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Urban Form at the Edge

Proceedings from ISUF 2013
Volume 1

Editors
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THE UNIVERSITY OF AUCKLAND NEW ZEALAND Te Whare Wānanga o Tāmaki Makaurau

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Contents

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Introduction

Urban morphology as a field of study has developed primarily in Europe and North America, and more recently emerging as a recurrent topic in China and South America. As a counterpoint to this centric view, the ISUF 2013 conference explored aspects of 'urban form at the edge'. In particular the conference examined 'off centre areas' such as India, Africa, Middle East, Central Asia and Australasia which require innovative approaches to the study of traditional, as well as post-colonial and contemporary, morphologies. Broader interpretations of urban form at the edge focus on minor centres and suburbia, with their developing and transilient character; edge cities and regional centres; and new technologies and approaches that are developing alongside established methods, tools and theories of urban morphology.

Sub-themes for the conference, which comprise the sections of this book, were:

- Cities on the Edge – cities on edge conditions, such as natural limits or political boundaries
- Off centre – urban form in emerging economies and postcolonial countries
- On the Edge of the City – peripheral areas and urban form in suburbia
- Edge Cities – new urban conditions
- Regional centres – cities and towns with local importance, but at the edge of national or regional urban networks
- Pushing the Edge – new technologies and new techniques.

Although Australia has historically been considered at the edge of the world due to its location, the conference will take advantage of its relative proximity to Africa, India and South East Asia, especially targeting the seminar to these geographical areas, and directly addressing the challenge for ISUF to develop into these continents.

The South East Queensland region incorporates both Brisbane and its neighbour the Gold Coast City. It is the fastest growing metropolitan region in Australia. The rapid processes of urban transformation have brought about challenges that are comparable with the experience of many developing nations.

We would like to thank QUT students and staff who volunteered their time before and during the conference; without their support the event would not have been possible.

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Suburban zone of 'The Transect': comparing morphologies and design qualities of residential neighbourhoods in Sydney, Kolkata and Miami

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Abstract. *Morphologies of human environments vary in terms of their nature, spatial characteristics, and intensity of development. 'The Transect', an integrated zoning code for the City of Miami in USA, provides form based guidelines for development along rural and urban continuum. 'T3 Sub-Urban' is a suburban zone out of a total of six types of zones classified under 'The Transect'. This paper focuses on examining morphologies and qualities of suburban neighbourhoods in three cities in three different countries of the world. Three cities: Sydney, Australia, Kolkata, India and Miami, USA are selected as their social conditions, cultural backgrounds and planning controls vary. An urban to rural cross section will be identified for each of these cities. Three typical suburban residential case studies, one from each of these three cities will be selected at a local scale. Using Geographic Information Systems (GIS), a spatial analysis estimates land cover pattern, dwelling density, and others relevant values for each of these three case studies. A visual analysis is conducted to understand design features, aesthetic qualities, and characteristics of these neighbourhoods. Outcomes of spatial analyses on the case studies are compared. Morphological characteristics can significantly influence neighbourhood sustainability and design performance.*

Keywords: transect, form based zoning, morphology, suburban, neighbourhood

Introduction

Morphologies are shaped by socio-economic conditions, peoples' lifestyle preferences and perceptions, performance of economies, and spatial geographies of locations, functions and interrelationships (Gleeson 2006; Forster 2004; Whitehand et al., 1999). Theoretical foundations of urban morphological research include three main theories. First, 'a theory of city building' was developed through Conzen's pioneering analytical research on Alnwick, Muratori's descriptive work on historical evolution of cities and Whitehand's establishment of new interdisciplinary inquiry methods and interactions (Moudon, 1997). Second, Caniggia's 'procedural typology' considered building types as the basis of urban form. 'A theory of city design' evolved focussed on understanding urban form for prescriptive purposes. Panerai, Castex and DePaule aimed to understand how urbanisation processes were influenced by social practices. Third, the theory of design 'as idea' and theory of design 'as practised' were assessed (Moudon, 1997). Potential of urban morphological research in understanding the design dimensions and qualities from a cross-disciplinary perspective is well recognised.

> The essential proposition is that urban morphology is the missing constituent in the process of urban design. Its value is in the provision of detailed physical characteristics in the evolution of urban form, bridging the divide that exists between this geographical knowledge, urban planning and architectural design (Sanders et al., 2008).

