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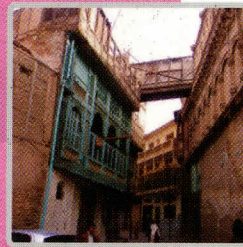
Protibesh

ENVIRONMENT

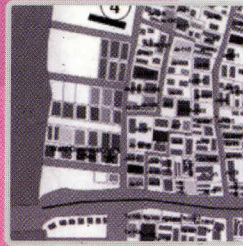
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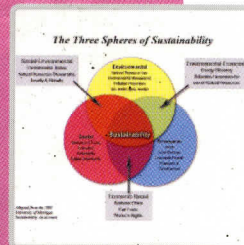
Volume 13 No. 2



Gender Studies



Housing



Sustainability



Environment



Protibesh is a peer-reviewed research journal published by Department of Architecture, Bangladesh University of Engineering and Technology, in January and July every year. Protibesh, meaning environment, aims to provide a forum for publication of original research and scholarship, for better understanding of the different aspects of and intervention for environment in urban and rural settlements. Protibesh is committed to act as a catalyst to bridge theory, research and practice in the broad field of Architecture of Bangladesh.

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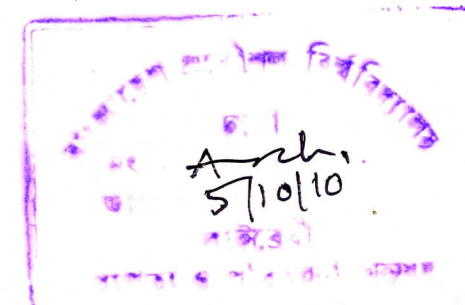
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Dr. Shayer Ghafur



List of Reviewers

<p>Dr. Saif Haq Associate Professor College of Architecture, Texas Tech University E-mail: saif.haq@ttu.edu</p>	<p>Dr. Kelly Shannon Department of Architecture, Urbanism and Planning KU Leuven (Belgium) Email: Kelly.shannon@asro.kuleuven.be</p>
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Editorial

Protibesh, the Architecture journal of Bangladesh University of Engineering and Technology, is a research journal dedicated to disseminating state-of-the-art design and technical knowledge relevant to the teaching and practice of Architecture. This issue of the journal includes four research papers on varying topics, which the Editorial Board has considered as having the potential to contribute new and innovative knowledge to academic and professional pursuits of Architecture.

The first paper is on gender studies – Gender and Space; Analysis of gender zones of Sethi Havelis, Peshawar – written by Samra M. Khan of Islamabad, Pakistan. The paper explores the hypothesis that forms have the ability to adapt to socio-cultural changes and needs in societies, and bases its discussion on the study of architectural spaces of the Sethi Mohalla, in Peshawar, situated in the North Western side of Pakistan. Beginning with a historic overview discussing women's role in society through the ages, the paper goes on to interview women of a traditional settlement with the aim of understanding the dynamics of their lifestyles and the connection with the spatial characteristics that they inhabit. Through interviews with the female residents of the havelis and direct observation of the spaces on the basis of gender, the author analyses the spatial configuration using the drawings. The analysis is based on criteria like access to women's spaces, integration or segregation of space in context of social contact and their aesthetic qualities. Along with an understanding of the manifestation of the socio-cultural norms of the era, the paper concludes that architecture is indicative of the socio-cultural era it is produced in and can be used as a mechanism to create a secondary role for the female gender.

The second paper is on environmental issues of building materials, their impacts and manufacturing methods titled, Reducing carbon dioxide emission by the adoption of contemporary earth construction in urban Bangladesh, by Mohammad Sharif Zami and Dr. Angela Lee of Salford, UK. Advocating the use of stabilised earth as an alternative building material, which is cheaper than conventional brick and concrete, while also being environmentally sustainable, the paper delves into environmental impacts and sustainability issues. Despite the fact that the use of earth on site as a building material saves manufacturing cost, time, energy, environmental pollution and transportation cost, most developing countries, including Bangladesh have no agenda to promote its use. Beginning with a discussion on Conventional brick manufacturing in Bangladesh and carbon dioxide emission, the paper goes on to present data from recent studies and research on this manufacturing system and ways in which the environment is being harmed by Greenhouse Gas Emissions through the process. Talking about Production methods of contemporary stabilized earth construction, the authors then expound on the advantages of this technology through citing examples in developing countries around the globe. The paper aims to demonstrate the dynamism of this earth material and its suitability for construction in urban Bangladesh, reviewing the examples and arguing for the environmental benefits (less carbon dioxide emission) of using stabilized earth as a building material and associated construction techniques for urban construction in Bangladesh. A critical literature review method was adopted in the paper to investigate how contemporary earth construction produces less carbon dioxide compared to the conventional brick and concrete construction. Among the examples given in the paper are works by Egyptian architect Hassan Fathy, and numerous experimental works in Auroville, India.

The next paper by Dr. Mahbubur Rahman from Universiti Teknologi of Malaysia, is titled Sustainable Housing and Role of the World Bank. Arguing that lack in institutional development, policy implementation, governance, participation etc have so far held back sustainable development of low-income or squatter housing, the paper focuses on relevant issues, discussing efforts by the World Bank in trying to change attitudes towards this group. The World Bank's influence according to the author has been stronger than other organisations in shaping development, due to its ability to dictate policies and strategies in the developing countries through large loans to urban and housing programs. Nevertheless, problems persist in the housing for these deprived populations as the benefits reaped by the policies are not multiplying in the expected proportion. This caused the World Bank to gradually reduce its direct involvement in sites and services projects towards the late-1980s, though its indirect support into social housing programs with self-help components continued through specialised institutions, or through NGOs and CBOs. In the early-1990s the World Bank, recognising housing as a productive item, which multiplies employment and generates income, reformed its housing strategies. The

concept of 'enablement', emphasised technical know-how, available resources, inclusive participatory approach among various stakeholders, capacity of the development agencies, and recognising and defining responsibilities of all, particularly relevant to new housing. The paper goes on to discuss the economics of squatter settlements emphasising process cost, tenure security, and sustainability of improvement, concluding with the caution that retention and regeneration of squatter settlement cannot succeed if isolated from other areas of development.

This issue of Protibesh concludes with a paper titled "Spatial and Social Adaptations: A Post-occupancy Evaluation of Multi-storey Social Housing in Dhaka" by Dr. Shayer Ghafur of Bangladesh University of Engineering and Technology. Investigating ways in which low-income households adapt spatially and socially in multi-storey (walk-up six-storied) social housing in Dhaka, this paper advocates a fit between the physical and social environments in designing and maintaining functional contexts for low-income households in Dhaka where human activities and interactions can be appropriately accommodated and developed. The paper is based on a broad research carried out in March 2001, on socio-spatial adaptation for living and livelihood in multi-storey social housing in Dhaka, which includes, but is not restricted to, post-occupancy evaluation through structured questionnaire, informal interviews and observations. The research employed a multi-method fieldwork to gather relevant data from all the dwelling units of two multi-storey social housing schemes in Dhaka, located at Badda (two six storied buildings with 48 dwelling units) and Islambagh (four six storied buildings with 192 dwelling units). The research investigates housing stress, which is indicated by a difference between household's 'residential situation picture' and 'aspiration picture' – a stress which can be lowered by making these pictures as congruent as possible. Passive and active adaptation towards relieving housing stress is discussed. The paper ends with evaluation of building performance for adaptation and their implications on design assumptions. This paper largely helps understand building performance as it responds to the needs of low-income dwellers by looking at the allocation, organization and use of spaces, and the extent and ways of socialization of household members.

I would like to thank all the Authors who, in keeping with the standard and reputation of Protibesh, Architecture Journal of BUET, have had to work hard, to finalise the drafts based on the comments and guidance of the Reviewers and the Editorial Board. I am also extremely grateful to the Reviewers, members of the Editorial Board and the members of the Protibesh Committee, for the cooperation and dedication towards quality that they have all extended and demonstrated. The contents of the papers and opinions expressed in them, as they are presented here are however the Authors' own, and the success, intellectual and academic value of their papers, likewise, belongs to them alone. We, the Protibesh team, have merely served as instruments in their presentation. In conclusion, I hope that the objective of Protibesh to contribute new knowledge to the teaching and practice of Architecture will be achieved through this issue.

Dr. Zebun Nasreen Ahmed

Editor,
Protibesh, Architecture Journal of BUET
and
Professor,
Department of Architecture, Bangladesh University of Engineering and Technology

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Gender and Space: Analysis of gender zones of Sethi Havelis, Peshawar

Samra M. Khan

Associate Professor
Department of Architecture & Design
CIIT, Islamabad, Pakistan
Email: sjmkhan@yahoo.com

Abstract

The haveli form evolved in vernacular architecture to support traditional patterns of living. The socio-cultural dimensions of society were strongly reflected in the spatial division of the haveli on the basis of gender. In the sub-continent, the understanding of vernacular architecture and its representation of women's status as outlined by spatial hierarchy is still largely un-documented. This paper explores the hypothesis that forms have the ability to adapt to socio-cultural changes and needs in societies, it studies architectural spaces of the Sethi Mohalla, Peshawar, on the basis of gender, in order to understand the manifestation of the socio-cultural norms of the era. The methodology of this study includes interviews with the female residents of the havelis, direct observation of the spaces and analysis of spatial configuration by drawings. The analysis was based on; i) the access to the women's spaces, ii) the integration or segregation of space in context of social contact and the iii) aesthetic quality of these spaces. The paper concludes that architecture is indicative of the socio-cultural era it is produced in and can be used as a mechanism to create a secondary role for the female gender.

Key words: Haveli, vernacular architecture, social- cultural, women, engendered spaces.

1. Introduction

Traditional cultures placed a great deal of emphasis on the hierarchy and organization of spaces; regulating the use and occupation of public and private space. The subsequent order of space in traditional domestic settings expressed the relationships between men and women and their hierarchy within the social fabric. The Sethi havelis built from 1823 -1920s in particular reflected the social and cultural values of their age through the organization of spaces into gender based domains, reinforcing the sex-roles as propagated by 19th century patriarchal society.

The Sethis were affluent businessmen who established a mohalla in Peshawar in the 1800s (Qizilbash, 1991), close to the Western Gate of Gor Khuttree and the trade center of Qissa Khawani Bazaar. The mohalla consisted of seven havelis which were constructed in the cultural traditions of 18th and 19th century domestic architecture of India and Bukhara (Per.com. Sethi, N. Nov 15th 2008). The built environment is shaped by human intentions and embodies cultural values and standards of acceptable behaviour (Weisman, 1981a). The organization of the Sethi mohalla, the havelis' individual layouts and their relationship with the streets, give an indication of the particular set of socio-cultural rules that dictated the formation of the spatial hierarchy.

The impacts of this spatial segregation on women of the havelis were dominant till the last two decades in which social values underwent a change and women became more integrated in society. The study of the architectural design of the Sethi havelis and the mohalla is undertaken in order to understand how socio-cultural norms of 19th century Peshawar enforced spatial hierarchies based on gender. The resultant separated zones helped to control and regulates access to the public domain in favour of men. The hypothesis behind the analysis is that the physical and visual qualities of architecture are indicative of the social order and structure of society. The assessment of the havelis' layouts is based on the movement between public and private zones and the responsiveness of space to social rules of segregation and integration. The aesthetic quality of space is also analysed to understand their importance within the spatial hierarchy.

2. Historic Overview: Women's role in Society

Culture has been one of the major forces that have shaped the built environment. Rapoport (1969 a) states that the environment reflects socio-cultural forces including religious beliefs, family/clan structure, social organization and social relations between individuals. The role of women in society is subsequent representation by the spatial hierarchy of architecture. The socio-cultural norms of a patriarchal society invariably form architectural space to the advantage of

men. The gendered nature of the field was challenged by feminist scholars in the 70s and early 80s (Ahrentzen, 1996a) who argued that it played an integral role in the processes of disempowerment of women. Architecture created by the patriarchal society confined women to less advantageous physical surroundings. According to Weisman (1981b) the 'man-made' environment reinforced the patriarchal definitions of women's role in society.

Studies carried out by Farah & Klarqvist (2001) on domestic space in Arab Muslim societies, endorse that the division of space and its use was based on gender classification. Men occupied *baitmaks* (reception rooms), which underlined their authority as head of the household. In these spaces of position and power, men took care of the business of the family. As a consequence, his work and time both were highly valued and merited his hierarchy within the house and its spaces. Traditional cultures assigned women to the kitchen and other service areas; these 'spaces of duty' did not add to her status or esteem. Within these, she was engaged in work that had no social value, significance or recognition by the patriarchal society (Grosz, 1991).

Within the context of the Muslim society of 18th and 19th century India, women were actively discouraged from being active in the public domain by religious and socio-cultural constraints. Religious guidelines emphasize *purdah* and discourage the active participation and integration of women in the public domain. It places them under the protection of their male guardian (*wali*). The male protection of females took the form of physical boundaries and confines within domestic architecture. Islam & Al-Sanafi (2006) confirm that the importance of privacy is one of the major considerations in the design of a Muslim's house. In Peshawar, the religious constraint of *purdah* was made more stringent by the conservative Pathan customs that resulted in the absence of women from all public domains. The gazetteer of the Peshawar district (1897-98) reports that within Pathan society, women are looked on as property to be watched and kept secluded.

These aspects of segregation were also reinforced by the 'progressive' male writers of 19th century India¹. Their books served as the moral guides of society, prescribing the honourable (thus acceptable) code of behaviour for women (Thanvi, reprinted 2007); encouraging them to restrict their movement within the *zenana* domain, avoiding contact with and intrusion in the male domain. These socio-cultural restraints reinforced the division of architectural space into the public and private realms. The *haveli* became a metaphor for gender roles and positions within the family and in society at large; creating separate spheres for men and women that coexisted but did not overlap.

3. The Development of the Sethi Mohalla

Charalambous (2007), states that social expressions of culture, such as groups and family structures often have settings associated with them or are reflected in the built environment. The establishment of a *mohalla* for the Sethis created privacy for their community, which helped to provide protection and prescribed acceptable social behaviours for members of the kinship and their families. Within the confines of the *mohalla*, the Sethis *havelis* had protected *haveli* entrances that helped to segregate the *beruni* (outer/public) from the *anderooni* (inner/private) spaces. The doorways had *chokis* for male members of the family to sit and socialize with other neighbours. Men had social interactions in the street and at the front door. The *haveli* had all other openings on the upper floors in the form of *jharokas* and arched windows, to discourage view from the street and to provide privacy for its womenfolk.

The *haveli* design placed the *mardana* (men's domain) next to the entrance, as part of the public sphere. The *zenana* (women's domain) was placed furthest from the entrance and mostly on the upper floors. The women of the households (1832-1930) confined by religious and socio-cultural traditions of *purdah* and rarely used the front entrance of the *haveli* (Per Com. R. Sethi, Nov 15th 2008). The contact between women (immediate family) took place through connecting doors between adjacent *havelis* and in 1902 the overhead bridge, the *chatty galli* (covered street) was built to connect the family *havelis* across the street (Per com. R. Sethi, Nov 15th 2008). The *chatty galli*, contained and regulated the movement of women in the public domain of the street (fig. 1). Rapoport writes,

who communicates with whom, under what conditions, how, when, where and in what context is an important way in which built environments and social organizations are related. (Rapoport, 1980 a)

1. Maulana Ashraf Ali Thanvi, Depty Nazir Ahmad

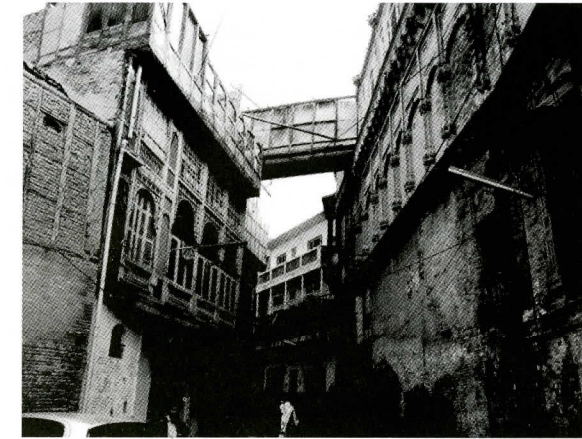


Figure 01: View of *chatty galli* in the main Sethi street.

4. Methodology of the Study

This is a retrospective study of the Sethi *havelis* constructed during the period from 1832 to 1920, when the spatial configuration was determined by the cultural traditions of the era. After an initial survey, three *havelis* (Gul Ahmad Sethi, 1832, Karim Buksh Sethi, 1898 and Abdur Rahim Sethi, 1912) were chosen as a representative sample for this study as these best reflected the nature of the gender zones under study and were accessible. The sample size was determined by the main focus, of this study on the qualitative issues characteristic of all seven Sethi *havelis*, and not on quantitative issues and statistical analysis.

The methodology employed for this study included direct observation of the spaces, photography, making measured and analytical drawings and personal interviews with residents of the *mohalla*.

The socio-historical information was collected by a series of interviews with the male and female family members. Spatial analyses via drawings and diagrams helped in understanding the physical and visual divisions of architectural space. The analysis focused on exploring the social significance of the spatial structure and how it responded to socio-cultural rules such as privacy, control and social interaction. The architectural quality of spaces was also studied in order to determine their role and importance of different spaces within the household.

The study focused on the following specific parameters of assessment of the *havelis*:

1. The Access into *havelis*
 - 1.1 Visual and Physical barriers
 - 1.2 Depth of men and women's areas from the main entrance
2. Responsiveness of space to social rules
 - 1.1 Degree of Control of space
 - 1.2 Social Interactions
3. The Aesthetic quality of space.

