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EDITORIAL

Protibesh, the journal of the Department of Architecture, Bangladesh University of Engineering and Technology, is a peer-reviewed academic publication dedicated to presenting latest research findings in order to keep abreast with developments in architectural and technical knowledge relevant to the teaching and practice of Architecture. This issue of Protibesh offers seven research papers on the topical issues of architectural history, housing, urban design and the environment.

The first of the papers, titled The Thin Line between Tradition and Modernity: The Poetics of Vernacular Dwellings of Chittagong Hill Tracts is based on primary fieldwork of the Mru architecture found in the hills of Bangladesh, conducted for a study in Australia. D. R. Ara and M. Rashid in this paper on housing, discuss a very close connection between the seemingly dissimilar concepts of tradition and modernity. The paper focuses on characteristics of vernacular dwellings of Chittagong Hill Tracts, arguing that the local building tradition is closely akin to the ideas of modernism in Architecture as propounded by the Masters. The paper also investigates some aspects of mainstream modernist design concepts as imbued in the broader vernacular of Asia. It focuses on such ideas and concepts such as modular or incremental design, standardization, flexible and temporal concept of designed space.

In Defence of Others: Culture and Context in Sustainable Housing Typology by S. Maher and J. McIntosh is a New Zealand entry on housing issues. In a critique on the way sustainability is addressed in contemporary solutions to housing, the paper argues that the ever-popular techno-fix of eco-design is predominantly theoretical and as a result alternative designs are effectively side-lined in the sustainable housing typology. The often inflexibility of layout, consumption of space and elision of the dynamics and particularities of context are instrumental in making housing solutions less than sustainable. After discussing the cultural frame of sustainable housing, the paper elaborates on an emerging form of housing, called conjoined housing, which receives only scant mention in present-day sustainable housing literature. The need for an exercise in vernacularising eco-housing so as to make room on the housing typology for other models, such as conjoined housing, and placing these models in a contextual frame can generate local solutions outside of the West. This enables the possibility of appropriating different models and methods of sustainability rather than narrowly relying on the one standard model of eco-housing, which is appropriate in some contexts but cannot be for all.

This issue of Protibesh includes two papers on environment. The first, H. M. Maruf's paper on MM5 Simulation study of Urbanization Influences on the Climate of Tokai area, Japan, is a highly technical paper explaining methods of using computer simulations to chart influences of land-use on climatic variations, specifically on surface temperatures. The paper is based on the premise that the heat island phenomenon becomes an obvious outcome of climate change in urban areas and shows consistently higher temperatures compared to surrounding rural areas. An attempt is made through this paper to present the use of computer modelling and simulation to identify areas of temperature difference found around the Tokai region in Japan of which Nagoya is the biggest urban centre. The results of the simulation show a significant change in the surface energy fluxes caused by land cover changes. The paper concludes that given the good agreement found between simulation and measured data, future work should involve developing a regional climate map and formulating a design strategy for urban planners and architects in order to mitigate the urban heat island effect and create comfortable and energy efficient urban environments.

The theme of environment is further elaborated in the UK-Zimbabwe paper titled Influence of Landscape Architecture on the Contemporary University Campus Design by M. S. Zami and S. I. Umenne. The paper contends that the success of the learning process in University campuses is related to the articulation of the campus spaces both in the interior and the exterior, and as much of the social, cultural, and recreational activities take place in outdoor spaces therefore, landscape design should play a major role in the organisation of these outdoor activities. The paper introduces a discussion of the key attributes which should feature in a fully established university campus, whether homogenous or heterogeneous, concentric, zonal or linear, viz it should present the notion of a quiet, comfortable "oasis" in an otherwise busy city while being able to adapt to dynamism or change in time and space. Elements of landscape design like ground forms, buildings, trees, vehicular and pedestrian circulation, green open spaces, soft- and hard-paved open spaces, water forms, are discussed related to the activities they generate.

Revitalizing the Mughal Settlements in Old Dhaka by M. S. Hossain is a paper on architectural history. This paper argues that the social characteristics of the historic areas of 400 year old Dhaka have undergone changes and patterns of invasion-succession of immigrant population, which have subsequently been superimposed onto successive and contemporary development in which the historic fabric has been allowed to deteriorate and be abandoned. Historic buildings need to be considered within the context of urban-settings in order to cope with development. This paper discusses ways in which Mughal artefacts of old Dhaka can be prevented from decay and dam-

ages, and be integrated within the urban fabric while ensuring social and economic viability. The paper through a discussion of the possible interventions at macro- and micro-level, outlines a comprehensive approach for architectural conservation, revitalizing these historic areas and incorporating the aging artefacts into contemporary urban life.

F. Ferdous and F. Nilufar's paper on Morphological Transformation and Evolution of Panthapath as a Commercial Belt of Dhaka City, is the second paper on urban design in this issue. The paper centres around the Begunbari Khal, one of the oldest canals in Dhaka, which in the early 90s was converted to a box-culvert and an arterial road Panthapath, paved along a natural depression. It is the expansion of the city that has created demand for new spaces for required urban activities at convenient locations with ease of accessibility and improved environment, thereby continually changing the urban fabric. This paper is an attempt at comprehending the evolution of this busy commercial spine, carved from waterways in the historic city of Dhaka, which has emerged due to densification and physical expansion.

The final paper of this issue, Water Prospect and exigency for regenerating natural waterways of urban Bangladesh: focusing the case of Buriganga by S. S. Hakim, also relates to the design of urban areas. The paper highlights the dominant hold that rivers have played in the historic development and flourishing of Bengali society and culture. But current issues like unplanned development, rapid urbanization, ecological hazards, unlawful encroachment and overall negligence are now challenging the very origin of the socio-cultural and ecological foundations once laid by these rivers. The paper, focussing on intense examination of the Buriganga of Dhaka, advocates revitalization of historic rivers, based on a redefinition of their role in light of the historic contribution they made through the ages. The process, along with policy intervention, calls for reclamation of the natural shape and composure of the rivers and regeneration following identification of the impacts caused by degeneration of rivers in urban Bangladesh.

It is expected that the seven papers included in the journal will throw light on contemporary thoughts of researchers and academicians in their attempt to theorise the issues pertinent to architecture. On behalf of the Board of Editors, I would like to extend my thanks to the Authors of these papers for their painstaking efforts to write the papers and then to modify them during the post-review phase. I would also like to thank the Reviewers for their thoroughness in the review process and for their intellectual input in suggesting modifications and corrections, suggestions which have no doubt added greater depth to the works. After the modifications, the Editorial Board had the responsibility of editing and finalising these papers for publication, while keeping the contents unchanged. Despite all the interventions at different phases, it is however the Authors' own thoughts and opinions that are expressed in the final contents of the papers, and the success, intellectual and academic value of their papers, likewise, belongs to them alone. We have merely served as instruments in their presentation.

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On behalf of the Editorial Board, Protibesh, July 2007

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The Thin Line Between Tradition And Modernity: The Poetics Of Vernacular Dwellings Of Chittagong Hill Tracts

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Abstract :
Much too often 'tradition' is considered as an antonym for 'modernity'. Although this view has been contested theoretically, in the discourse of vernacular architecture, hardly any study has been undertaken based on primary fieldwork. This paper investigates some aspects of mainstream modernist design concepts as imbued in the broader vernacular of Asia, particularly Chittagong Hill Tracts. It focuses on such ideas and concepts such as modular or incremental design, standardization, flexible and temporal concept of designed space.

Keywords:
Modern and vernacular architecture, incremental form, temporal space.

Introduction

A widely accepted popular framework of study focusing on vernacular architecture does not at present exist. The prevailing methodological dilemma of theoretical approaches in the field is explicit in the recent publication of the *Encyclopedia of Vernacular Architecture of the World* (1997) edited by Oliver, which summarises an intriguing range of diverse approaches and concepts from various disciplines. It concludes:

There is no single approach to the study of vernacular architecture. As a subject, which has yet to be defined as a discipline, it both suffers from the lack of co-ordination of approaches, and benefits by the diversity of perceptions which various research directions bring to it (Oliver 2003, p 1).

The current approaches and methods suggest reviewing of vernacular architecture from broad, open-ended, diversified perspectives, but as yet there is a lack of consensus on the definition of the term 'vernacular' in architecture. There is a common assumption, even in the aca-

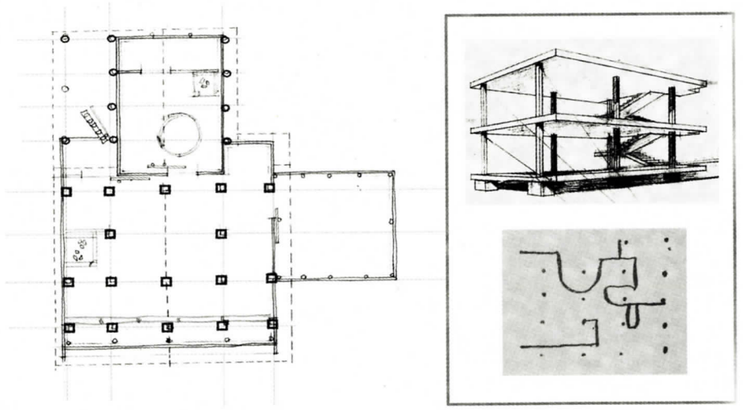

Figure 1: Modernist space – a flexible plan with freestanding pillars and movable walls.
Left: The grid of the column in a Mru dwelling; sketch Ara, PhD 2006.
Right: Maison Domino and the grid of the column in the free plan;
Tzonis, Le Corbusier: poetics, p 33; Graves, Le Corbusier selected drawings, p 22.

demic discourse, that vernacular architecture is a kind of traditional type of architecture, which is distinctive from modern architecture. In this dualist view – which is hardly contested - 'tradition' stands as an antonym for 'modernity'[1] (Bourdier 1985).This symptomatic view not only sets vernacular as a distinct category but also implies a kind of architecture which is nearly immutable, 'indeed unimprovable, since it serves its purpose to perfection'(Tzonis 2001, p 101). This notion however can be contested – not only theoretically but also practically. In this paper we look into a specific type of traditional architecture and show how it is synonymous with modern and contemporary design thoughts and practices. The findings are based on a primary fieldwork carried out in the Chittagong Hill Tracts (Ara 2006).

The five pillar construction

'One had therefore a structural system – skeleton – completely independent of the functions of the house plan. This skeleton simply carries the floor and the staircase. It is made of standard elements, combinable with each other, which permits great diversity in the grouping of houses.' (Broadbent 1973, p 47)[2]

It is well accepted that modern architecture is fine tuned to the design flexibility, which is often derived from structural sophistication (such as post and beam construction in place of load bearing construction), portability of features, compactness, standardization, prefabrication, and economy of structure – often result of a detailed technological consideration. Increasingly modern practices highlight architecture with smart design components that can be substituted, upgraded, replaced, maintained or repaired. Frequently walls are moveable and removable, i.e., non load bearing. Often for such practice modular design is the key. Much of these tenets also define the Mru[3] architecture in the Chittagong Hill Tracts of Bangladesh. The building process is mostly standardised where most of the physical elements are first made on the ground and then assembled together on the site to give the final form.

The walls are non-load-bearing and they stand free of the structural posts parallel to the gable ends in the public space. Along the gable ends, generally five pillars are found in the *kim-tom* irrespective of bamboo or wood construction. The five poles are erected in two rows, flanking the core space of *kim-tom* in between. On the free gable end side of the *kim-tom*, a part of the floor space juts out in a cantilevered fashion, outward from structural posts, usually over steep slope side of the site. The cantilever usually varies from 1m (or less) to 1.5m approximately. The five pillar-setting divides the space more or less equally into four parts giving a flexible but precise reference to organise other built elements such as openings in the open space (Ara 2006).

The five pillar set up also has certain direct technical advantages. By increasing the number of posts the roof load is more evenly distributed on the posts adding to the structural rigidity of the form. Another advantage, especially in wood constructed houses, is that by increasing the number of posts it is possible to span a larger space by trees of smaller diameters. Indeed it would have

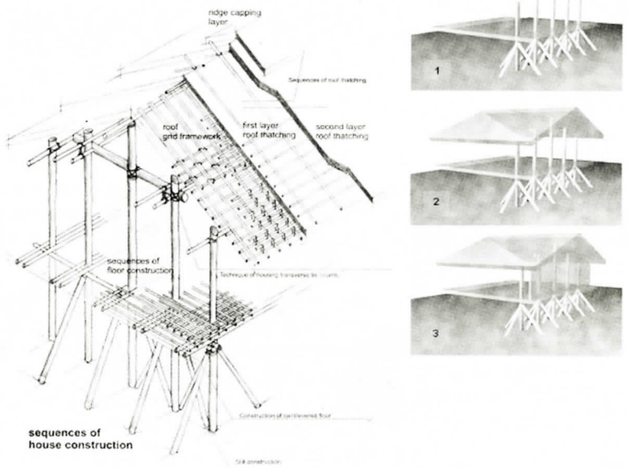

Figure 2 : Five pillar construction. Left: A regulatory framework of construction principles. Right: Construction process starts from the two gable sides where 5 structural posts in two rows stand freely from enclosing panels. This begins with finding the centre for the ridge pole on the gable side. After setting structural posts and floor, roof is added. Enclosing walls come much later in phase three. Sketch & CAD analysis by Ara, PhD 2006.

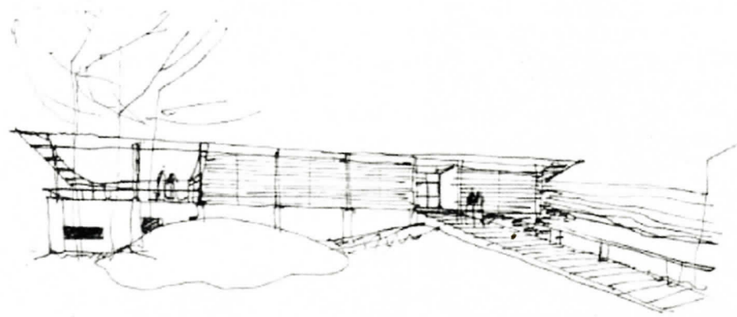

Figure 3: 'Touch the earth lightly '- a modernist approach that sustains the ecology and exhibits sensitivity to the local landscape and particulars of the site.
Top: Murcutt's sketch relating building to the site. Simpson-Lee house, NSW 1988-94.
Bottom Left: Simpson-Lee house., Fromonot, Glenn Murcutt p 206.
Bottom Right: Designing on unspoilt landscape. Ball-Eastaway house and studio, Glenorie, NSW, 1980-83.
Photo Anthony Browell.

required much wider diameter of trees to span the same open space, if number of posts were decreased. When interviewed, builders generally felt that there couldn't be any exception to this five pillar setting. However one case in rarity obscures the universality of the rule. In this case the use of 0.45m dia trees, in a three pillar setting, is an indicator that at one time when larger diameter hardwood trees were present in plenty and resources were available this type might have been present. However due to practical factors such as shortage of trees of larger diameter and constraint of resource and handling, the practice might have changed and what is widely adopted is now pronounced as a rule.

A similar transformation might have occurred in South China, where the *chaundau* framework of five pillar setting is also thought to be evolved in response to a shortage of timber of sufficient size to construct dwellings according to pillar-and-beam principles (Knapp 2000, p86). Although the elements of supports are separated from elements of enclosures, in the more private space – the *kimma*, the walls are tied to the structural posts and, depending upon the two general types, may be exposed outside, or stand inside the enclosures. [4]

The structural logic of the construction is also integrated with the particular function of space. The sensibility of treating cantilevered part – projecting from the five posts on gable end, with more porous slat gridwork is ingenious. This reduces dead load on the jutting part and creates a utilitarian extended floor, which can be used as an aisle for storing agricultural items. Air from beneath the floor thus flows in through the open gridwork and regulates humidity.

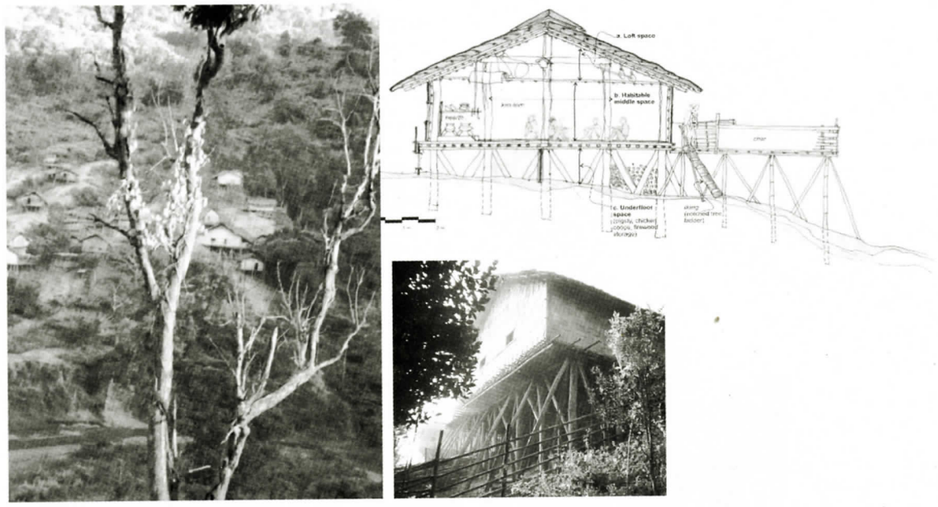

Figure 4: Left: a Mru settlement nestled harmoniously in the hilly terrain as seen from afar. Right: retaining the terrain; section showing minimum intervention into the landscape. Bandarban 2003; photo: authors.

Tectonics - structural poetics

Modern masters like architect Le Corbusier and Aalto designed to build spiritually revivifying environments in which man could live harmoniously within nature (Menin 2002, p 73, p 81). Aalto advocated that natural energy of light and air must filter into the designed spaces. He developed many different techniques for getting natural light into the interior spaces. Le Corbusier was well known for his deep concern for 'sun, space, greenery' in his designs. Australian architect and Pritzker Prize Laureate Glenn Murcutt is known for designing earth-friendly structures which are unpretentious, comfortable, and economical. He uses local materials. His design approach follows the local site, wind and the sun. He profoundly shares the aboriginal philosophy – 'touch the earth lightly'.

Similarly technological perfection in Mru architecture is derived from understanding of the locally available materials and the constraints of the site, climate and environment. These traditional design approaches don't deviate a lot from the modernist design concepts and concerns just outlined.

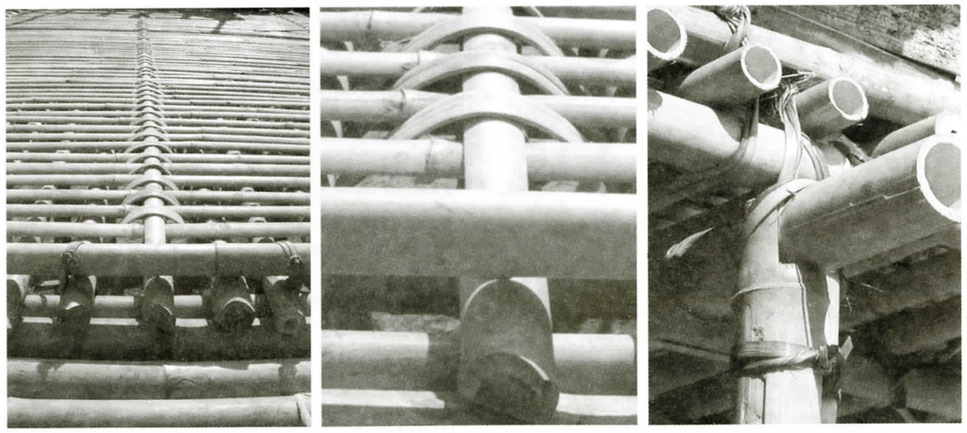

Figure 5 : Work of art or innovative building technology? Photograph showing the method of clipping without nails and thongs to join loose construction members in the char. Bandarban 2003; photo: authors.

Figure 6: Stilt construction in wood. Hardwood trees with barks removed are used as posts. Bandarban 2003; photo: authors.

The bamboo is literally the stuff of life. He builds his house of bamboo; he fertilizes his fields with its ashes; of its stem he makes vessels in which to carry water; with two bits of bamboo he can produce fire; its young and succulent shoots provide a dainty dinner dish; and he weaves his sleeping mat of fine slips thereof (Lewin 1869, p 9).

In the hills, even today such wide use of the same material virtually in every aspect of life can be noted. However the use of material also has other formal implications for example on the size of the dwelling. Even though all Mru dwellings are comparatively larger than the Bangali huts or dwellings of the other ethnic groups yet depending upon the material used in structure the sizes may vary. The size of the public space – the *kim-tom*, may vary from approximately 23 [252 sft] sqm (or less), as in a bamboo built dwelling, to 60 [650 sft] sqm (or more), as in a wood built dwelling (Ara 2006). This finding is an indicator that material and its structural property in a way influences the size of the built form.

The important species of the Chittagong Hill Tracts bamboos are *Muli, Mitenga, Dalu, Orah and Kaltcheri* (Ishaq 1971, p 103). Lewin notes eleven types of bamboo in the CHT of which he mentions, at least five to be used in house construction (Lewin 1869, Appendix C). Selection of bamboo is dependent on the use. For example the *Burially* found in plain area of the CHT is used for posts, rafters and cross beam of the house while the *Noyan Sook* – another variety is used only for making drinking tubes (Lewin 1869, p 9).