The three fundamental morphological components are form, resolution and time (Moudon, 1997). Form covers the physical characteristics of buildings and related open spaces, plots or lots and streets. Resolution is hierarchical and varies across four spatial levels of resolution: building/lot, the street/block, the city and the region. A classification system of urban forms conforms to a spatial hierarchy of scales of human habitat patterns (Ghosh, 2009). Micro and macro levels of this hierarchy are linked as the parts can be aggregated to form a whole settlement. Time relates to the capabilities of urban forms to undergo continuous transformation, replacement and evolution into new forms. The smallest 'cell' of the city is a combination of an individual parcel of land and building(s) and open spaces on that land (Moudon, 1997). The characteristics of the smallest block are determined by the socio-economic profile, configuration, density patterns, actual and potential use, and urban morphogenesis or evolution of the urban form over time (Whitehand et al., 1999; Moudon, 1997).

In this paper, morphologies and qualities of suburban residential neighbourhoods in three cities Sydney, Australia, Kolkata, India and Miami, USA in three different countries of the world will be investigated at block scales. 'The Transect' line is selected along a transport corridor either road or rail from the case study cities. A review of literature and visual and spatial analysis are conducted to understand backgrounds, design qualities, and patterns of these neighbourhoods. A comparative analysis of morphologies and visual characteristics and links to 'T3 Sub-Urban' design are identified to understand how meaningful solutions could be provided. As this is a pilot study, the scope is only limited to small scale patterns. In future, larger urban cross-sectional analysis will be conducted on the 'The Transect'.

Backgrounds of the cities

Three suburban neighbourhoods from three cities: Miami, USA; Kolkata, India and Sydney, Australia in three different countries of the world are selected as case studies. These three cities vary in population density, demographic profiles and are located in three different parts of the world. The City of Miami is located in eastern part of United States in the state of Florida. The City of Miami has a total population of 5.8 million in 2013, a population density of 1916 people per square kilometre and covers a total area of 3029 km^2 (Demographia, 2013). An estimated population of Miami-Dade County where the case study site is located was 2,591,035 in 2012. This county has an area of 4915 km^2 and a population density of 508 persons per km^2 (United States Census Bureau, 2012).

The case study in Sydney, the largest city of Australia, is located in Turrella – Bardwell Valley which is under the jurisdiction of Rockdale City Council. This council has a total population of 102,843 over an area of 28 km^2 with a population density of 3673 persons per square kilometres (Rockdale City Council 2013a). Rockdale City Council is located in the south subregion of Greater Sydney and this subregion has a population of 650,000 in 2011. Greater Sydney Region (Infrastructure NSW, 2012) has a total population of 4.6 million (Australian Bureau of Statistics (ABS), 2011). Sydney's social atlas (ABS, 2008) map shows that it had a population density of 2058 people per square kilometre in 2006.

Kolkata case study is located in the Kolkata Municipal Corporation (KMC) with an urban area covering 185 km^2 and is located on the eastern bank of the River Hooghly in the state of West Bengal in India (KMC, 2013). It is a part of a larger urban agglomeration of Kolkata Metropolitan Region (KMR) with an area of 1204 km^2; a population density of 12,100 people per square kilometre and is governed by Kolkata Metropolitan Development Authority (KMDA) (Demographia, 2013). According to the provisional 2011 Census India, population of Kolkata under KMC was nearly 4.5 million while the population of KMR was 14.1 million people and the literacy rate of the population is as high as 87.14 percent (Population Census India, 2011). The central city core of Kolkata has a population density is 24,000 people per square kilometres, very similar to the population density of Manhattan and De Ville Paris and the population density of the suburbs of Kolkata is around 9000 people per square kilometre (Cox, 2012).

'The Transect' and T3 suburban zone

Transect is a broader geographical concept of systematically measuring and recording observations on varying physical or natural or human environments such as soils, vegetation, flora, fauna, land uses, landforms, settlements and other relevant factors across a selected cross section (Gerlach, 2008). Transect has been applied in geography, science, planning and other disciplines to investigate different morphologies of environments across an urban/rural/urban to rural continuum. In this paper, 'The Transect' is defined to contain varying characteristics of human habitats along an urban to rural continuum. 'The Transect' is described as 'an index of diversity' (Duany, 2002, p. 257) and offering 'contemporary ways of envisioning' (Bohl and Plater-Zyberk, 2006, p. 5). It connects to new urbanism theory and provides a realistic basis of zoning for different types of urban and suburban land uses (The City of Miami, 2013).

> The transect approach is a planning strategy that seeks to organize the elements of urbanism—building, lot, land use, street, and all of the other physical elements of the human habitat—in ways that preserve the integrity of different types of urban and rural environments (Talen, 2002).