5. Analysis of spatial hierarchy and gendered spaces

5.1 The Access into *Havelis*

The *mohalla* and its *havelis* was composed of a series of social control mechanisms (Rapoport, 1969 b) that allowed integration of men and segregation of women from the public domain.

5.2 Visual and Physical barriers

Space mechanisms separating the external/male domain from the internal/feminine space included the use of bent *deorhis* (passageways), multiple doorways along the *deorhi*, levels and stairs in the *deorhi* and finally placing the family courtyard perpendicular to the street (Fig.2). These multiple boundaries maintained a high degree of visual and physical

privacy by keeping the men and women's domains separate. Rapoport (1980b) defines privacy as the control of unwanted interaction with other people. The deorhis of the Havelis, were bent at different angles ranging from 45°-180°, revealing the behavioural pattern and separation needs of the society; where street pedestrians and outsiders must not see the inside of the haveli and vice versa.

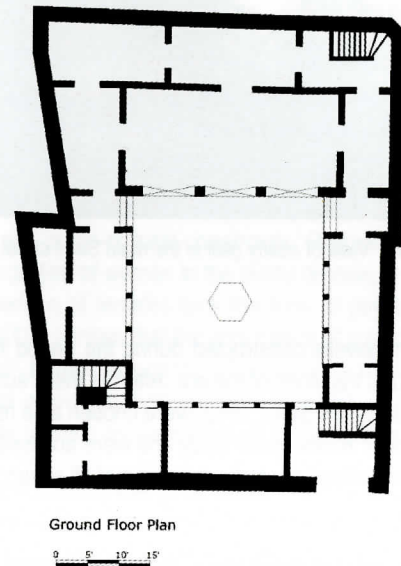


Figure 02: Plan of Gul Ahmad Sethi haveli; entrance deorhi sequence.

5.3 Depth of men and women's areas from the main entrance

An important factor in access to a space is its proximity to the main street. The depth of male and female zones was calculated in the three havelis (Table1) and the mean depth of each space calculated.

Table 01: Distance of Male and Female zones from the street.

Sl	Haveli	Distance of Male zones from street	Distance of Female zones from street
1.	Gul Ahmad Sethi	5 m	29 m
2.	Karim Buksh Sethi	3 m	26 m
3.	Abdur Rahim Sethi	5.5 m	24 m

Mean depth of male areas = 4.5 m, while the

Mean depth of female areas = 26.33 m.

This shows that on the average the travelling distance from the street to the female zones of the havelis was upto 6 times the distance to male areas (Fig 3).

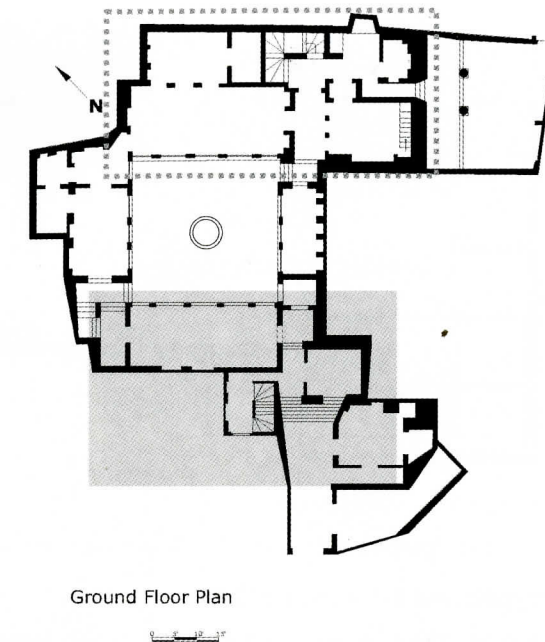


Figure 03: Plan of Karim Buksh haveli with gender zones; M (Shaded) F (dotted).

5.4 Responsiveness of Space to Social rules

Spatial connections of the male and female zones with the public realm and their interconnections can be studied to understand the degree of integration or segregation that a space has. This is studied in context of the following:

5.4.1 Degree of Control

The degree of control that one space has over another space, dictates the independence or interdependence of the latter. This can be expressed by the layout model of a house. There are generally two layout models of a house (Farah & Klarqvist, 2001 b). The first is the parallel model, which allows both genders to enter the house and have similar access to their spaces, the second is the sequential model where the female areas are accessible only through male areas and are set behind them (Fig:03 & 04).

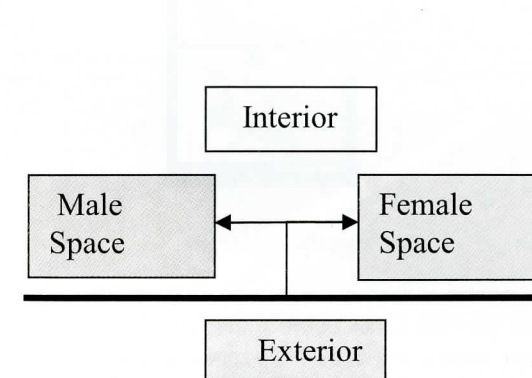


Figure 04: The Parallel Model

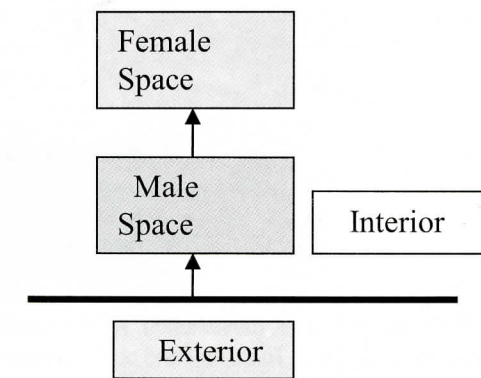


Figure 05: The Sequential Model

In all the Sethi havelis the layout follows the sequential model where all female areas are accessible by passing through the male areas. It shows that the male areas are more integrated with the public sphere, while the female areas are segregated and controlled via the male areas (Fig 5). This model also signals a more dominant position of the male gender (Farah & Klarqvist 2001c).

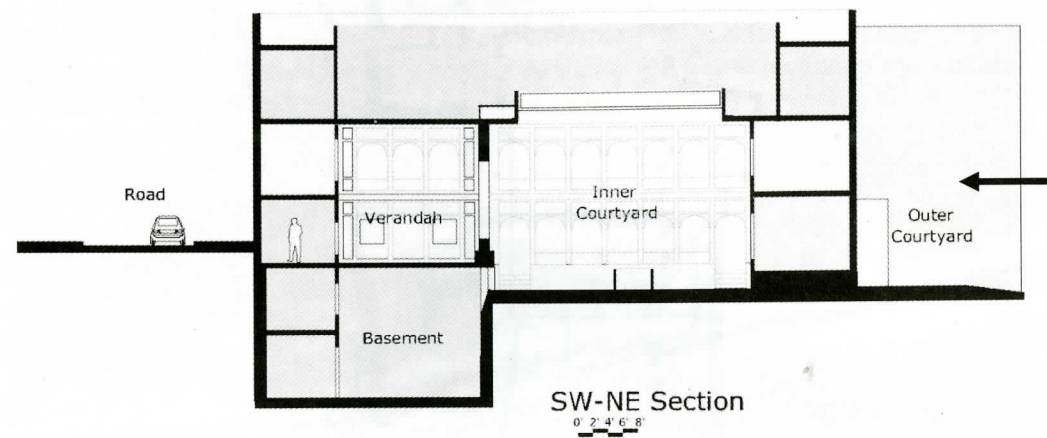


Figure 06: Section through courtyard of Gul Ahmad Sethi haveli, street entrance is from the right.

5.4.2 Social Interactions; Integration and Segregation of Space

The male zones lie between the female zones and the street. Most of the female zones are located on the top floors and had no direct connection with the street. The first and second floors of all adjoining havelis have connecting doors and all movement of women took place on these levels. The access between the female zones of different havelis was secluded (Fig.6) and above street level. An interesting and unusual practice of the havelis' design was the placement of the family's kitchen on the top floor and the construction of a large takht (bench) outside it. This indicates that socialization between women took place at the top level of the house. The chatty galli connected the women's zones of the Karim Buksh and Gul Ahmad Havelis.

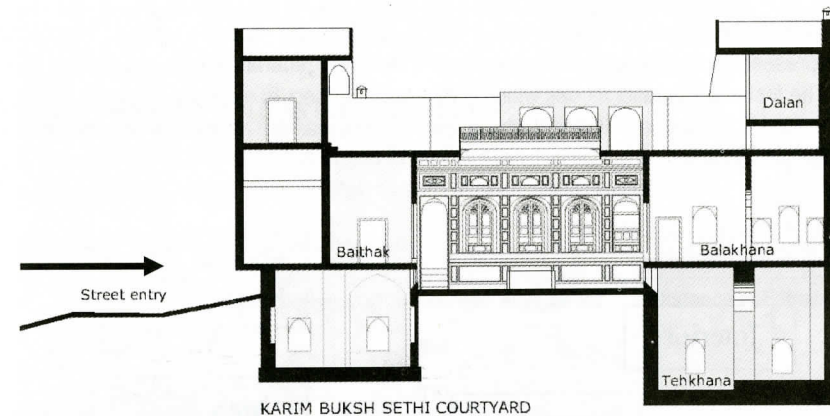


Figure 07: Street access directly into m (blue) and controlled access to f (pink) zones

The segregation of the gender zones (Fig 6) was horizontal and vertical. In the Karim Buksh haveli, there was segregated use of the two tehkhanas (basements). All the havelis placed the male zones between the street entrance and the zenana areas (fig 5 &6). The street and public domain was more integrated with the male zones, and were segregated from female zones, while all the private/female spaces were well integrated with one another.

5.4.3 The Aesthetic Quality of Space

The aesthetic quality of space is an important element indicative of its social value. Baithaks (Reception rooms) of the mardana quarter of the havelis were the most ornamental with naqqashi (fresco), aina-kari (mirror-work) and gachbori (painted and plain stucco) work. They had elaborate khatamband (marquetry) ceilings and Mughal chini-khanas (Fig 8). Their placement around the courtyard provided a cooler environment.



Figure 08: Interior of Male baithak, Karim Buksh Sethi Haveli



Figure 09: Kitchen and other service areas on top floor, Gul Ahmad Sethi Haveli

The kitchen and other utilitarian areas of the havelis were plain and unadorned. Their placement on the top floors, along with very functional structures exposed them to the extremes of the environment (Fig 9).

6. Conclusion

The study of the layout and design of the Sethi mohalla and its havelis reveal the creation of physical and visual barriers to separate gender based zones. The architectural design indicates the dominance of social values of privacy, male authority and female segregation.

The masculine zones are well integrated with the street and are placed between the public street and the private zenana, indicating the role of the male as protector of his realm. The women's zones are segregated from the entrance of the haveli and placed on the top floors, signifying that these are the controlled spaces. The integrated male zones have easy access to the street and the public realm; a place of exciting possibilities and independent decisions. Women's movement is restricted vertically and horizontally; they may only enter other women zones and never the public domain. The chatty galli is an iconic architectural mechanism of gender segregation of the Sethi Mohalla. This maintained the street level as a male domain by keeping women visually and physically absent from the public realm.

The aesthetic quality of spaces determines their importance within the spatial hierarchy. In the Sethi havelis, men had the power to control the production of the built environment and they controlled its subsequent use. The spaces men occupied were the most decorative and rich spaces of the haveli; the ornamentation of space attaches value to it and to its user. The better designed and decorated spaces of the mardana (men's quarters) indicates the dominance of the masculine areas over the plain, utilitarian feminine areas. The lack of ornamentation of the zenana areas suggests that the space is of relatively less significance, and reflects on its occupier as being the subordinate in social terms. The division of space symbolized the social position and control of men; it also underlines the powerlessness of women over their environment.

The spatial hierarchy of the Sethi havelis shows an order symbolic of the prevailing culture, where, women were constrained physically and socially inside gender based zones (Zenana). Patriarchal society used architecture to enforce the social order of empowering men, while rendering women powerless.

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Reducing carbon dioxide emission by the adoption of contemporary earth construction in urban Bangladesh

Mohammad Sharif Zami

Dr. Angela Lee

School of the Built Environment
University of Salford, Maxwell Building
The Crescent, Salford, M5 4WT
United Kingdom

E-mail: m.s.zami@pgr.salford.ac.uk a.lee@salford.ac.uk

Abstract

Stabilised earth is an alternative building material which is cheaper than conventional brick and concrete, and is also environmentally sustainable. Earth has been used as a construction material in every continent and in every age. The use of earth on site as a building material saves manufacturing cost, time, energy, environmental pollution and transportation cost. Most developing countries, in particular Bangladesh does not have any well structured and effective program to address the global agenda of environmental sustainability through the use of appropriate construction materials. In order to demonstrate stabilized earth as a sustainable appropriate construction material, the experiences and practices of using earthen architecture can be studied and harnessed from other countries to demonstrate the dynamism of this earth material suitable for construction in urban Bangladesh. This paper reviews and argues the environmental benefits (less carbon dioxide emission) of using stabilized earth as a building material and associated construction techniques for urban construction in Bangladesh. A critical literature review method was adopted in this paper to investigate how contemporary earth construction produces less carbon dioxide compared to the conventional brick and concrete construction.

Key words: Earth construction, sustainability, climate change, carbon dioxide emission.

1. Introduction

Cities in the developing countries have, since the 1950's, experienced unprecedented growth in terms of spatial development and population increase; urban population increase has particularly been high due to rural-urban migration (Dwyer et al, 1981; Mafico, 1991). Bangladesh is not an exception from most of the developing countries. The annual urbanisation rate of Bangladesh is 6% (Akbar and Ahmed, 2008) and this urbanisation is an inherent part of the process of urban economic and infrastructure development in Bangladesh. In 1981 the total population in urban Bangladesh was 14.08 million, which increased to 22.45 million in 1991 (UNEP, 2001). With increased urbanization, the number of building also increased rapidly which contributed more to air pollution and carbon dioxide emissions. According to Allinson and Hall (2007), it is estimated that the construction and the operation of buildings is responsible for around half of all global Carbon Dioxide emissions, thereby contributing the largest single source attributable to climate change. According to Ahmed and Hossain, (2008) air pollution is one of the major manmade environmental problems that have recently gained importance among environmental issues in Bangladesh and exposure to air pollution is the main environmental threat to human health in towns and cities. Therefore, a solution has to be found to provide sustainable solution to this air pollution which is 'eco'-friendly and will preserve the environment for future generations; because climate change has been described as one of the most important environmental issues facing world today. According to Barbosa et al (2007, p30), the use of unburned earth in construction will contribute to reduce energy consume, Carbon Dioxide emission, amount of residues and desertification process. A critical literature review method was adopted in this paper to investigate how the use of stabilised earth in the construction can potentially reduce air pollution and carbon dioxide emission in Bangladesh. The paper begins with demystifying climate change and describing current scenarios of conventional fired brick making in Bangladesh. The paper also describes the different contemporary earth construction techniques which is viable in terms of natural disaster and critically analyses the environmental benefits of earth construction in general.

2. Conventional brick manufacturing in Bangladesh and carbon dioxide emission

The total population of Bangladesh is 156 million (2006 census) and the area of the country is only 144000 sq. km (Ferdausi et al, 2008). Air pollution is one of the major environmental problems nowadays, especially for developing countries such as Bangladesh and brickfields have been identified as a vital pollutant source of the major cities of the country (UNEP, 2001, Ahmed and Hossain, 2008; Ferdausi et al, 2008). According to Ahmed and Hossain, (2008), numerous brick-making kilns operating in the dry season are one of the major sources of air pollution in cities and a significant factor is that brick kilns are usually clustered near big cities in different parts of Bangladesh (Figure 1). Every year more than 20 lakh (2 million) metric tonnes of low quality coal and 20 lakh (2 million) metric tons of wood are burnt in the brick fields along with tires and rubber in Bangladesh (BPPW, 2005). Therefore, the parts of the city in the immediate vicinity of the brick-field clusters have air pollution problems. Figure 2 shows a common scene of conventional brick making in Bangladesh, which is one of the major air pollutant in Bangladesh.

Moreover even under well-controlled processes worldwide, 0.2 microgram toxic equivalents of dioxins and furans are emitted as by-product into the air during the production of each ton of brick, which is very harmful for lives (UNEP, 2005). According to Akbar and Ahmed (2008), brick making in Bangladesh is an informal sector activity with more than a million people depending on it for their livelihood and it is seasonal, highly energy intensive, and a major source of GHG emissions. Total production in Bangladesh is estimated at 15 billion bricks annually, and given the extensive use of coal and wood in the industry, the GHG emissions are estimated to be 8.75 million tonnes of CO2 equivalent annually and demand for bricks is growing at about 5.6% annually, closely trailing the urbanization rate of approximately 6% (Akbar and Ahmed, 2008). Therefore, an alternative building material instead of fired brick is vital and the next section is going to analyse earth construction as an alternative solution in historical point of view.



Figure 01
Satellite image of the cluster of brick kilns near Dhaka City. Source: Ahmed and Hossain, 2008.

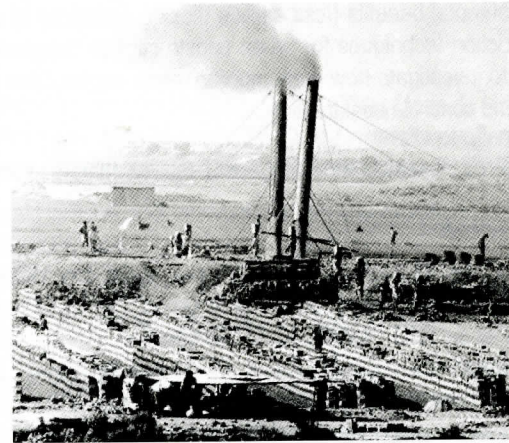


Figure 02
A typical brickfield in Bangladesh and air pollution. Source: BANGLAPEDIA: brickfield.

