

A Study of Space Use Pattern and Historical Residential Building Morphology of Chittagong

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Abstract— this paper presents a meta-analysis of historical dwellings in Chittagong. The first study investigated the relationship between activity patterns in dwellings and spatial morphology on a sample of six historical building plans in Chittagong which was constructed in more than 100 years ago. The second study focussed on the spatial morphology of historical architecture, and meaning in space use. All the studies employed Space Syntax theory developed by (Hillier and Hanson 1984) for the morphological analysis. Questionnaire interview of the users of these dwellers and their opinion are analysed to depict an actual activity pattern in given domestic spaces. This study attempts to examine the spatial patterns of the lower middle and middle income group dwellers who lived in old buildings whether it supports user lifestyle and spatial demand of their daily activities by means of the location and size of each spaces and the connectivity between them. The reason for the selection of the case studies, each of which form a fascinating body of data, is that to date no enough study has been carried out of these buildings which have significant individual characteristics in relation between activity patterns in dwellings and spatial morphology to their immensely rich historical and cultural background. It is also believed that the morphological analyses which they are subjected to in this paper will contribute to the growing body of numerical data on such buildings. The aim of the study is to analyse the morphology of these buildings in the light of 'space syntax', which is a method used to give quantitative descriptions of built space in a comparative way. In this study each building pattern and morphogenetic structure have been analysed and compared by visual analysis and using the method of space syntax in terms of logical examination. The findings include a strong continuity in space use meaning in Chittagong traditional dwelling types, despite changes in spatial morphology. Also, a relatively low specialization of spaces/rooms was found in the seven samples, as the generic function label used to describe many spaces rarely captured the variety of activities within the key spaces.

Index Terms— Historical building, Activity pattern, spatial morphology, Domestic spaces, Space use pattern, Chittagong, Space Syntax

1 INTRODUCTION

Chittagong is a major coastal seaport city and financial centre in south-eastern Bangladesh. The city has a population of more than 2.5 million while the metropolitan area has a population of over 6.5 million, making it the second largest city in the country. (CDA) The city is located on the banks of the Karnaphuli River between the Chittagong Hill Tracts and the Bay of Bengal. Modern Chittagong is a major hub of trade and industry. The Port of Chittagong is the largest international seaport on the Bay of Bengal. (CDA)

Chittagong is an ancient port city, with a recorded history dating back to the 4th century BCE. (Custom House Chittagong). Chittagong is an ancient and historic gateway of Bengal. It is situated within 22°-14' and 22°-24'-30'' N Latitude and between 91°-46' and 91°-53' E Longitude and on the right bank of the river Karnafuli. Chatgaon and Chattagram are the Bengali names of the city. From Mughal period to British Period Chittagong city enriched by culture, architecture, religion and so on. Many historical building exist in Chittagong which convey the time of previous period. Many historical buildings are destroyed by local people due to awareness of people about the preservation of heritage and greediness of people. Some buildings are used by some people as a residential

building. In the study we pick up seven historical buildings which is used as residence. The studies combine morphological analysis using space syntax methodology developed by (Hillier and Hanson 1984), with investigations into space use and meaning.

The morphological analysis focuses mainly on the analyses of the 'distance' of interior spaces from the exterior in a variety of dwellings, and is presented in combination with the activity and object locations and patterns of space use. Space use is traced particularly in the relation between the location(s) of domestic activity, and the location of objects around the domestic space. All five studies revealed some distinct differences in space use, particularly in the orientation of the home towards the internal domain or external world, despite some morphological similarities in the samples. These on the whole, point towards a need for a study of domestic space use to focus on key domestic activities and their related objects, as several nuances in space use were also found, that provide a rich overlay on the space morphology. In order to compare dwellings with one another and to interpret their sociological significance Hanson proposed to understand the space pattern in them (Hanson, 1998, 22). Analysis of domestic space configuration provides the link between the design of dwellings and their social consequences (Hanson 1998, 1). In other words, whilst space syntax analyses is based on the premise that the configuration of (internal) space is a direct expression of social relations, and its key focus being the ability to move from one space to another (permeability), as well as the co-presence of people within a space, further exploration of sociological phenomena is required for a strong picture of space use to contin-

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ue to be developed.

2 RESEARCH METHODOLOGY

2.1 The Justified Graph

The main measure that this study concentrates on in the Justified Accessibility Graph (or J-Graph). Both generic types of graphs that tend to occur- the 'tree' graph consisting of spaces with no alternative means of exit except through the original access, and the 'ring' graph with alternative means of exit or access to a space- were found in all six samples (see Figure 16 and 17 J-graphs).