Miami 21, an integrated zoning code developed based on the conceptual framework 'The Transect', provides form based guidelines for development along rural and urban continuum for the City of Miami in USA. Within Miami 21, each zone of the transect regulates building disposition, configuration, function and intensity as well as the share of different uses to be accommodated in a building, standards landscape and parking, successful integration of each property with public realm and justifiable connections across the different zones of 'The Transect' (The City of Miami, 2013). 'T3 Sub-Urban' is a suburban zone out of a total of six types of zones classified under 'The Transect'. Transect zoning is being developed and applied in other cities of the USA, for example, Nashville, Mississippi and Texas.

T3 suburban zone is the transition zone between urban and rural zones; it needs careful design and planning of nature and the built environment and is strategically important (Metro Government of Nashville and Davidson County, 2012). This zone is susceptible to significant morphological changes in its form and specific characteristics and, thus, it could be classified within other possible urban zones within a shorter period of time. T3 zone is low density with single and two family residential units, ample open spaces as setbacks, linear or irregular road networks with natural and historic features. As narrated by the Metro Government of Nashville and Davidson County (2012) in T3 zones, dominance of nature and open spaces in framing the quality of the environment and building should be integrated to merge within that framing. T3 zones require thoughtful integration of urban design elements of built form, vegetation, paths, character, landmarks, district in enhancing the new urbanism characteristics of walkability, connectivity, mixed use and diversity, traditional neighbourhood structure, sustainability and a good quality of life (NewUrbanism.org, 2013).

Research Methodology

Selection of case studies

All the case studies are located at approximately 10 km from the central business district (CBD) of each case study city with predominant residential land use pattern. The City of Miami is the reference city as it has already adopted a form based zoning code Miami 21.

In the City of Miami, the Transect – rural to urban continuum is assumed to route along the southern part of Miami CBD. There are altogether three types of subzoning within T3 suburban – T3R (restricted), T3L (limited) and T3O (open) and varies in density patterns (The City of Miami, 2012, IV.5). According to the Miami 21, the case study area (Case study One) selected is located in Miami-Dade County in the City of Miami and is zoned T3O suburban zoning and permits maximum density of eighteen dwellings per acre or seven dwellings per hectare (Fig 1). Parcel or cell level, lot occupational characteristics for T3O suburban zone include a maximum 50 percent as first floor coverage, lot size 465m², 15m permissible minimum lot width and 25 percent of the lot area as green spaces and front and rear setbacks are 6.1m while the side setbacks are minimum 2m (City of Miami, 2012, p. V.11). The case study in Miami is suburban characterised by detached separate houses and follows a traditional neighbourhood pattern.

Figure 1. *Transect and location of case study one, Miami*
Data Source: City of Miami, Prepared by Sumita Ghosh

In Sydney, the transect section is assumed to run towards the southern part of from the Sydney CBD. The case study (Case study two) selected is located close to Wolli Creek and two rail networks, Wollongong and Campbelltown in the Turrella-Bardwell Valley under the jurisdiction of the Rockdale City Council in Sydney (Fig. 2). In 2006, the main household type was couple families with dependents which constituted 40.1 percent of all households and 70.9 percent 'separate house' dwelling type increased to 75.8 percent in 2011 (Rockdale City Council, 2013b; 2013c).

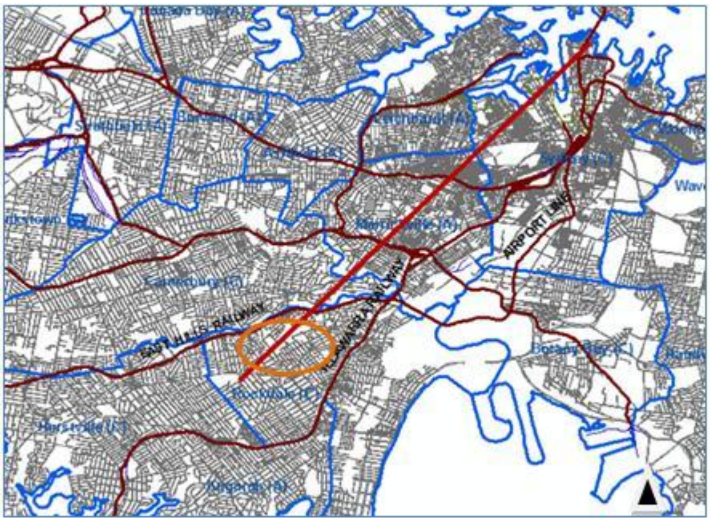

Figure 2. *Transect and location of case study two, Sydney*
Image: Google Maps, 2013' with 'Data Source: Sinclair Knight Mertz (SKM) imagery, Prepared by Sumita Ghosh

In Kolkata, the Transect is selected along the corridor Raja SC Mullick Road adjacent to Sealdah to Garia rapid transit rail corridor towards the southern part of Kolkata city from the CBD. The selected site (Case study three) is located within the suburb of Salimpur in close proximity to a number of shopping areas and public transport by rail and road (Fig. 3). This case study site is selected as this area is undergoing tremendous urban transformations, with single detached houses being transformed to four to five stories, mixed use developments and parts of these areas have been transformed into high density residential skyscrapers.