It is imperative to mention here that bamboo is a common building material in traditional construction of much of the Southeast Asia. Current researches carried out in the Southeast Asia, where approximately half of more than seven hundred species of bamboo found worldwide can be seen, also record that bamboo structures have high endurance against storm and earthquake – the climatic features very common to Chittagong hills (Dawson & Gillow 1994, pp 22-23). Bamboo as construction material has certain advantages. It is a highly organic material without any waste. It also has other interesting properties. In section, it is hollow inside and because of its hollowness it is lightweight and relatively strong at the same time. It does not require much labour as working with wood does. It can be sliced and flattened easily with simple tools. The shell can be chopped into suitable lengths. It can be split to produce half culms, and split-peeled to make binding or lashing materials. Bamboo splines can be woven to make partitions and screens. However bamboo has certain disadvantages too. Bamboo is vulnerable to buckling. And it can hardly withstand contact with wet soil. Careful details have to be worked out to solve these problems. The sophisticated technical details in bamboo which are worked out to perfection in Mru architecture exhibit how the Mru adapt their building practices to native landscape, climate, topography, available means and tools.

Stilts and framework

Oliver explains:

All buildings, whatever their function, have to meet certain physical constraints. Whether they are the outcome of a long tradition of received techniques, assembled by trial, error, and experimentation, or based on detailed mathematical calculations and the application of formulae, ultimately the basic laws of physics will determine whether they will stand up or collapse (Oliver 2003, p 69).

Indeed the stilt construction in the hills shows high degree of specificity to the region. Building a house on such structure reflects ingenuity of the builders to face the physical and natural constraints of the site. The dwelling is raised on wooden or bamboo stilts of varying length from uneven terrain. Foundation is never used (Dawson & Gillow 1994, p 10).[5] Inclined buttresses of wood or bamboo, brace the upright posts which makes the structure sufficiently stable to counteract any lateral sliding in case of shift of soil or earthquake and also to withstand the heavy wind load exerted on the very thick roof (Waterson 1990, p 103).[6] Such a solution gives substantial rigidity to

the structure. The CHT is a cyclone and earth quake sensitive region. Earthquakes occur frequently but the shocks are generally slight (Ishaq 1971, p 20).[7] There have been several records of earthquakes and cyclones since 1762. Landslide due to tremors is not infrequent worsened by heavy rain in monsoon season. However there is no record of any damage to the stilt built structures (Hutchinson 1906, p 3).

The structure is basically a post and tie beam system with a thatched gable roof. The roof, with a simple functional outline rests directly on posts rather than on beams. Horizontal tie beams are tied to the posts. These transverse tie beams are secured between two purlins running in the long direction (Ara 2006). Posts are free at the base, because they are not connected at the base they are able to move easily with rather than against any tremors like earthquakes. Thus any lateral sways are countered by flexibility, which allows resonance to the whole structure. In such a structure, walls are more vulnerable than the framework thus retaining the integrity of the framework to the last.[8]

Incremental dwelling

Today in contemporary design practice we increasingly put emphasis on 'smart architecture' - an architecture that almost has an organic presence which is able to grow according to the changing needs of the users:

The time factor and the fact that life is enacted in dynamic processes needs incorporating in the architectural design. A process-based architecture of this order brings about a process rather than a finished article, a set of possibilities that puts the product aspect in the hands of its users... It doesn't need to be an immaterial, virtual architecture. On the contrary, the presence of a physical, spatial structure always will be a necessary condition for potential use. It is the form that is no longer stable, that is ready to accept change. Its temporary state is determined by the circumstances of the moment on the basis of an activated process and in-built intelligence and potential for change (Hinte 2003, pp 130-133).

However this is not only hallmark of an architecture, which we narrowly define as modern architecture. This process-based incremental growth has long defined vernacular architecture, sometimes with more rigour and sophistication than generic modern architectural designs where it has been only marginally evident.

The traditional Malay house *bumbung panjang* shows a sophisticated building and additive system. The simple roof of the *bumbung panjang* is very efficient for making additions to the house. The core house is the *rumah ibu*, which is extended when addition is needed. It satisfies the need of a small family and can be big or small, depending on the family. If the family expands or resources become available a *rumah ibu* can convert to a kitchen, in which case a bigger *rumah ibu* is constructed.

Additive elements can be attached to the main block with only a distinction in roof level as in the *Serambi Gantung* or *Gajah Menyusu* addition, or they can be added with a transitional element such as *selang*[9] in the middle. Addition by a common court is also possible. Addition can happen sidewise or parallel, along the long axis or the short axis of the main structure (Yuan 1987, p 121). The Malay house achieves maximum utilisation and minimum use of resources by adoption of such incremental housing solutions. The house is not a final product but changes and grows with the inhabitants.

The connection of building modules by means of a terrace as the family expands is also found in a *Bon Thai* house. Marc Askew notes, 'This modular house form and its adaptability is also present in Thai –Yuan (northern Thai) and southern Thai houses, despite differences in design details.'(Knapp 2003, p 263) [10] When a traditional Japanese house needs to be larger, expansion takes place in two directions. The long section can be extended as in Malay house by simple addition of structural bay. A lean-to roof along the outer edge of the main roof is usually attached to the short section, if addition is needed in narrower direction. Lean-to roofs (*hisashi*) are commonly used devices for expansion to take place in a Japanese house. While in traditional Japanese types the main and extended roof are distinctly clear, in later models these are indistinguishable as the lean-to roof becomes integrated with the whole extended-roof structure (Knapp 2003). [11]

This additive quality can also be seen in traditional Chinese houses. The smallest Chinese dwelling is composed of a single *jian* (bay), which is a multi use space accommodating living, cooking, sleeping and other activities. Space has expandable qualities. Addition takes place by adding pairs of parallel columns and extending the overhead roof purlins (Knapp 1989, pp 34-35). In a typical rural Bangali house additional rooms are arranged perpendicularly to the axis of the core rectangle (as in a courtyard dwelling in northern China), thus forming a court.

The Mru dwelling also shows sophisticated additive property. The *kimma* is the core house, which expands as a basic family's needs changes. Connection of additional module such as *kim-tom* can happen with only a distinction in roof level. More modules can be added to the verandah or *machan*, similar to the Malay house, if more additional space is needed. However each extension takes place under a separate roof and the long axis of the additive blocks are always parallel to the main axis of the core house – the *kimma*.

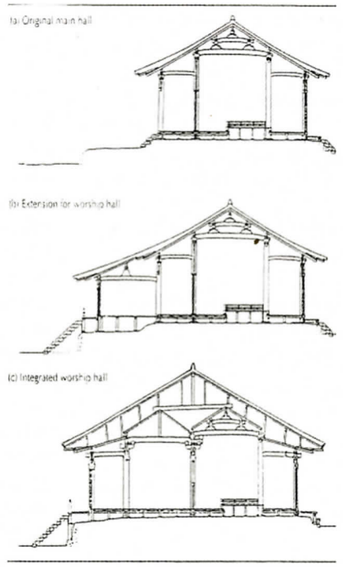

Figure 7: Incremental dwelling: different addition possibilities in a Malay house. Addition by lean-to-roof block, addition by selang and expansion by adding similar but smaller bumbung panjang house form can be noted in the picture sequences. Yuan, The Malay house, p 120.

Figure 8: Process of interior space expansion by hisashi in a Japanese structure. The sequences show how the interior space was expanded while the structure of the principal hall remained in its original condition. Knapp, Asia's old dwellings, p 299.

Spatial division: flexibility and multiplicity of fluid space

The traditional built environment evolved by indigenous groups greatly stresses the need to study the use of spaces, for which one needs to take into account human factors, lifestyles, cultural, social and environmental constraints. Because of cultural incongruity between 'insiders' and 'outsiders', this often turns out to be the most difficult part of observation. Indeed data on physical aspects of design can be gained more easily and accurately than use of spaces although without understanding the space, any study on architecture is limited (Yagi 1980, p 15).

One reason for looking into the culture when analysing architecture is because 'use of space is culturally determined ... it's a construct, not 'given'.' (Crouch 2001, p 259) As observed in a Japanese *minka*, 'transforming space from one function to the other in a daily cycle is a norm, supported by the fact that all necessary furniture is portable and easily stored away whenever the functions of the space change'.(Knapp 2003)[12] In a *bahay kubo*, Augusto Villalon notes, 'when night comes a sleeping mat is rolled out and the floor becomes a bed.' Space changes function as the day goes on.[13]

While describing a Malay house, Yuan explains 'Non-specialization of the use of space means that the same space is used for many different purposes at different times of the day and year. A living area can be used for sleeping at night.' (Yuan 1987, p 87) Numerous examples can be cited by studying elements of space in South-East Asian traditional societies which reveal that unlike Western houses which are predominantly designed according to the space allocation of individual and specific functional needs, a traditional space is made to manage time in order to meet different functions (Hall 1969, p 104). Multiple functions of space are intrinsic and it would be only a partial picture of a house if we associate a space to a single aspect of its multitudinous use.[14]

Possibilities of interchangeable use and the meaning of space are also observed in a Southern Chinese house. Ruan observes such flexible use of spaces and stresses that such implication is less about 'fixed distinctions between different spaces'. In a Dong house there is no distinction between bedroom and storage. Ruan describes the bedroom of a Dong house as 'left behind spaces'. In contrast to the bedroom in the Western sense he finds these spaces 'marginal spaces', 'edge spaces that are neither independent nor definite'.[15]

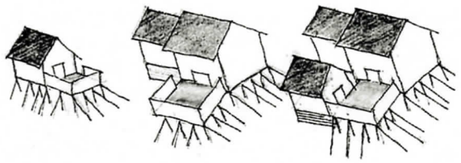

Figure 8: Process of interior space expansion by hisashi in a Japanese structure. The sequences show how the interior space was expanded while the structure of the principal hall remained in its original condition. Knapp, Asia's old dwellings, p 299.

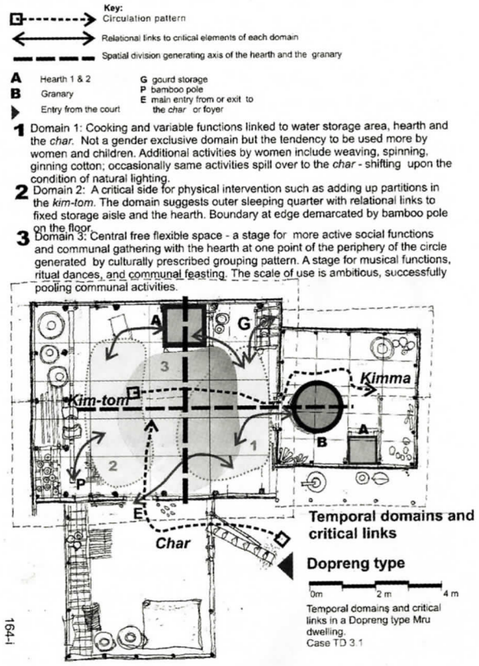

Figure 10: Fluid Space - space plays a more dynamic role inside a Mru dwelling - it changes function during different period. Sketch Ara 2006.

Similar observation can be made in a Mru house in the CHT. A *kim-tom* in a Mru dwelling is too limited in its scope to be named as a 'living room'. Löffler's initial observation on the *kim-tom* which he sees as a 'kind of a living room' becomes obscure as he adds on a list of multiple activities carried out in the same space, he elaborates, '...people cook and eat, receive visitors, and accommodate guests. Children and unmarried members of the family also sleep in the *kim-tom*.' (Löffler 1990, p 66) The point that Löffler misses is the interpretation of the dynamic role that space plays in such a dwelling. In such a dwelling space transforms one function to another when the arrangement of the equipment is changed. As detailed observation reveals, daily routine, seasonal habit and special occasions all may induce such changes. A continuing stimulus for altering the spatial configuration of the dwelling is generated by life-cycle and role changes. Inhabitants move from one space to another during different stages of life. When a Mru is married and becomes head of the household he moves to the *kimma*, older parents move to the *kim-tom*.

This change of space allocation during life-cycle change is not something unique to the Mru community. A *Minangkabau* house, as observed by Cecilia Ng, is built as women's domain. Space is allocated according to different roles; women move from sleeping near the central post into the *anjuang* when they marry and then through separate apartments until they end their reproductive life and come to sleep in the *pangkalan* on the opposite side of the central post (Fox 1993, p 21). The dominant use of certain space is also flexible in a Mru dwelling as in many other traditional dwellings; in the winter the *machan* [16] becomes more active as activity shifts towards the outside whereas in the rainy season the active role of the same space ceases. Hence space is often ambiguous and heterogeneous in such layouts.

Perception of boundary

The use of architectural elements to create bounded and organized spaces is not a universal scheme (Waterson 1990, p 91). In Japanese traditional houses the spatial conception of wall differs markedly from Western architecture where it is more dominant. In the absence of heavy walls territorial claims are made through various symbolic expressions, such as by varying heights and differences in the materials used to finish a floor. Delimitation of space takes place by varying ceiling heights, changes in material finishes, placement of columns and beams and even by a mat. In such architecture 'boundaries are created implied through a traditional code system and without the need to be defined by the explicit physical presence of wall'. [17]

Such definition of space enclosed not by physical boundaries such as walls, but by mere 'suggestion' is not something unique to the South-East Asian traditional architecture. While documenting the Nuna villages - a traditional village in Africa, a similar observation is made by Bourdier. The uncovered cooking areas are set up in the open space, as Bourdier notes, 'they are not clearly defined by walls, but simply suggested through a zone of packed earth'. (Bourdier 1985, p 57)

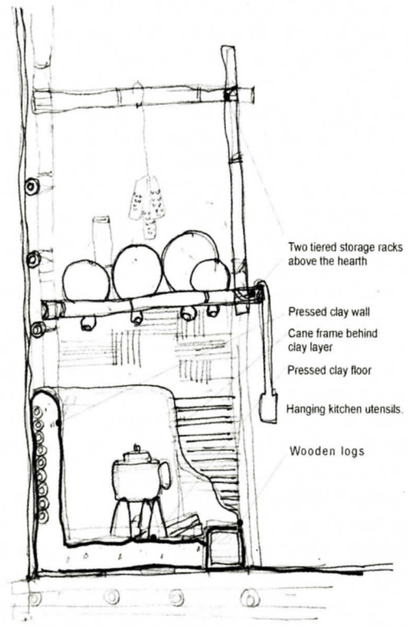

Figure 11: the hearth is built integrally with the main construction. it is geometrically defined by a rectangular volume, punctured by suspended planes arranged in two levels with the squarish bracketed frame and the stove, on the floor. Bandarban 2003; sketch: authors.

Figure 12: A bamboo headrest demarcates a sleeping space in the kim-tom. Bandarban 2003; photo: author.

In the West walls create individual rooms for the personal privacy of individual family members, but privacy in this sense does not exist in a traditional Japanese house. Instead individual space is suggested by a code that all family members respect and obey. Life within a *minka* takes place in one large space under one expansive roof that was shared by members of the family, with at the same time the possibility of seclusion via occasional and temporary compartmentalization of the greater space in order to serve different daily needs. [17]

In a single room, within a *bahay kubo* privacy is a function of eye contact: One "disappears" or becomes "no longer present" by simply looking away.[18] When one is within the space but outside eye contact, one is within a private space. As Waterson cautions the concept of privacy can prove to be completely different in many South East Asian societies. The Western lens can be fatal when reading into such concept, which is very much rooted in the social and cultural conventions of the dwellers (Waterson 1990, p 170). In many of these societies physical walls are non-existent simply because there is no need to have a wall, as social conventions quite adequately construct a non-physical wall through which privacy is retained.

Conclusion

Vernacular architecture is elusive and difficult to define. It is demonstrated in this paper that any boundary between tradition and modernity is fluid and complex. Part of this 'gray-boundary' definition is a result of the fact that tradition is not, and never was, a static concept, rather it is a perfected practice, which is always contested, transformed, invented, and finally progressed over time. Perhaps approaching tradition in this light would help us to redefine vernacular architecture - highlighting 'similarities' rather than 'differences' - from modern architecture. Starting from here, this paper demonstrates that the architecture of non-institutionalised simple communities (where designer, builder and user is the same) requires alternative avenues of enquiries, however alternatives do not necessarily suggest contrasting themes to contemporary approaches – it merely stresses a problem approach, without pre-assumption of architectural terms and issues. In contrast to the generic assumption, the concept and definition of 'space' and 'structure' is often found to be dynamic and temporal in regional architecture (such as

that of the architecture of the CHT). Rudofsky's observation that what we call 'audacious 'primitive' solutions often anticipate our cumbersome technology' (Rudofsky 1972), calls for a fresh viewpoint where tradition can't be highlighted as an antonym for modernity. This paper brings to light that there are many features in vernacular built environment, which are essentially 'modern' (such as concepts and practices towards minimalist designs, modular architecture, tactile and temporal/fluid architecture etc). Indeed many of the defining criteria for modernist designs (e.g. Le-Corbusier's 'five points of architecture')[19], which are considered as radical breaks by some, reveal by a closer investigation that such factors often rest on inspiration from much older vernacular forms where social, cultural, spatial and physical and technological logic and aesthetics of dwellings frequently fuse into one complex definition.

Notes:

1 Bourdier reiterates: The concept of tradition cannot be merely opposed to that of modernization without falling prey to the pitfalls of binary dualist thinking. See Bourdier and Minh-ha, 'foreword' in *Drawn from African dwellings*.
2 Le Corbusier on Domino cited in Broadbent, *Design in architecture; architecture and the human sciences*, p 47.
3 From an ethno-linguistic point of view Chittagong hill tracts (CHT) is the most complex region of Bangladesh. Eleven indigenous ethnic groups, collectively known as the *jhumias* live in the CHT area. The present paper focuses on the architecture of the Mru (the largest of the smaller ethnic groups). The findings are based on a primary fieldwork (2002-2003) carried out in the Bandarban region of the Chittagong Hill Tracts, where architecture of the Mru is predominant.
4 For location of *kimma*, *kim-tom* see figure 10.
5 It is more common in Indonesia to find traditional stilt houses resting on flat foundation stones. In Malaysia also stilts rest on a base.
6 In South-East Asia, builders in some areas, mainly North and South Nias use diagonal posts as well as vertical ones. The V shaped floor supports resist seismic activity and offer greater support to the structure, especially when the weight of the heavy roof is a factor. Here also non-load bearing bamboo panels act as screens to enclose the interior living space.
7 Several earthquakes have been recorded since 1762. As the region falls within the cyclonic belt of the Bay of Bengal cyclonic storms are also frequent.
8 On similar logic of construction see Knapp, *The Chinese house*, p 41.
9 *Selang* is a covered walkway. The two blocks remain distinct in roof line with a slightly lower roof of the *selang*.
10 Askew, *''Ban Thai'*: House and Culture in a transforming society', in Knapp, *Asia's old dwellings: tradition, resilience, and change*, p 263.
11 Naonori, 'Japan's Traditional Houses', in Knapp, *Asia's old dwellings: tradition, resilience, and change*, p 298.
12 Naonori, 'Japan's Traditional Houses', p 312.
13 Villalon, 'The Evolution of the Philippine Traditional House', in Knapp, *Asia's old dwellings*, p 215.
14 Many contemporary architects now opt for 'mobile spaces' in their design – on tight sites designs call for compact layouts where multiple functions can be carried out in one space with movable partitions and panels.
15 Ruan, 'Pile-Built Dwellings in Ethnic Southern China', in Knapp, *Asia's old dwellings*, p 365.
16 The elevated open floor which is extensively used for drying and washing and for other domestic purposes. This is written as *tsar* in Löffler's book.
17 Naonori, 'Japan's Traditional Houses', p 307 & p 310.
18 Villalon, 'The Evolution of the Philippine Traditional House', p 208.
19 E.g. his fascination for 'piloti' can be linked to the uncovering of lake dwellings on the lake of Zurich roughly around the middle of the nineteenth century.

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The Thin Line Between Tradition And Modernity

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In Defence of Others: Culture and Context in Sustainable Housing Typology

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Abstract: A central principle of sustainability and the foundation for livable community design and development is the recognition of the interdependence of economic, environmental, and equity issues. These principles are clearly evidenced in the resurgence of non-traditional housing involving forms of shared accommodation, which seek to reduce total housing cost (and total construction), provide opportunities for collective use of space, and increase overall quality of life by enhancing opportunities for social interaction. Literature on these forms of sustainable housing is dominated by research carried out in Scandinavia, the UK, and the US, with houses being narrowly classified as either examples of communal or co-housing, affordable housing or green-housing. Yet there are other emerging forms of sustainable housing which are almost unreported in the literature.

This paper discusses some of the political, economic and socio-cultural issues at work in sustainable housing design typologies. It begins by exploring the current definitions of sustainable housing and asks whether these are adequate descriptions of emerging housing designs such as conjoined or compound housing, which are not easily classified under the literature. Through an exploration of typology and case studies, it illustrates how the notion of sustainability has come to represent ecological sustainable models, as is seen with green housing, while other forms of sustainable housing designs have receded into the background. It argues that in the planning and design of sustainable housing attention must also be given to the sharing of resources and space as an added method of conservation.

Keywords:
Eco-housing; culture; sustainability; housing typology

Introduction

"The Culture of Maxima which enshrines consumerism and materialism has caused many to continuously seek bigger homes, ignoring the toll of their residential activities on the natural environment. We seldom ask ourselves whether we need all the space in our homes, how often the different rooms are used, and whether we need the sizes of the rooms as they are." (Chiu, 2004).

"What I've learned, living here in India, is that the most wonderful traditional solutions exist which exemplify all the concerns of the environmentalist today—we don't have to invent these things again" (Corrier, 2004).