The following spatial properties were identified in the J-graphs of the sampled dwellings: - Symmetry and Asymmetry, Depth and Connectivity. Symmetry occurs when spaces bear identical reciprocal relationships to each other, and no space unilaterally controls access to any other space, while asymmetry occurs when a particular space must be traversed in order to gain access to a third space. Connectivity measures how many spaces are linked to any particular space.

2.2 Study Area

The study area was selected in different location of Chittagong. Five historical buildings were selected for the research. Each building was built more than 100 years ago and still is used as a residence. Maximum dwellers who lived in those buildings are middle class family. Some dwellers are lower middle class family. All of the dwellers who lived those historic building are the family member of the building owner. Some buildings are used by tenants. In recent time 1000 square feet are considered as lower middle income group, 1000-1200 square feet is considered as mid-middle income group and 1200-1600 square feet is considered as upper middle income group and flats above 1600 square feet is considered as high income group in Chittagong City. In the seven case buildings the total area of the each buildings are more than 1600 square feet but the dwellers are mostly the middle income group people. Maximum historical building is located Sadarghat and Firingibazar area under Kotowali Thana in Chittagong city. It is observed that all buildings are used by relatives of the landowners and most of the family are joint family. Some buildings are seized by Muslims after deviation of two country: Pakistan and India. 2.3 Figures

All tables and figures will be processed as images. You need to embed the images in the paper itself. Please don't send the images as separate files.

2.3 Observation and Analysis

The primary data collection methods was observation. Published reports, bulletin, journals and newspapers were the sources of secondary data collection. A combination of quantitative and qualitative data analysis was used to grasp a better understanding of the real picture that exists in the study area.

The paper aims is to understand the certain uses of space that are important in the context of domestic settings in terms of their size and locations in the middle income group lived in

the historical residential building in Chittagong. The usability of the historic buildings were examined by physical form to accommodate new functions, flexibility, accessibility; the age and the quality of present situation, layout, function and relationship.

3 CASE STUDIES

3.1 Abdur Rahman Dobash Bari

Abdur Rahman Dobash Bari is situated Firingi bazar under Kotowali Thana in Chittagong. The owner of the house is Abdur Rahman Dobash. The Building was constructed with brick more than 110 years ago.



Fig: Front view of building



Fig: Interior View (Living room)

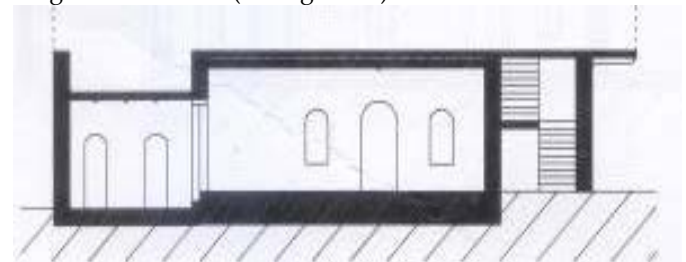


Fig: Section AA'

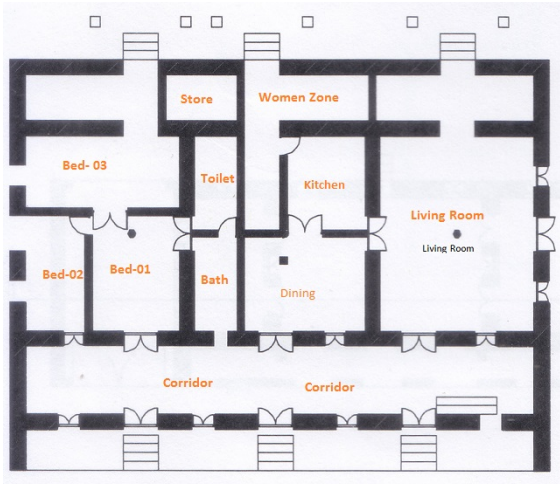


Fig: Ground Floor Plan

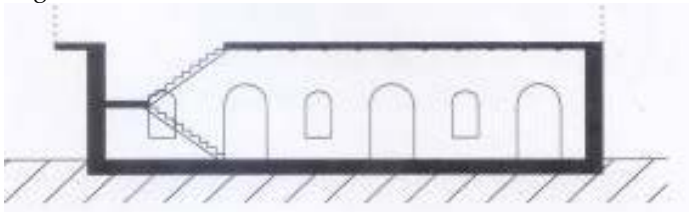


Fig: Section BB'