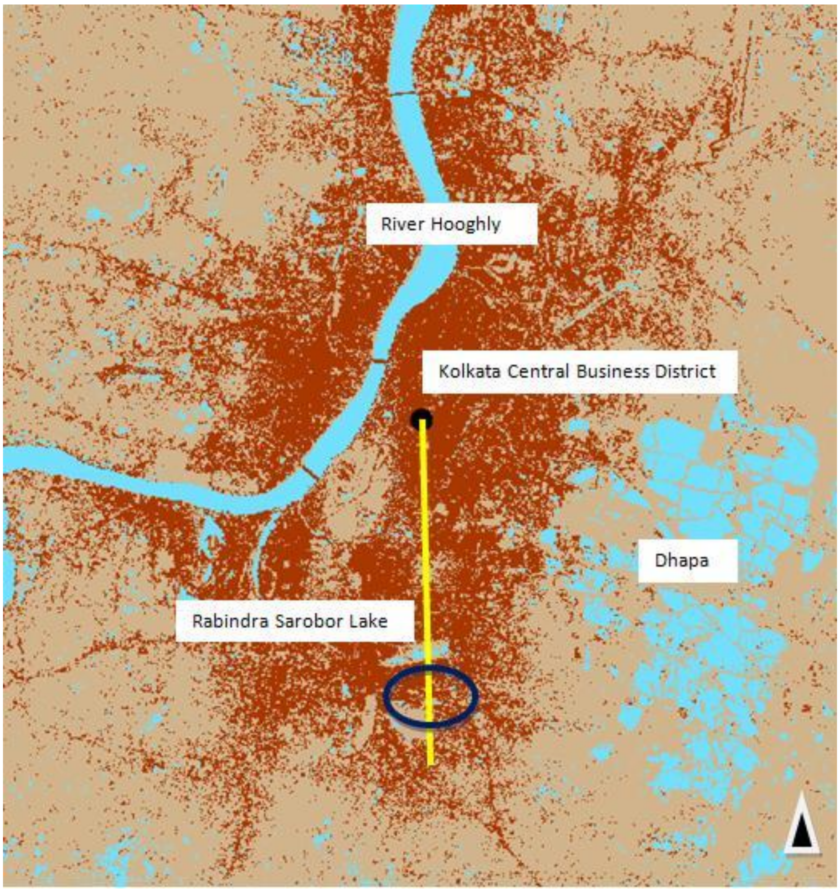

Figure 3. *Transect and location of case study three, Kolkata*
Image: Google Maps, 2013 with 'Data
Source: http://www.lincolninst.edu/subcenters/atlas-urban-expansion/gis-data.aspx,
Prepared by Sumita Ghosh

Data Collection and Methods

A review of literature, as presented earlier in this paper, is conducted to analyse the concept of 'The Transect', T3O suburban zone in Miami 21 zoning code and backgrounds of the cities where the case studies are located. Aerial photographs sourced from Google Earth were geo referenced using Geographic Information Systems (GIS) methods, cross checked for the accuracy of its coordinates and reprojected to the correct coordinate system of each country for conducting spatial analysis. Using GIS, new data is generated from the aerial photographs on land cover patterns (such as impervious cover including roads considering half road width of peripheral roads, building roof area, green infrastructure (tree canopy cover and productive land areas), setbacks and parcel areas. Based on this spatial analysis, density patterns and urban residential morphologies of case studies in Miami, Sydney and Kolkata are calculated and compared. The demographic and basic community profile data is collected from the census data of three countries, Australian Bureau of Statistics (ABS), Population Census India and United States Census Bureau. More information and data are collected from relevant research reports and internet resources.

