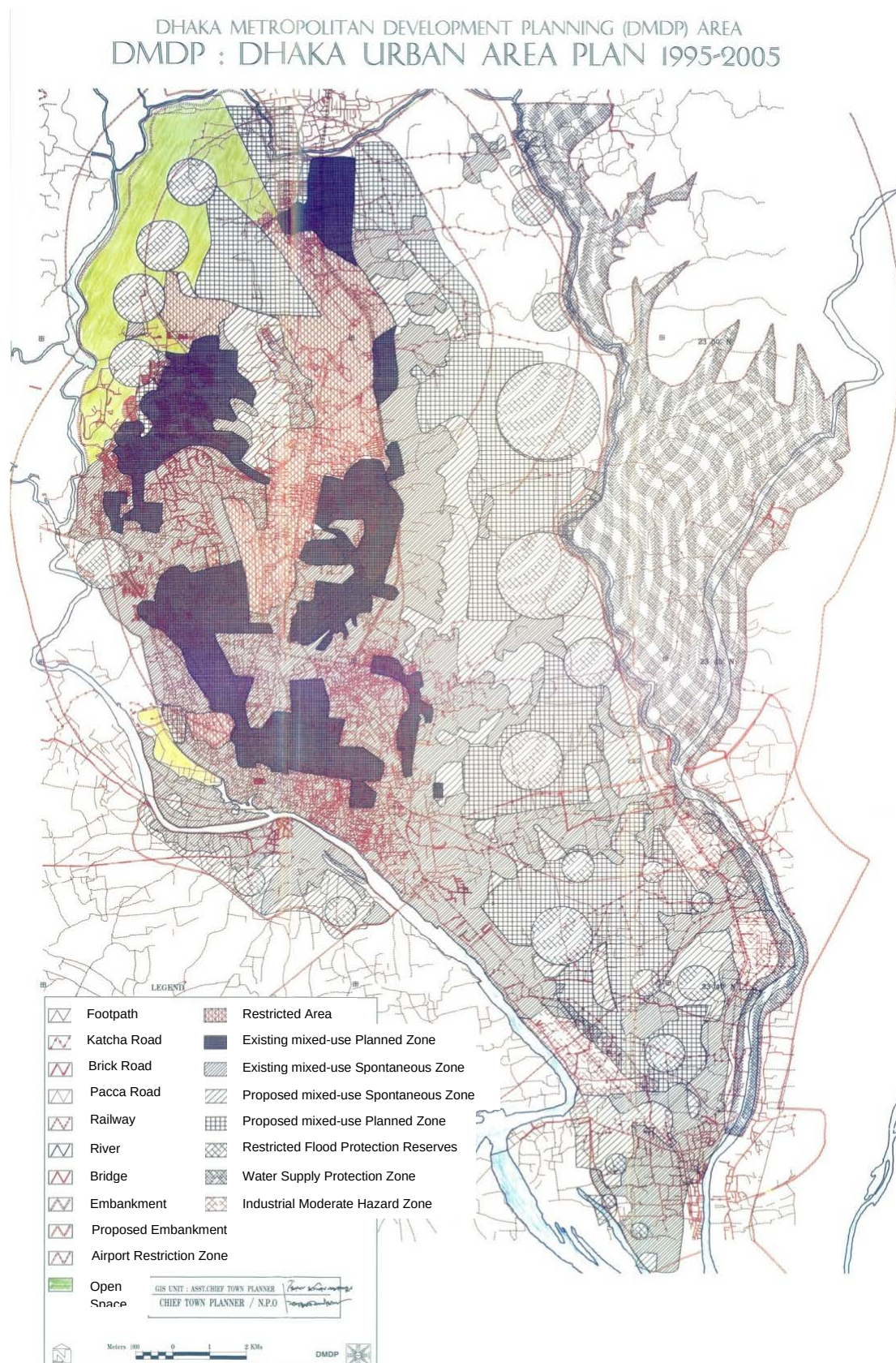
To shop/office owners

1. How have mixed-use functions (shops/offices) been governed?

To shop/office workers