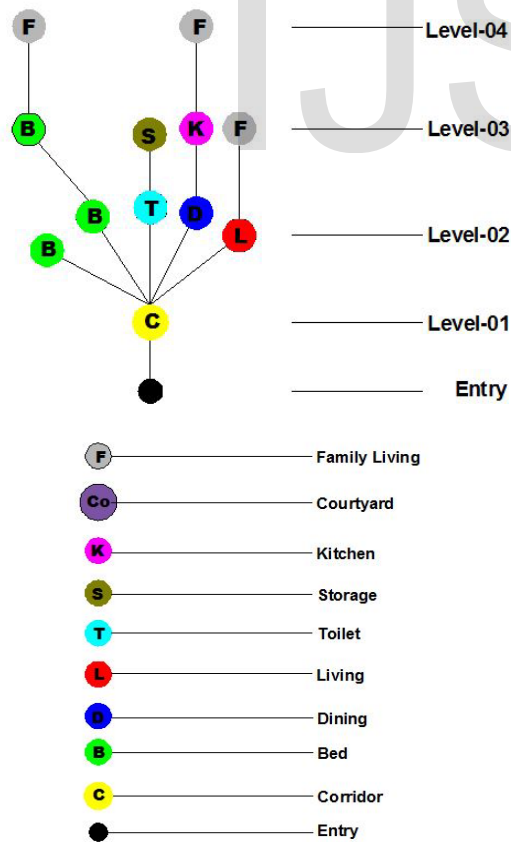


Fig: j-graph mapped with space labels of Abdur Rahman Dobash Bari

3.2 Zahirul Alam Dobash Bari

Zahirul Alam Dobash Bari is situated Firingi bazar under Kottowali Thana in Chittagong. The owner of the house is Zahirul Alam Dobash. The Building was constructed with brick more than 140 years ago.



Fig: Front view of building



Fig: Front View from road

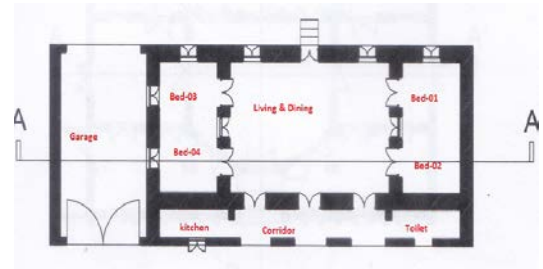


Fig: Ground Floor Plan

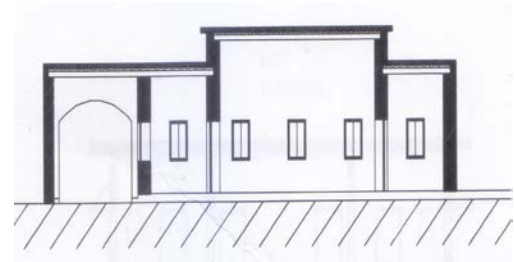


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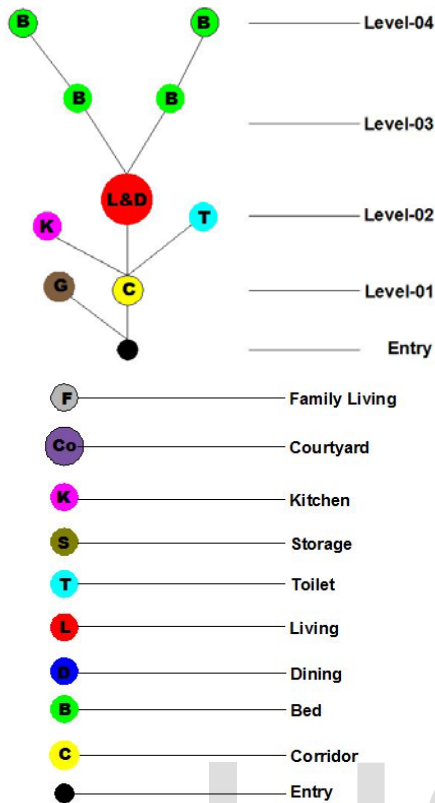


Fig: j-graph mapped with space labels of Zahirul Alam Do-bash Bari

3.3 Rafiq Chowdhury House

Rafiq Chowdhury House is situated Sadarghat under Ko-towali Thana in Chittagong. The Building was constructed with brick (Reinforced Concrete Repairs later). The construction year of the building was more than 100 years ago. The owner of the building was Hem Sen. Rafiq Chowdhury purchased the building from Him Sen in 1945.