Examples of emerging housing types that address all four dimensions of sustainability outlined in the often cited Agenda 21 (UN 1992)[1] do exist in the West as well as in non-Western countries. Yet in the bulk of literature on sustainable domestic architecture these examples hardly feature. Instead, what are found after a typological search are the same conventional examples of 'collective', 'affordable', and 'eco-housing' or 'green-housing'. While collective or communal housing is heavily stigmatised by its counter-cultural past as being 'So Berkeley, so 60s', eco-housing has become the housing exemplar of sustainability for middle-class home owners in the West. This ever-popular techno-fix design exists predominantly in the literature and as a result alternative designs are effectively side-lined in the sustainable housing typology.
In this article, we argue that eco-housing is a Western cultural housing type, which despite being represented as the 'universal' solution to a global problem, is not entirely sustainable because of its sometimes inflexible layout, consumption of space and elision of the dynamics and particularities of context. We argue that sustainability must be recognised as a place and time specific prob-

lem—with its own potential local solutions— as much as a global one. As the above quote from Indian Architect Corrier makes clear, solutions to sustainability already exist; it is just a matter of acknowledging this fact rather than ignoring it.

What follows in this paper is first a brief interpretation of the concept of culture as it pertains to sustainable housing and our research. We follow this with a closer look at the three categories of sustainable housing most commonly found in the literature, beginning with a discussion of the cultural history of eco-housing. After introducing the three categories and placing them in a cultural frame, we consider why an emerging form of housing, called conjoined housing, does not feature in the sustainable domestic architecture literature. We then discuss the parameters of the definitions and suggest that these be widened to include alternative designs such as conjoined housing.

'CULTURE' in Sustainable Housing

"It is incorrigible to build a glass skyscraper in Ecuador and the same building in Moscow. The climates are different, the customs are different. There's a word that is seldom used in architecture nowadays, one that is rather kitch, and I believe it should be used more: appropriateness. Things have to be appropriate." (Souto de Moura, 2003)

To take into account the many complex influences of context, in the design and building of architecture, means to act appropriately. The above words from renowned Portuguese architect Souto de Moura (2003) can be fittingly mapped onto the progressive sustainable housing movement, with its lack of contextual gaze and disregard of people's divergent needs and values. De Moura's words, which echo critic Frampton's call for a 'critical regionalism' (1980), ask us to not only be mindful of the physical contextual elements but also of culture. A simple swapping of his words 'skyscraper' with that of 'eco-house' would produce the same rhetorical answer that indeed it is incorrigible to build this design in two different places, which have separate customs and histories. The reason for the incorrigibility is that people occupy houses, they do not leave their cultural understandings and ways at the doorstep, and as a result these behaviours and perceptions affect the way the house is experienced; whether its intended use and function is fulfilled or not.

Furthermore, houses—as objects made by people—are cultural artefacts; material evidence of a culture's values, ideals, politics and history. A basic anthropological definition of culture makes this aspect perfectly clear, "Culture consists of the things people make, their behaviour, their beliefs and ideas" (Rosman & Rubel, 2004). Culture therefore is both a verb and a noun; that it is a concept, a way of seeing the world which becomes materialised and visualised into objects like buildings, into clothing, performances, and even everyday behaviours that are taken for granted such as putting out the rubbish.

Culture is not an isolated entity, held by some and not others. We are all part of culture; agents who are informed by culture and able to change it to a certain degree. Yet despite this accepted thinking about the built environment and its intimate relationship to context, Western sustainable solutions such as eco-housing are represented and presented in literature and the media as though they are cultureless and context-free (see Guy & Farmer 2001). This problem of disassociation or denial means that sustainability remains in the realm of science, and the socio-cultural influences that have created the ecological crisis are not fully recognised nor addressed[2]. Eco-housing and other western housing types need to be placed back into the cultural realm. In order to do this we must recognise the historical and political influences of the single family house design—the basic building block of eco-housing.

ECO- HOUSING: history and culture of a western model

From the late 1800s through to the 1950s, there were manifold examples of non-traditional housing types in the West (Grieve & Hon, 2005). However, after World War II the idea of living communally with non-kin or in an extended kin-situation lost desirability, as people sought individualised, private, secure spaces in which to reside (King, 2004; Whitehand & Carr, 2001). The prototype of post-war housing was the detached single-family dwelling, a post-industrialist version of the European villa. This Anglo-Saxon model of housing was developed in tandem with suburbanisation, a phenomenon now gone global. The two embodied the ideals pursued by the growing middle class at the time: low density; auto-dependency; single-use zoning; controlled development; safety and privacy.

The spatial layout of the single family house materialised these citizen ideals, while the house itself became a symbol of upward mobility as it referred back in form to the country houses of the English upper class. In this way, the single family house brings together nostalgia for a past offering certainty—before industrial capitalism destroyed human relations and created urban congestion—and a desire for the freedom promised by modernity through consumerism. This desire to retreat from the crowded, dirty city and aspire to a higher social position was met through the Fordist production of generic 'cookie-cutter' designs. This basic design remains ever popular to both

developers and consumers alike; one achieves predictable market performance and the other, knowable conventionality. This marriage, marketed to steer consumers towards the same few designs, has created landscapes of sprawl, standardisation, and unsustainable living in the West[3] and is spreading globally as the taste for the lifestyles these houses promote and sustain increases (see Munch, 2004), "Of what use are energy savings in a sustainable house if the occupants must continue to use the automobile on the average nine times per day?" (Ingersoll, 2006).

The current trend in the West, to build single family eco-houses, is in part because of the representation of the single-family house as a transferable commodity. Because of this emphasise on the house being ultimately exchangeable on the market, the reliable and popular design layout of the single-family home has remained unchallenged, even within the sustainable discourse. Its design layout reinforces certain rituals and ways of living that are Anglo-American and unsustainable: individualism and reclusion into the private residential space away from the public sphere of society. In the house, modes of expression take form in the purchasing of modern appliances and as a result the house has increasingly become a mere backdrop to these consumables[4]. Moreover spaces have expanded, as houses have continued to grow to meet the cultural values of privacy, "The problem is not so much that current energy conservation initiatives are flawed, but that they do not consider the most significant determinant of building energy use—space" (Addington, 2003).

The cultural aspect to eco-housing—the unsustainable behaviours conduced through the spatial layout—is often elided in the media because of eco-housing's association with the universalistic solutions offered by science. It is precisely because science appears objective and above people and culture that eco-houses have been assigned such a predominant role in the literature on sustainable housing; as a global, universal solution to a global problem. Yet sustainable issues are grounded in places and are pluralistic; articulated through particular time specific locales. Authors Guy and Farmer (2001) write that the technically focused sustainable model of eco-housing that attends to the global rather than the local is similarly distanced from context in time, through its constant reference to the future and not the present. These two aspects—time and place—when coupled with the techno-rationalist solutions of eco-housing, further separate it from the concrete situations from which sustainable issues are lived and experienced. In the two following sections we briefly introduce the other two dominant categories of housing that appear in the literature and then end the typological overview with an introduction of a new housing type: conjoined.

Collective Housing Types: longing for community

Collective or communal housing has been used in the literature to describe a whole spectrum of types, from 1920s Soviet apartment blocks to post-materialist intentional initiatives such as cohousing. The quintessential example of contemporary collective housing in the West is the philosophically minded cohousing or eco-village.

Cohousing was first developed in Scandinavia in the 1970s, and was adopted in the United States, Australia, Canada, New Zealand and England in the 1990s. As a new form of intentional community, cohousing organisations form with an explicit intention of creating a socially cohesive and mutually supportive community (Meltzer 2005:2). In this type of housing, the 1960s counter-cultural movements' societal and ecological promises remain important cardinal points for the advocates of cohousing. Because of this philosophical underpinning, collective housing groups all perceive a modern living malaise in contemporary industrial society and 'believe' that the only living model equipped to remedy this is a community-centred one. In cohousing an implacable belief in the benefits of community manifests at every possible level. From the initial stage of site planning through to whose turn it is to cook the communal meal at night; all decisions are made consensually and with the strengthening of an ecologically sustainable community in mind. Thus 'community' is the central concept of cohousing, and is a guiding ideal that is held above context. In this regard, like eco-housing, eco-villages and cohousing offer their solution to sustainability as a universal, humanistic one that should be adopted by all.

In design, cohousing and eco-villages consist of either free-standing self-contained dwelling clusters or multiple suites in one dwelling (see Ahrentzen and Francks 1989). Invariably collective housing designs include a common building or central common space, which provide residents with a shared kitchen, dining hall and, depending on the model, a library, laundry or hobby-room. The occupants of collective housing are usually multiple single families, who maintain their own individual households and are home-owners not tenants, as is the case in shared or affordable housing.

Although the definitions of what actually constitutes cohousing vary somewhat, differences are only minor. McCamant and Durrett (1988), who coined the term, describe it as resident-owned, developed and managed cooperative communities in which individual households are clustered around a village-like courtyard or street and share facilities in a large common house. The shared facilities are for cooking, dining, social activities and child-care. In some instances there are also shared recreation and workshop areas outside the main common house. The number of households in cohousing can be from as

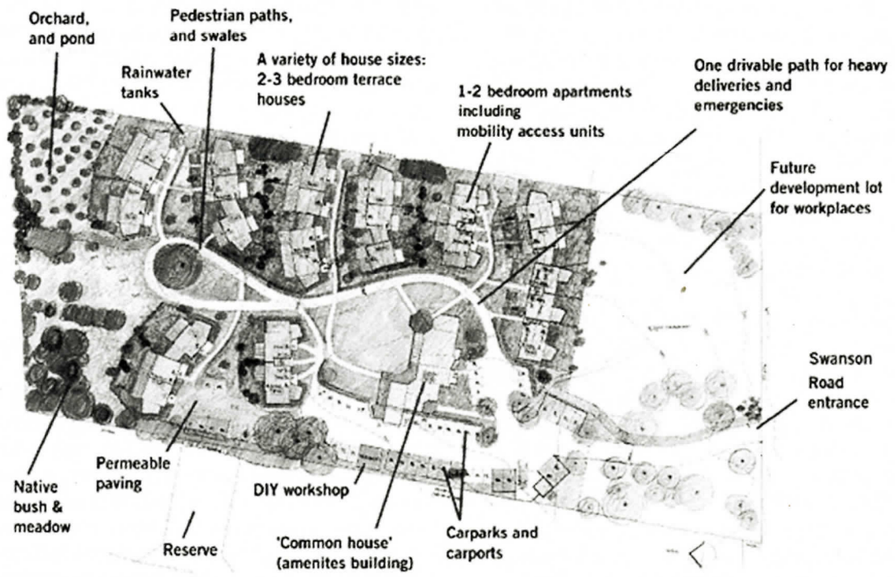


Fig 1: An example of co-housing—Earthsong Eco-Neighbourhood, Auckland, New Zealand.

few as 3 to over 100, however most are made up of 10 to 40, with the number of households allowed being set by the collective's members. Numerous publications deal with cohousing, from handbooks for interested groups (Norwood and Smith 1995) to case studies and in-depth analyses of individual cohousing communities (Fromm 1991, Meltzer 2005). All of these publications begin by sketching a brief history of communitarian movements, from the nineteenth century utopian communities in the US, through to the experimental communes of the 1960 and 70s.

Meltzer (2005), in a serious attempt to distinguish cohousing from its stigmatised precedents, singles out four key points of difference. In cohousing, he argues, the political philosophy is one of democracy not autocracy; decision-making is always reached by way of consensus. Secondly, cohousing residents are enmeshed in mainstream society, not marginal to it (this he names the 'Outreach vs. Withdrawal' approach). Thirdly, the amount of private space granted to individuals is larger than what past intentional communities allowed. In fact, privacy is fastidiously debated among residents during the initial design phases[5]. Apart from the points of difference made by Meltzer (2005), contemporary collective housing types, and its predecessors, share at least one feature: a belief in the benefits of community.

AFFORDABLE HOUSING TYPES: economics as the bottom line

The euphemistic term 'affordable housing' is used to describe the Western equivalents of public or social housing (Bullivant 2003, Fromm 1991, Hemmens, 1996). It is linked to sustainability through its emphasis on economics and equity issues. Commonly defined in the literature, affordable housing is policy driven, subsidised, low-cost housing for people who can not afford to own their own homes. The 'affordability' in housing refers to the amount of rent residents should pay and is accepted as being no more than one-third of their gross monthly household income. One of the principal design aims in affordable housing is to make units desirable for occupants to live in and to move away from the high rise, high density standardised modernist apartment blocks of the past that blighted landscapes across the globe. An essential part of this departure is the change in terminology, as well as in design. However these solutions only address two of the four principles of sustainability.

According to Ahrentzen and Franck (1989), affordable housing is when individuals, kin or non-kin, share a kitchen, living room and possibly a bathroom. They have little autonomy and minimal private space. Examples of shared housing include multi-family dwellings (MFD); single-room occupancy (SRO); mingle units and group homes. This category of housing includes government subsidised housing and other forms of economically driven housing options for those on limited incomes. The sustainability of affordable housing is mostly economically motivated, as a result of the sharing of services and housing infrastructure, energy and materials. As Ahrentzen and Franck make clear, the motivation for sharing of this type, including more innovative examples such as the United States GoHomes, is still "Largely economic rather than social or practical" (1989:7). In the literature, sharing is described as being a situation borne out of necessity rather than a choice.

Publications about affordable housing in the West range in focus from those concentrating on housing for single people, to those that give overviews of plans and the types of multi-family dwellings (MFDs) built in Japan, Europe and the United States (Cooper and Rodman 1992, Crosbie 2003, Mackay 1977, Raimy 1979). A great deal of the literature traces the emergence and evolution of shared habitation from the late nineteenth century through to the early twentieth century[6]. The main concern in affordable housing literature, both past and present, is how to house the poor or working in liveable dwellings. This perpetual societal and cross-cultural issue is, for the most part, the reason for the mass and breadth of publications on the topic.

Recent innovative cultural types of affordable housing include 'homesharing' for the elderly or single-parent family in Australia. In this situation, a home owner is matched with another person who is seeking a home, for a temporary period of time. This matching is facilitated through an NGO, church or homesharing agency such as www.co.abode.com or www.homeshare.org (Homeshare Organisation 2005). Shared housing types are also built to accommodate large numbers. Recent examples include the YWCA Family Village in Washington D.C., which is a residential apartment of two to three floors refitted to include common facilities; and California's Laurel/Norton Intergenerational Complex with multiple self-contained units for families of forty or more (Crosbie 2003).

CONJOINED HOUSING: an emerging type in the blind spot?

Conjoined or Compound housing is a pastiche of affordable, collective and eco-housing and depending on the design, is concerned with addressing economic, environmental and social-cultural issues because of its focus on context and regionalism. It is both similar to yet distinct from the dominant sustainable housing models discussed in the literature. Designed for non-discrete, non-traditional households, conjoined housing is where a small number of kin and/or non-kin owner-occupants share a dwelling that is designed for both common and private space use. As well as being purpose built, a conjoined house may also be formed from two or more detached

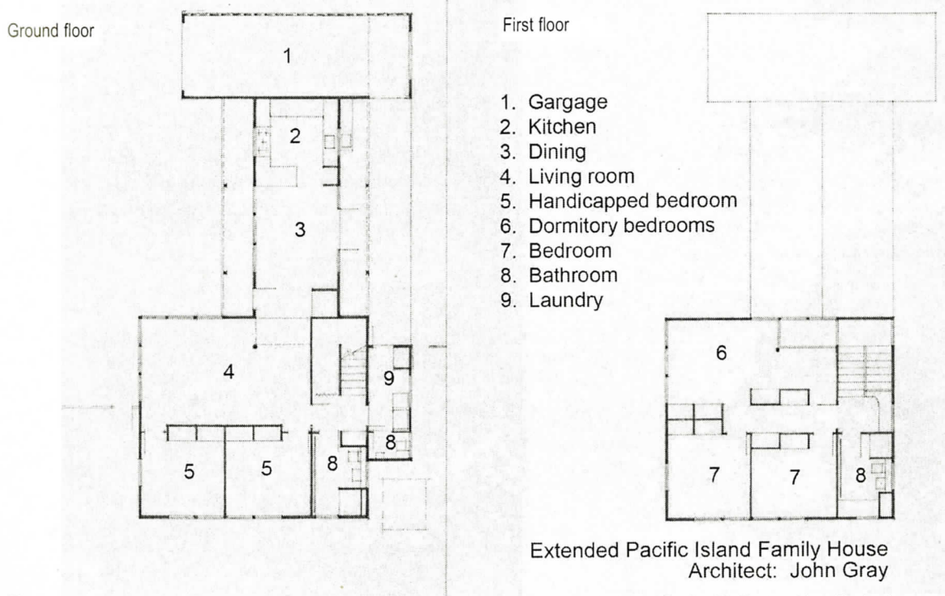


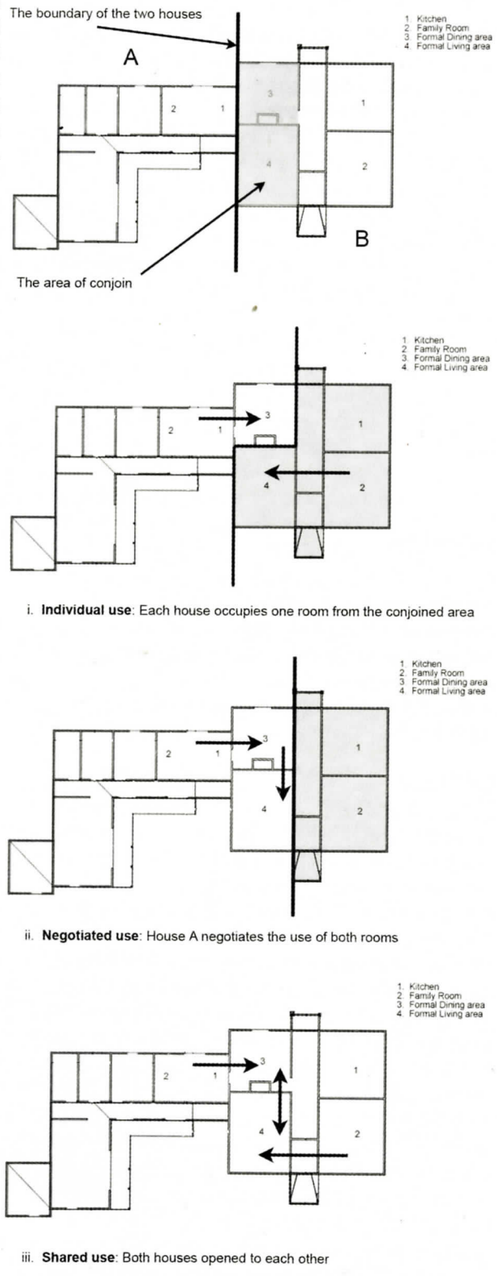
Fig 2: An example of shared, affordable housing for an extended (9 member) Pacific Island family, Wellington, New Zealand.

houses that are joined together to create shared space(s). The occupants come to reside in a conjoined house for a myriad of reasons; there is no single, stated philosophy in residents' housing choice. Our identification of this emerging type was first noticed in a design brief, a request by two sisters (the King House, see fig.3) to join their adjacent houses to create both communal and private spaces for the extended family.

Questions of how to design for two individual yet inclusive families arose in the process, the answers to which were not found in the architectural literature because of the narrow defining and biases of Western sustainable housing types. Preliminary research uncovered the terms conjoined and compound, but searching for contemporary examples proved problematic. An image search, for example, found only the most superficial of examples, such as terrace housing.

Although by definition conjoined or compound households may be formed on either kin or non-kin relations, in general it was found that households consist of extended families, stem families, joint families and siblings. Stem families are fuller versions of an extended family; they occur where two single-families in adjacent generations are linked together by one individual who is a member of both families. The joint family, another form of kin relation, occurs where two or more unrelated single-families create a corporate unit. This was the case with the architect Rudolph Schindler's (1887-1953) Kings Road house in West Hollywood, California. In this prototypical Western compound housing model built in 1921, Schindler and his wife co-resided with another single-family, the Chaces until 1924, after which a different single-family, the Neutras, moved in.