3. Earth construction in history

It is essential to look at historical evidences of success of earth construction. Earth has been the most basic building material since the dawn of man and rammed earth construction was first recorded by the Babylonians in 5000 B.C (Das, 2007). It is currently estimated that over one third (Dethier, 1981) to over one half (Smith & Austin, 1989) of the world's population lives in some type of earthen dwelling. The history of earth building lacks documentation, because it has not been highly regarded compared to stone and wood (Houben & Guillaud, 1989, p8). Archeological evidence shows, nearly 10000 years old of entire cities built of raw earth, such as: Catal Hunyuk in Turkey; Harappa and Mohenjo-Daro in Pakistan; Akhlet-Aton in Egypt; Babylon in Iraq (Easton, 1996, p3). "30% of the world's population, or nearly 1,500,000,000 people live in a home in unbaked earth. Roughly 50% of the population of developing countries, the majority of rural populations, and at least 20% of urban and suburban populations live in earth homes" (Houben & Guillaud, 1989, p6). Figure 3 illustrates the world geographic locations of where earth structure is used and Figure 4 shows the spread of different kinds of earth structure being used by different regions of the world.



Figure 03:
Geographic locations of earth structure.
Source: Houben & Guillaud, 1989, p6.

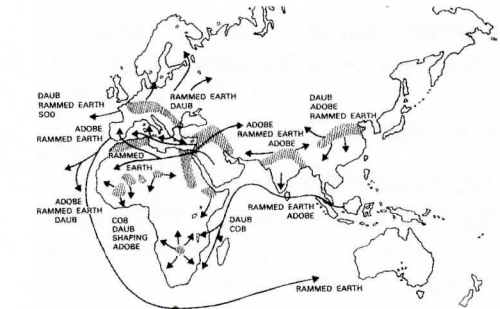


Figure 04:
Different forms of earth structure being used by different region of the world.
Source: Houben & Guillaud, 1989, p12.

In Europe, primitive dwellings were constructed of woven wood and clay evolving to un-burnt clay (Houben and Guillaud, 1989, p10). The un-burnt clay brick was jointly used with Tuff (hard volcanic rock composed of compacted volcanic ash), Gypsum, Schist, Marble and Wood. According to Easton (1996, p4), rammed earth construction was brought to the temperate regions of Europe by the Romans and Phoenicians. During the Roman Empire, houses were constructed using earth brick walls before stone replaced them for the rich, while the poor remained housed in buildings of earth until the time of Augustine who recommended the use of earth on a national scale (Houben and Guillaud, 1989, p11). Raw earth construction was not a forefront building method until the 18th century when an emerging use of cob, rammed earth and un-burnt brick could be observed and building with earth continued until the 1950s; there was a sudden increase in the use of the material after the Second World War, as the demand of housing increased due to war displacements (Houben and Guillaud, 1989, p11). According to Morton (2007, p377), traditional techniques of building with earth largely died out in the UK during the 19th century and despite this loss of traditional earth construction, there are estimated to still be 500,000 inhabited earth buildings in the UK (ICOMOS UK, 2000).

According to Denyer (1978), "earth architecture should not of course be considered a miraculous solution to neither all our housing problems, nor one which can be applied successfully anywhere, everywhere." Before any building is constructed with earth, it is essential to identify the soil to be used. The identification process involves various tests, which need the use of a laboratory. Apart from the laboratory identification process, local knowledge of the soil and traditional skills is necessary. Therefore, it is essential to analyze the contemporary stabilized earth construction methods. The following section is going to highlight on contemporary earth construction methods which can be applicable as a sustainable urban construction in Bangladesh.

4. Production methods of contemporary stabilized earth construction

Nowadays, stabilisation of earth is a very common modern construction method. Stabilisation is done in three ways, namely: - Mechanical, Physical and Chemical stabilisation (Houben and Guillaud, 1989, p74). Mechanical stabilisation involves the application of force directly on the soil by compressing or ramming, thus changing the density, compressibility, permeability and porosity. Physical stabilisation is the modification of the texture by varying the percentages of the mixed particles. Chemical stabilisation makes use of chemicals or other materials to modify the soil properties. According to Houben and Guillaud (1989, p163), the possible ways in which earth can be used as a construction material are very numerous. Among the most widely known and practical construction methods are rammed earth in formwork, and compressed earth blocks, which are produced in presses. Below are the brief descriptions of rammed earth (RE) and compressed stabilized earth blocks (CSEB) production methods.

According to Walker et al (2005, p2), rammed earth is formed by compacting moist sub-soil inside temporary formwork. Stabilised Rammed Earth is an alternative form of wall construction that uses the rammed earth technique, but includes cement, primarily as an additive to change the material's physical characteristics (Walker et al, 2005, p1). Walls are typically 300-450mm thick, but this can vary widely according to design considerations and requirements. Correct proportions of sand, clay, and water are mixed together and poured into the formwork in layers 100-150mm deep and compacted by ramming to the sufficient wall strength after which the framework is moved to another section of the wall, either horizontally or vertically, repeating the same process until the wall is finished. The soil is normally collected from the excavation and screened through a mesh to remove large stones and unwanted particles. The breaking down of small particles is necessary to ensure an even distribution of soil particles and in the case of clay soil; pulverisation

affords the opportunity to mix with a sand proportion to attain an ideal mixture. Soil mixing produces a homogeneous mixture of soil at which point a stabiliser is added. According to Lal (1995, p121), the exact quantity of stabiliser to be added depends on the type of soil and a rough guide under normal situation is as follows: - Sandy soil: 5% cement stabilisation, Clayey soil: 5 to 6% hydrated lime and 2% cement, Normal red soil with up to 25% clay: 2.5% hydrated lime. Figure 5 shows manufacturing process of stabilised rammed earth production in construction.

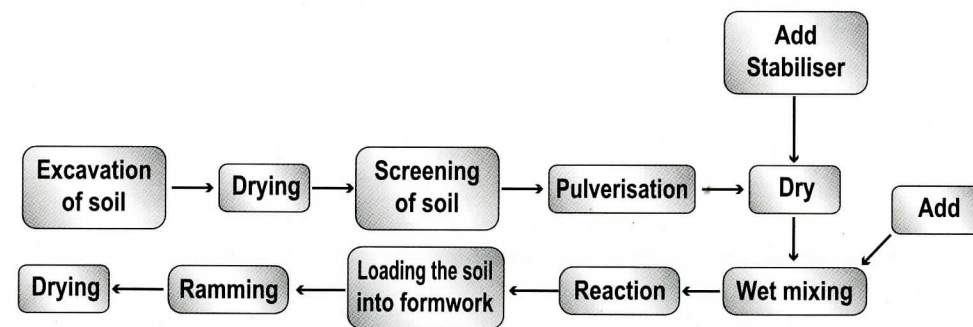


Figure 05: Production process of in situ stabilised rammed earth. Source: Zami and Lee, 2007

According to Walker, et al (2005), in recent years, in line with the general move towards off-site fabrication of building elements, prefabricated rammed earth has developed. To date, prefabrication has been used by only a very small number of specialist overseas practitioners (Kapfinger, 2001), and the wider use of pre-formed rammed earth is largely unproven in UK. The use of prefabricated rammed earth is likely to increase in forthcoming years. According to Rauch (2007), increasingly prefabricated rammed earth walls are – are completely or in segments – transported to the building site and installed with a crane. Examples to date include large load bearing wall (300-500 mm) blocks (Figure 6) as well as 100-200 mm thick cladding panels. In recent years, rammed earth has been used for a variety of innovative items of furniture (Figure 7), sculpture and utilities, including fireplaces, stoves and church altars (Walker, et al. 2005, p21), and toilet fittings (Figure 8) as well (Minke, 2007).

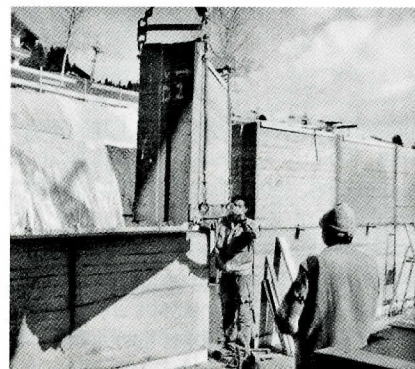


Figure 06: Prefabricated rammed earth wall. Source: Rauch (2007).

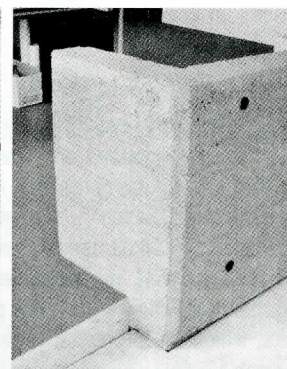


Figure 07: Prefabricated RE Office desk. Source: Walker, et al. 2005, p21.

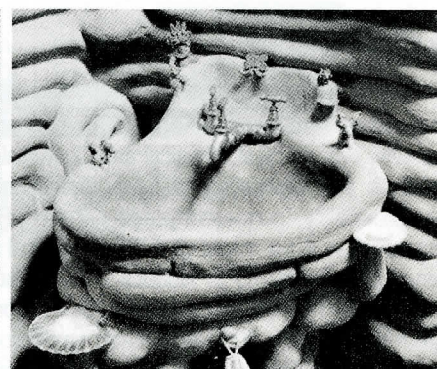


Figure 08: Wash basin from stabilised loam. Source: Minke, 2007, p17

Prefabricated rammed earth technology is really advantageous for developed nation. In the case of developing nations, particularly Bangladesh, transportation of prefabricated rammed earth segments might be impossible due to sophisticated nature of transportation, packaging and handling required. Besides, skilled professional and labour in the prefabricated rammed earth factory is essential to control quality of the product; which is not affordable by some of the developing nation, particularly Bangladesh.

Compressed stabilised earth bricks or blocks are becoming popular in various part of the world especially with the introduction of sustainable construction concepts and soil is the main raw material used in CSEB manufacturing (Jayasinghe, 2007, p252). Some of the process stages in the production and construction with compressed stabilised earth blocks are similar to RE. First, the subsoil is excavated after the removal of the topsoil. Soil for block making should be reasonably free from organic material (root, humus, grass etc.). The soil is then dried and pulverised. After pulverisation, the soil is screened so as to use particles no courser than 6 mm in diameter. Homogeneous colour is first obtained in mixing the dry components. Water is added gradually to the mixture to obtain a semi-dry blend reaching the optimum moisture content. Finally, blocks are made in a press machine; there are many types of presses, ranging from hydraulic, motorised, electrical and manual. The fresh blocks are stacked in piles up to one meter in height where they are cured in two stages. After moulding the blocks, they are maintained under humid conditions for 7 days and then exposed to air to cure for a further 21 days. Figure 9 shows the total manufacturing process of CSEB production.

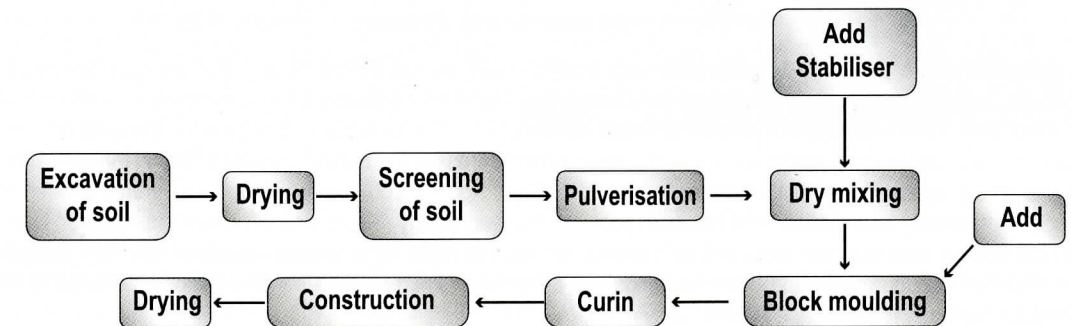


Figure 09: Production process of stabilised compressed earth block. Source: Zami and Lee, 2007.

5. Contemporary earthen architecture and natural disaster:

The above sections discussed the contemporary earth construction techniques in general applicable as an alternative solution to fired brick construction. But one may ask whether these alternative construction techniques are suitable in Bangladesh considering the natural disasters. According to Houben and Guillaud (1989, p 305), in 1976 alone seismic activity in the Philippines, Indonesia, Turkey, Italy and China caused the loss of more than 500,000 lives. Figure 10 shows the seismic areas of the world and part of Bangladesh is within seismic area. Figure 11 shows storm regions of the world and Bangladesh is situated within the storm area of the world. Flood is another form of natural disaster which causes many deaths and the destruction of human settlements every year. During the Honshu Tsunami on 15 June 1896, 26000 people were killed in Japan (Houben and Guillaud 1989, 324). Figure 12 shows the flood areas of the world in which it is clearly shown that Bangladesh is affected by flood as well. So, from the above discussion it can be posited that contemporary earth construction needs special consideration of natural disasters in Bangladesh.

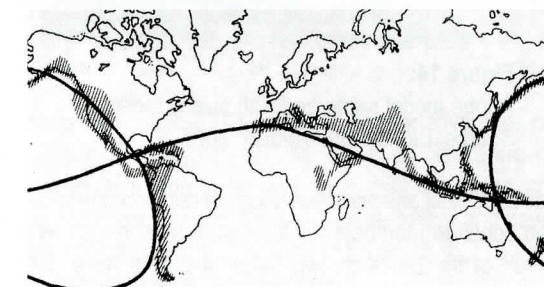


Figure 10: Seismic regions of the world. Source: Houben and Guillaud, 1989, 306.

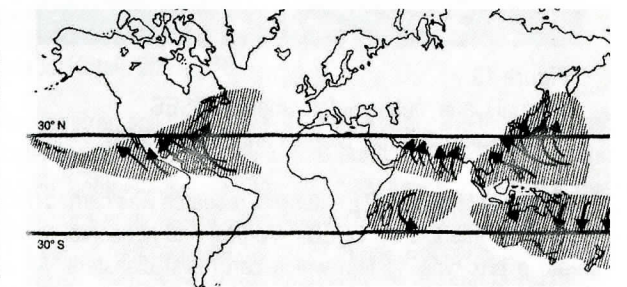


Figure 11: Storm regions of the world. Source: Houben and Guillaud, 1989, 320.

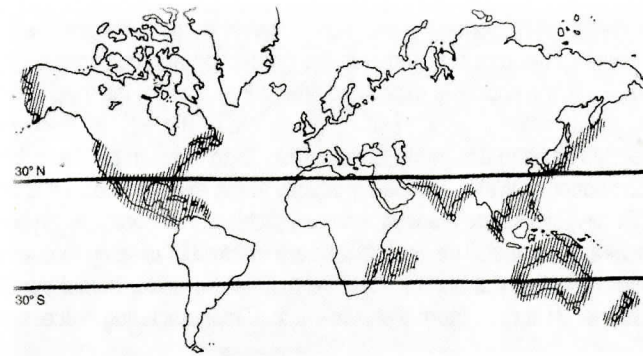


Figure 12: Flood regions of the world. Source: Houben and Guillaud, 1989, 324.

As discussed above, geographically Bangladesh is located in such a position that, flood and storm is a real threat to earth structure. A significant progress in research on disaster resistant earthen structure has been made recently which could be considered before the implementation of urban earth construction projects in Bangladesh. Bangladesh frequently faces natural disasters and contemporary earth construction addresses the natural disaster effecting the buildings, which is going to be explained this section. According to Blondet and Aguilar (2007), most vernacular earthen houses are built without professional intervention, and thus with poor construction quality. Besides most present day earthen houses are built without any structural reinforcement, with several stories, thin walls, large windows and door openings, irregular plan and elevation configurations and these buildings are extremely vulnerable and suffer significant damage or collapse during earthquakes (Blondet and Aguilar, 2007).

During last three decades, researchers at the Catholic University of Peru (PUCP) have attempted to find solutions for improving the seismic performance of earthen buildings (Vargas et al. 2005). The principal alternative solutions of seismic reinforcement for these vulnerable buildings are consisting of: internal cane mesh reinforcement (Figure 13), external wire mesh reinforcement, and external polymer mesh reinforcement (Figure 14).

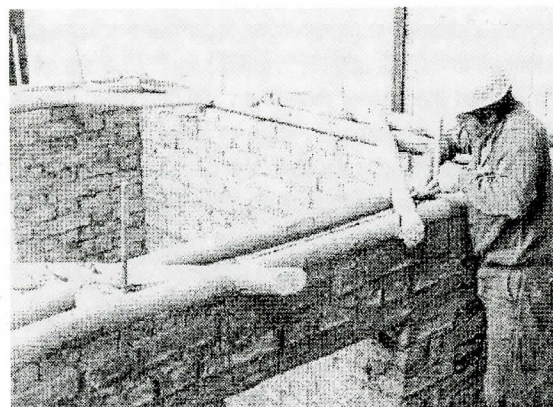


Figure 13: Internal Cane mesh reinforcement in CSEB Construction. Source: Blondet and Aguilar, 2007.