Fig: Front View of building

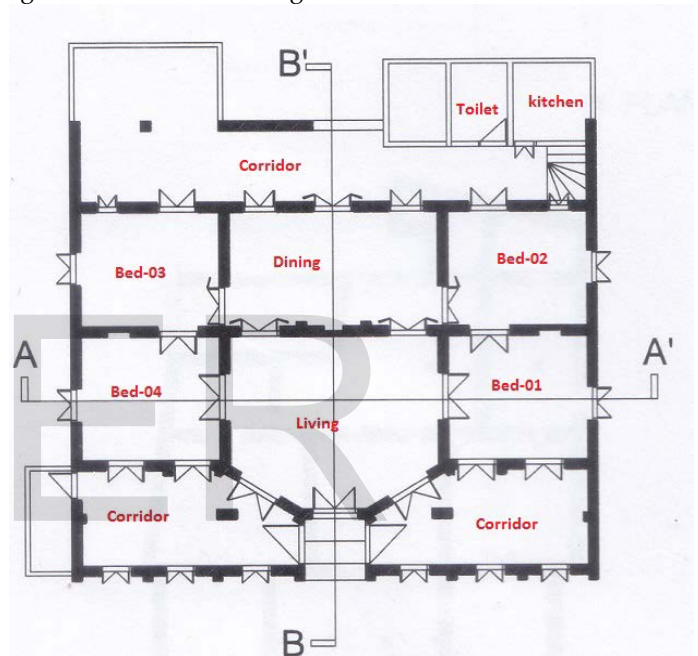


Fig: Ground Floor Plan

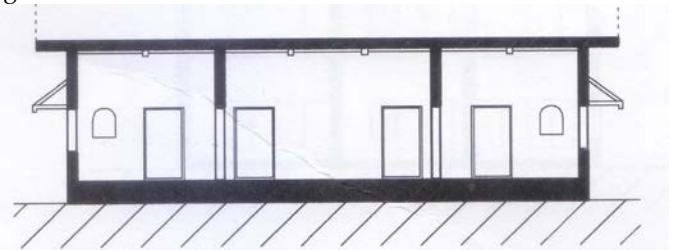


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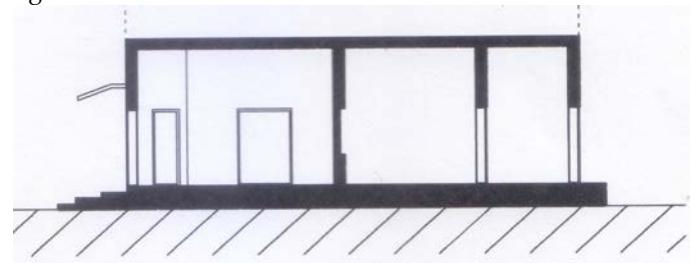


Fig: Section BB\'



Fig: Front view of building

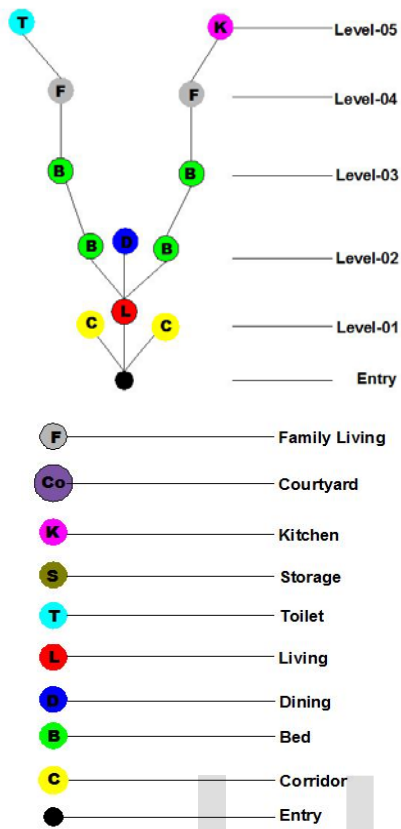


Fig: Front View of building

Fig: j-graph mapped with space labels of Rafiq Chowdhury House

3.4 Bijon Kutir Bari

Bijon Kutir Bari was constructed with Reinforced Concrete. The construction year of the building was 1930. The owner of the building was a Hindu family, but it seized by local people and now used as residence.