The Schindler house is a one-story, open floor plan dwelling, with two adjoining wings, one for each of the two couples with a guest room linking the wings. Schindler's house (1922) was purposely built for two couples: the Schindlers and Chaces; his design reflected their close, friendly relationship with its two adjoining wings and shared kitchen. The contextual element of compound housing makes it different from other sustainable non-traditional housing types which narrowly focus on making material social or economic agendas and often elide the cultural context.



i. **Individual use**: Each house occupies one room from the conjoined area

ii. **Negotiated use**: House A negotiates the use of both rooms

iii. **Shared use**: Both houses opened to each other

Fig 3 : Diagrammatic representation of the King House conjoined design. External limits of the two existing houses

CLASSIFYING SUSTAINABLE HOUSING TYPES IN THE WEST

"Sustainable housing development can be defined as housing development that meets the needs of the present generation without compromising the ability of future generations to meet their needs and demands. Housing is more than meeting accommodation demands;

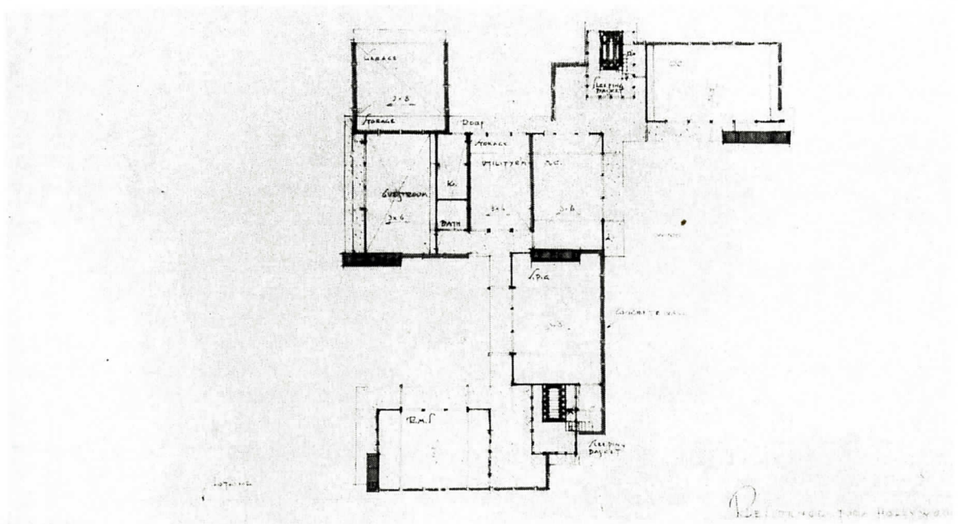


Fig 4: Floor Plan—Schindler House, West Hollywood, California

it is simultaneously an important measure of social developments, a key economic concern and a cultural element. Thus sustainability of housing development embraces the environmental, social, cultural and economic aspects" (Chiu, 2004).

Conjoined or compound housing is an emerging sustainable housing type that in practice incorporates elements of economic, environmental and socio-cultural sustainability. However within the sustainable housing literature, this housing type can not be easily placed as belonging to any one category. Principally, this is because the definitions of the categories are too narrow. The literature only captures examples of affordable housing, cohousing and most predominantly, eco-housing. Historically, the literature has been split between housing for economic sustainability—affordable housing—or socio-ecological sustainability as is the case with the philosophically driven cohousing model. But more recently, the notion of sustainability has come to be overly represented by the supposed universal solution of ecological sustainable models, as is seen with eco-housing, while other forms of sustainable housing designs have receded into the background[7].

A search on research databases reflects the predominance of this particular definition of sustainability, with most if not all articles focused on detached single-family houses fitted with ecologically sustainable technodevices. However, sustainability in housing means more than ecological sustainability as is stated in Agenda 21 (UN, 1992) and the Brundtland Report (World Commission on Environment and Development, 1987), it also means attending to the 'soft' socio-cultural dimensions alongside the environmental and economic, "Today, an appreciation of the significance of the non-technical issues is growing and it is realised that these so-called 'soft' issues are at least as crucial for a sustainable development in construction. Economic and social sustainability must be accorded explicit treatment." (Agenda 21, 1992)

Despite the various ways of defining sustainability, for the most part sustainability has come to stand for a one-size-fits-all 'ecologically responsible', detached single-family homes, which use recyclable materials and are energy efficient: scant attention is given to the option of sharing resources or space as an added method of conservation. In addition, most of these designs do not take into account the cultural needs of the occupants. The definition of sustainable housing designs needs to be widened to include models that may not stand for just one principle of sustainability, but in varying degrees incorporate all.

Conclusion

In this article we have attempted to place eco-housing and other forms of sustainable housing models from affordable and collective categories into a cultural frame. We have also shown how the examples all in some way fail to encompass the four principles outlined in Agenda 21. With collective housing there is a presumption that by simply attending to the community, our relationship with the environment will also become more harmonious and

less hierarchal. Similarly, with affordable housing types, the environment and socio-cultural aspects are ignored for the bottom line of economics. After highlighting these short comings, we questioned why western models such as conjoined do not appear in the typology and why eco-housing has risen in prevalence; presented as the universal solution to an essentially contextual experienced and created issue. This problem is one that can be addressed by redefining it as one cultural solution that has been formed from a particular place, in time, and according to a belief system. What we call for is an exercise in vernacularising eco-housing in order to make room on the housing typology for other models, such as conjoined housing. By placing the models in this frame we can then look for local solutions outside of the West, and explore the notion of appropriating different models and methods of sustainability rather than narrowly relying on the one standard model of eco-housing, which is appropriate in some contexts but cannot be for all.

Acknowledgements

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End Notes :

[1] The four principles or dimensions stated in Agenda 21 are: social sustainability; cultural sustainability; environmental sustainability and economic sustainability. As Chiu (2004) notes, these four strands actually interlink and should not be thought about in isolation. This stance is similar to our approach to sustainability in housing.

[2] Guy and Farmer (2001) write that the preoccupation with finding consensus transnationally in the sustainable movement is one of the reasons why science, with its 'objectivity', has come to dominate research.

[3] For the past few decades in the US, 75% of all new construction has been of this generic form (see Dunham-Jones 2000).

[4] For a sharp comment on this new consumerist function of houses see Ingersoll (2006).

[5] Norwood and Smith (1995) offer a diagram of the ideal spatial arrangement of private and communal areas. The authors suggest that in order to maintain a stable community, a graduation from public to private space is necessary. At the design level, this requires the placing of patios, porches, walk ways and gardens in the zones between the public and private spaces.

[6] See, for example Hayden's seminal work *Redesigning the American Dream: gender, housing and family life* (1984), and *The Grand Domestic Revolution* (1981).

[7] The problem faced with such narrow and slanted definitions within the literature is that different ways of living, which could be understood as being sustainable such as compound or conjoined housing, are not being recognised and researched. As a result therefore, urban legislation and cultural biases which restrict the exploration of alternative housing forms are not identified and challenged.

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MM5 Simulation study of Urbanization Influences on the Climate of Tokai area, Japan

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Abstract
Evaluating urbanization is necessary to make realistic representation of urban influence on local climate as well as to improve the living environment in urban area. One month numerical simulation has been conducted using NCAR/PSU Mesoscale Model (MM5) during August 2003 to reproduce the local urbanized meteorological fields in Tokai area. A newly classified land cover to account for the heterogeneity of the urban area in Nagoya using LANDSAT +ETM satellite images, a simple modification by including sky view factor and anthropogenic heat are introduced in MM5. Three different locations have been chosen in urban, suburban and rural area to investigate the land cover effect on near surface temperature and surface energy fluxes. These simulated data by the modified MM5 with new land cover is validated through comparison with the JMA observation station in urban area. The sensitivity simulations using modified MM5 prove considerable improvement in the near surface temperature and surface energy fluxes in urban area due to urban parameterization in MM5. Large temperature difference between urban and rural areas has produced the heat island phenomenon at the center of Nagoya city. Thus modified MM5 shows better interpretation of urbanization effect on local meteorology because of urban parameterization and land cover classification.

Keywords
Urbanization modification in MM5, land-cover classification, urban heat island

1. General introduction

Urbanization due to its rapid associated changes in land-use pattern (Oke 1982) is worthy of special attention, because the Intergovernmental Panel on Climate Change (IPCC 2001) report confirms the stronger evidence that over the last 50 years global climate change is considerably attributed to human activities.

Climate in a particular area is substantially influenced by urbanization, which defines the land cover characteristics and changes in land-use pattern. Urban surfaces, generally have lower albedo and higher thermal heat capacity, contain large amount of heat and are unable to retain rain water for evaporation. The three dimensional street canyons along high-rise buildings trap solar radiation at day. Vehicles, industries, air-conditioning systems also produce anthropogenic emissions of heat, water vapor and pollutants in atmosphere (Kimura and Takahashi 1991). These alterations influence the absorption of solar radiation, surface temperature, evaporation rate, storage of heat and turbulent wind production and drastically transform the conditions of the near-surface atmosphere. Consequently heat island phenomenon becomes an obvious outcome of climate change in urban area and shows consistently higher temperatures compared to surrounding rural areas as illustrated in Figure 1.1. The effect of heat island is strongest in the city center where large population densely resides. Change in temperature profile along with other meteorological phenomena and high rate of energy consumptions occur due to adverse effect of urban heat island. Whereas in rural area the presence of green surfaces and water body keep lower temperature due to lower thermal heat capacity, presence of moisture and higher latent heat flux.

The Tokai area is a sub-region of Chubu, Japan along Pacific Ocean (Figure 1.2) having mixed land-use characteristics with mountains and forests, seaside plain land with populated commercial, industrial and residential areas. Nagoya is the biggest urban center in Tokai area in respect of population and GDP, which has complex urban

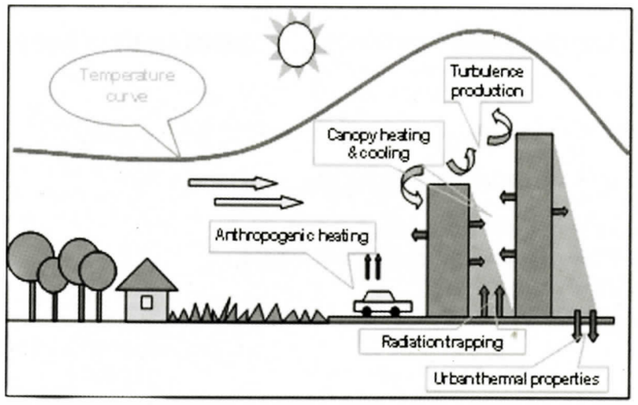


Figure 1.1: Schematic of urbanization influence on climate and heat island effect.

characteristics because of dense urban structures, high traffic flow and highest energy consumption. Nagoya has a central core with commercial zone of large spatial extent beside the Nagoya castle surrounded by mixed commercial-residential areas. Large residential areas of xeric and mesic[1] characteristics are encircled by mixed commercial-residential zone and stretched to the other side of river. This study has focused on urbanization in Nagoya city and its influence on local climate.

Mesoscale atmospheric models are increasingly employed to improve the understanding of processes related to neighborhood scale climate, urban heat island phenomena and mesoscale circulations caused by urban-rural land cover differences. Those processes are strongly influenced by the energy and momentum exchanges between the atmosphere and the underlying surfaces. Several studies have investigated the sensitivity of mesoscale models to idealized land cover scenarios, in particular the abundance of vegetation which was shown to have a significant influence on the simulated near surface temperatures (Taha 1996). This paper is based on study where a classical mesoscale model is applied to investigate the urbanization influence on climate of Tokai area in terms of near surface temperature and surface energy fluxes by characterizing the urban and rural land cover correctly.

1.1 Objectives

The main objective of the study was to investigate the urbanization effect on local meteorological fields in Tokai area using mesoscale model MM5[2]. To accomplish this goal, an urban parameterization was adopted in MM5 to simulate meteorological fields in planetary boundary layer to produce satisfactory result and when compared with

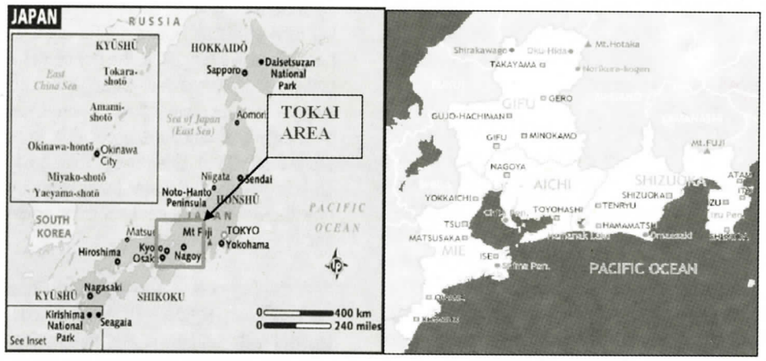


Figure 1.2: a) Map of Japan, b) Map of Tokai area.

(Source: http://www.nikkanren.or.jp/english/tokai.html)

observed meteorological database to give an accurate interpretation. The USGS 24-category global land cover data does not represent the actual topography and land use pattern in Tokai area. That is why, a new classification of urban land-cover data was done based on high resolution satellite images to represent the complex land-use pattern in Nagoya. One of the prime objectives of this research was to simulate the urban heat island phenomena and measure its intensity for understanding the urbanization impact on local climate.

2. Methodology

2.1 PSU/NCAR mesoscale model MM5

The Fifth-Generation Penn-State/NCAR mesoscale model MM5 (Dudhia 1993), the latest in series is a numerical meteorological model designed to simulate and predict mesoscale and regional scale atmospheric circulation. The MM5 model is supported by several auxiliary programs i.e. TERRAIN, REGRID, INTERPF and MM5 which are referred to collectively as the MM5 modeling system. Since MM5 is a regional model, it requires an initial condition as well as lateral boundary condition to run. To produce lateral boundary condition for a model run, one needs gridded data to cover the entire time period that the model is integrated.

2.1.1 Dynamic equations and physics options of MM5

The basic equations of MM5 are based on equations from Anthes and Warner (1978), which include pressure, momentum, thermodynamics, advection, and divergence terms. In addition to the dynamic equations that govern the basic variables, schemes and parameterizations for atmospheric radiation, planetary boundary layer, moisture, etc are used to quantify additional grid scale and sub-grid scale meteorological processes.

2.1.2 Land-cover data

A global land use/cover data-base classified according to the 24-category USGS land/cover system is provided with MM5. USGS global elevation data with the resolution 30 sec, USGS 25-category vegetation data of global coverage with the resolution 30 sec for land-use and land-water mask, were used as input to the TERRAIN program of MM5 modeling system. These data contain values of different surface physical parameters such as albedo, emissivity, moisture availability, roughness length and thermal inertia during summer and winter seasons.

2.2 Classification of land-cover

In USGS 24-category land-cover/vegetation dataset the extent of the Nagoya city area is not well represented. A single type of urban land-cover is used in this land-use dataset to represent the entire complex urban area. To make a better representation of complex urban area of Nagoya in the input land-cover dataset for the mesoscale simulation by MM5, a classification system was adopted to classify Landsat thematic image data and thus incorporated into the USGS 24-category land-cover dataset. A supervised classification process was implemented here using simplified maximum likelihood method.

A Geo-Cover Landsat ETM+ data with 30m resolution has been required to completely cover the Aichi area focusing Nagoya city (acquired on December 08, 2000) as the baseline dataset for generation of an initial land cover classification. The study area as shown in Figure 2.1, a subset of 2160x2160 pixels covering same area to the innermost modeling domain (1km grid resolution) selected for TERRAIN program, has been transformed into GeoTIFF format which comprises of urbanized, undisturbed and agricultural regions. These different types of land-uses have distinct texture that can be used as input into classification algorithms. Urban areas typically have significant texture resulting from building and street grids.

A freely available software Multispec (©Purdue Research Foundation) was used in this study to classify the land-cover dataset. Multispec is a processing system for interactively analyzing Earth observational multi-spectral

Figure 2.1: LANDSAT ETM+ image of Nagoya and surrounding area acquired on December 08, 2000 acquired from the Global Land cover facility data center.

(http://glcfapp.umiacs.umd.edu:8080/esdi/index.jsp).

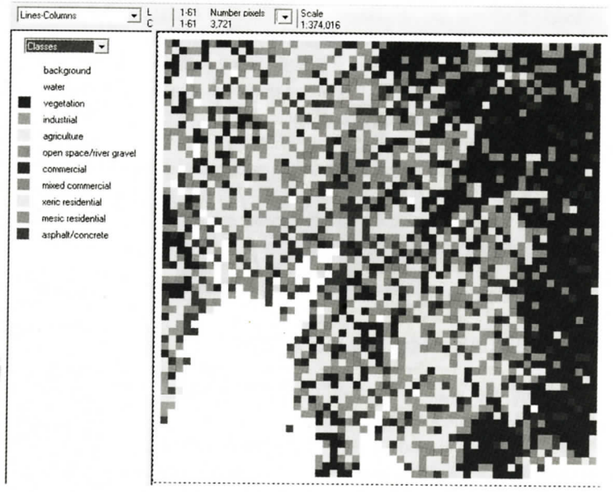


Figure 2.2: New 10-category land use/cover data of Nagoya and surrounding area at 1km resolution by implementing maximum likelihood classification process in Multispec.

image data such as that produced by the Landsat series of Earth satellites.

Figure 2.2 shows the newly classified land use map of Nagoya and surrounding area comprising new 10 land-use classes at 1kmx1km horizontal grid resolution. In the technique for classifying multispectral data, the first step in the analysis is to obtain training samples that are representative of each class of interest. 10 classes of land-use type were selected with 100 training fields (each field is a selected area of each sample class) in the Landsat image by using photo interpretation of Google Earth satellite imagery.

The maximum likelihood classification process was followed with an overall class performance accuracy of 91% in Multispec. Thus a new 10-category land cover classification dataset of 30m resolution was derived from Landsat ETM+ reflectance data. Then the dataset (30m x 30m pixel size) produced by Multispec was transformed in the dataset of 1 kmx1km pixel size (Figure 2.2) by rectification with scale factor 0.027.

The newly classified land-use data was incorporated into MM5 by mapping the 10 categories to the subset of 24 categories in USGS dataset found in the study area. Each MM5 30s grid cell was assigned with highest associated fraction of the land cover class. In addition, two additional urban land use/cover classes were introduced into the revised land cover classification to give three urban categories: urban built-up, urban xeric residential and urban mesic residential which were distinguished by the fraction of vegetation, bare soil and mad made surface. The new urban categories are assigned indices 23 and 24 replacing bare ground Tundra and Snow/Ice in the modified USGS dataset.

Figure 2.3 shows a newly classified land use map of Nagoya and surrounding area at 1kmx1km grid resolution incorporating new 10 categories land use data as shown in Figure 2.2 and standard 24-category USGS land cover dataset. Here Nagoya and surrounding areas are represented as mosaic of different distinct urban zones with urban built-up, xeric residential and mesic residential area. The land-class 1 combines the commercial area, mixed commercial and residential area, industrial area and asphalt/concrete surfaces, mainly concentrated in central Nagoya city around Nagoya castle. The Nagoya sea port and industrial zone along the Pacific Ocean are

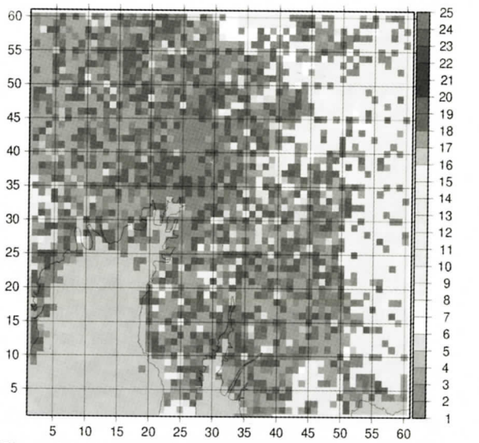


Figure 2.3: Newly modified 24-category land-use types combining standard USGS 24-category and Multispec 10-category land-use types.

represented as urban built-up area. The asphalt made road network and concrete surfaces also constitute the urban built-up area. Some pixels represent the existence of vegetation within Nagoya urban area and also few pixels as water body. The surrounding sub-urban zone made of xeric and mesic residential area is represented by the newly added two urban land-use types 23 and 24 respectively. The wide spread presence of xeric and mesic residential area is shown in the above figure. Irrigated cropland, mixed dry land and even the barren land are effectively shown in the newly classified data set.

2.3 Urban modification in MM5

2.3.1 Parameterization of long wave radiation balance by adding sky view factor

The sky view factor is the fraction of visible sky from a reference point on flat horizontal surface without view obstruction. It is dimensionless parameter ranging from 1 to 0. According to Masson (2000) if width of a road is ***w*** and the building height is ***h***, the sky view factor will be,

$$\psi_{sky} = \left[(h/w)^{0.5} + 1\right]^{0.5} - h/w$$

A typical distance between two houses (including street and front yard) of 25 m and an average building height of 6m were assumed to determine the sky view factor for a road. A sky-view factor of 0.85 for the xeric and mesic residential land-use categories was obtained by averaging between sky-view factor of road 0.78 and a sky-view factor of 1 for roofs which cover about 30% of an urban

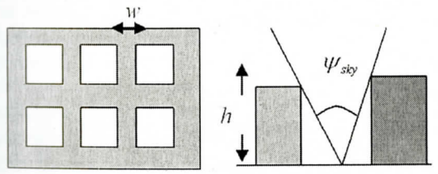


Figure 2.4: a) Typical grid structure of roads and house blocks in city plan (above left); b) Sky view factor.

model grid cell's plan area. As the large variation in road width (30 m to 100 m) and building area complicates the assignment of a single sky-view factor, ψ_{sky} , we therefore assigned the same value of 0.85 as for the commercial categories (Clarke 2005).

The sky-view factor was introduced to the long wave radiation balance of the urban land cover categories in MM5's slab model (Dudhia 1996) leading to the following equation:

$$R_{long} = \Psi_{sky}\varepsilon_g (L\downarrow - \sigma \cdot T_g)$$

Here $L\downarrow (W \cdot m^{-2})$
is the incoming long wave radiation from the sky, ε_g
is the emissivity of the surface, $\sigma (W \cdot m^{-2} \cdot K^4)$
is the Stefan-Boltzmann constant and
T_g (K) is the ground temperature.