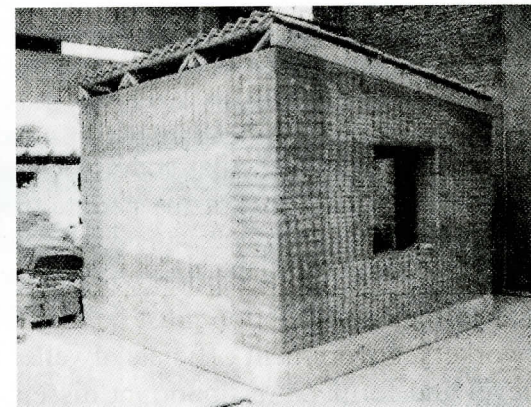


Figure 14: Adobe model reinforced with plastic mesh. Source: Blondet and Aguilar, 2007

According to Maini (2007), extensive research was carried out to develop cost effective technology of reinforced masonry with hollow interlocking CSEBs. Vertical and horizontal reinforced concrete members reinforced the masonry so as to create a box type system which can resist disasters. As a result of the research two types of blocks have been developed: the square hollow interlocking block suitable for two storied building and the rectangular hollow interlocking block suitable for single storied building. This technology has been used extensively in Gujarat for the rehabilitation after the 2001 earthquake with a six months technical assistance of Auroville Earth Institute and with this assistance the Catholic Relief Services built 2698 houses and community centres in 39 villages (Maini, 2007). According to Maini (2005), this technology has been approved by the Government of Gujarat (GSDMA) as a suitable construction method

for the rehabilitation of the zones affected by the 2001 earthquake in Kutch district (Figure 15), the Government of Iran (Housing Research Centre) as a suitable construction method for the rehabilitation of the zones affected by the 2003 earthquake of Bam (Figure 16), the Government of Tamil Nadu, India (Relief and Rehabilitation) as a suitable construction method for the rehabilitation of the zones affected by the 2004 tsunami of Indonesia (Maini, 2007)



Figure 15: Houses built by the CRS – Gujarat, India. 2698 houses built in a year time, in 39 villages. Source: Maini, 2005.

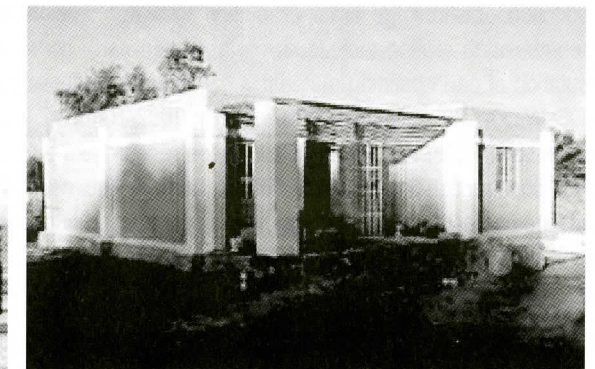


Figure 16: House built by the International Blue Crescent. Bam – Iran. Source: Maini, 2005.

According to Kotak (2007), there was a huge demand for houses to rehabilitate the earthquake affected families in Gujarat state (India) after 2001 Kutch earthquake. HUNNAR SHAALA Foundation for Building Technology and Innovations, Bhuj, India is a registered not-for-profit corporation who built several stabilised rammed earth houses for the earthquake affected families. There were two types of houses built in this rehabilitation exercise: - Circular (Figure 17) and Rectangular (Figure 18) stabilised rammed houses.



Figure 17: Circular house under construction in 2001 Kutch earthquake rehabilitation exercise. Source: Kotak, 2007, p71.

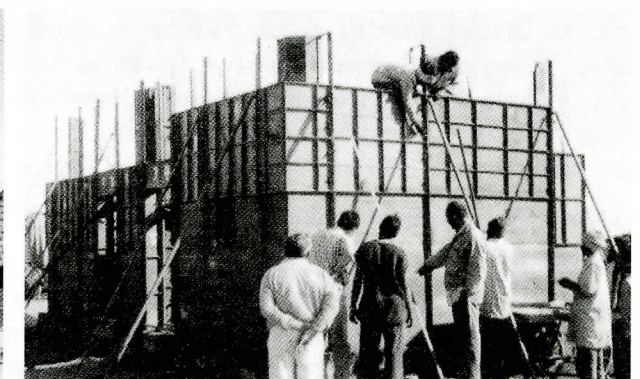


Figure 18: Rectangular house under construction in 2001 Kutch earthquake rehabilitation exercise. Source: Kotak, 2007, p70.

According to Lal (1995, p122), the major advantage of the stabilized soil block vis-a-vis the burnt brick is the significant saving in energy (about 70%) and such blocks are cheaper by 20 to 40% compared to burnt bricks. The pure mud constructions (un-stabilized) suffer from two major drawbacks: complete loss of strength on saturation and erosion due to rain impact; hence, the soils are stabilised and used for various engineering applications (Reddy, 2007, p194). In the case of urban earth structures of Bangladesh, flood and excessive rain could be the major threat. But cement stabilized earth construction can overcome the problem of structural failure due to flood or rain. According to Bui and Morel (2007, p113), in order to comply with the standards devoted to industrial materials, more stringent durability norms are expected from rammed earth. Several types of durability tests (i.e. spray and drip test, wet to dry strength approach, etc.) are proposed for earthen materials in general and rammed earth in particular (Heathcote, 1995). Since non-stabilized rammed earth could not pass these tests, it was systematically abandoned and replaced with stabilized rammed earth

(Bui and Morel, 2007). These statements of various authors (Lal, 1995; Reddy, 2007; Bui and Morel, 2007) support that the disadvantages associated with un-stabilised earth can be overcome by suitable soil stabilization. Therefore, the drawbacks of earth construction can be addressed and solved by different solutions invented in contemporary stabilized earth construction research and innovation.

Reduction of shrinkage cracks, solution to water erosion, enhancement of binding force, increasing compressive strength, earth roofing technique, prefabricated earth construction, strength against abrasion and increasing thermal insulation of earth building material is explained by different researchers, such as Houben and Guillaud, 1989; Minke, 2006; Walker, 2005; Raunch, 2007; Reddy, 2007; Barbosa, 2007 and Maini, 2005 and 2007 in their published books and publications (reference list) in detail. These researchers published several journal papers and handbooks on stabilized earth construction which cover how to address the drawbacks of earth construction. Furthermore, Ahmed (2005) published a handbook titled, "Design and construction of housing for flood-prone rural areas of Bangladesh", explains in detail about the flood resistant stabilized earth construction.

Therefore, natural disaster resistant contemporary stabilized earth construction is effectively solving the problems of natural disaster destructive to shelters all over the world in particular in India – a neighbouring country of Bangladesh.

6. Success of stabilized earth construction in India

Auroville is an international township under construction, located on the Coromandel Coast in South India. The Auroville Earth Institute in India is a research and training centre in earth architecture, and training courses have been conducted for the very onset and many technologies have been researched, developed and promoted under the supervision of the director Satprem Maini. This institute is the Asian representative and Resource centre for the UNESCO Chair "Earthen Architecture – Constructive Cultures and Sustainable Development". Since 1990, more than 4775 people from 50 different countries have been trained in Auroville and elsewhere in the world. According to Maini (2005, p5), cost is too often limited only to the monetary value and it is understandable and one can remember that in Auroville a cubic metre of CSEB (compressed stabilised earth block) is around 23.6 % cheaper than a cubic metre of country fired bricks. But the energy approach should be integrated: some studies have shown that, in the Indian context, building one square metre of masonry with CSEB consumes 5 times less energy than a square metre of wire cut bricks masonry and 15 times less than country fired bricks. CSEB are generally cheaper than fired bricks and this varies from place to place and specially according to the cement cost (Maini, 2005, p6). The cost break down of a 5 % stabilised block will depend on the local context and in India with manual equipment (AURAM press 3000), it is usually within these figures:

- Labour: - 20 - 25 %, Soil & sand: - 20 - 25%, Cement: - 40 - 60 %, Equipment: - 3 - 5 %.

Maini (2005, p6) further stated that, in Auroville, a finished cubic metre of CSEB wall is generally 48.4 % cheaper than wire cut bricks and 23.6 % cheaper than country fired bricks. The strength of a block is related to the press quality and the compression force, and to the quantity of stabiliser and this implies that to reduce the cost of a block one should try to reduce the quantity of cement but not the cost of the labour with unskilled people. One should also not cut down the cost of the press with cheap quality machines, which would not last long and would not give strong blocks.

According to Maini (2005), some studies have shown that, in the Indian context, building a square metre of masonry with CSEB (compressed stabilised earth block) consumes 5 times less energy than a square metre of wire cut bricks masonry and 15 times less than country fired bricks. Maini (2005) also stated that the compressed stabilised earth blocks (CSEB) are more eco-friendly than fired bricks and their manufacture consumes less energy and pollute less than fired bricks.

Energy consumption	Pollution emission
4.9 times less than wire cut bricks	2.4 times less than wire cut bricks
15.1 times less than country fired bricks	7.9 times less than country fired bricks

Table 1 shows a comparative analysis of energy consumption and carbon dioxide emission of four types of building material. According to the numerical data shown in Table 1, CSEB consume the lowest energy and lowest carbon dioxide emission if compared with Wire Cut Bricks, Country Fired Bricks, and the Concrete blocks.

Product and thickness	Number of units (Per square metre)	Energy consumption (MJ per square metre)	Carbon dioxide emission (Kg per square metre)
CSEB – 24 cm	40	110	16
Wire Cut Bricks – 22 cm	87	539	39
Country Fired Bricks – 22 cm	112	1657	126
Concrete blocks – 20 cm	20	235	26

Table 01: A comparative analysis of energy consumption and carbon dioxide emission of four types of building material. Source: Maini, 2005.

Beside the low energy consumption and carbon dioxide emission, contemporary earthen structures proved adequate structural performance and aesthetically beautiful compared to fired brick construction. According to Maini (2005), The Visitors' Centre (Figure 19) of 1200 square meter was the starting point of the development with earth architecture in Auroville and it was granted the "Hassan Fathy Award for Architecture for the Poor" in 1992. CSEB was used to construct this visitor complex. To date, Auroville can show a wide variety of earthen projects: - public buildings (Figure 20 and 21), schools (Figure 22), apartments (Figure 23) and individual houses (Figure 24).



Figure 19: Arches of the Visitor's Centre at Auroville, CSEB Technology. 1992 Hassan Fathy Award for Architecture for the Poor. Source: Maini, 2005.

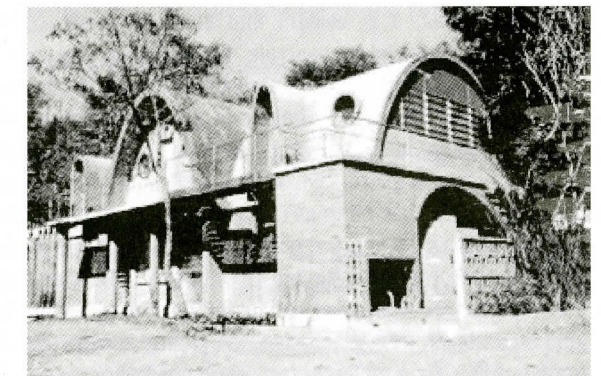


Figure 20: Training Centre at the Auroville Earth Institute, Various vaults with stabilized earth waterproofing. Source: Maini, 2005.

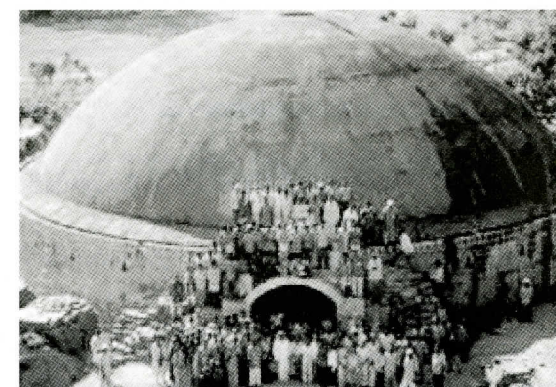


Figure 21: Dome of the Dhyanalagam temple near Coimbatore, 22. 16m dia, 7.90m rise, 570 tons – Built in 9 weeks. Source: Maini, 2005.

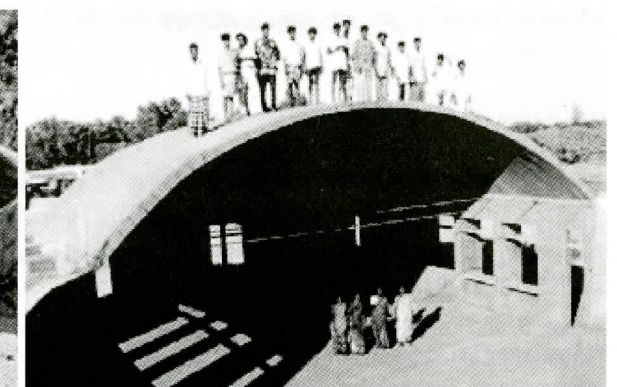


Figure 22: Vault of Mirramukhi School at Auroville, CSEB. 10.35m span, 2.25m rise, 30 tons – Built in 3 weeks. Source: Maini, 2005.



Figure 23:
Staff quarter of the Health Centre. CSEB Technology. Source: Maini, 2005.

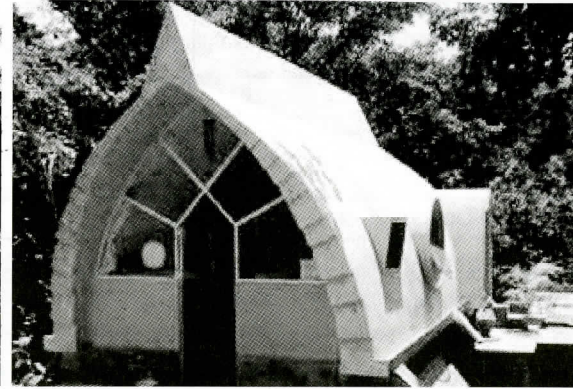


Figure 24:
House at the Auroville Earth Institute, 3.60m span, Built in 36 days. Source: Maini, 2005.

7. Conclusions

It is notable from this paper that there has been increasing levels of Carbon Dioxide emission due to the unplanned brick manufacturing in Bangladesh contributing to the severe air pollution, which will in some way affect every individual person. Besides, it is evident that stabilized earth construction is environmentally sustainable compare to the conventional (fired brick, concrete, etc.) building materials and would be appropriate in the case of urban building construction in Bangladesh. Promotion and implementation of earth as an alternative urban construction material is worthwhile and significantly helpful in achieving environmental sustainability (less fossil fuel is used, therefore, less carbon emission). It is also notable from this paper that stabilization of earth doesn't only mean the cement stabilization. There are other stabilizers which is more environmentally sustainable than the cement stabilized earth. It is possible to use un-stabilized raw earth as rammed earth or compressed earth blocks; this paper described why the stabilized form is more suitable for the Bangladesh context in terms of overcoming the Natural disasters. The only challenge that prevents earth becoming the preferred choice of building material amongst the general population is the acceptability of this material. An awareness and understanding by people to environmental issues such as air pollution, deforestation, land degradation, climate change and energy conservation would help them change their attitudes and views towards earth building. As a matter of fact, earth building conserves energy during construction or during other lifecycle stages. Rammed (Stabilized) earth construction, due to their low thermal conductivity and higher thermal mass as opposed to conventional Brick-Block or RCC construction, is more thermally comfortable. Hence, it consumes less energy during operation. Operational energy use is important to tackle/mitigate the impacts of climate change. It is generally accepted that if lifetime energy consumption of a building is 100 units, approximately 15 units are consumed during construction and the rest 85 units are during operation. This is why, tackling operational energy use is essential for ensuring energy security of a nation as well as to reduce CO₂ emissions from buildings. Besides, in earth construction individuals and community as a whole can easily participate in building their own homes in affordable ways addressing their moral obligation to climate change.

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Sustainable Housing and Role of the World Bank

Mahbubur Rahman

Professor, Universiti Teknologi Malaysia,
Kuala Lumpur 54100.

Email: mmrahman417@gmail.com

Abstract

Squatter settlements provide housing to 30-70% of the urban population in many developing countries. They have grown in size due to widespread poverty and inadequate housing finance and land development systems. Governments mostly assisted by the international aid agencies have improved environment, tenure security, income and resources in many such settlements. Yet the problems persist as benefits did not multiply due to lack in institutional development, policy implementation, governance, participation etc. The squatter dwellers' ability to bring affordable and sustainable solutions was ignored too. This paper discusses the changing approaches to the issues of low-income groups housing worldwide in the above context. The role of the World Bank in setting the core themes and its support for the low-income groups housing in the developing world is particularly examined as to their effect on policies and solutions.

Key Words: Housing Policy, Self-Help, Squatter Settlement, Sustainability, Urban Development, World Bank.

1. Introduction

Rapid urbanisation is a critical phenomenon transforming the developing countries, and hence needs to be managed. Now there are more people living in the urban areas than in rural. The recent appreciation of the growing importance of the cities in the national economies recognises dependence of development on the ability of the urban centres to meet the essentials like housing. A rising standard of living and political ideologies increasing the awareness of human needs and social values, forced the governments in the developing countries to intervene in housing provisions. The Habitat Conferences too endorsed such roles of the governments.

Number of squatter settlements with substandard housing in many developing countries is increasing due to abject poverty and inadequate systems to make resources like finance and land available at affordable prices to the low-income groups. Despite the efforts by most governments, aided by the international agencies, the problems persist as project-based benefits did not multiply. There were lacks in areas of institutional development, policy implementation, governance, participation etc. Yet, the strength of the squatter dwellers in bringing solutions within their affordable means was ignored. This paper discusses the changing approaches to the issues of low-income groups housing worldwide in the above context. It was mainly the World Bank, among other international bodies, that influenced housing policies and solutions in the developing countries, and hence many of the failures could be ascribed to the failure of the approaches by the Bank. The Bank was aware of it, and reviewed and revised the effects of its policies from time to time.