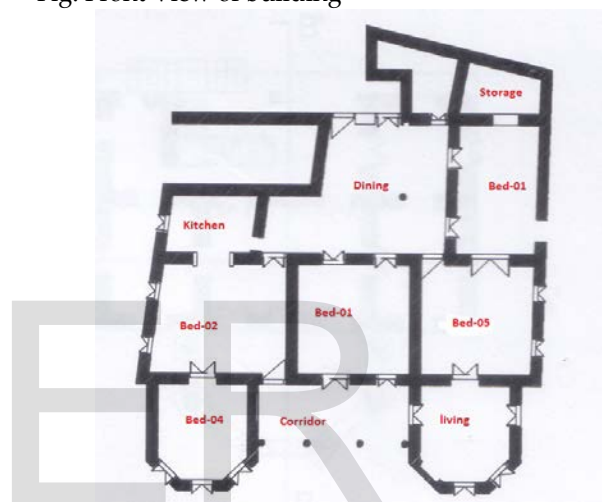


Fig: Ground Floor Plan



Fig: Front view from road

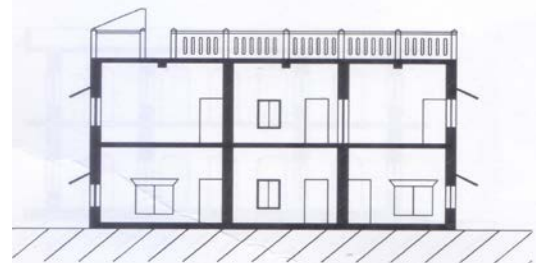
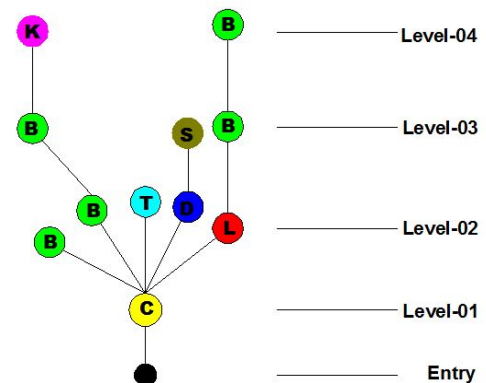


Fig: Section AA'



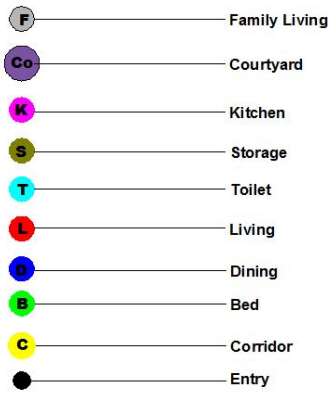


Fig: j-graph mapped with space labels of Bijon Kutir Bari

3.5 Obijit Krishna House

Obijit Krishna House is situated in sadarghat in Chittagong city. The building was constructed with Brick. The construction year of the building was more than 110 years ago for Jomindar (in Feni) and now it is used as a residence.



Fig: Front view from road



Fig: Courtyard of the building

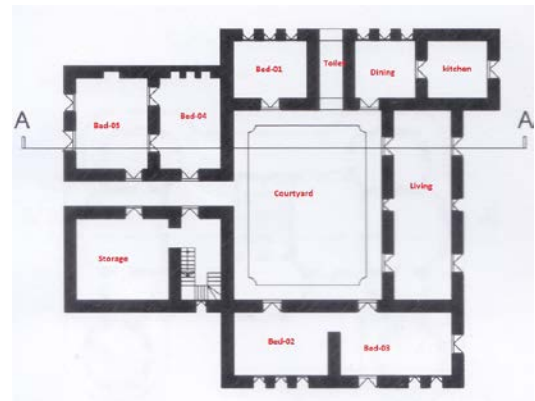


Fig: Ground Floor Plan

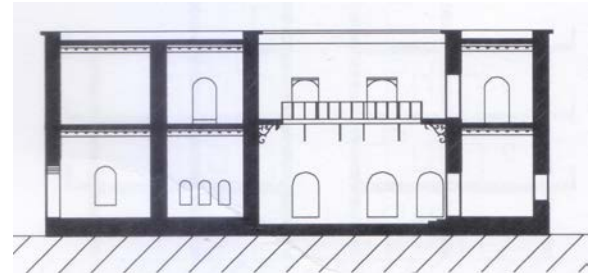


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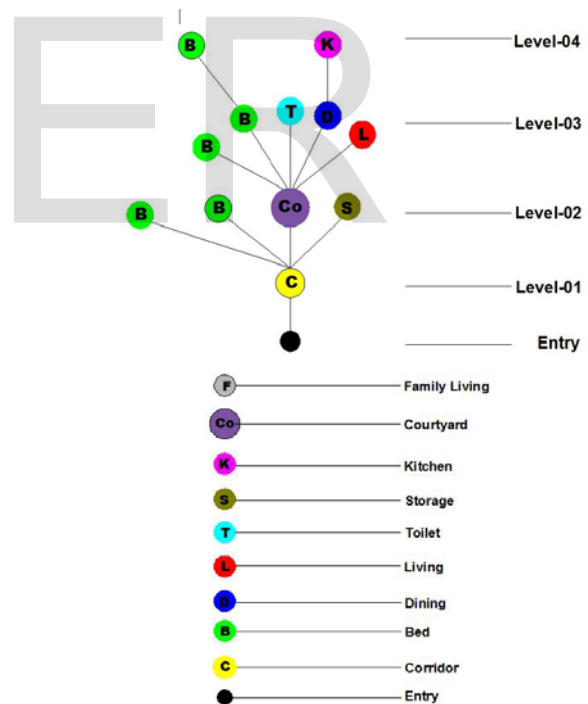


Fig: j-graph mapped with space labels of Obijit Krishna House

3.6 P.K. Sen Bhaban

P.K.Sen Babhan is situated at sadarghat in Chittagong city. The construction of the building was started in 1920 and completed in 1923. The building was constructed with Reinforced Concrete. Former owner of the building was P.K. Sen (Jomin-

dar in Noa Para) and later it was purchased from P.K. Sen in 1947.