2.3.2 The addition of anthropogenic heat source term in MRF scheme:

The approach of Sailor and Lu (2004) was adopted here to calculate the anthropogenic heat flux, $Q_a (W \cdot m^{-2})$ as a function of residents and working population densities. The anthropogenic heat flux from traffic for each urban land use class i, $Q^i_{a,v}(h)$ for each day, is calculated according to:

$$Q^i_{a,v}(h) = \rho^i_{pop}(h) \cdot F_t(h) \cdot DVD_c \cdot EV / 3600$$

Where, $\rho^i_{pop}(m^{-3})$
is the average population density, DVD_c
is the average daily vehicle distance traveled per person, F_t is the hourly traffic fraction and EV
is the energy release per vehicle per meter of travel with values for , DVD_c F_t EV ,as in Sailor & Lu (2004). Division by 3600 leads to a conversion of the units of $Q^i_{a,v}$ from $J \cdot hr^{-1} \cdot m^{-2}$ to $W \cdot m^{-2}$

The anthropogenic heat released through electricity consumption $Q^i_{a,e}(W \cdot m^{-2})$ was calculated by means of monthly totals of electricity consumption by the population of Nagoya city, which was obtained from the official website of Nagoya city authority at http://www.city.nagoya.jp. The data were converted in the daily per capita consumption, $E_c (J \cdot day^{-1})$ and used in the following equation to calculate. $Q^i_{a,e}(h)$

$$Q^i_{a,e}(h) = \rho^i_{pop}(h) \cdot F_e(h) \cdot E_c / 3600$$

Where F_e
is the average electricity consumption per day adopted from Sailor and Lu (2004).

The total anthropogenic heat flux Q_a for each urban land use/cover class is then given as the sum of . $Q^i_{a,v}$ and $Q^i_{a,e}$ Considering that anthropogenic heat is released directly into the air in the urban canopy, a source term was included in the governing equation of the temperature at the first prognostic level of the MRF scheme as suggested by Taha ('99).

Table 2.1: Physical parameters of urban land use/cover classes as used in modified MM5.

Parameter	Urban built-up	Mesic residential	Xeric residential	Source
Albedo	0.16	0.18	0.18	MOD global albedo dataset
Moisture availability factor	0.005	0.12	0.02	Hope et al.(2003)
Roughness length	0.8	0.5	0.5	Grimmond & Oke (1999)
Volumetric heat capacity	3.0	2.4	2.7	Liu et al.(2004)
Thermal conductivity	3.24	2.4	2.6	Liu et al.(2004)
Sky-view factor	0.85	0.85	0.85	Hope et al.(2003)

2.3.3 Physical parameters of urban land-use classes.

Some physical parameters characterize the land cover categories with respect to their influence on the surface energy budget in MM5. For the urban land use/cover categories these physical parameters were adjusted according to the Table 2.1 based on the fraction of vegetation and manmade surfaces and available data for each land-use type under the given environmental conditions.

2.4 Dataset for initial, boundary conditions and verifications.

The gridded meteorological analyses data as input to REGRID is from the Japan Meteorological Agency (JMA) with 10 km resolution. This AMeDAS gridded regional analyses data provided the initial and boundary conditions for MM5 mesoscale simulation.

For the verification of simulated results with observation, hourly data from Tokai city observation stations (Figure 3.1) was acquired from JMA (http://www.data.kishou.go.jp/).

3. Mesoscale simulations of the urban climate

3.1 Design of numerical experiments

The mesoscale model MM5 version 3.7 was employed for one month simulation starting at Universal Standard Time (UST) from 01 to 30, August, 2003 during summer season. This time was chosen primarily, because during August the maximum near surface temperature prevails at Nagoya city according to the Japan Meteorological Agency (JMA) observation data.

The focal point of modeling domains was centered at Nagoya city with 35.1 degree N and 137.0 degree E. Three computational domains were chosen for nested simulations with 24 vertical layers as details shown in

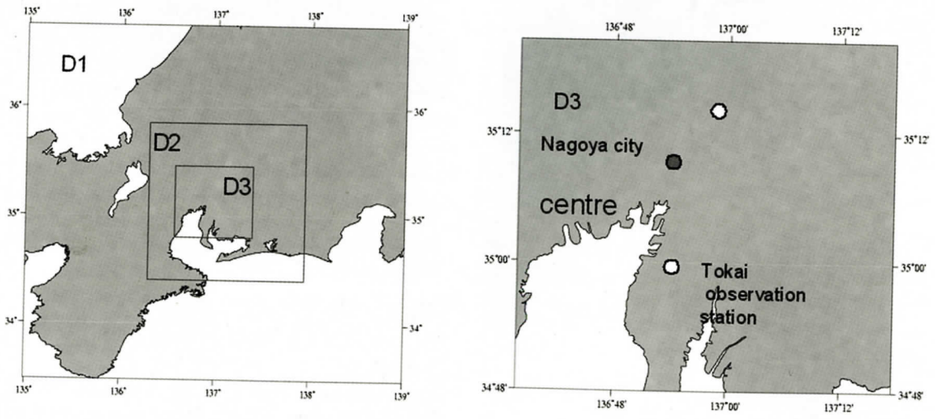


Figure 3.1: a) Modeling domains in MM5, and b) location of Nagoya city centre and observation stations in D3.

Table 3.1: Computational domains and grid arrangements.

Domain	Domain coverage (km x km)	Grid number	Horizontal Grid Size (km)
D1	369 x 369	41 x 41 x 24	9.0 x 9.0
D2	165 x 165	55 x 55 x 24	3.0 x 3.0
D3	61 x 61	61 x 61 x 24	1.0 x 1.0

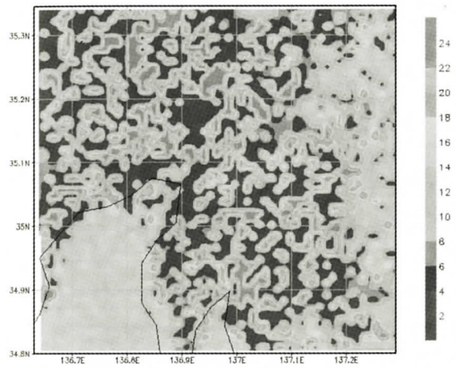


Figure 3.2: Land-use pattern in D3 (resolution: 1km) with newly modified 24-category land-cover.

Figure 3.1 and Table 3.1. The lowest prognostic level was approximately located at 7m above ground level.

Figure 3.2 shows the land-use pattern of Tokai area for domain D3 as generated by MM5's preprocessor TERRAIN for the modified version of 24-category USGS land use/cover-data. The features of the modified land use/cover map area are recognizable as the extended urban built-up area to the south and the relatively large mesic residential area to the west. Simulations were carried out with standard and modified land-cover configurations in order to investigate the model sensitivity of the land-use pattern changes around the urban area.

To investigate the influence of the different land-use/cover scenarios on the simulated 2m air temperatures and surface energy fluxes, three different grid point locations (Table 3.2) in the study area were chosen based on their land-cover characteristics as shown in Figure 3.2; 1) the urban area, which represents urban built up area (type-1) in newly modified 24-category land-use types. This urban type includes central dense commercial built-up area, mixed commercial and residential area, 2) the suburban area, which represents mesic residential area (type-23), and xeric residential areas (type-24) and 3) the rural area, which is mainly made of grass land and mixed forest areas (type-7 & 15) with maximum vegetation and some built forms around.

3.2 Results and discussions

3.2.1 Temperature at 2m

Figures 3.3 and 3.4 show the time series of diurnal temperature at 2m from 01 to 30 August 2003 in urban, suburban and rural area (locations are shown in Figure 3.2), simulated by the standard and modified MM5, respectively. Although the diurnal temperature changes show similar pattern, there are clear differences of near surface temperature among these three locations in both cases. In the first and third weeks, the standard MM5 simulates the high temperature environment (30-34°C), whereas the modified MM5 shows much higher values of temperature (33-38°C). In the middle of month (14 and 15 August 2003), due to high precipitation (45-59 mm) and high wind speed (5-6m/s), the temperature did not rise

Table 3.2: Features of three locations in urban area

	Land-use type in new 24 - category	Latitude	Longitude
Urban	Type-1	35.14 N	136.91 E
Suburban	Type- 23 & 24	35.27 N	136.83 E
Rural	Type -7 & 15	35.14 N	137.14 E

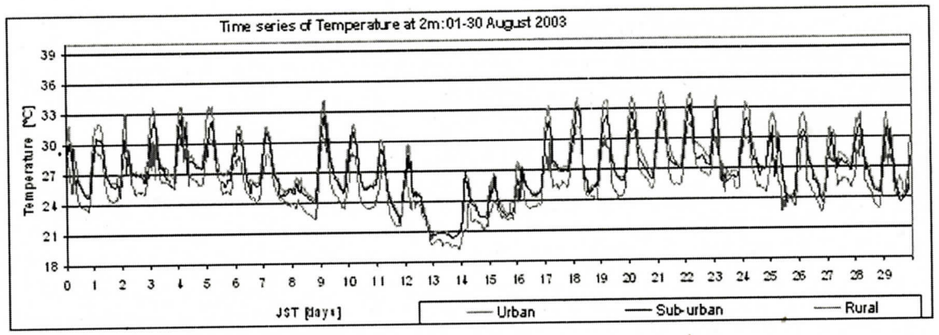


Figure 3.3: Time series of temperature at 2m (01-30 August 2003) by the standard MM5 with USGS land-cover data.

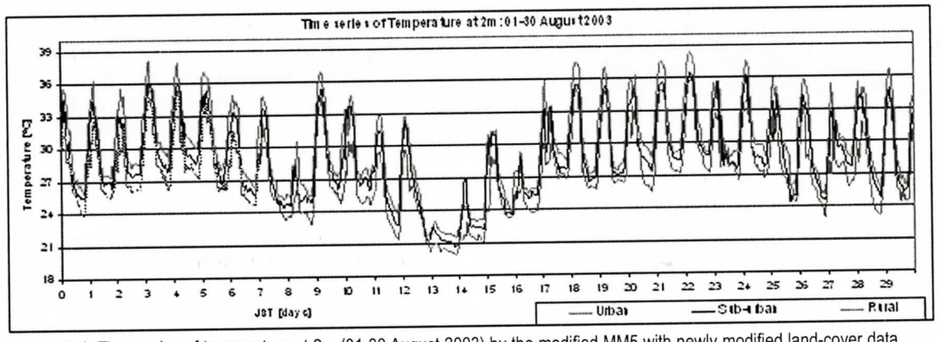


Figure 3.4: Time series of temperature at 2m (01-30 August 2003) by the modified MM5 with newly modified land-cover data.

above 22°C. The results by the modified MM5 indicate consistent increase of temperature with the standard MM5.

In Figure 3.5 the temperature of rural area is lower than that of suburban area and urban area due to the presence of vegetation and wet soil conditions with high moisture availability. The temperature difference between urban and rural area ranges from 3°C to 6°C during the daytime as shown in Figure 3.6, indicating effects of land-cover conversions and additional anthropogenic heat from traffic and electricity consumption on temperature in urban area. An average night-time temperature increase of 2°C in urban area proves the existence of the trapped heat inside building canyons. In rural area, the quick and large radiative heat transfer from vegetated earth surface decreases nocturnal air temperature.

Figure 3.7 shows the distribution of mean temperature at 2m height in the smallest domain D3 from 01 to 07 August 2003 simulated by the modified MM5. In this Figure, the center of Nagoya city concentrates high temperature anomalies (3-6°C) through the whole week, which reveals the signature of heat island phenomena and the highest UHI intensity occurred at 1PM on 03 August 2003, having a temperature difference of 6°C as shown in Figure 3.6. According to the above results, this UHI phenomena happened in Nagoya due to the heat storage in the urban built up surfaces of higher thermal capacity at mid day coinciding with maximum solar radiation. However the night-time temperature difference (1-3°C) is not large enough to develop severe UHI effect in urban area.

3.2.2 Surface energy fluxes

Figure 3.8 shows the time series of latent heat fluxes in urban, suburban and rural area, and Figure 3.9 shows the distribution of mean latent heat fluxes from 01 to 07 August 2003 simulated by the modified MM5. The simulation results indicate that vegetated rural surfaces with more moisture contents have mostly higher latent heat fluxes (up to 440). The urban surfaces are mainly made of asphalt and concrete with characteristics of quick surface runoff and little moisture content for evaporation. Therefore, central Nagoya area shows concentrated lower latent heat fluxes (up to 30) as illustrated in Figure 3.9.

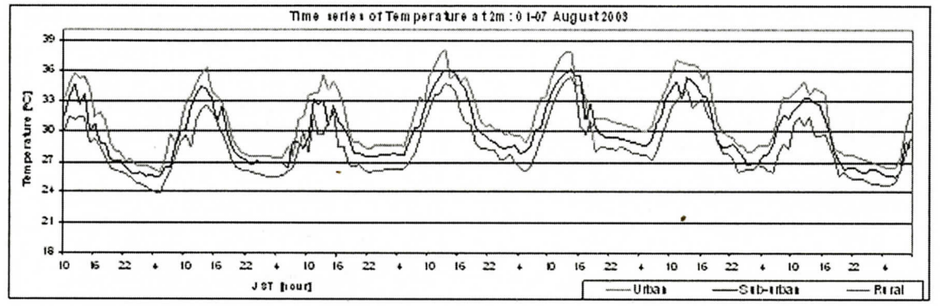


Figure 3.5: Time series of simulated temperature at 2m (01-07 August 2003) by the modified MM5.

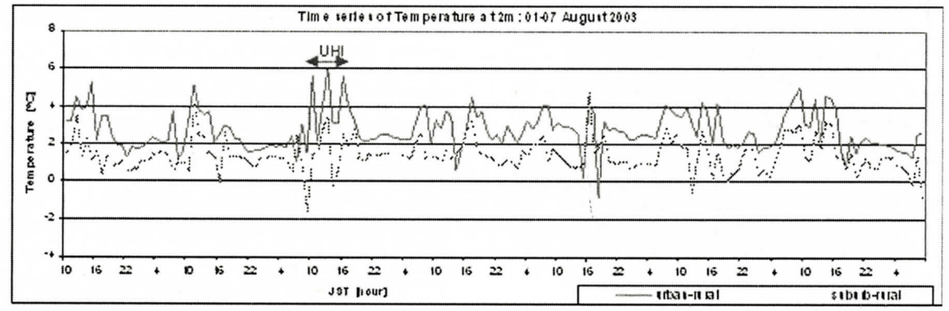


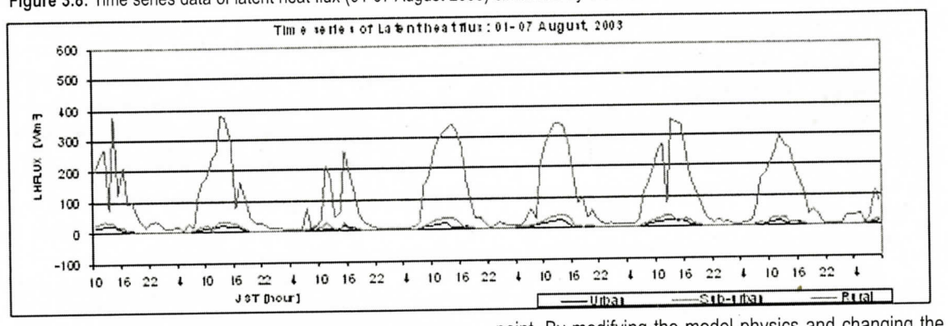
Figure 3.6: Diurnal temperature differences between urban and rural area (01-07 August 2003) by the modified MM5.

Figures 3.10 and Figure 3.11 show that the sensible heat fluxes, are considerably higher (up to 700) in urban area than that of surrounding suburban and rural area. Because urban area is covered with concrete and asphalt surfaces, which have higher volumetric heat capacity (=3.0), and lower albedo (=0.16). On the other hand, rural surfaces mostly covered with vegetation and forests, have lower heat capacity with high moisture availability. The rural surfaces cool atmosphere faster due to high latent heat fluxes. The maximum difference of sensible heat between urban and rural area is 228 on 04 August 2003.

Figure 3.7: Distribution of mean temperature at 2m (D3:1km) on 01-07 August 2003 simulated by the modified MM5 with newly modified land-cover.

According to the above discussion, a significant change in the surface energy fluxes is actualized by land cover changes. Large manmade land-cover in Nagoya city with the presence of few urban parks and water bodies influenced the surface energy fluxes substantially. The heat island phenomenon is closely correlated with lower latent heat fluxes and higher sensible heat fluxes in Nagoya city center as illustrated in the simulated results of Figure 3.9 and 3.11. The urban parameterization of MM5 by modifying heat balance equation has considerable impact on day time energy fluxes in urban, suburban and rural area. Thus it is emphasized that the new land-cover classification with updated physical parameters of urban land-use types substantially changed the energy fluxes in urban area.

Figure 3.8: Time series data of latent heat flux (01-07 August 2003) simulated by the modified MM5.



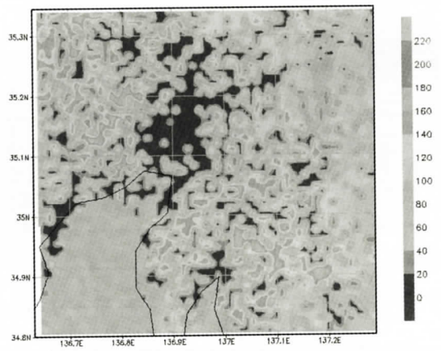


Figure 3.9: Distribution of mean latent heat flux (D3:1km) on 01-07 August 2003 simulated by the modified MM5 with newly modified land-cover.

3.3 Verification of simulation results

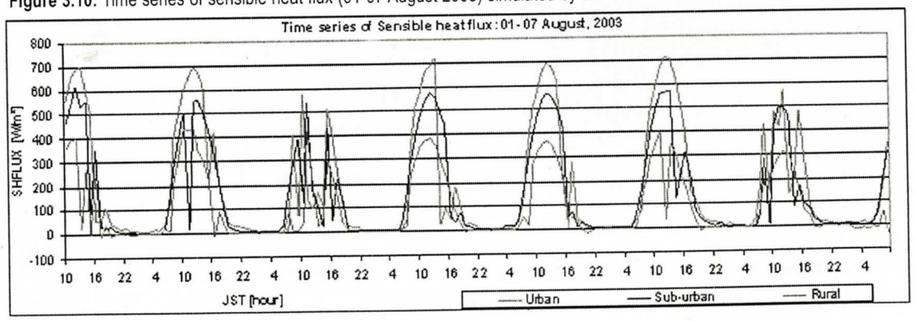
Accuracy of MM5 simulations was evaluated by comparing simulated 2m air temperature, with observation data from Japan Metrological Agency (JMA) observation stations at Tokai city (http://www.data.kishou.go.jp).

Figure 3.12 shows the comparison of time series of observed and simulated temperature at 2m height by the standard and modified MM5 at Tokai city observation point. By modifying the model physics and changing the physical parameters of urban land-use categories (land use type-1, 23 and 24 in Table 3.2), a significant agreement is found in the modified MM5 results (Figure 3.12) at daytime when compared with observed temperature at Tokai city. Comparison of the time series in Figure 3.12 shows the overestimation of night time temperature in case of modified MM5. This overestimation could be related to little radiative cooling as model performance tends to decrease in the day to night transitional period where the rate of decrease in observed temperature exceeds the rate of decrease in simulated temperature. The addition of sky view factor in long wave radiation balance increases the heat storage in urban canyons, decreases the rate of radiative cooling and thus increases night time temperature. The overnight observational temperature typically drops below the modeled temperature by as much as 1°C to 3°C as shown in Figure 3.12.

From the above comparison, it is perceived that the simulations by the modified MM5 has acceptable agreement comparing with observation data at day time as having bias error of -0.102 and correlation coefficient of 0.96.

Generally the locations of the JMA observation stations are outside of the urban neighborhoods, where enough vegetation and irrigated agricultural land exist. The observed dataset is evidently affected by the absence of

Figure 3.10: Time series of sensible heat flux (01-07 August 2003) simulated by the modified MM5.



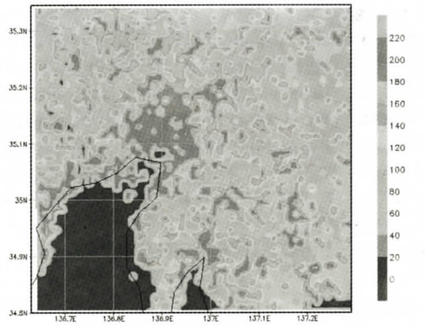


Figure 3.11: Distribution of mean sensible heat flux (D3:1km) on 01-07 August 2003 simulated by the modified MM5 with newly modified land-cover (above right).

different urban factors such as anthropogenic heat, heat storage inside buildings, etc. while measuring the surface air temperatures. Unfortunately atmospheric observation data in Nagoya downtown area was not available for this study; therefore we had to use the freely available JMA data to compare the simulated results.

4. Summary and conclusions

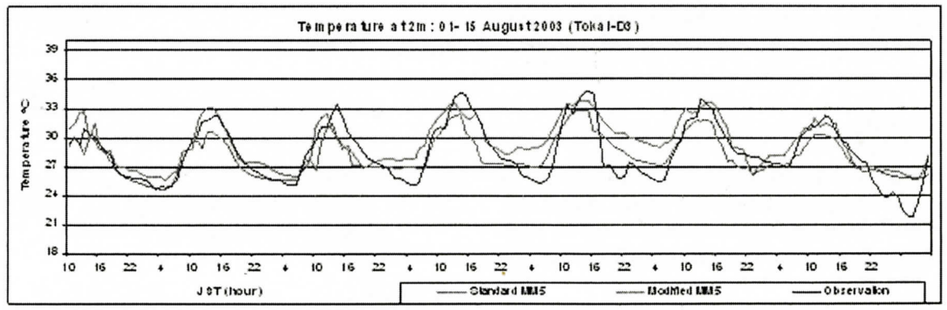
The research process in this study consists of three parts. Firstly, a classical mesoscale meteorological model was modified by including urban factors such as the anthropogenic heating term and sky view factor in the surface energy budget equation. Secondly, a land use category map, related to the several important land surface parameters, was newly classified based on the high resolution satellite images. And thirdly, mesoscale simulation of Nagoya city and surroundings was conducted to evaluate the impact of urban modification using the newly developed model.