This paper shall review the changing approaches to the housing of the low-income groups in the developing countries, brought by the policy orientation of the World Bank, and will explore a more economically and socially sustainable approach.¹

2. Housing policy and practice worldwide

International agencies were involved in the conception and formulation of housing policies and projects in various developing countries. Among others, the World Bank's influence has been stronger due to its ability to dictate policies and strategies in the developing countries through large loans to urban and housing programs (Pugh, 2000). It has led its low-income housing thrusts in three main phases (1972–82, 1983–93, and post-1993; Pugh, 2000). Self help housing

1. The dimensions of sustainability are often taken to be: environmental, social and economic, as the three mutually reinforcing pillars (Serageldin & Steer, 1994). The model has been criticised for not adequately showing that societies and economies are fundamentally reliant on the natural world. Therefore, economy is taken as a component of society, both bounded by, and dependent upon, the environment. Porritt (2006) seeks to establish the values and direction needed to achieve sustainability: "We must join together to bring forth a sustainable global society founded on respect for nature, universal human rights, economic justice, and a culture of peace."

advocated in the 1960s by Abrams (1964) and Turner (1967, 1972, 1976) influenced the low-income housing theories and policies for decades. Leading the UN missions to developing countries in the 1950s, Abrams (1964) brought the gross housing shortages and huge squatter settlements lacking in basic utilities in the growing cities in those countries to the notice of the world. He suggested using in situ slum upgrading and incremental building in order to reduce the shortage.

Turner's advocacy of sites and services and slum improvement schemes had a human side. With Latin American experience, he identified self-fulfilment of the slum-dwellers and their commitment to housing, expressed through aesthetic marks on the shelters (Pugh, 2000). 'Freedom to build' or 'housing is a verb' emulates a process, not the product, and endorses people's capability to participate. Turner found that households given a scope, would gradually improve their housing with resources they can master. Such incremental upgrading was more sustainable compared to public housing, which is mostly subsidised and often does not reach the target group (Rahman, 1999, 2004). A loan from the Inter-American Development Bank loan for a post-earthquake housing scheme in 1958 in Peru gave Turner a chance to implement his ideas, which was then adapted by the World Bank in the 1960s.

But in next decades, low-income housing moved on from a focus upon self help of Abrams and Turner to a development of the housing tied to the urban development sectors (World Bank, 1993; Kessides, 1997). The World Bank gradually started to encourage more involvement of the private sector entities and the non-government organisations (NGOs). Yet the main theme of Turner's ideas remained valid in the broader context, extended into the 'brown agenda' of the Rio Conference that laid down guidelines for sustainable urban development. This was followed by UN calling the local governments to mobilise their communities for broad-based, participatory environmental improvement.

The 1976 Habitat Conference advocated a large-scale intervention by the government in housing resources like land and finance which are beyond low-income group's reach. A new approach to environmental planning and management 20 years later supported the involvement of stakeholders like government agencies, business, professionals, and representatives of communities, identifying feasible priorities and transforming them into action plans, through public-private partnership. Hence the developing countries were directed to create urban environmental institutions, and increase stakeholders' capacities. However, these could only be sustained by making the economy, environment and society parts of an overall development (Barbier, 1988). In reality project-oriented housing theory, practice and policy remained strong throughout the 1970s and later due to available funding, and short-term benefits satisfying all (Rahman, 1999). Meanwhile, squatters transformed themselves by organising self-help homeownership in many places, often militantly, for example in Latin America and South-East Asia.

Support of the World Bank and other international agencies for sites and services and in situ slum upgrading projects in the 1970s was based on the principles of affordability, cost recovery, and replicability (Choguill, 1987). According to these, capital costs were to be based on the target group's ability to pay, not set by planning and design ideals, though the poor leave only the residue for housing to which they attach lower priority as food takes up 65–85% of their income (Rahman, 2004). But cost recovery formula followed conventional economics where all components had to be repaid according to the Bank's imperative of ensuring recovery of the international credit and make proper economic and social use of the grants (Rahman, 2004; Pugh, 2000). Successful projects could be replicated in similar contexts elsewhere (Choguill, 1987; Pugh, 2000). But Pugh (1990) and Nientied and van der Linden (1985) identified that in reality the costs were seldom recovered; sites were often remote from employment opportunities; institutional capability to implement and monitor was weak, corruption was common; and the projects scarcely led to citywide housing reform.

By the late-1980s, the Bank realised that institutional reform and support had to be placed through urban policies and full programs so that those could be sustained, rather than being founded on isolated projects that could not be scaled up (World Bank, 1983). As the World Bank (1993) recognised that the self-limiting site-based projects could not bring the socio-economic development of the entire urban areas, it was ready to reorient its policies. It also found alternative ways of housing involvement by building and channelling funds through structured finance and purpose-built agencies. This could disburse funds faster, reach target groups better, and increase recovery through small groups (in countries with developed housing finance).²

2. In Bangladesh as international grants were pouring in after the floods of 1988 and 1989, the government established a Foundation to disburse and monitor fund. Before that such fund was forwarded through the central bank. Similarly, an allocation of US\$ 250 million by the World Bank in 1988 in India helped the Housing Development Finance Corporation to extend its credit coverage down the income ladder and stimulate local institutions. With another innovative Bank loan, Chile introduced housing vouchers for low-income housing.

Thus the World Bank gradually reduced its involvement in sites and services projects towards the late-1980s, except indirectly where central banks on-lent funds through specialised institutions, or through the NGOs and CBOs, into social housing programs with self-help components, concentrated more on policy and structural reform. The squatter upgrading continued in a different path, for example in Brazil.³ Some of the in situ slum upgrading programs were implemented by retaining more than 85% of the self-help housing units by reorganising the lay-outs through participation, e.g. in Indore.

The projects ensured financial sustainability by setting target according to affordability, and hence met the Bank's imperative of proper fund utilisation and cost recovery. Moreover, the municipality-owned programs divested responsibility for maintenance, cost recovery and social effectiveness through the participation of beneficiaries' groups, ngos, CBOs, etc. Thus compared with the older shelter-oriented approach, the new approach emphasised on institutional reforms and development, creating a basis for future reorientation. However, because of weak security markets in many developing countries, funding through the local bodies proved effective.

Lastly, in the early-1990s the World Bank reformed its housing strategies taking lessons from its past that ignored the role of comprehensive housing in socio-economic development (World Bank, 1993), and did not address the issues of subsidies, poverty, and land policy. Moreover planning and building regulations based on western ideals were inhibiting a proper expansion of the housing sector, extension and remodelling, employment generation, etc. in the developing countries. The Bank took a holistic approach to further develop the finance systems, improve the backlogs and infrastructure, reform negative land policies, introduce financial transparency to accelerate supplies in low-income housing, increase competitiveness of the construction industry, provide subsidies only to the needy, and establish/reform institutions (Pugh, 2000).

This recognised housing as productive item, which multiplies employment and generates income.⁴ More significantly, the Bank promoted the idea of 'enablement' through the creation of congenial legal, institutional, and financial frameworks to enhance economic efficiency and social effectiveness. By 1995 besides encompassing institutionally-loaded reform, enablement put governance into focus in all development agendas and state-market-society relations, as it was evident that benefits would not be possible to sustain without good governance (Rahman, 1999). This encouraged the community-based participatory elements in upgrading the squatter settlements.

For developing enablement, emphasis was given on technical know-how, available resources, inclusive participatory approach among various stakeholders, capacity of the development agencies, and recognition and defined responsibilities of all. An underlying socio-economic rationale could guide the roles of each partner in the multi-level environment where firms would contribute efficiency and entrepreneurship; community-based organisations would mediate between households and authorities; public bodies would provide management expertise; and participants would provide finance, self-help resources, and local context in the upgrading efforts. These represented a complex process that risked failure, out of institutional incapacity, politicisation of the process to serve narrow coterie interests, corruption, and market manipulation by firms.

The idea of enablement was relevant to new housing too, where a multi-level framework could facilitate adequate supplies and access of the builders to competitive development funds. Proper land policies co-ordinated with the service agencies could make well-placed serviced land available at reasonable price. The legal system could safeguard the housing and other rights of the low-income group; finance institutions could provide funds and cover various risks. The socially relevant and sustainable policy and enablement framework could have pro-poor and egalitarian elements. Thus sustainability was brought through enablement in the sites and services schemes in India, and in the small loan program in Sri Lanka (Pugh, 1997), particularly achieved by Chile, Hong Kong or Singapore that already had various institutions.

3. In 1983–88, several Brazilian municipalities agreed to participate in Parana Market Town Improvement Project to create a fund based on a seed fund from the World Bank. The terms required to recover the cost through skilled management of the transactions. However, the municipalities and households could have their own sub-projects, and select price according to need, priority and affordability through participation.

4. Hitherto with 7:1 capital-output ratio, housing investment did not contribute directly to the growth of output or foreign exchange earning. Sectors like agriculture or industry that created employment and added value received priority. Apart from the social benefits, effects of housing multiply through the generation of production, income, employment, savings and consumption (Burns & Grebler, 1977). Its true importance is greater as self-build and independent contractors' activities are often under-reported. Subsidised housing and implicit rents of the owner-occupiers also enhance the claim. While investment leads to increased output of labour and added investments in non-housing elements, it does not reciprocate significantly in low-cost housing, though it makes under-utilised labour productive at low cost (Raj & Mitra, 1990). As low-cost housing has low import requirement, incremental investments generate a higher domestic multiplier than import-sensitive investments (UNCHS, 1995). The price elasticity is thus higher in housing services than in the dwelling as a capital good alone.

Most other countries experienced gaps, inadequacies, and institutional incapacities due to the less-developed institutions. As a result squatter settlements continued to grow, occupying a good part of total housing in many cities in the developing world.

The World Bank's recent thoughts on development policy were based on presentations to its Board by Stiglitz (1998) and Wolfensohn (1999), who broke away from the concept followed by many developing countries favouring economic stabilisation through export-led growth, and market liberalisation. Besides including the significance of poverty alleviation and environmental issues, these were based on macro-economic stabilisation and market-led development of the early-1980s. Lacking a broad basis in the socio-economic development politics and limited due to the market-led approaches, the drawbacks of such approaches were exposed in the Asian financial crisis of 1997-99.

Stiglitz, a Nobel Laureate, favoured medium-term strategic development policies to alleviate poverty and make socio-economic transformation. He emphasised on holistic societal changes that could be understood specifically as the transitions interrelated the urban, environmental, and health dimensions, and the changing volumes and characteristics of poverty. In overall context, such development policies could use transitions in varying emphasis on different sectors based on the context-based realities of socio-economic opportunities. The Bank emphasised on urban issues in the late 1990s to enhance and sustain economic growth and modernisation. Thus improvement of living qualities, poverty reduction, environmental sustainability, and agglomeration of economies were the strategies for a proper urban development (World Bank, 1999), which prioritised finance and management to squatter settlement improvement.

3. Economics of squatter settlements

Jimenez (1982) showed the economics dynamics of self-help housing that produces individual and collective assets in the stock. Changes in wage rates in the formal sector directly influence the availability of unpaid self-help labour, and reflect competitive options and better uses of time. However, self-help is regarded as implicit saving and investment, which creates a social asset. Even after a house is constructed, its value continues to accumulate through use and rent. Rooms added to a house can be a source of income too – rented out or used as a workshop for mainly informal sector activities (Rahman, 2004). Moreover, low-income settlements provide a pool of labour for urban economic and infrastructure development.

Upgraded squatter settlements with improved environment multiply many economic, health, and social benefits accruing to the residents.⁵ During investment appraisal, the value of a demolished property is often added to the cost of an urban renewal project, and even in sophisticated costs-benefit analyses. Yet, each investment appraisal would have to address the particular circumstance of a squatter settlement and its comparative redevelopment and rehabilitation options.⁶ Pugh (2000) supported rehabilitation by incremental improvement as a better alternative in the developing countries. It provides for an extended life where the existing structure has a real value, the rental differences between old and new buildings are narrow, and the rate of interest and the cost of redevelopment are relatively high.

When the whole housing process is considered, such incremental rehabilitation reduces initial cash requirements for (re)building, perhaps in exchange for social obligations to be met over a long time. Benjamin and McCallum (1985) found that a self-building family can reduce capital requirements by half. The vast majority of such houses is built gradually as communities take shape, needs are felt, and money becomes available (Angel & Benjamin, 1976). Also to be noted that the lower income people can live in unfinished shelters until resources to improve are available in small amounts from time to time.

Financing and resource gathering in self help housing has its own characteristic. The sweat equity of self build management of the process that often replaces up to a third of the labour cost (Payne, 1983),⁷ and saving through

5. Improved housing lowers work absenteeism and incidence of social deviation, raises level of health, increases labour and educational productivity, absorbs surplus labour, and reduces traffic congestion and commuting expenses (Burns & Grebler, 1977). The individual and social returns of improved housing were evident in increased land values, raised incomes, better health, and skills upgrading in training and gender programs in an Indian upgrading scheme (Abelson, 1996), which distributed benefits of the increased land values to households by regularising tenure. While average incomes among the project households rose 50% during 1988-91, the value of housing and land rose 82%, reflecting their increased economic efficiency and social effectiveness.

6. For example, Needleman (1965) adapted the appraisal formula to take account of the variable needs of public policy, including area rather than single property analysis, variable densities, and different forms of redevelopment.

7. Materials cost is reduced by often using recycled items in the informal sector. Family labour is usually free, and skilled labour can be bartered for. In lower-income housing, 35% labour is self-help; another 60% is semi-skilled (Gerrul, 1979).a

participatory environmental improvement, can reduce the finance cost (Pugh, 1994). While incremental building and improvement distributes the affordable consumption and saving over time, formal long-term finance may only be required to afford higher standards. But wisdom of formal sector finance is not based on the needs of survival and flexibility of the low and intermittent income patterns of the poor (Smets, 1999).

Moreover, the private sector financiers often make tight and infeasible demands for collateral, and their costs and profit structures favour economies of scale and low credit risks, which screens out the poor. Repayment spread regressively with no grace period cannot secure cost recovery in low-income housing (Pugh, 1990; Smets, 1999; Ward, 1984). In this regard, the informal money lenders cater for the needs for flexibility and economy in the shorter planning horizons of the poor, featured by small budgets and survival strategies (Pugh, 2000).⁸ Organised community self help in micro finance has often been successful in stimulating savings and investment, with social co-operation and peer control providing a financial sustainability, e.g. for the Grameen Bank (Rahman, 1999).

4. Process cost, tenure security, and sustainability of improvement

Lower income dwellers can house themselves in an acceptable way for much less than either the public or the formal construction sector cost, in some cases for as little as 25% (Benjamin & McCallum, 1985). Moreover, the type of dwelling that results from people housing themselves is often more suitable to the socio-cultural and economic needs of the lower-income people (Turner, 1976), and hence is sustainable. For the lower-income family the building of a house is an apocalyptic event. Even with humble result, it is an occasion for marshalling all the physical and monetary resources, collecting all debts, and calling upon the community and the family for assuming new debt and obligations. Extended over time, it is the beginning of a longer commitment of constant improvements, additions, and cooperation.

The first way of building low-income and low-cost housing is self-built used by the poorest families in the informal sector, usually with as many family members as can be co-opted for the occasion. However, the middle and upper-income groups use self-management more, where the skilled crew and hired labourers do most works. The procedure works well with incremental process too. The least common way is by the small contractor used by the wealthier people, who have difficulty in raising fund to cover the construction on their own or keep competent track of materials and labour.

Tenure prospect motivates the residents, and dynamically changes the type and expression of built form in squatter settlements. Along with extending their shelter according to need and affordability, they also mark own identity and taste on it. Such improvements in aesthetics and amenities take place due to feeling for the home and its location, perceiving the improvements as a part of wider resident activities in localised sustainability. Although literature is found on the resourcing and organisation of improving infrastructure and making personal investments to squatter houses, little has been discussed on enhancement of aesthetics and cultural amenities.

Marcus (1995) testified to personal meaning attached by the residents to their home that leads them to improve design and express the meanings. Turner suggests that the aesthetic elements marked by the low-income people represent a commitment to home; the personalised expression is seen where occupancy rights are secure or regularisation of tenure is foreseen (Rahman, 2004). More of these can be found if it takes place over a very long period (Pugh, 2000).⁹ Expression of local culture, environmental change, and design and construction knowledge in such settlements show colour, adaptability, and space for rituals and festivals; these create specific and varied living environments (Rapoport, 1988). Designers and planners could devise strategies from these spontaneous, open-ended, multi-sensory, and semi-permanent settlements adding on elements.

Even a make-shift shack is an outcome of rational thinking within available limited resources, and therefore is 'architectural' same way as a 'designed' building. It also reveals beliefs, aspirations, and the world-view of the dwellers, simultaneously impacting the political, the visual, and the cultural. Squatter settlements can be seen as aesthetic output by some, or as eyesores to be demolished by others, like the city authorities who loath such view (Peattie, 1987; Rahman, 1995). Thus perception and images have influenced housing policies and actions, including the destruction of communities. However, international policies now favour improvement and regeneration, not eviction. The self help and the modern technology can stand next to each other with reasoned acceptance of both in cultural-aesthetic form.

8. Public effort could expend in the unorganised money market that has a strong presence in Asian countries, which could be utilised in a productive manner only by linking that to the organised market. Even though a large part of it is needed in agriculture, there is always a potential surplus that can be channelled to use in housing.

9. For example, *San Miguel*, Mexico, or *Klong Toey* squatter settlement with 70,000 families in Bangkok's Port Authority land.