Fig: Front view from road



Fig: View of the building

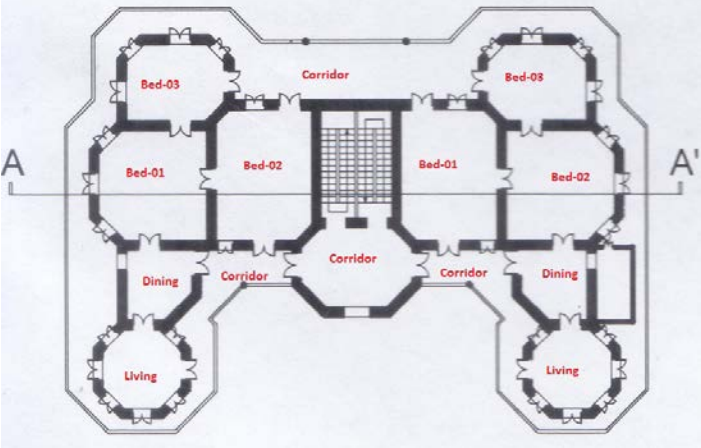


Fig: Ground Floor Plan

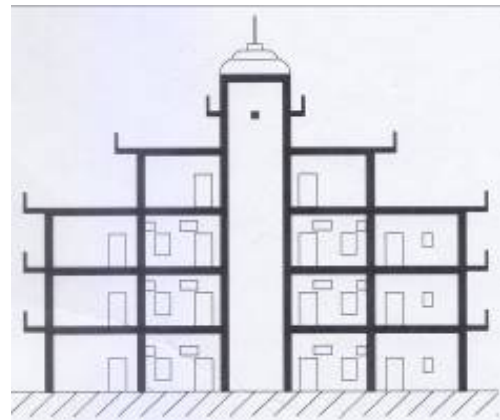


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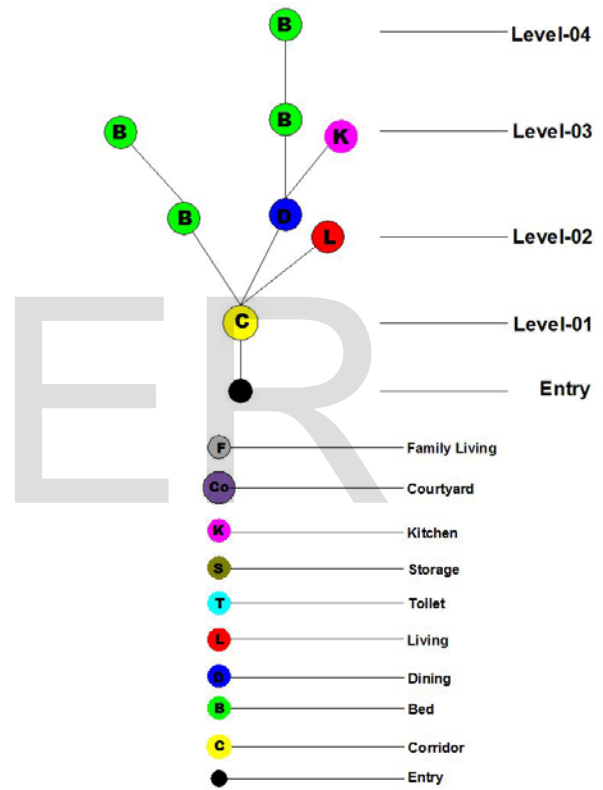


Fig: j-graph mapped with space labels of P.K.Sen Babhan

4 ANALYSIS

Physically in Architecture, movement through space gives rise mainly two types of space along with personal activity spaces which are present in the spatial organization in a cellular manner. Hanson labeled the rooms which clearly intended to support activities as function spaces and those intended for circulation as transition spaces (Hanson, 1998, 187, 284-286). This paper will analyze the Function Spaces whether they are adequate to support the activities to take place properly.

4.1 Analysis of spatial pattern and user activity:

4.1.1 Corridor

Corridor is very common in all historical buildings. Corridor

links all the spaces in all case study buildings. Corridor works as a foyer which gives clear direction to all the interior spaces. From all the study samples we have found corridor like spaces except Obijit Krishna House. In Obijit Krishna House exist corridor like space but it did not provide clear direction to the interior spaces of the building. The corridor works as a pathway to the central courtyard and other spaces around the courtyard. In P.K. Sen Babhan the whole building is surrounded by corridor and the each room is connected with corridor where the corridor works as both balcony and connecting space with all spaces of the building.