In order to perform numerical simulations of Tokai area heat island phenomena, two-way triple nested domains were centered at the Nagoya city center with horizontal resolution 9km/3km/1km. Two-case simulations were performed for one month during the summer in August 2003, using standard MM5 and urban modified MM5. Model performance was validated using surface observation data from Japan Meteorological Agency (JMA). Surface observations were compared with the closest model grid point values in 1km model domain. Results of near surface temperature and surface energy fluxes were analyzed both qualitatively and quantitatively.

Compared with observation data, both models appear good agreement in case of innermost domain with 1km horizontal resolution. In the modified MM5, the 2m air temperature was better simulated at daytime due to addition of anthropogenic heat fluxes and modification of the physical parameters. But the nocturnal near surface temperature differs in comparison with observation. Radiation cooling seems to be a major factor in nocturnal temperature errors that are not well simulated by the modified model. The subgrid scale heterogeneity seems to be the major source of error which is related to improper representation, specification and initialization of surface features including soil moisture, land-use and texture as well as surface energy budget. The observation data provided by JMA is not located in urban areas to maintain representativeness of the data sample. Therefore the observation data does not always reflect the urban phenomenon which differs in some cases. Due to the lack of data for some important parameters, such as energy consumption by vehicles and air-conditioning, and building average height, these values were assumed in reference to other cities derived from published research papers (Sailor 2004 and Clarke 2005). But the qualitative performance was acceptable in terms of comparing temperature and energy fluxes. In future more observations are needed especially within urban area to validate simulated dataset.

The achievement through this study can be summarized to some specific points as follows:

Figure 3.12: Time series of temperature at 2m on 01-07, August 2003 at Tokai observation point.



1) An urban parameterization is implemented in mesoscale model MM5 by adding anthropogenic heat flux in the heat balance equation and sky-view factor in the long wave radiation balance in simple soil model.
2) A land use/cover classification for Tokai area is refined as the newly modified 24-category land-cover types by Multispec software using LANDSAT + ETM images. The single urban area of USGS 24-category is classified in urban built up area, xeric residential area and mesic residential area.
3) Values of physical parameters land-use types such as surface albedo, moisture availability, roughness length and thermal heat capacity are adjusted in accordance with local urban phenomena.
4) The results simulated by urban modified MM5, confirm significant improvement in simulated diurnal temperature cycle (average 3.2°C at daytime and 1.7°C at night) and surface energy fluxes (sensible heat flux up to 260 W/m² and latent heat flux up to 600 W/m² at day) in urban area compared to the standard MM5. Although the simulated daytime temperatures show good agreement with observed temperatures, these differ slightly in case of night time temperature (1-3°C), because of improper representation of urban area in observed data.
5) Differences of meteorological fields between urban and rural area suggest the evidence of heat island existence (maximum UHI intensity 6°C) in Nagoya city center. This study also shows that the land-cover changes which result in the decrease of the surface albedo and emissivity, will generate urban heat island phenomena.

Faced with mounting unfavorable circumstances in urban area, the rehabilitation and mitigation of adverse urbanization effects on climate are essential for architecture and urban planning engineering. Therefore future work should involve developing a regional climate map and formulating a design strategy for urban planners and architects in order to mitigate the urban heat island effect and create comfortable and energy efficient urban environment.

End Notes:

1. Mesic and Xeric residential area: Mesic residential areas are defined by having higher fraction of vegetation, irrigated agricultural land and bare open spaces (type-23), whereas xeric residential areas (type 24) have less vegetation and higher built-up area with irrigated agricultural land and bare open spaces

2. MM5 modeling system: MM5 modeling system consists of TERRAIN, REGRID, INTERPF and MM5 sub-programs where terrestrial and isobaric meteorological data are horizontally interpolated (programs TERRAIN and REGRID) from a latitude-longitude mesh to a variable high-resolution domain on either a Mercator, Lambert conformal, or polar stereographic projection. Program INTERPF performs the vertical interpolation from pressure levels to the sigma coordinate system of MM5.

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Influence Of Landscape Architecture On The Contemporary University Campus Design

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Abstract
The University campus is capable of providing the foundation for developmental activities for catchments human settlements. It is not only established as a higher learning centre but it also constitutes a cultural centre for the region in which it is situated. Different attributes of university campus design namely size, patterns of growth, circulation, and hierarchy of open spaces enhance open-air learning and cultural activities within the campus environment. Landscape design elements namely pedestrian walkways, courtyard and landscape forms influence directly open-air student activities and it is very interesting to observe the behaviour and nature of student outdoor activities in respect of these landscape design elements. The aim of this paper is to justify the above claims.

Key words: University campus, open-air space, landscape architecture, pedestrian walkway, courtyard spaces, landscape forms.

01. Introduction

The university campus is basically a place of academic, social, cultural, and recreational activities. The core objective of the university as a tertiary institution is students' academic learning, which is usually fulfilled through varied experiences. The success of the learning process is related to the articulation of the university campus spaces both in the interior and the exterior. However, the social, cultural, and recreational activities take place in the outdoor spaces of a university campus. Therefore, landscape design should play a major role in the organisation of these outdoor activities. The attributes of the university campus are therefore also related to the student's outdoor activities. The varied attributes of the university campus are discussed early in this paper followed by the influence of landscape design on campus outdoor activities. On the basis of the analysis of the two, the factors of effective design are derived.

02. The attributes of the university campus

A fully established university campus can be likened to a city on a small scale because apart from the academic facilities, it provides most of the socio-economic needs of the university community. Moscow University commonly referred to as a city in a city. It is a typical example, situated in the heart of the mega-city, Moscow, it provides for all the basic needs of members of the university community. Unlike a city, however, the university is not a profit making entity but primarily, a place of study – learning not only in the classroom or in the library building but also in the outdoor space. The campus, therefore, ought to be a closely-knit environment with clusters of buildings and intimate open spaces, a unique environment for learning and recreation. It should ideally be a quiet, comfortable "oasis" within the normally busy, noisy, congested communities around it. In this sense a campus may be likened more to a residential neighbourhood than a commercial entity of the city.

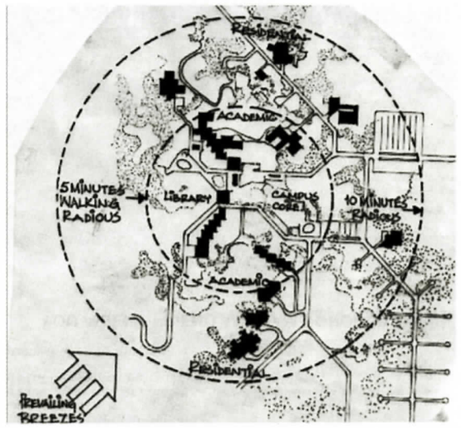

Figure 1 : A campus layout showing the walking radius from the centre of the campus to the periphery.
Source: Haider, S. (1994)

The university campus should not, be isolated from its surrounding communities. The university and the region in which it is situated will mutually benefit from proper interaction of the "town and gown" ideal. The university can serve as a cultural centre, if the surrounding communities are allowed to share in its facilities and activities. It can contribute to the generation of economic activities and provide progressive ideas and new knowledge if its research projects are tied to the particular problems of its region. The open spaces between university buildings, if properly harnessed, provide areas where students may congregate informally between classes for discussion and rest, or where they can gather in large numbers to watch or participate in sports and other recreational activities. A well landscaped campus encourages socialisation of all kinds in student activity hubs. It provides a place for literary, artistic, musical and dramatic occasions, which culturally enrich life in the university community as a whole.

One of the most important attributes of a university campus is dynamism or change in time and space. The university management normally seeks for a satisfactory degree of stability and continuity as the institution undergoes progressive changes required for maintaining its pace-setting tradition. Consequently, it is not possible to produce a final landscape design of a university campus because growth and change, in response to changing academic and social demands, are not permanent features. A direct consequence of the attribute of change is size. The ideal size for a university campus depends upon individual circumstances. The demands on the university, the location of the campus, the academic focus, all influence the size. Experience has shown that even when an ultimate size is predetermined, the university often continued to grow beyond what was originally considered best. Usually, a simple rule of thumb for size is the walking distance (Kanvinde & Miller, 1969). Ten minutes from hostel to classroom is considered a maximum allowable walking time. Three to five minutes is optimum (Fig-1).

A related attribute of a university campus is the pattern of growth. What manner of design will likely succeed in producing an ultimate campus form most appropriate for the needs of a university? It is easier to classify campuses by

Figure 2 : Aerial view of model of the central core of NUST Site campus, Zimbabwe. A Homogeneous campus.
Source: Director of Works office, NUST, 2003.

Figure 3 : Site plan of a Heterogeneous campus allowing for growth. Roorkee University, India, 1947.
Source: Haider, S.,1994

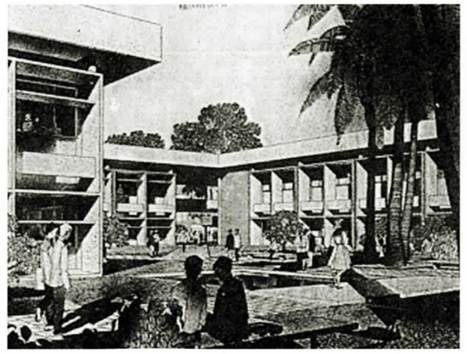

Figure 4 : Academic court, University of Baghdad, Iraq. Source: Fry and Drew, 1964, 184.

Figure 5 : Aerial view of the NUST Campus with a pre-designed circulation system. Source: NUST Information and Public Relation Office, 2002.

comparing their relative physical characteristics and their pre determined patterns of growth. In reality, campus forms are as individual in personality as members of the human race. Since time, place, conditions, attitudes and intentions of each case differ in combination, no two campuses are alike. Nevertheless, there are two broad categories: "Homogenous" and "Heterogeneous" (Dober, 1963). A campus of homogenous style is a mannerism conceived as an entity in a kind of geometric pattern utilising the same materials and forms consistently throughout (Figure 2). This style is based on a close–ended system. In other words, it is conceived and built as one whole with only minor additional growth expected and tolerated. However, that may not always be true because several new campuses are "homogeneous", yet anticipate considerable future expansion (Kanvinde & Miller, 1969).

Campuses that are "Heterogeneous" are made up of individually designed buildings that are distinct entities not in harmony with each other, nor providing open space- planning to unify them. This is characteristic of a majority of older campuses that have suffered under the hands of changing administrations and usage through the years. Such a style is certainly "Open ended" and considerable growth occurs with very little consideration given for future identity (Figure 3).

Contemporary patterns of growth are many and varied, though Robert Mathew, Johnson – Marshal & Partners Architects, in their report; "The Proposed University of Bath" suggest four basic patterns that might encompass most of the types in use. They are as follows: the Concentric[1], the Zonal/ American plan[2], the Molecular[3], and the Linear pattern of growth[4].
No matter whether the patterns of growth of a university campus are concentric, zonal or linear type, the design should be meaningful as well as beautiful. Beauty is the evident harmonious relationship of all parts of a thing observed. In observing the natural landscape character there is a very real pleasure in sensing the unity and harmony of the total scene. In the university campus landscape design this factor or quality should be explored.

Figure 5A : The Structural skeleton.
Source: Kanvinde & Miller, 1969.

Figure 5B : The circulation strings.
Source: Kanvinde & Miller, 1969.

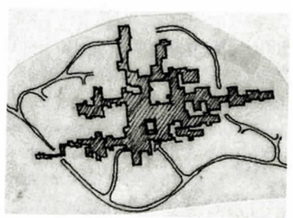

Figure 5C : The muscles.
Source: BUET Arch. Library

Ugliness is found wherever man insensitively placed his structures in the landscape. It follows that a visual harmony of all parts of a landscape, including buildings and other man made elements, is a desirable objective in the design of a university campus landscape. Thus, in creating an ideal campus environment, the necessary classrooms, offices and living spaces ought to be as closely related to the existing natural setting as possible. The selection and use of materials should be restrained and indigenous. It is however incorrect to think of landscaping as a setting after the building structures are placed. The landscape existed in the beginning. The man-made elements must be carefully added so as to harmonise, complement, and be completely integrated with the existing natural environment. Thus, skilfully designed, building and landscape will be one in a beautiful, harmonious environment totally appropriate for human use.

Since buildings occupy a piece of land, the organisation of the adjoining earthscape is next in importance. Often the exterior spaces for movement and access are what are left after buildings have been placed. However, in any effective university campus design, the exterior spaces should be as carefully articulated as the interior spaces. The University of Baghdad, Iraq, where the designer concentrated on the exterior space to achieve a very effective campus space (Figure 4) is a good example. Some exterior spaces exist for educational purposes, such as play fields, but they are no more important to overall campus design than other exterior spaces, all of which are simply extensions of, and linkages with, interior spaces.

Circulation (pedestrian and vehicular) and service systems (sanitary, electrical, water, etc.) are primary considerations, which nevertheless should be properly designed as an integral part of the total fabric of the campus and not later superimposed on a framework that initially ignored them, as is often the case. The University of Melbourne, Australia, boast of one of the good examples of a well-designed pedestrian walkway. In some instances the pedestrian circulation system may be allowed to establish the basic framework of the campus, since movements of students is a primary functional requirement. The National University of Science and Technology campus, Zimbabwe, demonstrates one of the good examples of a pre-designed circulation system (Figure 5).

A campus is made up of visible, physical, measurable systems, which directly express and support invisible, psychological and immeasurable systems of human interactions. The visible on the landscape includes the open spaces, pedestrian walk-ways, vehicular access, the framework of buildings and the various utility service systems (Dober, 1963). The invisible are the interaction of

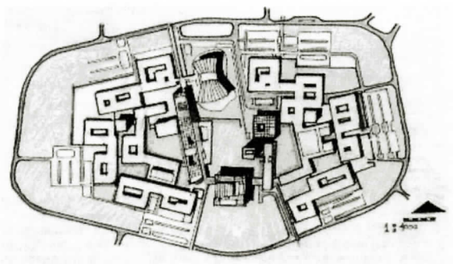

Figure 6 : Site plan of University of Baghdad,
Source: Fry and Drew, 1964, 183.

academic and living activities, the time, motion and communication required. How well the visible total landscape fabric, as an expression of the invisible, satisfies the philosophy and intentions of the university community, determines the ultimate quality and success of the campus design.

Like an organic entity, a campus landscape should consist of a kind of hierarchy of elements that give it a comprehensible form (Kanvinde & Miller, 1969). The integrated systems, as in any organism, are a part of that hierarchy. The "structural skeleton" is the framework of buildings (Figure 5 A). The services provide the networks of "nerves" and the "circulation system" consists of pedestrian walkways and vehicular roads (Figure 5B). The "muscles" are the ordered sequence of linked spaces, classed as static or dynamic, collector, focal, intimate or monumental (Figure 5C).

International practices show a trend toward breaking down the rigid zoning and intermixing of facilities. An excellent example is Gunnar Birkert's proposal for the new campus at Tougalou, Mississippi, U.S.A. It significantly contributes to the possibility of the integration of all campus activities into a unified community, placing living units directly above learning facilities(Schmertz, 1969). Another trend is towards a more compact and denser campus. The University of Baghdad (Figure 6), designed by Walter Gropius, became more widely accepted because of variety of comparatively small exterior spaces are more desirable than large spaces that create excessive distances between buildings. A sprawling campus lacks in unity and clarity.

Figure 7 : University of Newcastle Upon Tyne, UK.
Source: Undergraduate Prospectus 2003/2004

Figure 8 : University of Melbourne, Australia.
Source: Information Guide 2000/ 2001.

Figure 9 : University of Durham's Stockton campus, UK.
Source: University of Durham undergraduate prospectus, 2003.

Figure 10 : Bangladesh Agricultural University. Wide pedestrian walkway is located in front of the campus central facilities.

03. The influence of landscape design elements on campus activities

Nowadays, landscape design has become synonymous with the unified design of the social landscape. The forms for landscape design include ground forms, buildings, trees, vehicular and pedestrian circulation, green open spaces, paved open spaces, water forms as well as the multiple detailed furnishing, equipping and enriching elements of the man-made world and the world of nature. Thus landscape design begins with the common or garden variety of local landscaper and ends with the merging of all the space-planning professions and all other fields of design concerned with improving our world. There are many social and physical forces converging on this field of landscape design to shape our environment. These are: architecture, nature, history, and society, with architecture as the most pertinent force of influence for our subject matter. Architecture is important to landscape design because it is the primary expression in the landscape of human creativity and control of nature.

Nature is important to landscape design because it is the world of forces and processes within which we live and work. It is the world of which man and all his works are an inseparable part. Climate, vegetation, soil, topography, and water movement are all fundamental to landscape design thinking. Very often, landscape design plays the role of a defender of nature against the destructive attacks of human beings. Its true constructive role is the establishment of connections, relations, and adjustments, both physical and visual, between buildings, sites, and their surrounding landscapes, that is, between people and total landscape around them(Eckbo, 1969, 62). In the case of the university campus these connections and relations between the students and the total landscape around them are essential because of its career fulfilment goal.

It is essential to understand how students live and how the landscape affects their daily lives. Student's activities in every hour, every day, every weekend, every vacation, and on other special occasions, shape the landscape around them. Architecture and the landscape for students must respond to their perception of the world, the nature of their consciousness, memory, attitudes, needs and desires. It is also essential to know how the students relate, in their activities, to the landscape. Do they relate to it by lying down, sitting, standing, walking, running, climbing, swimming, working, or simply recreating in the university campus landscape?

In the light of the above, it is understandable that the university campus is not only an institution of learning but also a place of social events, recreation, meditation, rest, sports, multicultural events, multi-traditional events, etc. These important activities mostly take place in the open spaces. As discussed previously (on the relationship between human beings and nature), there are definite influences of landscape design on campus activities. To elaborate on that, we briefly consider three major landscape design elements as they influence the activities of university communities.
These are: -
Pedestrian walkways and footpaths
Courtyard and open spaces
Landscape forms (hard and soft)

03.1 Pedestrian walkways and Footpaths

The characteristics of pedestrian traffic can best be understood by comparing them with those of a stream or river(Simonds, 1961, 159). Footpaths, like flowing water, follow a course of least resistance. They tend to connect the shortest possible distance between two points. By its nature a footpath has momentum, force, and it erodes. Swift movement requires a straight smooth channel with

Figure 11: Bangladesh Agricultural University, Open-air court inside student hostel Building. Source: Author's Photograph, 2002.

Figure 12 : Dhaka University, Bangladesh.Curzon Hall, front open space , stimulates a prescribed emotional response. Source: Author's Photograph, 2002.

increased width at the curves. If not provided, such a channel will be forced. In the case of the university campus, students generally walk around, sit, socialise, read, and eat in groups. They go to attend lessons from the hostels to the academic buildings first thing in the morning and come back from the academic buildings to the hostels at the end of the day. These are "rush hours" on campus. The curvatures of pedestrian walkways should be designed on campus considering that, students walk in groups (Figure 9). Intersections are points of maximum interest in a university campus landscape. These places are full of excitements and activities. They can resemble a market place, trade show, book fair, amusement park etc. Where two or more intersecting streams of traffic are to be merged into one fast, free-flowing stream, the area of juncture must be widened and shaped to provide a smoothly swelling transition and uninterrupted flow.

Pedestrian routes can find interest at the bottom of a ramp or a flight of stairs. The pedestrian environment is the connective web of open spaces threaded through the university fabric, in which people can move about on foot (Gage and Vandenberg, 1975). The following general observations are made with regard to the influence of pedestrian walkways and footpaths on the users: -
Students prefer to socialise standing on the pedestrian walkways, especially in front of the entrances of either academic buildings or any other buildings on the university campus (Figure 7).
Students prefer to sit beside the pedestrian walkways or footpaths. In many university campuses it is observed that students spend so much of their time socialising and reading seated beside these pedestrian walkways (Fig : 8).

The size (width) of the pedestrian walkways in the university campus can be a factor of the rate of interactions among the students (Figure 9). A well-designed pedestrian walkway or a footpath can serve and function as a central plaza of the university campus (Figure 10).

03.2 Courtyard and open spaces

The basic ingredient of architectural design consists of two elements, mass and space. The essence of design is the interrelationship between the two (Bacon, 1974). In theory a definite open-space can be created or articulated using forms (Ching, 1979). In an unobstructed base, if we set an upright plane, it becomes an element of high interest and a point of orientation for the visible field. We are drawn to it, and come to rest at its base. The vertical plane or wall gives us protection and suggests shelter. Two intersecting upright planes afford increased protection. They provide a corner into which anybody can get a feeling of shelter. Additional vertical planes define spaces that are further controlled by the introduction of overhead planes (Simonds, 1961, 87). Such spaces assume not only their size and shape, but their degree of enclosure from the defining planes. This space may be one of tension (Figure 11) or repose; it may be stimulating or it may be relaxing. It may be immense, suggesting certain uses (Figure 12), or it may be confined and suggest others.