Spontaneous and informal settlements are necessary; with importance of the product, process and use in built form and socio-economic evaluation (Kellest & Napier, 1995). The people living in these settlements are set in specific institutional conditions and processes that determine their housing and social status, providing contrasting examples.¹⁰ Thus intricacy, variety, accomplishment, and resource efficiency in squatter settlement and built form are simultaneously social, cultural, economic, political, and architectural (Pugh, 2000). Cultural heritages and sustainability have been expressed in the living conditions of the world's poor amidst squalor and disease. Their housing, the locales for the life's drama and human contributions of millions in enormous urban and socio-economic transformations, will remain a dominant form of dwelling on a world scale for many decades.

5. Concluding discussions

The self-help housing, spontaneous and mainly outside the formal realm, remained an important part of the housing policies in the developing countries in last 50 years. Varying in terms of theoretical, economic and technical characteristics, and in their role in overall housing, urban and environmental policy had to traverse long till implications of such housing in the developing countries were recognised (Lawrence, 1997; Lirig, 1997).¹¹ There already were assisted self-help housing programs in India (1950s) and Kenya (1960s), before strong advocacies by Abrams, Turner and other contemporary housing experts influenced the World Bank and of other funding agencies later to support such approaches. Experience and periodic reviews enabled the Bank to change its focus from site-specific projects, to programmatic approach mediated through formal institutions, and subsequently to new directions in developing policies, governance, cooperation and participation.

'Good practice' examples can be found among the squatter upgrading schemes.¹² These also add economic and aesthetic value to urban assets. Though the roles of individuals and households could be described by self-help, household economics, affordability, and home sense, researchers dominated by the economists were interested only in market exchange value, the design and impact of subsidies, or social questions of poverty and inequality (Pugh, 1997; Stretton, 1976). They ignored capitals of the low-income families like resources, time and energy used for home building, domestic chores, income generation, housing and environmental improvement, human capital formation, and use of time in personal and community activities as a socio-economic asset. Most of these, e.g. the value of the product and human capital formation, including the value of time and equivalent market products, and attribution of childrearing in human capital formation, are measurable, and thus could add to the economic significance of self-help incremental housing.

Self help, central in socio-economic, political, environmental and developmental sustainability, goes beyond the construction and management of housing and the local environment. The domestic sector is generally sustainable for its use of own resources to produce home-based goods and services, and less dependence on imported materials and technology. Further human development of the sector depends on access to state services and the security of a safe and healthy environment. Thus the domestic, commercial, and the public sectors are interdependent in bringing overall socio-economic development. This raises the importance of domestic economics in sustainable development through affordable housing and environmental improvement that also supplements other areas by contributing to the human and labour development. Thus sustainability cannot be fully accounted and understood without considering the domestic sector. Furthermore, retention and regeneration of squatter settlement would not succeed if isolated of the other areas of development.

The upgrading of squatter settlements is not an option that is well-established. Though any community has a right to improve its settlement, the professionals and participatory processes hardly concur to make that happen.¹³ Social homogeneity, good community leadership, social co-operation experience, visible tangible outcome, and prospective ownership can often help to achieve consensus on housing improvements (Rahman, 1999). Stable growth of income,

10. The gradually transformed and consolidated *Santa Marta* settlement, Colombia, is recognised and accepted into the formal sector. In Durban, spontaneous settlements are juxtaposed near formal settlements, being impermanent and temporarily linking kith and kin.

11. Self-help construction existed in old civilisations, e.g. in Rome, medieval Europe, and in early periods in the developed countries. Murals in Pompeii on self-help housing have become part of housing folklore. The Swedish 'magic house' was built by households in their free times, while the local government provided land, materials and technical advice. In Sri Lanka, self-help housing was the norm in urban settlements 2,500 years ago.

12. Cross-subsidisation in land pricing and plot allocation enabled sites and services and squatter improvement programs to reach down the income rung in India. Housing investment and wealth increased for all, and the related contracting between the World Bank, state government, and the implementing authorities blended state, market, and household self-help (Pugh, 1990, 1997). In the Kampung Improvement Program, the World Bank provided US\$439 million in 4 project loans to improve living conditions, spontaneous housing investment, income and health. Some of the lessons of the project led to wider community participation and deeper institutional reforms (World Bank, 1995).

13. Social groups in Jordan strongly contended priorities and access to political and economic power (Raed, 1998).

recognition of squatters housing rights, affordable in situ improvement, and the development of social capital and empowerment (e.g. leadership, organisation, networking, and civic association) bring housing and environmental improvements for low-income groups. Thereon, social, ethical, and aesthetic expressions cover the full range of living, and encompass environmental, social, economic and political facets, and those that encourage people to value lives. Given a chance for one to participate and express attachment, heightened by ownership, results in more commitments to bring affordable and sustainable improvements in a varied socio-political context.

Proper land policy and housing finance systems based on innovative schemes can facilitate the target groups' access to the two most essential housing resources— land and finance (Rahman, 1999).¹⁴ Environmental improvement often creates conflicts among various interest groups that can be resolved by arbitration, experience and overt output of social co-operation, e.g. community resource, and involvement of all stakeholders. Despite variations in contexts, settlements require development of socio-economic and institutional capabilities, and leadership (Rahman, 1999). The obstacle of converting environmental improvements into action plans and partnership can be overcome by distributing responsibilities, attribution of costs and self help, and agreed-upon participatory and transparent management. In essence, the process and the project need good governance, organisation, management, and policy (Pugh, 2000). Technical and financial knowledge offers more informed choice of options, and adjustments required according to income, age, etc. (ADB, 1983).

In most of the developing countries, activities of the low-income groups including housing belong to a large informal sector. The economy of this sector, if legitimised, can contribute more in socio-economic developments (de Soto, 1989; Fernandez & Varley, 1998), in conserving economy, construction, environment, and health, and hence beckon for sustainable improvement. Regeneration schemes related to living conditions and social opportunities for millions adds more socio-economic and environmental values than high-profile projects do, and hence is more sustainable. As income increases and needs arise, households upgrade houses in terms of materials, space and utilities, often personalising various parts. Thus low quality makeshift shacks are transformed through incremental building into more substantial homely structures, encouraged by tenure security or improved services and amenities through in situ upgrading.

Potentials for conservation and regeneration of squatter settlements vary with their characteristics.¹⁵ Improvement can take place either spontaneously in established settlements where a form of tenure security is envisioned, or in formal sector planned settlements. Political skills and pressures often influence the selection of components of improvements and distribution of costs and benefits among the households. State-assisted regeneration often dwells with redesigning lay-outs and re-alignments (Potter & Lloyd-Evans, 1998), and thus displacement or uprooting of socio-economic ties and identity. But slum improvement should be part of overall housing development and urban macro-spatial planning.

The conventional approach to affordability cannot meet the objectives of mobilising private fund for housing as the public sector's capacity was limited, minimising public intervention in the market to ensure efficient and equitable development, and be flexible to accommodate variety of needs (ADB, 1983; Rahman, 2004). If a low-cost housing program is to be replicated, non-productive offsite infrastructure costs must be reduced to a minimum to keep the cost low. Otherwise it will escalate public subsidies and a shortage in the administration and maintenance fund to make them affordable. Projects could be sustained by setting the standard at affordable level to ensure cost recovery and optimise usage of otherwise expensive and scarce own resource. Households could be let to determine their own affordability in a less dogmatic approach to income targeting.¹⁶ Lack of financial sophistication of the participants and the concern of the soundness of the projects could hinder this method. Monetary guarantee and readiness to intervene by the authority should reduce the risk of the beneficiaries taking financial decisions (ADB, 1983). Instead of binding public housing programs tightly, the rules can be redefined to allow more households, previously excluded for being too poor, to participate in the program. This questions the basic nature of public housing that allows households only with above a certain income to benefit, raising the average costs per beneficiary and reducing the number of beneficiaries, instead of reducing housing shortage.

14. The Grameen Bank (Bangladesh) developed credit and technical advice for women's enterprise, housing, and for transforming social development among the poor; the World Bank and others support such initiatives (Rahman, 1999).

15. Their population size range between 100 to near million. Often the squatter dwellers have expectations of imminent redevelopment, whereas in others *de facto* occupancy rights are secured. Sometimes a settlement grows its own leadership and organisational structures that can negotiate with politicians and bureaucrats for installing infrastructure; others suffer apathy or powerlessness.

16. The layout may contain a variety of housing options (size, orientation, payment methods, level and standard of services) to suit all types of households. Commercial uses too could be introduced to cross-subsidise housing. While the repayment for services and infrastructure could be set at an affordable level, residual cost could be recovered through cross subsidy from elements with an optional take up.

Poverty is the deprivation of capability to expand social opportunity in households, in markets, and in state policy, affecting the freedom of individuals to choose values and worthy lives (Drèze & Sen, 1995; Sen & Wolfensohn, 1999). Poverty reduction needs personal commitment and proper human bondage. Nobel Laureate Fogel (1994) argued that improved nutrition, advanced medical knowledge, and the qualities of housing sustain health and economic productivity over long-term development transitions. The principles are evident in low-income housing, requiring social co-operation to improve environmental conditions in a sustainable way. The welfare role of a state extends beyond taxation to institutional reform, social and private property rights, and governance quality – the main priorities in modern development and urban policy agendas, as recognised in the new reforms of the World Bank (Pugh, 2000). Another Nobel Laureate North (1990) focused on the way quality of institutions influenced comparative performance in long-term growth, putting institutional reform in the policy interest of the developing countries.

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Spatial and Social Adaptations: A Post-occupancy Evaluation of Multi-storey Social Housing in Dhaka

Dr. Shayer Ghafur

Professor, Department of Architecture
Bangladesh University of Engineering and Technology, Dhaka – 1000
E-mail: sghafur@bangla.net

Abstract:

This paper* investigates how low-income households adapt spatially and socially in multi-storey (walk-up six-storied) social housing in Dhaka, by looking at the allocation, organization and use of spaces, and household members' extent and ways of socialization. Evidence is presented from a broader research on socio-spatial adaptation for living and livelihood in multi-storey social housing in Dhaka. Post-occupancy evaluation, through structured questionnaire, informal interview and observation, helps understand the building performance in responding to the needs of the low-income dwellers. Low-income households' access to the surveyed two housing projects at the old and new Dhaka implies a change in the location and mode of dwelling, from single to multi-storey housing, requiring households' spatial and social adaptations. The findings indicate that households generally adapt 'actively' to the dwelling environment to suit their spatial and social needs. This paper concludes by calling a fit between physical and social environment in designing and maintaining functional contexts for the low-income households in Dhaka where human activities and interactions can be appropriately accommodated and developed.

Keywords: adaptation; post-occupancy evaluation; social housing; low-income households; Dhaka.

1. Introduction

Access to housing of the lower-income households, especially the urban poor, has been a critical issue in Dhaka, Bangladesh, like most other large cities in developing countries. While this access to shelter issue persists in critical proportion, design and use of domestic spaces in urban housing in Bangladesh have changed in the last few decades due to demographic, social and economic forces active in the broader urban context. Rising costs and scarcity of land have also contributed significantly to changes in design and use of domestic spaces. This change in design and use of housing has two major implications for the urban poor households. First, construction of 'social housing' has become a specific public response to give slum/squatter settlement dwellers access to shelter. Second, a dwelling type in the multi-family and multi-storey social housing has evolved for the lower-income group; this type is different from the traditional concept of organization and use of space, especially, in terms of private-public and front-back notions.

A multi-storey approach to social housing—a new setting—creates a context for the low-income dweller's adaptations in at least two possible situations. They are: First, target slum/squatter settlement dwellers would have to adapt to a new dwelling if a given housing scheme fails to reflect their prior life-style and dwelling situations. Second, in the possible event of target dweller's involuntary exit from and/or lack of access to these housing, non-target low-income households will move in eventually and would have to adapt to a dwelling not designed for their life-style and dwelling situations. In the context of these two probable situations, this paper investigates how low-income households adapt spatially and socially in multi-storey (walk-up six-storied) social housing in Dhaka, Bangladesh, by looking at the allocation, organization and use of spaces, and household members' extent and ways of socialization. A key intention of this investigation is to suggest how this knowledge can be used for future design of housing for the urban poor households.

This investigation is important because studies have shown that social structure, life style, and cultural practices relate to a given group's 'habitation'—a place of abode and its physical environment (Rapoport, 1969; Oliver, 1987; Lawrence, 1987; Chandhoke, 1980). 'Habitation pattern' of any community indicates its practice or custom with regard to the pattern of its abode. A locational change in their habitation—dwelling premise—necessitates subsequent adaptation for living and livelihoods, for example, in the new context of planned resettlement projects. Household adaptation, due to locational change in habitation, would have at least two dimensions: 'spatial' and 'social'. Spatial adaptation refers to the initiatives taken by the members of a household for use and reorganization of dwelling space by means of adjustment or alteration in the physical environment. Social adaptation, on the other hand, takes place in the physical environment for social interaction.

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2. Methodology

A theoretical framework based on a set of five dependent variables explains household adaptation mechanism; they are: household's position in the labour market, life-cycle, life-style, condition of present dwelling, and condition of previous dwelling. The first three variables are termed as 'household factors'. 'Post-occupancy evaluation' (Preiser et al, 1988; Zimring and Reizenstein, 1980; Rabinowitz, 1979) has been used as a method to investigate the building performance in responding to the needs of the low-income households in their adaptations in the two multi-storey social housing schemes in Dhaka, located at Badda and Islambagh (Ghafur, 2005). Housing in the former case consists of two six storied buildings with 48 dwelling units. The latter case, called Ershad Colony, consists of four six storied buildings with 192 dwelling units.

This research employed a multi-method fieldwork to gather relevant data from all dwelling units of these cases. It carried out a questionnaire survey, in addition to informal interview and observations, in these two social housing schemes in March 2001. The researcher, i.e. the author, had himself participated in the questionnaire survey along with thoroughly briefed one Research Assistant and three Field Assistants. The author, however, conducted himself all the informal interviews. Completed responses obtained from survey in Badda and Ershad Colony housing projects are 46 and 169 respectively; either absence of household members during the survey or their non-cooperation had resulted in not getting responses from the rest of the dwelling units. Housewives were the main respondents. It used a combination of both qualitative and quantitative analysis. Quantitative analysis is limited within frequencies and simple cross-tabulation. Analysis included collection/preparation and analysis of measured drawings (of houses) to use them as a basis for further analysis. Qualitative evaluation of different space uses and performed activities came from informal observation and photographs.

Table 01: Indicators and Attributes of Adaptation

Concept	Indicators	Attributes
Spatial Adaptation	Existing space use Change in space use Security and Privacy	Locational grouping Circulation Proximity
Social Adaptation	Social use of space/Socialization with Neighbours Linkages with village relatives Leisure activities	Social Interaction Privacy Territoriality

Source: Ghafur (2005)

3. Multi-storey Social Housing in Dhaka

Bangladesh National Report to the Habitat II (GOB, 1996) identifies 'social housing' as a specific category of public housing that involves social costs i.e. some form of subsidy either in its land development, construction or rent. Social housing, thus defined, provided housing for 1.16 per cent of all households in Dhaka (GOB, 1996, p.68); later this report noted that social housing in Dhaka had increased from 1.12 per cent in 1993 to 12 per cent in 1998 (UDD, 2000). Neither this broad definition of social housing nor any of its subsequent estimation of constructed housing units gives reference to low-income households. Another study reports low-income household's limited access to government housing: 5.4% and 5.9% of all urban poor in Dhaka and in all urban areas are tenant in government houses (Islam et al, 1997, p.200).

Recent public sector interventions in urban low-income housing have shown diversity in the delivery mechanism by constructing multi-storey flats in addition to the development of new settlements and upgradation of service-deficient settlements (HSD, 2000). In terms of height, housing in Dhaka can be classified into the following categories: low-rise (1-2 stories), walk-up medium-rise (3-6 stories), and high-rise (8 stories and above). The middle walk-up category denotes 'multi-storey' in this research. The government of Bangladesh (GOB) has an agenda of enabling 'social housing', i.e. provision of shelters with state subsidy either for rental or hire-purchase scheme for the poorer section of society. Since the early 1980s, GOB has been pursuing the idea of multi-storey housing for lower income groups, e.g. the Class III and IV government employees and displaced squatter settlement dwellers. The lower income groups represent the urban poor and households whose monthly expenditure equals or just below the income poverty level.

Recent estimates identify high-density multi-family housing developments as the only feasible alternatives in Dhaka, Bangladesh, to give the urban poor households access to shelter. The discrepancy between urban land and house price, and incomes of below median income groups sets this option (Hoek-Smith, 2000, pp.114-117). Ranking of priorities of what the urban poor households in Dhaka want include increase in income, access to shelter and services, recreation etc. (Islam et al, 1997, p.247). Experiences from private developers built apartments for high- and middle-income households suggest that multi-storey housing projects could provide some of these needs more efficiently than dwellings in single-storey high-density settlements. The government of Bangladesh has taken initiatives to construct multi-storey housing for the urban poor. In an initiative by the Ministry of Land, 9000 and 6000 flats are now under construction in Bhashan Tek by a private sector developer for the slum dwellers and Class III and Class IV government employees; this type of housing will be first of its kind of significant scale.

4. Surveyed Multi-storied Social Housing

On 29th May 1984, the Ministry of Housing and Public Works decided to construct a housing project to stop development of public health threatening environment. Low-income people with a monthly income below Tk. 1000 would be the beneficiaries of this project by paying a rent of Tk. 250 per month. Initial project target was to construct 32 apartments, each with 24 dwelling units and 405 sq.ft (with half stair) per unit, in 10 acres of land. HSD was given the task of implementing this project with two specific objectives: First, to apply cost-saving structure; second, to provide housing at a subsidized rent for the welfare of low-income people, and transfer the ownership to its occupants after 60 years (cited in HEC, 2000, p.2). In its first and last phase, only 2 apartments with a total of 48 dwelling units were constructed in 1984 in Badda near Gulshan, Dhaka.