A visual analysis was conducted on each of the three case studies to understand urban design qualities and urban morphological changes. Visual analysis includes analysis of photographs of case studies to understand architectural styles, street patterns, public realm, mixed use patterns, tree types, visual amenity values and evidence of morphogenesis. GIS methods are applied to generate new data from aerial photographs on urban design parameters such as block length, front and rear setbacks, building footprints and tree locations. While visual analysis allowed subjective analysis of the case study sites, GIS analysis assisted in further objective assessment of the sites such as land use patterns. An analysis and discussions are provided based on the results. An analysis on overall transect or large cross sectional level would require application of remote sensing methods in addition to GIS methods. This analysis is not within the scope of this paper and therefore not included.

Analysis and discussions

Using GIS, the land cover pattern of five morphological characteristics: building roof, ancillary structures, road area (half road width) and footpaths, tree canopy and productive land areas are calculated from the rectified aerial photographs. In addition, total site area, total parcel area, average parcel size, average building foot print, total number of dwellings and dwelling density are estimated. Land area under other uses such as driveways, entry paths, footpaths swimming pool, walkway within parcels, paved surfaces in backyards and sides of the buildings is calculated by subtracting areas of building roof, ancillary structures, road area (half road width) and footpaths, tree canopy and productive land areas from the total site area. Productive land area calculates the pervious land area currently available on site for growing vegetables and fruits and includes lawn cover as it has the potential to be converted into productive land. Tree canopy measure could be effectively associated with stormwater, carbon, energy and air pollution benefits, and productive land could provide carbon benefits through local food production and better stormwater management. It is considered that the land area under the tree canopy cover will not be counted as productive land due to shade and potential conflict with tree roots. Overlap areas on land covers such as tree area overlapping with road area are calculated using geo processing methods and the overlapping area is calculated only in one land cover category to avoid duplication.

An analysis of morphological characteristics of case study one in Miami, Florida show that the building roof area with ancillary structures, such as garages and sheds, cover only 23.2 percent of the overall site while tree canopy covers 14.5 percent. Tree canopy cover is mainly in the rear gardens and the not along the streets. A higher percentage of the site is paved mainly driveways and footpaths in the front and other uses (29.5 percent) include mainly impervious areas with a very little land area that could be used for productive purposes and stormwater benefits. The total area of the site is 20.7 hectares, with an average parcel area of 660m^2, average building roof area (without ancillary structures) 168m^2 and a density of 14 dwelling per hectare. The mapping of land cover pattern shows spatial distributions of different land cover patterns (Fig. 4) and frequency distributions of building roof areas (without ancillary structures) (Fig. 5).

A visual analysis of case study one reveals that it is a typical low density suburban neighbourhood with one to two storied contemporary and traditional houses (Fig. 6). Most of the driveways and footpaths along the main road are paved and landscaped front gardens contribute positively to the aesthetic quality of the environments. Large setbacks of the buildings from the road create appreciation spaces along the road. Again, minimal number of trees, larger setbacks in the front up to 8m and lower building heights on wider neighbourhood street create minimal enclosure.

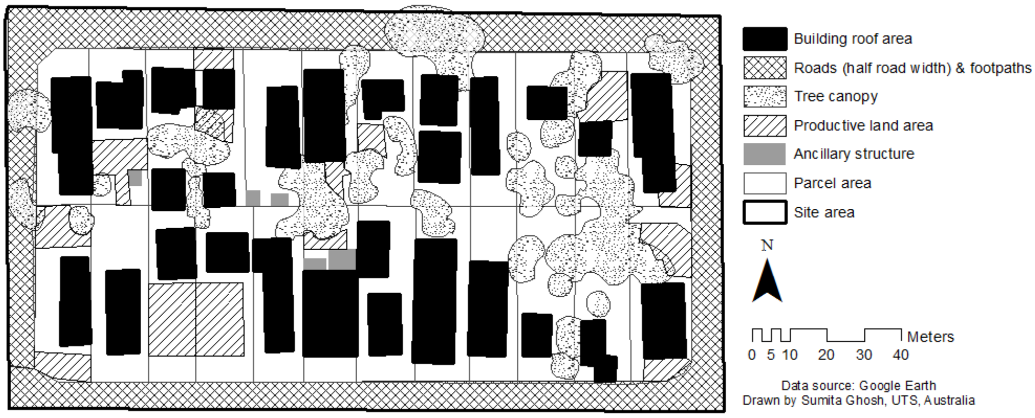

Figure 4. *Land cover pattern and parcel areas in Case Study One, Miami, Florida*
Source: Prepared by Sumita Ghosh