The forecourt or area immediately in front of a structure or group of structures should be well planned as these open spaces are an integral part of the structure, at least in diagram. These open spaces are designed to attract and accommodate specific types of approaching traffic. They receive guests and direct services. They focus attention on the entrances, prepare one for entry, and establish the appropriate atmosphere. In most of the university campuses it is observed that these open spaces are always occupied by the students for social interaction or study purposes. The following general deductions with regard to campus courtyard spaces are made: -

- Courtyard space and open space in the university campus can be used as a study space or a lecture space. University campuses situated in the tropical countries prefer outdoor learning facilities because of their climatic conditions (Figure 13).
- Courtyard space and open space in the University campus is widely used for recreational, social and cultural activities (Figure 14). Students prefer to go to nature for recreation and for its purifying qualities.
- Courtyard space and open space can be used as a design tool to solve the climatic problems of the building (Fig : 15). It is efficient to solve cross-ventilation and natural day lighting problems by providing courtyards in the building.

Figure 13 : Faculty of Arts University of Southampton. Inner courtyard is transformed by glazed aisles, which have replaced narrow institutional corridors. Source: The Architects Journal, No. 20, Vol. 204, 1996, 33.

Figure 14: Brunel University, UK. Students are relaxing in the campus open space. Source: BU Undergrad. Prospectus 2003/ 2004
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Figure 15: Bangladesh Agricultural University, Faculty of fisheries. The open-air courtyard in between the lecture theatres – an effort by the architect to relate the courtyard, the study area and to solve climatic problem. Source: Author's photograph, 2002.

- Courtyard space is used on some of the university campuses as meditation space for the students, and they need concentration and to be focused on their studies while they spend their time on the university campus.

03.3 Landscape forms

Earlier in this paper it was discussed that a form can dominate a space and this form has influence on the student's open air activities. So, landscape forms can be man made or natural, hard or soft. They can be a structure, stone block, tree, column, mountain, sculpture or a fountain, which is located on the natural earth surface. The influence of these landscape forms are discussed below.

03.3.1 Hard landscape forms

Hard landscape forms include pavements, street furniture, mountains, rocks, sculptures, monuments. Concrete, brick and stone are the major construction materials for hard landscape forms. Pavement is one of the commonest hard landscape forms. Students' open-air activities often take place on the pavements depending on the form of the pavements. There are different types of pavements: - pavements for open-air pedestrian footpaths, covered pedestrian walkways/ corridors, boulevard, plaza, pedestal, pavements for leisure walk in the open-air courtyard, or any other open space including pavements for car parks and bicycle bays. It is observed that a significant number of students use all these paved spaces either for learning or social gathering purposes in the contemporary university campuses.

Street furniture is also treated as hard landscape forms and street furniture enhances student open-air activities. There are different types of street furniture, which enhance these activities: light posts, seats, post boxes, signboards, plant containers, etc. A seat, if it is well located, attracts students to sit or gather around it (Figure 16). Beside pavements and street furniture, sculptures and monument play a major role in enhancing student open-air activities (Figure 17). Most of these monuments and sculptures are constructed either out of respect for any historical events of the particular nation, or as symbols of some important events. It is observed that these sculptures and monuments influence the psychology of the students.

03.3.2 Soft landscape forms

These are normally natural elements of the landscape. Trees, grass and hedges are the major components of the soft landscape forms; others include water in various shapes and forms. Trees give welcome shade in an otherwise open landscape. That is why students always prefer to sit and to gather under the shade of the tree (Figure 18). Green lawn with shrubs also attracts students for relaxation (Figure 19). Soft landscape form in the form of trees is necessary for protection against wind, noise, or fumes, to screen undesirable views into or out of the particular open space, to give privacy to the open space, and visual or ecological links with the surrounding landscape; to frame views, to give shade and form space divisions. Soft landscape forms can enhance open-air activities in several ways.
For effectiveness it is very important to specify the right plant and the role it is to play in the landscape. A detailed knowledge of the visual characteristics of plants is essen-

Figure 16 : Brunel University, UK.
Students sit, read around trees.
Source: Undergrad. Prospectus 2003/ 2004.

Figure 17 : Bangladesh Agricultural University. Statue Victory-71, where students and staffs always gather for various events.
Source: Author's photograph, 2002.

Figure 18 : Brunel University. Students are in the Academic courtyard block and the space is dominated by the soft landscape form (tree).
Source: Brunel University

tial in this regard. It has been observed that students' open-air gathering is greatly enhanced by different forms of trees, which is determined by the way the main stem or branches grow (Figure 20). Too many different forms can give a restless effect to users. So, it is effective to limit variety and use strong forms for specific reasons where student gathering is expected.

For instance the leaf colour can be employed to attract students to specific areas on the university campus. It is very important to consider the appropriate colour of the overall tree leaves when planting in the open spaces. The size, spacing, disposition, grouping, attitude of leaves and branches, and the detailed structure of the plant growth are related to the overall landscape texture. The texture depends on single trees and combination of trees. The textural pattern is determined by the play of light and shade on the tree mass (Weddle, 1967). Glossy and small leaves give a finer texture because light reflections are more broken up. Large leaves appear coarse in near view, and this is particularly noticeable when the leaves are widely spaced. Texture of the soft landscape form is very closely related to scale, and wrong texture can easily disturb the apparent size of an open area as well as the open air activities. Texture is especially important in choosing plants for backgrounds (Weddle, 1967). For example, close matt textures make the best foil for sculptures or monuments. All in all, Trees, lawn, and hedges contribute to the success of landscape design of open spaces on these campuses if the right forms of trees, textures of plants, and variety of grasses are specified.

04. Conclusions

The university campus is a place of life fulfilment for the future generation. This life fulfilment does not take place in isolation in the university academic building, classrooms, or in the library building alone; rather it involves the interactions of different ideologies, cultures, traditions, religions, ethnic background carried by people of international communities. Such interactions take place in various spaces of the university campus and these spaces include: interior space, courtyard open space, semi-covered open space, playfields, circulation spaces, etc. This study is focused only on open air spaces on the Greenfield university campus. The factors of effective design imply the landscape design tools, which help to create a favourable environment for the functions of a university campus. One of the ways to assess the effectiveness of those landscape design tools is to observe the users' responses towards the design or users' activities. The main focus of this paper is the outdoor space, which is subjected to landscape design based on the students' outdoor campus activities & needs. Landscape design plays a major role in students' outdoor activities and the different attributes of university campus of Size, shape, paterns of growth, circulation systems, are all significant. Pedestrian walkways, courtyard open spaces and landscape forms are the major landscape design elements which are discussed and identified in relation to student open air activities. Besides these three major landscape design elements of university campus open spaces, the achievement of environmental control through the effective landscape design is also discussed.

Figure 19 : University of New Castle Upon Tyne. Students are relaxing on the grass lawn on a public park near the campus. Source: . Prospectus 2003/ 2004

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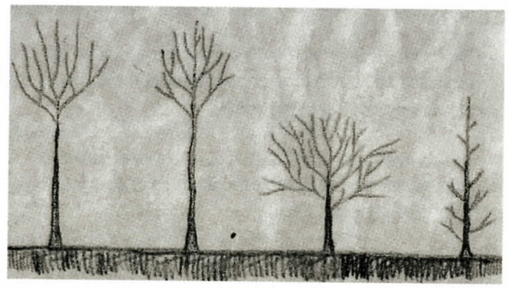

Figure 20 : Different forms of tree

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End Notes :

[1] The central area or "core" of the campus becomes tightly enclosed and successive rings of development shut in and prevent selective expansion.

[2] Typical American plan; zones allocated specifically to academic, residential or recreational; handicapping integration of campus activities.

[3] Growth accomplished through addition of self contained units or "molecules," each a microcosm of the whole. The campus is complete at each stage of growth, but the system is perhaps limited to a 'many centred' campus rather than a 'centralised' type.

[4] The pattern chosen for the University of Bath; the central core can expand at either end as the University grows; existing elements extend outwards and grow independently of one another; new ones are added to extensions of the core, which never becomes shut as in the concentric pattern.

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Revitalizing the Mughal Settlements in Old Dhaka

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Abstract

The dynamics of rapid urbanization, shifting economic activities, rising cost of urban land are exerting serious pressure on the built heritage of Dhaka city which is more than 400 years old. The social Characteristics of the historic areas have undergone changes and patterns of invasion-succession of immigrant population have been superimposed onto the successive development. The historic buildings needed to be considered within the context of urban-settings in order to develop coherence among urban elements. This paper attempts to make some suggestions to protect the *Mughal* artifacts of *old Dhaka* from decay and damages, integrate them within the urban fabric as sustain in urban elements while ensuring social and economic viability. The objective of the paper is to regenerate the historic area for sustainable urban development. The paper will explore the existing crisis of the built heritage to manage the underlying issues and finally outline a comprehensive approach for conservation.

Key words

Mughal Settlements; Revitalization; Conservation; Adaptive reuse.

Preamble

The historic *Mughal* sector is currently the commercial nerve of Metropolitan *Dhaka* and known as *old City*. It is a dense settlement (strategic planning zone-3) that covers an area of 284.3 acres with 8, 87,000 population (DMDP 1995-2015). Once a vibrant settlement, most of it is now facing gradual physical deterioration. Scarcity of open spaces, coupled with high plot coverage limits the scope for recreation and cultural activities. Buildings of *Mughal* era were once the focus of settlement layout, which are now pushed into the backyard (Mowla, 2003). Important historic buildings have been subdivided for multiple families and densities have risen to inordinate level. Illegal settlements are growing without the consideration of basic urban services. To promote the urban quality, characterized by the strong sense of continuity, conservation of the *Mughal* settlement pattern in the area has now become an important urban issue. The objective of the paper is to prevent decay and manage transformation in the old fabric, to integrate the historic artifacts within the urban fabric and link up with traffic network, and to enable it to regenerate for sustainable urban development. (Appendix: Defining the terms)

The Urban Settings of Mughal Dhaka

Dani (1962) mentioned that Dhaka for the first time came into lime light under the *Mughals(1608-1764AD)* and became the center of political cultural and social life and it dictated the trends of events throughout Bengal. The Mughal sector was laid out around *Chauk* in old Dhaka and started to extend westward up to *Sarai -begampur* and northward to *Bagh-I- badshahi* (Mowla, 2003). During this time the greatest business center, the *Chauk*, near the *Bara-Katra* was developed. The *Chauk Bazar* remained as the main emporium in the city. *Chauk bazaar* was connected with the *Sadarghat* by a road running parallel to the river. The road is a continuation of old *Patuatoli* and the extension bears the name of *Islampur* and *Mughal tull* (Mowla, 2003). The Mughal structures may be grouped as *(i)* Mosque and religious buildings *(ii)* tombs *(iii)* Katras *(iv)* Forts (v) Bridges. (Fig, 1-5)

Conservation Positional:

The *Mughal* rulers established this magnificent city as the capital of Bengal to control the trade and commerce in the entire region and the city became the centre of political, cultural and social life. To manage the rapid transformation in urban structures it is important to consider the sig-

nificant *Mughal* artifacts for contextual conservation. To maintain the scale and proportion of the urban elements and the interrelation of the spaces within the urban fabric it is important to integrate the historic interventions. The old city, located at the bank of the river *Buriganga* is the focal point for city development and major roads radiated from the area during the expansion of the city. Conservation-measures at urban level may recover the harmonized form of urban elements of the *Mughal* city through integrating the artifacts within the existing urban landscape as unity in forms, texture and materials. The integration of the old settlements into the city is also important to maintain the continuity (Mowla, 1997b) .

Social Settings: Traditional Civic Management: The traditional spatial divisions adopted indigenous mechanism for civic management that involves citizen's participation to manage urban services at neighborhood to city level (Mowla & Hossain 2006) .The traditional civic institutions adopted public private partnership and community participation as basic components for sustainable urbanization. So it is important to synthesize the traditional with the contemporary approach to manage conservation (Mowla& Hussein, 2006). Traditional *panchayet* system which had substantial control over local society may be considered along with modern concepts of community management (Mowla, 1997a).

Cultural and Economic Base: The old city is characterized as major trade centre by the economic activities. There is a need to establish control over the economic driving forces to manage the rapid transformation in urban structures as the increasing activities for trade and commerce are exerting serious pressure on the traffic and utility network of the old fabric (Hossain, 2006b). Moreover the micro level enterprises needed to be properly organized for promotion of tourism in the area.

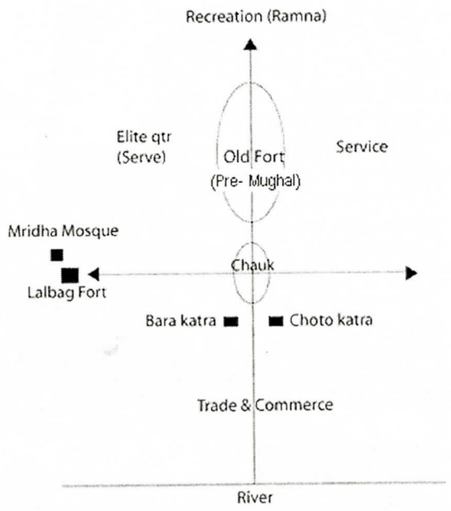

FIG 1 : Schematic layout of the Mughal Quaters in old Dhaka (based on Mowla, 1997b)

Landownership Pattern: One of the major constraints for conservation at the historic *Mughal* core is the complex landownership pattern that has developed there. Encroachment of the open spaces in and around the historic buildings and roads is a common practice in the area (DMDP, 1915-2015). Moreover the *Katras*[1] are in *dispersed form of submission*[2] that resulted in the lack of interest by each party to invest on proper maintenance. There is a need to unite the owners, users and actors on a common platform to generate collective action to protect the heritage properties.

Physical Settings: *Conservation on urban level focuses on urban elements, of which individual buildings are by products (Cohen, 1999).* It is necessary for urban conservation to identify the urban hierarchy of spaces to determine the elements for preservation.

Urban Pattern: The old city web is very difficult to maintain now as the dense settlements and organic growth has remained apparently unaffected by coerced geometry. However, it is important from the perspective of urban conservation as many design qualities are inherent in such town planning. The socio cultural dynamics resulted in the formation of spontaneous neighborhood, known as *para, mahalla* that act as the basic spatial unit to form the organic pattern in the urban web. Comprehensive strategy may be required to determine different level of interventions for different spatial divisions on the basis of their townscape value .The basic pattern evolved a hierarchy of spaces; *uthan, gullies, morh, Chauk and Bazars* [3]that manifested the socio-cultural quality of urban life *(Mowla, 1997a)* that should be preserved. Formation of the major streets has got significant relation with the river. Historically important roads in the area are:-*Azimpur road, Waterworks road, Mitfordroad, Islampurroad, Patuatuli road, North brook road, Johnson road, North south road,Bangshal road,Nawabpur road ;Embankment road(Hossain,2006b)* . The typical gullies(lanes and by lanes) of old Dhaka are extremely narrow with delicate curves that often create difficulties for the modern transport but offer changing views during usual movement. The streets are typically accompanied by urban services. The street front should be considered as principal part for

conservation as the continuous façade of old settlements and bazaars represent strong urban character. (Fig, 1)
Observation point: Magnificent view of the old city was observed from the river as the river front was the most dominant part for the *Mughal* city that was considered to be approached through the river route. However, the riverbank has now moved away from the *Mughal* settlements and the newly built settlements and over height of the residential buildings around the artifacts creates obstacle for visual exposure from the river and different part of the old city. There is a need to identify different observation points from where the important urban elements can be viewed from long distance.

Mughal Monuments : Most of the monuments in the *Mughal* core are well documented but the *Katras* are not. *Katras* are therefore taken as a case, expecting the structures to follow the model.

Lalbag Fort and *Mridha* Mosque : An incomplete *Lalbagh* fort was commenced in A.D. 1678 by *Muhammad Azam* during his viceroyalty in *Bengal (Dani,A.H 1962)*. The fort is situated at the bank of the river at ward no62, *Lalbag road.* The historic structure shows a long fortification wall with gateways. The fort consists a magnificent two-storied building which contains audience hall and *hammam* (bath house). There is a three-domed-mosque, a few yards west of the tomb, known as *Bibi pari's tomb*. *Khan Mohammad Mridha's Mosque* is standing on a high platform and located close to the north-west corner of *Lalbag fort*, was constructed in 1706AD *(Dani, 1962)*.

Bara Katra and *Chota Katra* : The artifacts are the two historically important *Mughal Caravan Sarais* standing at *Chauk bazaar*. The *Mughal* prince *Shah Suja* appointed his chief architect *Abul Qasim* to build *Bara Katra* and its foundation was laid in 1644A.D *(Dani, 1962)*. Except the southern wing all other part of *Bara Katra* has almost disappeared. There are traces of walls and foundations of east and west wings standing with the newly built residences on east and *madrasa* on the west side. *Chota Katra* is situated about 200 yard's east of the *Bara Katra* on the bank of the river *Buriganga*. It was built by *Naiwab Shaista Khan* in 1663 AD *(Dani, 1962)*. This *Katra* is of similar plan and structure as the *Bara Katra*, but smaller in size. The entire premises are now heavily encroached by settlements, defacing the historic artifacts. The enclosed quadrangular courtyards are now overcrowded with newly built settlements like shops, ware houses, and workshops. The artifacts are in deplorable condition and gradually deteriorating due to the lack of maintenance.

FIG 2 : Bara Katra

FIG 3 : Chota Katra

The narrow and poor road network doesn't permit easy access as the historic structures are hidden within dense settlements that have resulted in visual obstacle also. This isolation and inaccessibility cause deterioration of the structures. The artifacts are declared as protected-monument by the Department of archaeology, Bangladesh but only the fort and *Mridha* mosque are conserved. Architectural conservation is necessary to protect the *Katra* buildings from decay and damages with special emphasis on its townscape value. Supporting services are not adequately provided in these areas for tourism. The historic buildings needed to be considered within the context of urban-settings rather than as an isolated example of architecture in order to develop coherence among urban elements during urban conservation.

Damage Survey:

Though the Fort and *Mridha* mosque are well maintained by the department of Archaeology but the *Katra* buildings are in deplorable condition and gradually deteriorating due to the lack of maintenance. As an example of *Mughal* buildings, extensive inspection is required for these buildings to record the level of damage and decay prior to any interventions. There is a need to identify major structural damages especially at foundation level. Dampness, Efflorescence and vegetation is a common problem and in some cases walls have deteriorated to a extent that the bricks are coming out and cracks are found on the load bearing walls. Seasonal temperature variation, humidity, and precipitation of rain, ground water moisture in soil dust, particulates, and dust and sand particles in air, Vegetations, Termites, Earthquake, Flood, Lack of maintenance, Purposeful alternation, Traffic vibration, Vandalism and arson, Encroachment are some common reasons for decay of these historic buildings (Hossain,2006b).

FIG 4 : Lalbag Fort and Mridha mosque in the old fabric

Planning Conservation

Urban conservation is more than merely preserving few historic buildings and requires comprehensive approach to integrate focal urban elements of the past within the existing urban tissues and open them up to the city dwellers(Mowla,2003)). The dynamics of rapid urbanization, shifting economic activities, rising cost of urban land, changes in land use-pattern and zoning, growing population density, modernization transportation are bringing transformation in the city structure that has to be managed though integrating the urban elements within the fabric and keep the city's identity intact(Hossain,2006b). Shifting focus from individual buildings to urban context during conservation may reinforce the urban pattern to incorporate the new structures into the old fabric. Conservation therefore may be judged as a planning concept and tool to justify the urban form to incorporate the new and the old to maintain the urban continuity and identity. *Urban conservation can be correctly conceived within the frame of a general approach to urban problem (Geddes, 1917). Basic methodology of urban conservation can be compared with classical town planning that considers the past along with future as fundamental element of planning (Lemaire, 1996).* To a large degree historic city manifest characteristics of self preservation. Considering the townscape value for the heritage buildings the concept of *integrated urban conservation* was promoted by the ICOMOS, 'Charter for the conservation of Historic Towns and Urban Areas', in 1991. It is important to establish guidelines as to the nature of intervention to meet the standards of historic value and adopt those in response to the economic and social realities in which the building is to be used. It requires multi -disciplinary approach involving different professionals to develop comprehensive plan for urban conservation. Planning interventions to revitalize the *Mughal* settlements in old Dhaka may be taken at two levels as follows:

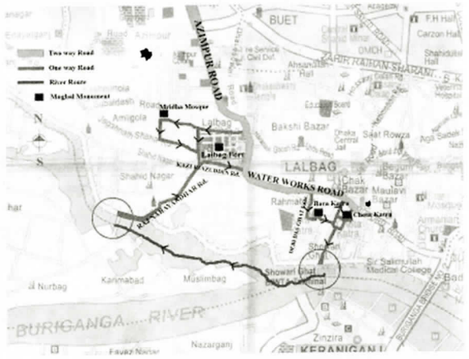

FIG 5 : The Traffic rout (Hossain, 2006b)

Interventions at Macro Level:

- View corridors may be created from main circulation spine to the historical artifacts and to the river to properly hook them up with the city fabric.
- Conservation at urban level should consider minimum buffer space and height restriction zone, circling the area occupied by the artifacts, to protect scale, visual exposure and the quality of the old urban fabric. Removals of illegal settlements, standing close to the historic monuments will ensure proper access and setback.
- Narrow Street, curves, irregular crossing, and shortage of parking possibilities, of the old city are not suitable for modern mechanical traffic system as the old pattern was developed to provide efficient living condition, based on pedestrian circulation or slow moving vehicles. Moreover unrestricted access of slow and fast moving vehicles results in protracted congestion. Combination of different form of transport may be adopted to serve the old city. Parking may be considered on the perimeter outside a ring road with loops into the center. These loops may be served by slow moving vehicles like *riksha*. To reduce traffic load due to commercial activity transportation route should be developed to establish link between the periphery and the new city. The proposed traffic route over the existing layout starts as a continuation of *Azimpur* road and approached to *Lalbag* to establish a link between the city centre and the *Lalbag* group of monuments. The route continues towards *Chauk* through *Waterworks* roads to establish link with Katra buildings. The later phase of the route permits the choice of river trip, launched from *Swarighat*. A one way access loop for vehicular movement can be introduced around the artifacts to reduce the regular traffic congestions on the roads. *Chompatuli Lane* may be expanded in width to establish proper linkage between *BaraKatra Lane and* Chota *Katra Ghat Road* through *Swoarighatroad* and *Chompatuli Lane*. The narrow part of, *Chota Katra ghat road*, *DebidasGhat road*, should be expanded to ensure easy traffic movement.(Hossain,2006b).As far as possible some space may be cleared around the artifacts to increase accessibility and visibility.
- Atmospheric and ground pollution are threats to the old city. Poor access to municipal services augmented the pollution level at the area. FAP-8B and *Dhulai khal* improvement project may reduce the drainage problem. Moreover the *Islambag* environmental project is an important opportunity to improve sanitation in the area (DMDP 1995-2015).
- Coexistence of the inhabitant of different religions opened up vast field for cultural diversity and religious and non religious practices have become integral part of urban culture that has to be properly explored to evolve coherent urban culture.