The only other known example of social housing was constructed at the personal directives of the then President H. M. Ershad to rehabilitate squatters. In old Dhaka, Dhaka City Corporation (DCC) had built four six-storied apartments with 192 dwelling units at Islambagh during the late 1980s; people popularly call this project as 'Ershad Colony'. The squatters were reportedly let live in some of the two-room dwelling units with kitchen and toilet before they were eventually evicted in 1993/94. No further details were obtained from the DCC on this issue. Despite stated objectives, none of the mentioned social housing projects are now inhabited by the targeted beneficiaries. Class III, IV government employees, and Class IV employees of the Dhaka City Corporation are now the respective occupants of the former and latter case.

The government had designed the dwelling units, allocated different domestic spaces, allegedly for the urban poor households in Badda and Ershad Colony under the following assumptions: First, poor urban nuclear family will use the dwelling units; the number of poor urban household members living in the dwelling unit will remain unchanged at any given point in time. Second, poor urban household's formal living and sleeping take place in different rooms, under modern practice of living. Third, poor urban households use living and sleeping spaces in the dwelling unit in association with modern furniture and fixtures while practice traditional way of cooking. Fourth, poor urban households separate their place of living from place of working.

5. Forms of Household Adaptations

Household adaptation in this paper denotes a form of response to housing stress, and is indicated by a difference between household's 'residential situation picture' and 'aspiration picture'. The former refers to the significance attached to the residential situation not only in present terms but also by the situation in youth and previous residential situation. The latter aspiration picture refers to "the picture of the situation which one regards as most suitable for one's present household situation". The aspiration picture is related to (aspects of) dwelling that households consider realizable within the supply of dwellings in the housing market. Household attempts to make the residential situation picture and the aspiration picture as congruent as possible in order to avoid stress. There are two possible household responses to avoid this stress: passive and active adaptation. The first response—passive adaptation—is household's decision to move to a new location or stay in the existing house with its inconveniences; household adjusts its aspiration picture. The second response—active adaptation—relates to household's making adaptation while staying in the new or earlier dwellings; household's residential situation picture is adjusted. Construction of multi-storey housing projects and their subsequent occupation by the squatter dwellers and non-beneficiary low-income households had created contexts for adaptation with reference to the household and residential factors. These two groups of households' adaptation responses are further explained with reference to the following five forms of adaptation (Priemus, 1986). Observations on household adaptation are summarized below.

- **Move:** Two separate but linked events i.e. move in by the low-income households and move out by the urban poor, had taken place in this form. In the former case, despite slum-dwellers'/homeless peoples' living with aspiration picture—housing satisfaction—in Ershad Colony they were forcefully displaced to make room for the DCC allotted low-income households. This involuntary displacement had put them under greater housing stress. In the latter case, the existing low-income dwellers were under housing stress in their previous dwellings. Despite housing stress, they were financially not capacity to make a move to a better dwelling closer to their aspiration picture. So they had to live without fulfilling their aspiration pictures. When access to dwellings through allotment became available, either due to patronage or personal network, existing low-income households moved in.
- **Conversion:** This is active adaptation. Here household members adapt the environment to suit their needs. For example, low-income households made structural conversions by adding a partition wall to make an extra room for either self-use or renting for income generation. Turning the adjacent corridor an extension of the dwelling inside has compensated households' shortage of indoor spaces for social interaction.
- **Change of Use:** This is also active adaptation. Households in Ershad Colony converted their kitchen into an extra bed due to shortage of space. Households are involved in different income generation activities inside their dwellings.
- **Loyalty:** This is passive adaptation. Here dwelling households adapt themselves to the environment. A section of the non-beneficiary dwellers have continued staying despite absence of services, crowding, sense of security and dilapidated structural conditions. In Ershad Colony, they also had to seal off the corridor-facing windows with paper to ensure privacy inside dwelling.
- **Protest:** This is a form of non-adaptation.

6. Profiles of Household Adaptation

Low-income households, after they move in, face spatial and social changes in their present dwelling circumstances in relation to their previous ones. These changes have taken place respectively, first, in the availability of types and extent of domestic spaces and services for household use; second, in the creation of a new context for intra- and inter-household socialization. The next two sections explain how households have responded spatially and socially to adapt to their present residential situation.

6.1 Spatial Adaptations

Households' spatial adaptation for living and livelihood take place in conversion, change and loyalty of use. The manifestations of households' spatial adaptation are explained next in the following three inter-linked areas.

6.1.1 Existing domestic space use

The total dwelling unit area in the Badda and Ershad Colony multi-storey social housing project are 301 sq.ft and 232 sq.ft respectively, excluding circulation space. Designed spaces for services are basic and similar in them; these spaces are toilet, kitchen, and a small multipurpose space in between meant to serve as dining or circular space. The areas where both these projects differ are the type and allocation of spaces for sleeping and living. In Badda, the given large room (220 sq. ft. approx.) has an option of its sub-division into two equal rooms, invariably for living and sleeping. The designed two equal-sized rooms (74 sq. ft each) accommodate living and sleeping activities in Ershad Colony.

Table 02: Percentage Distribution of Domestic Spaces

Types of Spaces	Badda		Ershad Colony	
Total Carpet area	301 sft	100%	232sft	100%
Sleeping/living	204	67.8	153	66
Dining	36.5	12.2	30.5	13.2
Kitchen	30	10.0	22	9.6
Toilet	30	10.0	26	11.2

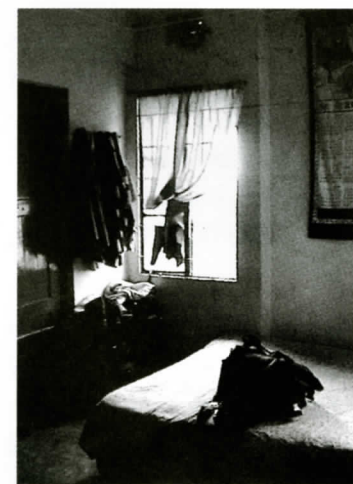
Source: 2001 survey

To examine the uses of different function-specific spaces (or rooms), observation of the presence (or absence) of furniture has been taken as a preliminary indication of the respective dwellers' way of using these rooms or spaces. Observations on households' domestic space use, in relation to a given space's corresponding furniture, are organized by describing their use pattern and explaining their implications for spatial adaptation.

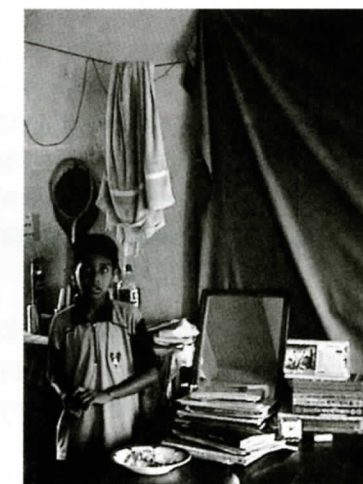
Entry to a dwelling unit first leads one to public space that is explicit in the form of a room in Ershad Colony and implicit in Badda with the possible sub-division of the room. The most common furniture used for formal sitting is 'sofa set' whose presence is few and far between (13.5 %); most of the surveyed households do not show their preference of using sofa sets in a living room to socialize with guests, in addition to their own informal living. Meanwhile alternative furniture like a 'bed' has been observed used for sitting. After public, private is the next layer with functions like sleeping, dining and cooking, toilets etc. A very high 98 % households use beds of different qualities for sleeping in addition to their occasional use for sitting. Households' wider use of bed indicates its essential need. An average household size of 5.34 demands more space if not rooms for sleeping with due provision of privacy. Out of this necessity, all dwelling units in Badda have converted their large room into two separate rooms, with bed(s) at least in one room. Some have placed both beds and sofa set (or chairs) in the second room, therefore, giving that room a dual purpose for sleeping and living.

Bengali word 'almeera'—denoting cupboard, clothing cabinet, cabinet or sideboard—is another essential domestic furniture usually placed in bed room with additional purpose of safe keeping of valuables. Although available data shows that 60% of all households own at least one almeera it varies noticeably among Badda (71.7 %) and Ershad Colony (56.8 %). This difference, in part, is as an indication of lower socio-economic status of the dwellers in the latter case. Space allocation for dining in both cases, despite its labeling in the original plan of Badda, has been barely adequate. As a result, observed very low percentage of dining tables (20 %) in the two sites suggest two issues: first, using dining table as part of eating has not yet become a regular part of their domestic habits as they have preferred to retain their rural dining habits, i.e. eating being seated in floors. Secondly, even if households are willing to eat in the dining table they cannot afford placing it in the scanty designated space or in other room due to space shortage in place of higher priorities. In most cases, the observed dining table has also been used as a study table. Household's informal dining practice is related with their traditional ways of cooking.

A Bengali house uses 'meat safe'—a kitchen cabinet—to store cooked food and different uncooked items and ingredients. Its type, size, and frequency of use are indication of household's kitchen use and cooking practice. Meat safe ensures hygiene and protects its items from insects and mice. Presence of meat safe among a little more than half of all households (52.1 %) suggests an inadequate and unhygienic kitchen and cooking process and also the low affordability of the people.



Living room has bed that is also used for sitting during day time



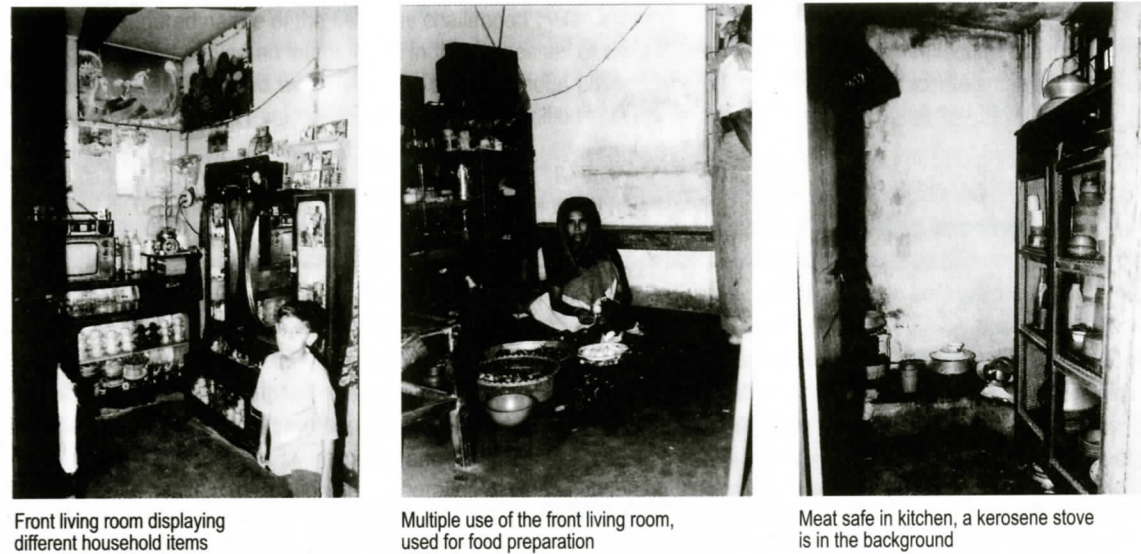
A small table is used for dining and study in the bed room; a curtain separate spaces and gives privacy



Extensive use of the floor in the kitchen food preparation and cooking in the traditional way

Source: Survey 2001

Figure 01: Domestic space use in Badda Multi-storey Social Housing Project



Front living room displaying different household items

Multiple use of the front living room, used for food preparation

Meat safe in kitchen, a kerosene stove is in the background

Figure 02: Domestic Space Use in Ershad Colony Multi-storey Social Housing Project. Source: Survey 2001

6.1.2 Change in use and space

The concerned authority had allotted designed dwelling units to households with different income levels. Households with different social composition and needs have adapted differently by initiating changes in use and space in the following ways.

- **Rent:** There are few instances of renting to non-allotted people in the surveyed households. Although the rate of rent in the two sites is 7.6 percent (16 cases), the rates in each site are wide apart; the rate of rent in Badda and Ershad Colony are 19.6 % (9 cases) and 7.6 % (7 cases) respectively. A separate room and part of a room are rented in 10 and 6 cases respectively, within a total 16 cases. Tenants share available services with the host household.
- **Income Generation:** To supplement household income, low-income households have also been engaged in different income generation activities based on their dwelling space. There are only 10 observed cases of home-based income generation (4.7 %) in the surveyed multistoried social housing. The rates of this practice are 4.3 % (2 cases) and 4.7 % (8 cases) in Badda and Ershad Colony. Observed types of activities are teaching, tailoring, business, and cooking. These activities are performed inside a room (6 cases), in a separate room (3 cases), and in verandah (1 case). Five cases have reported to earn less than or equal to Tk. 1000 and the rest above this figure.
- **Physical Change:** Households made physical changes in their dwelling for either renting, economic activities or to make up space constraints. All 46 households in Badda have made physical changes in their dwellings by sub-dividing the room into two separate rooms of equal sizes. These physical changes are permanent in nature: brick wall and temporary partition make the sub-division in 31 and 14 cases respectively. In Ershad Colony, only 2 households made physical change mainly because the dwelling unit has been designed with two separate rooms. Households in Ershad Colony, however, had initiated innovative adaptive changes within their dwelling; these new changes are either conversion of kitchen into a small bed space, or makeshift overhead storage space.



Space above toilet is used to store household items

Overhead storage facility in between kitchen and toilet

Kitchen has been converted into a bed room
Source: Survey 2001

Figure 03: New uses of Ershad Colony

6.1.3 Security and Privacy

Emerged senses of security and privacy are the results of the spatial disposition of different spaces in relation to the public-private realm as well as households' socially constructed sense of privacy. Dwellers' sense of security is manifested by their installing security gate; dwellers' perceived sense of privacy, however, requires careful observation. Perimeters of the Badda and Ershad Colony sites have been porous—open to outsider's intrusion—from security point of view. There were no security guards and gates at each stair in both these sites. When asked, four in every five households in Badda and Ershad Colony have reported to open their main entrance door only when required. However, the rest have shown a habit of keeping their main entrance door open throughout the day until late night. This habit fluctuates noticeably between the two sites: the rates for Badda and Ershad Colony are 8.7 % and 21.4 %. Observation and informal discussion suggest that long intra-dwelling unit interaction, community's collective surveillance that arise from these interactions, and most importantly, the use of corridor as public space for children contributed to keep their door open at different buildings and levels of Ershad Colony.

Measures for privacy is spatially manifested and are attained at different levels: first, privacy within the enclosure for domestic functions like sleeping and dining etc.; second, privacy within the social grouping for washing, and socialization with neighbours; third, privacy within the community. At the dwelling unit level, household brings the notion of 'front-back' for separation between the public and private spaces. People living in Ershad Colony manoeuvre and improvise their window panels of the corridor facing two rooms without exceptions for privacy and protection against petty thefts. The glass panels are either painted or pasted with papers from inside to block outsider's intrusive gaze from the corridor or simply replaced with G.I. sheet, especially in the case of the bedroom. A door close to the entrance door connecting the two rooms is closed permanently for privacy of the bedroom.

6.2 Social Adaptations

Households' social adaptation has mainly taken place for living, and not for their livelihood. The two site contexts and the presence (or absence) of corridor have set different spatial contexts for household 'socialization', irrespective of the dwelling unit design. Socialization refers to the person-to-person contact for different formal and informal purposes, ranging from non-committal to deeply involved activities. Socialization of women and children—the dominant users during most of the day—attains more analytical focus. An initial identification of the socially significant space(s) sets a basis for subsequent understanding of the ways in which women and children use these space(s) for socialization. The following discussion helps explain the extent in which design at the building level, in particular, arrangement of dwelling units in each floor plays its role in dwellers' social adaptation.

6.2.1 Socially Significant Spaces

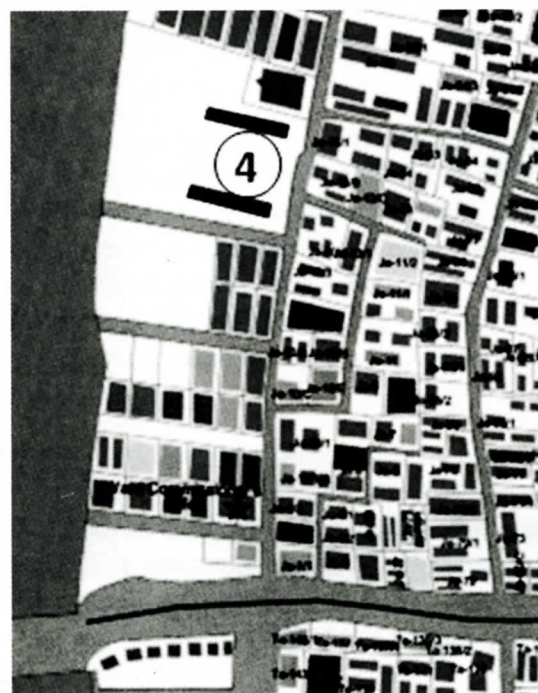
Urban low-income households perform different formal and informal activities. These activities have social significance, requiring appropriate space. Households living in unplanned settlements use a hierarchy of spaces, starting from home, for these activities. When spaces within dwelling unit become inadequate, their access to public (or even semi-public) spaces within/beyond housing becomes crucial. Their access to outdoor spaces compensates inadequate spaces inside dwelling. Performing informal activities outside dwelling unit has always been vital for social interactions and establishing networks, especially, for women and children. While living in ground floor, household members' access to spaces immediately outside a given dwelling unit—however small—was possible. But living in a multi-storey social housing presents a different phenomenon. A hierarchy of spaces of social significance, in a private-public continuum, as observed in the two sites is noted in Table 2. The performed formal and informal activities in these spaces are explained next.