In the contemporary middle income group apartment the size of the veranda was tremendously reduced in respect to the traditional houses where veranda was located as a semi open space and was used for various family activity. And the verandas are connected with bedrooms and at least two or three veranda is provided with rooms especially bed rooms in apartment buildings. In the studied buildings no veranda is found or attached with bed rooms or other rooms. Corridor like spaces works as veranda. In contemporary apartment buildings the user have to pass through the bed room to go to the veranda, but in studied buildings user have to pass through corridor to go to the bed rooms. Generally corridor is used for drying clothes and connecting space with other spaces.

4.1.2 Courtyard

Among of seven studied buildings we found one sample in which courtyard act a central space to connect each space with one another. Activity areas is located around the central courtyard where all other rooms are connected with this space. A large corridor is located around each activity area which is surrounded by courtyard. Courtyard is used as a meeting place, children play area, woman's gathering zone and guest sitting zone. Different types of program like wedding ceremony or other festival are held in the courtyard.

4.1.3 Living Room

Traditionally living room is directly connected to main entry and segregated from the rest of the domestic spaces. From the sample buildings it is found that in most of the case living is directly connected to corridor except Rafiq Chowdhury House and Obijit Krishna House. In the above two buildings the living room is connected to entry.

Basically the large hall room type spaces are used as living room in all sample buildings. In every case living room is used for greeting the guests. As none of the study buildings have separate family living space, family members of most buildings use living room as their meeting place. In Obijit Krishna House the courtyard is used as a family living space. Abdur Rahman Dobash Bari have some spaces which was not clearly identify to us, but the family members are using the spaces as a family living where the family members are gossiping with each other. The family spaces are arranged with some traditional furniture and used mostly in night time. It is also noted that in case living room is used as dining space also where the

hall type room is extra-large. In some buildings living room is used as guest bed (Zahirul Alam Dobash Bari) having an extra bed in the furniture layout.

4.1.4 Dining Room

Among the studied buildings there is a separate dining room in 6 cases and combined living-dining in 1 building (Zahirul Alam Dobash Bari). Dining room is generally act as a common shared space. In contemporary apartment buildings the dining space is the central spaces and connected with all interior spaces. But in studied historical buildings we found that dining area is separated from other spaces and it is not act as a central space except Zahirul Alam Dobash Bari.

In all study dining room is used for eating and family together in formal and informal way takes their meal thrice a day in the dining. Other than eating dining is used for activities like cooking preparation, family meeting and child's study space. In most of the cases dining room is the only space to place home appliances like refrigerator, washing machine and electrical cooker.

4.1.5 Combined Living & Dining

In all case buildings we found that living and dining spaces are separated with each other except Zahirul Alam Dobash Bari. In Zahirul Alam Dobash Bari the combined living and dining spaces are seen. In that case owner have removed the partition wall to make the living connected with dining due to invite natural light and plenty of available rooms.

4.1.6 Bed rooms

Bed rooms are meant for sleeping by the members of the family. For rest and family activity purposes the cell like bed rooms are used. In compact apartment plans the bed room are two or three in number in the middle income group flats.

The master bed room is the main bed room in the house that is used by the family head in cases and it is identified with its ancillary facilities like attached toilet and veranda. Usually both second and third bed are used by family members for sleeping, though sometimes third bed is designed as a guest bed in the spatial formation and accessed from living room. From the studied buildings we found that there is no specification of rooms such as master bed, child bed or guest bed. Even it is seen that there is no variation of room size. The bed rooms are used by occupants as their personal needs. Plenty of rooms in buildings, sharing the rooms with family members (two or three brothers or sisters sharing a room) is seen in all case study buildings. From the studied historical buildings a clear idea on room sharing is found. In most of the apartments now a days, user do not share bed rooms with parents and children or among siblings in regular time. In most of the case study buildings it is seen that bed rooms are inter-connected with each other. One have to pass through the one bed room to go to another bed room. But in contemporary apartment building each room is separated and no interlinked with other bedrooms. Dining act as a central space from where we can easily go to the other internal spaces easily.

Depending on the physical layout of the studied six historical residential building four types of spatial pattern is found.

Type 1: Corridor like spaces which connected all other rooms and most of the rooms open to the corridor. Here corridor act as a space which act as a connecting space.

Type 2: Activity areas around the central courtyard where all

other rooms are connected with this space.

Type 3: having continues living and dining space where all other rooms are connected with this space.

Type 4: having separate living and dining spaces and bed rooms, kitchen and common toilet are connected with living area.