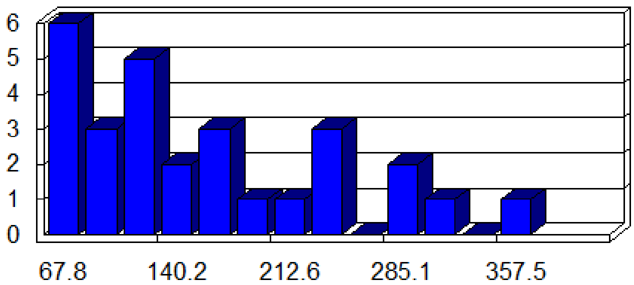

Figure 5. *Frequency distributions of building roof areas in Case Study One, Miami*
Source: Prepared by Sumita Ghosh

The characteristics of low density T3-O suburban zone are clearly visible in this neighbourhood. The pattern is legible and well linked as the overall street pattern of the area is grid iron and approximate block length 192m. Mainly rectangular linear shaped houses overlook the streets and the architectural styles of the houses conform to local style of buildings. The side lanes at the sides of buildings are narrow and the houses are constructed close to the boundary to facilitate sufficiently wide driveway on the other side in the plot.

Figure 6. *Built form and streetscape in Case Study One, Miami*
Source: Sumita Ghosh

Morphological characteristics in case study two in Sydney, Australia show that it is low density development with detached single and double storied houses. The total area of the site is 16.9 hectares, with an average parcel area 430m^2, average building roof area (without ancillary structures) 149m^2 and a density of 16 dwelling per hectare. The percentage of building roof area with ancillary structures covers 29.3 percent of the overall site; the road area is as high as 30.8 percent while tree canopy covers only 8.0 percent. The area of tree canopy cover is sparsely distributed throughout the site, limited number of large trees and trees along the streets. There is an ancillary structure almost for each building and some buildings have more than one ancillary structure. The total area of ancillary structures is 942 m^2 which is equal to 8.7 percent of the total site. Mainly lawns as pervious land covers are seen in the front and rear gardens and 14.9 percent of the site is calculated to be available as onsite productive land. Availability of onsite productive land could provide many sustainability benefits. Due to less impervious surface cover, the percentage of other uses (17 percent) is significantly lower in case study two than the case study one. The land cover pattern map (Fig. 7) and frequency distributions of building roof areas (without ancillary structures) is presented in Fig. 8.

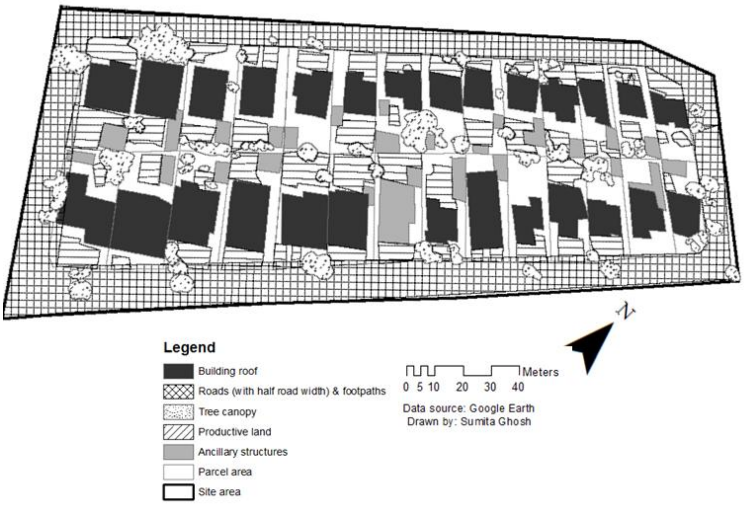

Figure 7. *Land cover pattern and parcel areas in Case Study 2, Sydney*
Source: Prepared by Sumita Ghosh

Visual analysis of case study two indicates a number of similarities in the building massing, streetscape with minimal trees, and in creating typical suburban neighbourhood qualities. The street façade if not well defined by the buildings then the feeling of an enclosure could be lost. All the houses in case study two have generous open spaces in the front and rear and the block length is approximately 208m. The surrounding street patterns are a combination of irregular and regular patterns with cul-de-sacs and irregular block patterns which provides a semi walkable neighbourhood. This development provides an enormous opportunity for future infill development. It represents the typical characteristics of suburban zone T3O and, as mentioned earlier, could act as a transition zone for morphological transformations from suburban to urban.