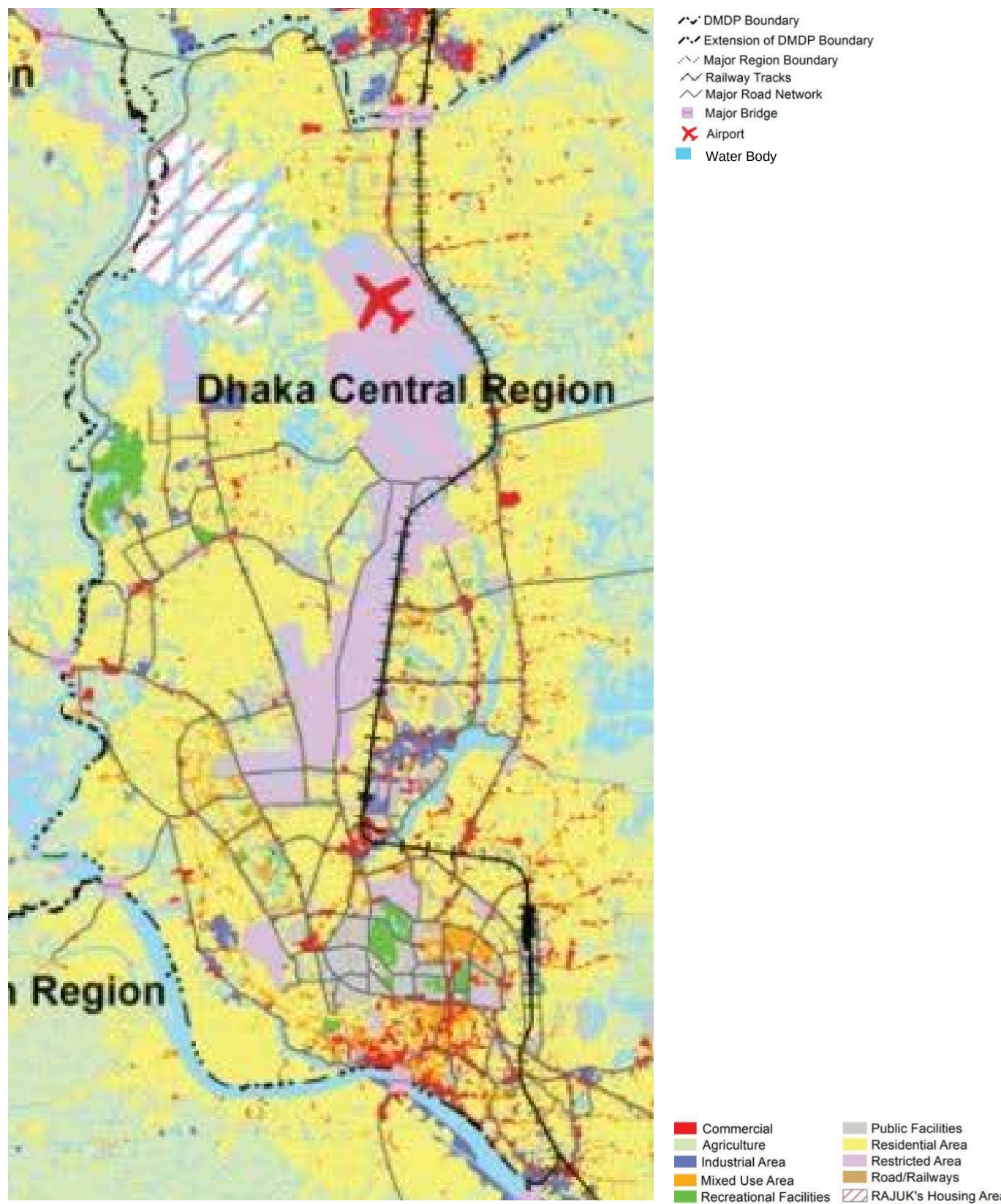
1. How have mixed-use functions (shops/offices) been governed?

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