Type	Type 1	Type 2	Type 3	Type 4
J graph from entry				
J graph from Corridor				
J graph from Court-yard				
J graph from Living				
J graph from Dining				

Table: Mean depth (M.D) and Relative asymmetry (R.A)

From the table we find, in both types, Corridor, courtyard or in some cases Living/dining room has the lowest mean depth (M.D) and Relative asymmetry (R.A), therefore this types of spaces are the most integrated space in the total domestic organization of historical building. As a result the spaces (Corridor, courtyard or other spaces) contain highest circulation.

In all type of historical buildings, bed rooms have higher mean depth (M.D) and Relative asymmetry (R.A), therefore these rooms are more segregated and as acts well as private domain as like as contemporary apartment buildings.

5 CONCLUSION

The study helped to clarify the mechanism behind the old

buildings culture that lead to the identification in both the spatial organization and activity pattern of the dwellers of middle income group in Chittagong. Moreover, the potentiality of the space transformation has shown that they are compatible and adaptable for the new functions according to the current need of the users.

The study also revealed that people will adopt with the current space organization if there is no freedom of choice to transform but he will also satisfy him by practicing his culture, ritual and habitual attitudes within the limitations.

A number of drawbacks are also a disadvantage for such qualitative research as nothing is so accurate and genuine.

In the case studies, the numbers of samples are too low to eva-

uate and coming to a conclusion. In addition, the families have different requirements and demands, their sizes are also different and above all their physical setting and formation are not identical. But an apparent idea about the space use pattern and life style of the user of middle income group dwellers who lived in old buildings can be understood from the study. Adopting the functional interrelation between spatial patterns and changing lifestyle of users in the newly built apartments may solve the conflict between affordability and adoptability of the middle income group dwellers in Chittagong.

The research additionally exposed that individuals may follow using the present room business when there is absolutely no independence of preference in order to change however he'll additionally fulfill him or her through training their lifestyle, routine as well as chronic behavior inside the restrictions.

Numerous disadvantages will also be the drawback with regard to this kind of qualitative investigation because there is nothing therefore precise as well as real. In case research, the actual amounts of examples tend to be as well reduced to judge as well as visiting the summary. Additionally, the actual households possess various needs as well as needs, their own dimensions will also be various as well as most importantly their own bodily environment as well as development aren't similar.

6. ACKNOWLEDGMENTS

I would like to thank all of the people who helped make this investigation possible, in particular: Architect Istiaque Ahmed, Chief Architect and CEO of Space jam, for giving me information related to my topics, Mr. Md. Mehedi Forhad, Lecturer, Port City International University for his technical support and the Dept. of Architecture, BUET, Dhaka, Bangladesh for technical support.

REFERENCES

- [1] Ahmed, N. & Khan, N. 2004. Evolution of House form in Dhaka City, Global Built Environmental Review (GBER) Vol. 3 (3): 38-48.
- [2] Shihabuddin Mahmud, 2013. TRANSFORMATION A WAY TO MAKE AN OLD BUILDING POTENTIAL FOR INCOME GENERATION: A STUDY IN CORE DHAKA, BANGLADESH. Emirates Journal for Engineering Research, 18 (1), 67-80 (2013)
- [3] Zahur, M. (2008). Private Apartment Housing for Middle Income People; A Study on Affordability, unpublished MURP thesis, submitted to Bangladesh University of Engineering and Technology, Dhaka.
- [4] Gomes, C. D. (2014). Visibility effecting gender aspects in middle income group apartments in Dhaka. In: Proceedings of the 10th International Space Syntax Symposium.
- [5] Hillier, B., Hanson, J. (1984). The Social Logic of Space, Cambridge University Press, Cambridge: 257---261
- [6] Hall, E. T. (1969). The Hidden Dimension, Man's Use of Space in Public and Private, the Bodley head, London, Sydney, Toronto: 121.
- [7] Hanson, J. (1998). Decoding homes and Houses, Cambridge University Press.
- [8] Manum, B. (2009). A-graph complementary software for axial-line analysis. In: Proceedings of the 7th international space syntax symposium, Stockholm, Sweden, 070, 1-9.
- [9] Hillier, B. and Hanson, J. (1988). The Social Logic of Space. Cambridge: Cambridge University Press.
- [10] Hillier, B., Hanson, J., and Graham, H. (1987a). Ideas are in things: an application of the space syntax methods to discovering house genotypes. Environment and Planning B: Planning and Design, 14 (1), 363 -385.
- [11] Hillier, B. (2007). Space is the machine: a configurational theory of architecture. London: Space Syntax Laboratory. Zako, R. (2006). The power of the veil: gender inequality in the domestic setting of traditional courtyard houses. In: Courtyard Housing: Past, Present, and Future; Individual Chapters, edited by Edward, B., Sibley, M., Hakmi, M., & Land, P. (Eds.), 65-75. New York: Taylor & Francis Group.