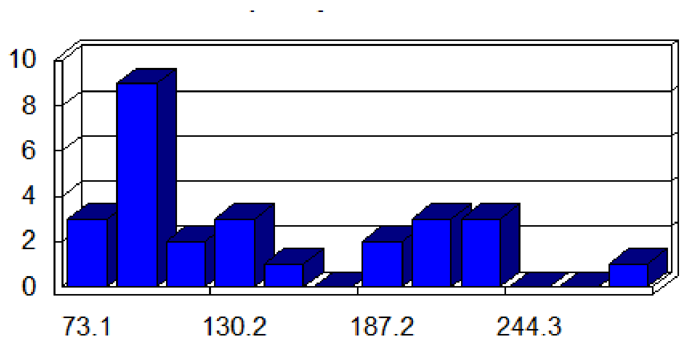

Figure 8: *Frequency distributions of building roof areas in Case Study 2, Sydney*
Source: Prepared by Sumita Ghosh

Morphological characteristics in case study three in in Kolkata, India show that it is a medium density development with two to five storied houses. The total site area is 10.8 hectares, with an average parcel area 379m^2, and dwelling density of 60 per hectare assuming on average three apartments per ground foot print of each dwelling. The percentage of tree canopy cover is significantly high and up to 22.7 percent and building roof area with ancillary structures covers 43.4 percent of the overall site. It has a high impervious cover; no front gardens as the building façades are constructed along the road. Case study three lacks in onsite availability of productive land area and there are minimal land spaces at the rear. Morphologies though do not exhibit typical characteristics of T3O suburban zone, but transformations are clearly evident from its built forms.

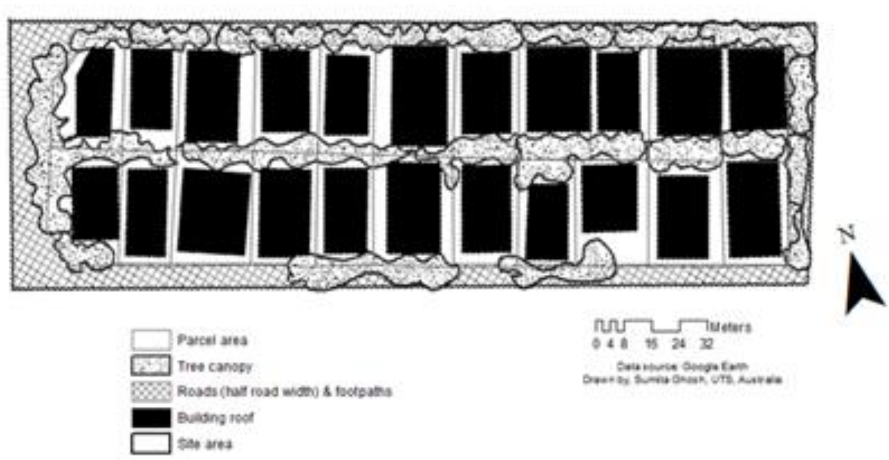

Figure 9: *Land cover pattern and parcel areas in Case Study 3, Kolkata, India*
Source: Prepared by Sumita Ghosh

The land cover pattern map (Fig. 9) and frequency distributions of building roof areas (without ancillary structures) is presented in Fig. 10. A comparative analysis of land use patterns of three case studies is presented in Table 1. The morphologies in case study three located in Kolkata, India show very different visual characteristics. The streets are lined with mature trees, and the three to four storied apartments, narrow footpaths and the roads create a well-defined street facade and enclosure (Fig. 11). The block length is much shorter and is equal to 179m. Scale is appropriate to experience the street features, views and vistas. With surrounding smaller block grid iron pattern of street layout creates a legible environment. A number of grocery, corner shops and other types of compatible retail shop create a public realm at the ground level which offers a continuous network of social exchange and use by the community. The residential uses on the upper floors and ground floors are connected visually and experientially through the balconies immediately to activities on the ground level. The outdoor becomes an extension of indoor for experiencing and engaging the communities but at the same providing sufficient privacy for the people who would like to only observe.

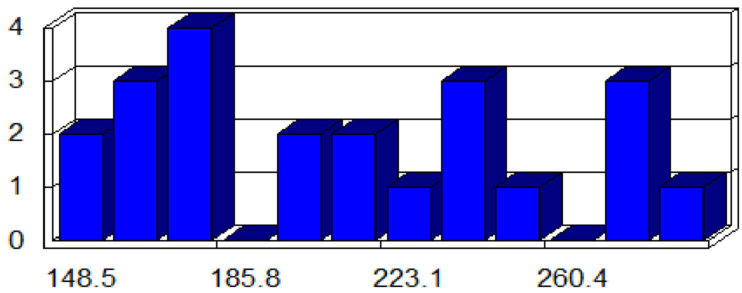

Figure 10. *Frequency distributions of building roof areas in Case Study 3, Kolkata*
Source: Prepared by Sumita Ghosh