Table 03: Hierarchy of Spaces in Socialization

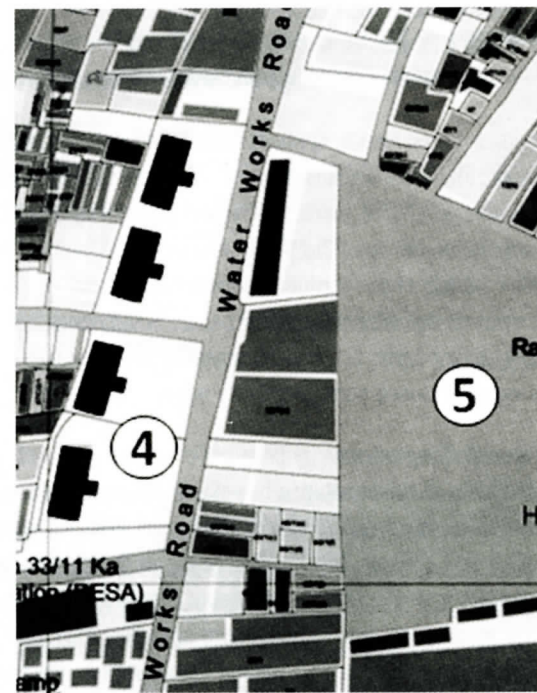
Levels in Hierarchy	Spaces in Hierarchy	Nature
First	rooms within dwelling unit	private
Second	corridor	semi-private
Third	stair verandah and roof (only in Ershad Colony)	semi-private
Fourth	forecourt	semi-public
Fifth	urban play field (adjacent to Ershad Colony)	public

Source: Survey 2001

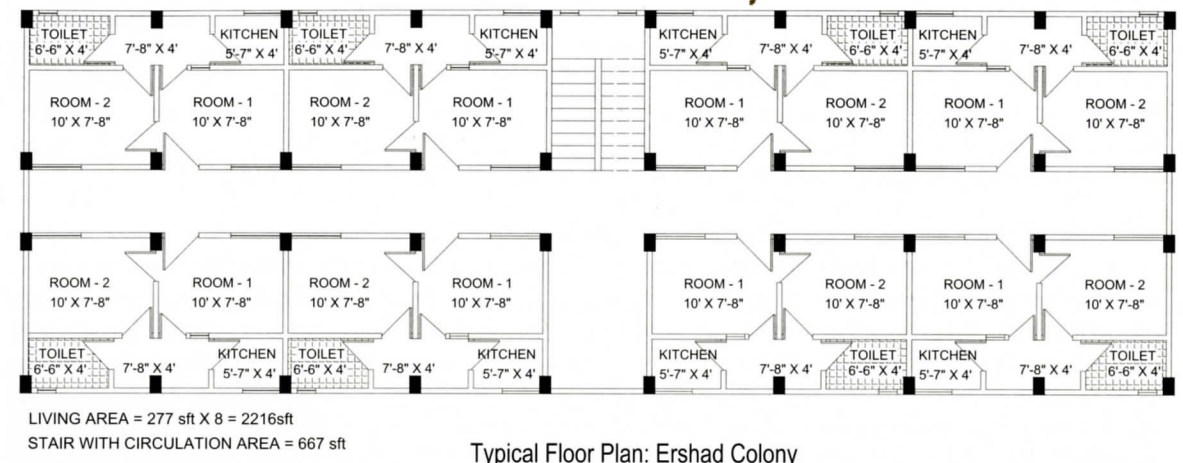
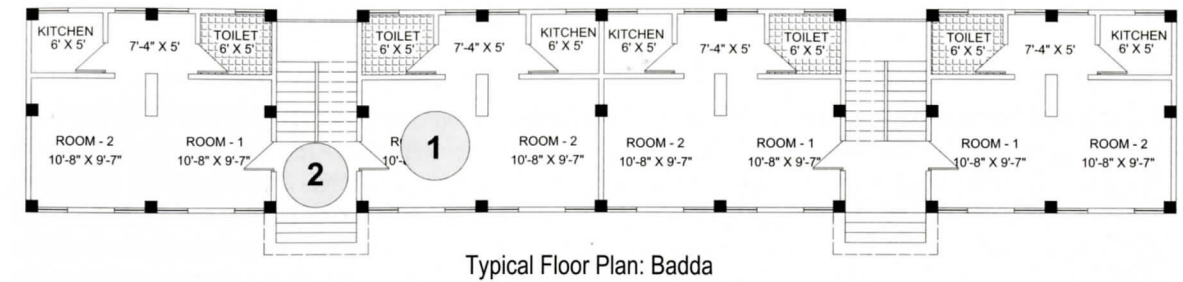
Social activities like birthday party, milad (a social gathering for religious purpose), wedding ceremony become formal because they are organized in advance and people are invited to participate. Nearly four out of every five respondents have reported to perform their formal social activities inside house, presumably due to the private nature of that activity.



Badda Social Housing



Ershad Colony Social Housing



Source: Ghafur 2005

Figure 04: Hierarchy of Socially Significant Spaces: Badda and Ershad Colony Multi-storey Social Housing Projects

For absence of any public spaces within the building, the next notable spaces mentioned by the households in Badda are the ground floor and clubhouse, situated within the housing premise. Options outside dwelling unit include outdoor, stair veranda, roof, ground floor, and clubhouse; the roof at Badda, however, is inaccessible. These formal activities are performed outside dwelling when the scale of that particular activity becomes large and public in nature. The presence of corridor and adjoining stair veranda in Ershad Colony creates possibilities for meaningful contacts among residents, among women and young children in particular, in a given floor and this in turn generates activities and interactions. The subsequent outcomes of these contacts are both socialization and domestic works. Significance of the presence of corridor and stair veranda is felt when compared with Badda where households are deprived from their access to the semi-private spaces as outlined in the spatial hierarchy – corridor, stair veranda and roof. Due to their absence, spontaneous informal contacts hardly generate in Badda.

6.2.3 Socialization with Neighbours

A majority 76.8% respondents judge their social life with neighbours in the new multi-storey social housing as better in comparison to their previous house. What then are the factors present in multi-storey social housing creating a setting for socialization? This question is probed with reference to an opinion that 'homogeneity', i.e. common problems and socio-economic background among a given group of households, influences neighbouring households' meaningful social interactions (Fastinger, 1972; Jehl, 1987). Households have shown socio-economic homogeneity among themselves. First, occupation of 93.9 % of all household heads are in government service; Class Four government employee (66.5%) is the single largest category, in addition to a few higher-level officers. Class Four employees constitute 76.1 % (36 nos.) and 63.9 % (106 nos.) of all household heads in Badda and Ershad Colony respectively. Other indicators showing similarities among households include:

- Household nature: 95.8% households eat from a single or common source of income;
- Low income: 57.5 % households have average monthly income equal to or less than Tk. 3000 during the period of survey;

- Food-clothing expenditure: 79.6 % households spent 60% or more of their monthly income on food-clothing;
- Life cycle: 62.7 % household heads are in the 'middle-age' stage of their life-cycle.

The surveyed households' average period of staying in Badda and Ershad Colony are 21.5 and 14.2 years. Are these years long enough to develop a meaningful social relationship with one's neighbours? This paper first inquires into the frequency of, participants in and reasons for meeting neighbours. Discussions of these issues would tell more about individual responses and trends than 'group life' they have developed over the years. Probing these questions with specific reference to women is important. For women, a large number of whom are homemakers and spent their time indoors, the issue of social interaction as part of their social adaptation is very important. In a society that imposes spatial restrictions (of purdah) on women, it is also important to know the nature and extent of women's mobility for socialization. To understand the role women plays within the households, this research asked questions for their opinion on the decision-making role they play in the resource allocation on different household needs. Male household heads—husbands—gave decisions in 48.8 percent cases while wives gave decisions in only 13.2 percent; the figure for decisions given by both husband and wife is 37.3 percent. Although issues related to social adaptation, especially for women, are quite complex, tangible responses on the issue of socialization, at a general level, are sought. Issues examined are frequency of, participants in, and reasons for meeting with neighbours.

All households meet their neighbours, either situated beside their dwelling unit, in the same floor, or in other floors of the same building: 87.7 percent respondent meet 'daily' and the remaining 12.3 percent 'sometimes'. The variations in responses between the two sites are not statistically significant. No responses of 'never' meeting their neighbours imply the fact that possibilities for person-to-person social contacts among all have always existed in both sites. Therefore, we can see that possibilities for primary contacts for socialization among members of the households has been in practice as an outcome of living all these years. When asked who are the participants in these meetings, it is reported that 'all'—everyone meeting everyone irrespective of age and sex—as the highest category (49.5 %) besides the next highest 'women-women' (43.4 %). Interestingly, categories like 'men-men' (5.2 %) and 'women-men' (1.9 %) are very few in percentage. However, a comparative examination of these instances between Badda and Ershad Colony suggests the following observations:

- Women meet women more in Ershad Colony (47%) than Badda (30.4%) implies the fact that women have been prone to stay more inside house in the latter case; the main reason for this higher contacts among women, in Ershad Colony, is the presence of different types of (semi-private) space outside dwelling unit for socialization, especially the corridor and stair verandah.
- Women's coming out of home and meeting other women in Ershad Colony is more (47%); its equal instance with 'all', implying both men and women, (47%) indicates a gender balance in social interactions.
- In both cases of Ershad Colony and Badda, socialization does not always take place with immediate neighbours, i.e. adjacent dwelling units.

The survey questionnaire included a list of probable options to catalogue household members' reason for meeting their neighbours. Neighbours meet each other for a variety of reasons that include: formality, discuss daily household affairs, to seek help/advise during crisis. The highest reason is 'all' (62.7 %)—a combination of these three reasons. The next highest as well as statistically significant reason is 'formality'; neighbours meet each other out of social courtesy, which is equivalent to exchanging 'salam' (i.e. similar to the western context of saying hello). At closer scrutiny, the response of formality suggests two aspects of residing households. First, socio-economic differences or status exist among an apparently homogenous community. Second, there are small households where only the male members meet with their neighbours while females stay inside.

Responses on location of women's travelling for socialization give us more insight into the dynamics of their social adaptation. Questionnaire included location options, in a hierarchy of spatial settings, to record their responses; the location options are: adjacent house, a house in the same floor, a house in the same building, a house in other building, outside housing site, and all. There are very few reported cases of going outside housing area and all. All responses suggest highest movement within a given building. Taken together these observations, it indicates the development of a community—in the social sense of the term—comprising a given group of households first within a building and then the site. From a different perspective, it also suggests that women's mobility is restricted predominantly within the multi-storey building and then within the site.

Socialization in multi-storey housing in relation to its different levels is discussed now. Both projects are six-storied high. In Ershad Colony, the number of dwellings within a building—served by a stair—is 48 with 8 units per floor; this figure for Badda is 12 with only 2 units on both sides of the stair. Households living in fourth and fifth floors have shown a tendency to socialize more within their respective floor of living. On the other hand, households living in second and third floors interact least with their respective floor of living. They avail the opportunities for socializing households living top or bottom two floors. However, for dwellers of all floors, the covered distance is limited within the building. Occupational status, indicated by income and presence of furniture, does not show any pattern for households' preference for floors. Households of different income level are evenly distributed in all six floors to suggest an absence of any given income group's concentration in a particular floor. Households are satisfied with their respective level of dwelling unit.

7. Evaluation of Building Performances for Adaptation

This section evaluates the building performance to comment on the effectiveness of design in dwellers' spatial and social adaptations. This evaluation is carried out by comparing the 'performance criteria' and 'performance measures'. For this evaluation, two performance elements are taken into consideration in varying degree of investigation; they are: functional and behavioural. This research did not carry out an in-depth evaluation of the technical elements other than the attribute of security. It is worth repeating the limitation of this evaluation of building performance. Evaluation is not users' own evaluation of their residential environment through a structured format within the framework of Environment-Behaviour studies. Evaluation is qualitative and descriptive based on observation and questionnaire survey, and not in scale. The utility of this (limited) evaluation lies in providing a basis for future in-depth analysis of how users' perception and cognition of the dwelling environment influences their behaviour in using domestic space and socialization.

The surveyed two housing projects—Ershad Colony and Badda—are different in the way in which dwelling units are organized. Aspects of design, in these two projects, that worked well in favour of dwellers' active adaptation are: self-contained dwelling unit found in both projects; grouping of eight dwelling units around a corridor in Ershad colony; the 'front-back' notion is arranged in both dwelling units in two layers that has later been re-defined to suit the needs of the users. Physical environment is the setting where scopes for socialization are created and practiced. Hierarchy of spaces in Ershad Colony, i.e. corridor, stair veranda, fore court (and roof) worked well for creating a hierarchy of social activities. These activities are organized with reference to age and sex. Presence of large number of dwelling units creates possibility for women's mobility within the building and site.

Table 04: Framework for Evaluation of Building Performance for Housing Adaptation

Performance Elements and Attributes	Performance Criteria	Performance Measures
Functional		
Locational Grouping of space and dwelling units	Self-contained dwelling unit and function-specific use of space as per design assumptions	Deviation in use of domestic space from design assumption that led to dwellers' adaptation
Circulation	Stair and corridor used only for circulation.	Social uses of circulation space.
Front-Back	Presence and use as per design.	Alterations for flexible presence in time
Behavioural		
Socialization	Inter- and intra-household social interaction	Group life and social interactions among homogenous households
Privacy	No user-initiated alteration	Presence of user-initiated alteration to ensure privacy
Territoriality	Defined territory, and correspond-ing mobility and use	Defined territory, and corresponding mobility and use

Source: Ghafur 2005

Behavioural elements that emerged in this study as significant for social adaptation are socialization, privacy, and territoriality; these elements are aspects of user satisfaction and wellbeing. Presence of group life and homogeneity among dwellers are pre-conditions for socialization. On the other hand, physical environment is the setting where scopes for socializations are created and practiced. Specific elements of these setting are corridor, stair veranda and fore court. These elements are arranged in a hierarchy, and create a more conducive setting for socialization and group life in Ershad Colony than in Badda. This observation supports Gehl's (1987) claim that the hierarchy of social grouping is reflected by a physical definition and disposition of these spaces, especially in Ershad colony, and are in close conformity with the dweller's social definition and use of space. Given the extent of interaction, the social consequences of arranging eight dwelling units around a corridor, on a face-to-face situation, is a positive design aspect. Dwelling low-income households have shown a propensity to make a fit between the physical environment and behaviour.

Dwellers closing of corridor-facing windows refers to the presence of user initiated adjustments to ensure privacy of the adjoining rooms. Design location of window offer flexibility, an option for opening to bring light and air inside or closing to ensure privacy. Dwellings in Badda are devoid of these options in favour of rigid privacy control at the dwelling level, but at the cost of social interaction. A demand for rigid application of privacy at the inter-household level has been reduced significantly in Ershad Colony due to the extent of socialization observed in the corridor.

8. Implications on Design Assumptions

While low-income households in Dhaka are offered domestic spaces in the multi-family and multi-storey context they do not use spaces in the ways and extent in which they had been intended. Consequently, a gap between the assumptions that guided the dwelling unit design and their actual use persists. This gap has been a major source of housing stress for the low-income households, leading to their spatial and social adaptation. Major observations that make the design assumptions invalid, and therefore, led toward dwellers' spatial adaptation are organized in terms of 'user' and 'use'.

- User: Dwelling units are not always lived by the assumed urban poor or even low-income nuclear families. There are many reasons for this. First, impossibility of housing mobility of the grown-up children, especially after sons get married, meant that they live with their parents. Moreover, retired father (or old parents) prefers to live with their children instead of living independently. As a result, over crowding and congestion (due to excess furniture) become inevitable, subsequently triggering dwelling households' coping initiatives through spatial adaptation. Living with relative comfort, without cramped situation, is not preferred in favour of over-crowding. Low-income households are most likely to continue living not as a nuclear family but sharing their dwelling space with dependants. They have seen provision of shelter as the key purpose of dwelling unit.
- Use: Traditional living practice and performances are adapted within modern dwelling. Even though it had been expected that the availability and quantity of furniture would be an indication of the respective household's socio-economic status, furniture's placement and use have been adjusted to their traditional way of life than the other way round. This observation comes in contradiction with the assumed dichotomy of formal living-sleeping spaces. In defiance of the design assumption, in addition, low-income households retain their pre-existing sense of security and privacy, but adapted them in the new context of multi-storey and multi-family dwelling.

9. Conclusions

Social and spatial adaptations are inter-related; one usually acts to influence the other. Households' passive and active adaptations are the cumulative outcome, to a large extent, of these spatial and social adaptations. The findings of this research have shown that urban house planning and design do not necessarily determine urban house use if design assumptions are set apart from the prospective users' socio-economic status and life style. Post-occupancy evaluation of the two surveyed multi-storey social housing has shown the significance of a fit between physical and social environment. This research has reiterated the significance of an objective for consideration in social housing: designing and maintaining functional contexts where human relationships can be more appropriately accommodated and developed. Negation of this objective, in particular, is most likely to cause housing stress, manifested in either household's active or passive adaptation. Given the changing (and different) household factors, and their previous residential situation, household's spatial and social adaptation would take place any way. However, design assumptions if based on user's social structure and cultural practices and priorities then designed dwelling units, and their grouping, are most likely to make a supportive setting for positive adaptation.

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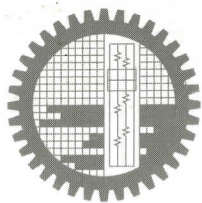
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