Table 1. *Morphological analysis of suburban forms*

Parameters (ground coverage in m^2)	Case study One (Miami, USA)	Case study Two (Sydney, Australia)	Case study 3 Three (Kolkata, India)
Site area	20711 (100%)	16981(100%)	10842 (100%)
Total building roof area with ancillary structures (% to total site)	4815 (23.2%)	4972 (29.3%)	4710 (43.4%)
Road area (half road width) and footpaths (% to total site)	4974 (24.0%)	5237 (30.8%)	1337 (12.3%)
Tree canopy (% to total site)	3202 (14.5%)	1354 (8.0%)	2457 (22.7%)
Productive land area (% to total site)	1613 (7.8%)	2524 (14.9%)	Negligible value (0.0%)
Land area under other uses (e.g. driveways, entry paths, side lanes, swimming pool, paved backyards etc.) (% to total site)	6107 (29.5%)	2894 (17%)	2238 (21.6 %)
Average building roof area without ancillary structures	168	149	214
Average parcel area	660	430	379
Total number of dwellings	28	27	22
Dwelling density per hectare	14 (single to two storied detached houses)	16 (single to two storied detached houses)	60 (three to four storied residential houses and flats)

A visual analysis of the built form of case study three shows that it has travelled through the journey of morphogenesis. Changes are visible as additions and alterations of two storied residential houses, infill developments, demolition of older houses and replacements by four to five storied apartments to accommodate urban growth. Some old photographs of the houses in the area give evidence of this process. Further a GIS and remote sensing analysis of urban growth by Bhatta (2009) support a significant increase in the built up area coverage in south Kolkata where case study three is located. The built up area coverage increased from 11.39 percent in 1975 to 70.31 percent in 2005 (Bhatta, 2009: 4739). Surrounding morphologies in this case study establish that it is still going through further transformations into denser neighbourhoods with skyscrapers for residential purposes (Fig. 12).

Figure 11. *Streetscape Case Study Three, Kolkata, India*
Source: D. Ghosh

Figure 12. *Changing surrounding morphologies in Case Study Three, Kolkata, India*
Source: D. Ghosh

Is this natural self adjusting capability of urban and suburban forms to transform? Would case study one, two and three or all T3 suburban zones of the Transect go through the similar or different processes of morphogenesis over time? In this paper visual analysis and GIS methods are applied to complement and to determine suburban morphologies and their urban design qualities. Visual analyses of case studies show different morphological transformations and urban design qualities of built forms that are shaped by different drivers such as historical backgrounds, planning regulations, traditional architectural styles, climatic patterns, location, people's choices, social and economic conditions and many more over temporal scales. Future research should importantly explore these aspects in detail. It is also essential to recognise importance of developing integrated understandings of urban and suburban morphologies. Therefore, urban morphological transformations should be comprehensively analysed considering three fundamental morphological components of form, resolution and time together with qualitative socio-cultural-economic variables that guide changes.

Applications of new options and technologies for retrofitting urban forms would be essential. The roofs of case study three could recreate the open space lost to the building footprint as green roofs. Street trees could play a very important role in defining suburban streets when it is less well defined by the buildings in lower suburban densities in some urban and suburban forms. Vertical building walls with a variety of openings can create visually attractive and safer environments. Appropriate detailing of elements of design is important to experience the environments at human scale. The overall city structure has a crucial role in this process. Kolkata region with its population of 14 million people may be accommodating morphological changes due to urban growth through a further consolidation process such as four to five storied apartments are replaced by skyscrapers. Miami and Sydney with comparatively smaller population sizes could accommodate future urban growth in these suburbs through infill developments including apartments and terrace houses. Outcomes would be different for different cities. 'The Transect' for different cities will also vary. The zones of 'The Transect' can calibrate considering these varying elements of urban morphologies and design qualities as required on a case by case basis and can reinterpret evolution of the urban form in a more useful, adaptive and functional manner. 'The Transect' can create an order in planning new or retrofitting existing urban environments at the different spatial resolutions of buildings, blocks, neighbourhoods and regions, and can shape the human habitat over time in different contexts. All these components should be understood holistically for informed planning and policy decision making.

Conclusion

Morphological studies can develop understandings on urban structures and form specific layout patterns of human environments. Morphological characteristics and design qualities could significantly influence neighbourhood performance. Integrating objective assessments and subjective qualities in neighbourhood design and planning through the applications of 'The Transect' as a planning strategy will be able to provide meaningful solutions.

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