Interventions at Micro Level:

- Relocation of Central Jail and *BDR* head quarters will open up huge possibilities for the area for comprehensive redevelopment programme to reduce pressure on the old fabric and to reestablish linkage with rest of the city. Completion of the western flood protection embankment and improvement of Buckland embankment offers an opportunity to provide additional access into the zone by widening the embankment as access road. (DMDP 1995-2015)
- Hotel, entertainment, restaurant, shops, art galleries, craft shops and micro level enterprises that accompany tourism should be focused for economic rejuvenation during adaptive reuse.
- To reduce densities relocation of shelters and commercial activities at the urban fringe may be considered. Parts of the *Katra* buildings are presently occupied by ware houses that should be relocated at the adjacent fringe areas.
- Most retention and least intervention should be done to preserve the aesthetic, cultural quality and patina of age.
- Necessary steps should be taken for emergency maintenance, Routine house keeping and periodic maintenance.
- To revive the damaged parts restoration can be done on the basis of authentic documents, drawings and archaeological evidences.
- Physical up gradation of the existing built-environment should be accompanied by better services and special consolidation is required for the coverage of municipal services in the old fabric.
- As different efforts have failed in past to evict the existing users, contemporary use should be considered along with tourism for *adaptive reuse*. Moreover phase wise development may be considered as mode of operation at implementation level (Hossain, 2006a). So small schemes may be encouraged for rehabilitation rather than large.
- Some consolidation may also be carried out for repairing the damages at foundation level and on structural elements that are partly damaged. Application of the supportive or adhesive material like grouting should be considered in fabricates for continued durability and structural integrity.
- Finishing work on the floor should be based on special technical method followed in *Mughal* period. During restoration of door and windows recent addition and changes should be substituted by original typology.

Epilogue

The Mughal city layout as shown in fig 1 may be revived as discussed. The city must continue to renew itself .So it is not necessary to enact special legislation to preserve the original urban plan of *Mughal Dhaka* or to restrict the

urban continuity in a static frame of any specific period. Physical and visual accessibility to man made (historic)and natural elements need to be created to integrate them into the urban fabric .Preventive maintenance strategy should be effective as an intermediate guideline and to avoid rigidity in architectural conservation different degree of interventions may be synthesized for different *Mughal* monuments. So it is not necessary to conseve the historic artifacts in the conventional manner. Moreover Integration of historic monuments within the present urban fabric through development of contextual circulation pattern can promote interrelation among the monuments .During urban conservation it is important to manage the urban dynamics to control increasing pressure that causes rapid transformation. So policy and plans should be formulated to focus on adaptive reuse for the *Mughal* monuments to safeguard the historical patrimony to regenerate the potential cultural market of *old Dhaka* for sustainable development. In short some strategic actions were proposed in the paper to revitalize the Mughal settlements in old Dhaka.

Appendix: Defining the terms.

Prevention of Deterioration: Prevention entails protecting cultural property by controlling its environment, thus preventing agents of decay ad damage for becoming active. (Feilden, 2003)

Preservation: Preservation deals directly with cultural property. Its objective is to keep it in its existing state .Repairs must be carried out when necessary to prevent further decay (Feilden, 2003).

Consolidation: With historic buildings, when the strength of structural elements has been so reduced that it is no longer sufficient to meet further hazards, consolidation of the existing material may have to be carried out .However the integrity of the structural system must be respected and its form preserved(Feilden, 2003).

Restoration: The object of restoration is to revive the original concept or legibility of the object. Replacement of missing or decayed parts must integrate harmoniously with the whole, must be distinguishable on close inspection from the original so that the restoration doesn't falsify archaeological or historical evidence. (Feilden, 2003).

Revitalization: To bring vigor back to an area or object after decline .This includes redevelopment along with conservation and restoration. (Mowla, 2006)

Adaptive Reuse: Adaptive Reuse, a particular type of approach, combining area conservation with the preservation of individual monuments with upgrading, and some renewal is more nuanced and flexible approach. Adaptive reuse should be accompanied by area conservation, which focuses on the conservation of urban character as well as some monuments .Legislatively this means the control of new and offensive construction and the restoration and reuse of key buildings as appropriate (Serageldin, 1996).

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Morphological Transformation and Evolution of Panthapath as a Commercial Belt of Dhaka City

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Abstract:

Densification is one of the major urban phenomena of the developing cities like Dhaka. Dhaka has undergone phenomenal growth since last three decades. In due course of time, the expansion of the city has created demand for new spaces for required urban activities at convenient locations with ease of accessibility and improved environment. All these aspects reclaimed some unused and less-used areas of the city and integrated those areas with the main flow of life. As a result, in addition to the physical expansion of the city, the internal morphology of urban areas has been evolving to time; thereby continually changing the urban fabric. Such morphological transformations are taking place both at the level of urban grid and at the level of plots in different parts of the city.

The Begunbari Khal, one of the oldest canals, in Dhaka was converted to a box-culvert and an arterial road Panthapath was paved along the natural depression in early 90's. After developing Panthapath as one of the major transverse roads the transformation on both sides has thrived and suddenly backyards of the houses within a residential zone evolved as a commercial spine of the city. Panthapath is now one of the leading commercial streets for the city dwellers. This paper tries to understand the evolution of the Panthapath from waterways to one of the busy road of Dhaka city. It also tries to reveal the morphological transformation of the adjacent areas and the forces that had been shaping the morphology itself.

Key Words: Evolution, transformation, commercial belt, morphology, urban core.

1. Introduction:

Today's Dhaka represent a composite form developed through the ages. Indeed, above the levels of technology and economic condition of the population, the patterns of areal expansion and the form of Dhaka have been dominated largely by the physical configuration of the landscape in and around the city, particularly the river system and the height of land in relation to flood level. (Islam, 1996: 191) Moreover, Dhaka city had an abundance of canals, drainage connections, ditches, swamps, ponds, wells, and tanks and the city used to be criss-crossed by many large and small canals. *Begunbari* Canal, a major waterway lying on the east-central part of today's Dhaka, was a significant canal (khal) of historic city. During Mughal time (1608 - 1764) Dhaka's limit was upto Kawran Bazaar when Begunbari Canal worked as an entry to the city. The city extended towards north and large extent of areas were incorporated under urban limit since the British period. A map of 1960 shows the trace of Brgunbari Khal and its connection with Dhanmondi Lake (Figure 01). After the liberation of Bangladesh in 1971, Dhaka has undergone phenomenal growth.The rate of urbanisation in Dhaka in 1974 and 1991 were 30% and 54% respectively (Hossain, 1995). The expansion of Dhaka city created demand for additional spaces for required urban activities at convenient locations with better accessibility and environment. As a consequence of such infilling, the central location and advantageous position of *Begunbari* Canal contributed substantially towards the urbanization process of Dhaka city. In this course of development, an arterial road 'Panthapath' was paved along the natural depression of the *Begunbari* Canal in 1991 and the waterway was converted to a box-culvert beneath the road upto certain length. Thus the canal was transformed into a major road passing along the boundary of four residential areas - Kalabagan and Kathalbagan on one side and Sukrabad and Rajabazaar on the other side.

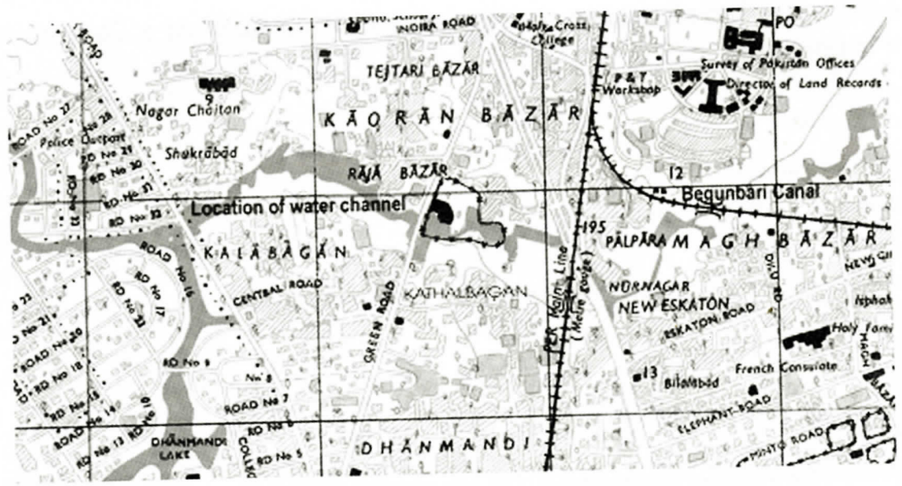


Figure:1 Interconnected Canals of Dhaka City.
Source: Map published by The Survey of Pakistan, Dacca, 1960

The urban transformation and morphological changes of the area surrounding *Begunbari* Khal through its evolutionary process are very remarkable. Panthapath was developed initially to serve as a transverse road of Dhaka city, as there was a long felt demand of such connection betweeen the major arterial roads of the city running longitudinally. Locational importance of Panthapath is also considerable as it was situated very close to the second CBD of Dhaka at Kawran bazaar area at one side and the high class residential area Dhanmondi on the other. After the construction of this major road a rapid and rigorous transformation on both sides have undergone and suddenly the backyards of the houses within a residential zone evolved as a busy commercial spine of the city. As being an unplanned part of the city, commercial use easily invaded in the area through the loop holes of development control of the city authority. Within a decade, Panthapath appears as an active commercial street of the city and the locale has become one of the important mixed use area. Hence, the study mainly investigates on the evolution and morphological transformation of the commercial development along the newly inserted Panthapath road. It also concentrates on the possible causes of such configurational changes in the global network of a city in relation to the movement and land use pattern, which has been generated through out the period .

2. Objective of the Study

From historical background it has been known that the emergence of Panthapath had great impact on the land use transformation from residential to commercial area. Such changes have significant impact on the morphological pattern of development. Therefore, the objective of the present research is to observe and understand the morphological evolution along Panthapath and the subsequent land use transformations in the surrounding area. In addition, it also aims to identify the possible forces that shaped Panthapath over the year from privately owned residential area to commercial belt. Moreover, understanding of the causes for transformation of plots in the surrounding area after developing Panthapath as well as to trace the gradual transformation and evolutionary changes of Panthapath beyond the existing pattern of development also needs to be investigated.

3. Methodology of the Study

Both the physical and social aspects of urban morphology have been considered in this particular investigation. In this process, the primary and secondary sources were used. To depict the morphological changes due to the development of Panthapath along the *Begunbari* Canal cartographic records were considered. For the spatial analysis of Panthapath commercial area the layout map

of that particular area was used as the base map to show the spatial variation of land uses. This present research has also consulted an analysis of configurational patterns of the urban grid of Dhaka (Nilufar, 1997) where interpretation of spatial data was made with the method of 'Space Syntax' [2] to determine the global character of the urban grid of Dhaka after the inclusion of Panthapath. This research has undertaken reconnaissance survey with photographic and observational study to depict the current physical environment, with particular focus to the plots under study. In this process a number of plots in two distinct areas (from road side and from inner area) have been investigated in detail, both for physical as well as economic transformation, which had been recorded. It has also conducted a questionnaire survey to understand the users' response in identifying the possible forces of transformation. The field study was conducted in different periods since 2002 to 2007.

4. Urbanization process in Dhaka City - Socio-Spatial Structure and its' shifting cores

Cities are the products of unique situations of their origin. It is the circumstances, culture, societies, politics and economy of their origin and growth that make them different. Therefore, the interpretation of morphological forms and its meaning requires an examination of the continuing forces that shape the cities with its millennia of urban evolution. With all it's idiosyncrasies from the established planning theories, the harmonious development of Dhaka's land use with its morphological transformations is significant. Dhaka, the capital city of Bangladesh, has grown from a small Hindu-trading centre to a metropolis. The history of Dhaka as a town is of four hundred years old and its different phases have developed and been structured at different historical stages based on the vigour of that particular period of development (Nilufar, 1997). In different periods of history the city expanded due to significant development in trade and commerce (Islam, 1972). The spatial structure of Dhaka faced a number of major phases of socio- economic and political changes during its evolution. After the political change in 1971, the landscape of Dhaka has experienced rapid and uncontrolled urbanisation and this changing pattern also change the shape and character of its CBD (Chowdhury, 1981).

The morphological analysis of Dhaka identified that the city have had a dynamic structure which has been transformed with time. (Nilufar, 1999) With the growing upper and middle class residential areas, the retail and commercial areas also expanded towards the northern part of the City (Ahsan, 1991). Thus it provides evidence of a shift in importance from the old city towards the newer part in northern direction that serves as the central area for commercial facilities in the global context of Dhaka city. The CBD shows a northward pull and has become diffused from Motijheel (Ahsan, 1991:412-13). The changing land use and land value in Dhaka over the recent period of expansion have proven that a complex socio- economic process along with the advantage of location has influenced a shift of the retail area from Gulistan to the New Market area (Chowdhury, 1981). In later period, to meet the demand of growing population of Dhaka City, some higher order activities or central functions of the city invaded in northwest part of the city. However, a second CBD emerged around Newmarket while Kawran Bazaar, Sher-E-Bangla Nagar are also demarcated with new pockets of commercial and governmental institutions.

From last three decades the business and commercial zone shows a gradual growth pattern towards the northern part of the city The government or public sector has not been able to cope with the tremendous growth of commercial activities, which has lead from a need to meet the demand of the growing population Previously an extensive growth of commercial building started to develop through private initiative with the absence of any planned policy for zoning. The changing land use and the short supply of land accelerated by the rapid and extensive growth of population in the capital city which has resulted in increased demand for compact and multi-

Figure: 2 Panthapath appears as part of Integration Core of Dhaka in 1997.
Source:. Nilufar, 1997

storeyed shopping centre and other retail development.

From morphological analysis of the urban grid it has been revealed that the global integration core[3] of Dhaka identified the functional core, both commercial and administrative, in each corresponding period. (Nilufar, 1999) Consequently, a strong correspondence between the commercial and retail growth and the global integration core of the city has been found through out the period (Hossain, 2000). Here we find that the commercial and retail areas are also growing along the major roads, which followed the highly integrated lines of global integration core of the city. The syntactic analysis of the Dhaka city in 1997 shows that the location of Panthapath from it's inception appear as part of global integration core and it is one of the more integrated lines in the context of total Dhaka (Figure 02). It is one of the major connecting roads between different areas and localities in Dhaka and thus

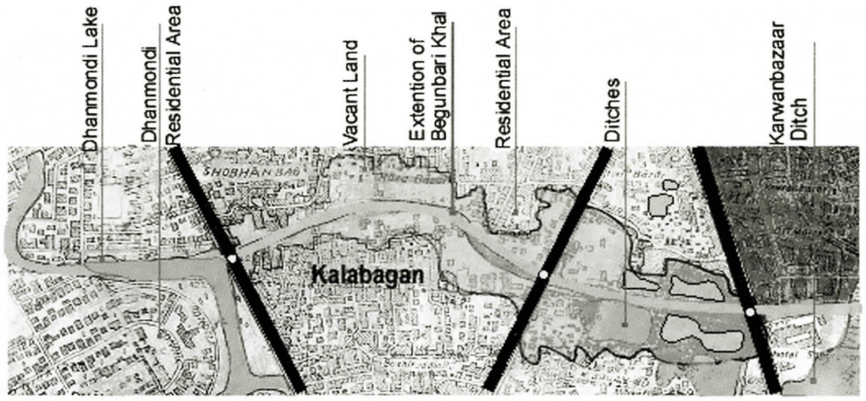


Figure: 3 Location of Panthapath in the site of Begunbari Khal *Source: Mappa 1982*

recognised as a prominent transverse link in the city. Therefore, the natural growth process and development of Panthapath following the location of a water body can be considered as a natural extension of shifting CBD and thus serves as the part of the core area for commercial facilities in the global context of the Dhaka city.

5. Evolutionary Changes and Morphological Development of Panthapath:

Although the development of Panthapath meets the demand of transverse road in expanding metropolis, the interruption of water body ecologically disturbed the natural flow of water. In Figure 3 the low land defined the boundary of Kalabagan, Kathalbagan, Sukrabad and Rajabazaar area. RAJUK proposed a road layout along this natural depression in 1985. Later in 1996 Panthapath had evolved in the global scenario of Dhaka. The impact of shifting CBD in the course of time perhaps has accelerated the development of Panthapath, a transverse road that has connected four major roads like, Mirpur Road, Green Road, Airport Road and Sonargaon Road, in east-west direction. Originally, the natural depression existed in between the built structures at their back. Along the geographical location of Begunbari khal, all the land on the outer edge of Kalabagan, Kathalbagan, Sukrabad and Rajabazaar was Khas land, i.e., the land under the possession of Government, which remained vacant because of the location of canal (Figure 03). However, the government ownership of this vast area had accelerated the implementation of the initiative and the development process of Panthapath was exceptionally fast. It has been observed that Kawran bazaar ditch, Begunbari Khal, Dhanmondi Lake and all ditches in this zone were interconnected (Figure 01). Begunbari Khal acted as one of the major outlet of storm water and drainage channel from central area, Dhanmondi, to the eastern fringe. However, the emergence for developing this road was introduced and continued without interrupting the flow of water from Dhanmondi Lake to Begunbari khal and upto Eastern fringe.

In the urban morphology of Dhaka one of the significantly integrated road is Panthapath that accommodates huge traffic globally.This increased natural movement obviously attracts commercial enterprises, as claimed by Hillier in his theory of natural movement (Hillier, 1996) Therefore, it is evident that the integration core coincides with the city's functional core (Figure 02). The integration core of 1997 consists of two reverse wedges inclined towards the west incorporating the newer growth centres at the

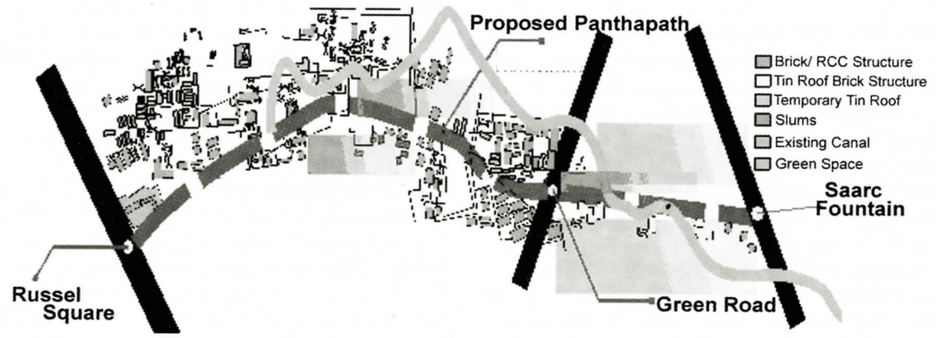


Figure: 4 Proposed Road by RAJUK in 1985.
The morphological evolution of Panthapath along the water channel is shown on the map.
Source: Rajuk,1985

location of Panthapath (Nilufar, 1999). However, the morphological structure has exerted impact on its elements like plot, block, circualtion and landuse. The pattern of development and transformation of plots are explained in the next section.

6. Transformation of Plot configuration and Land Use:

After the development of Panthapath suddenly the backyards of the houses within a residential zone evolved as a commercial belt of the city (Figure 4). In this process, the plot size along the road and their configurations has faced major modifications. The plots which were along the road side, i.e. the commercial areas, and those which laid on the inner side, i.e. in the residential areas, both have spatially transformed.

6.1 Pattern of Development in roadside plots

It has been reported that before the insertion of Panthapath the plots along Begunbari Khal were mainly used for household activities in the residences or were slums (temporary shelters). However, land was put up on market and trading has been started with the proposal of a road in 1985. As a result, after the establishment of Panthapath in 1996, suddenly land use transformation was clearly visible. Within ten years time multi-storeyed mixed use structure with commercial offices and apartments, and even hospitals were erected. To find out the pattern of development and transformation through time, four plots were taken randomly from both side of the western segment of Panthapath. The road layout and the boundary of plots under case study along with their sur-

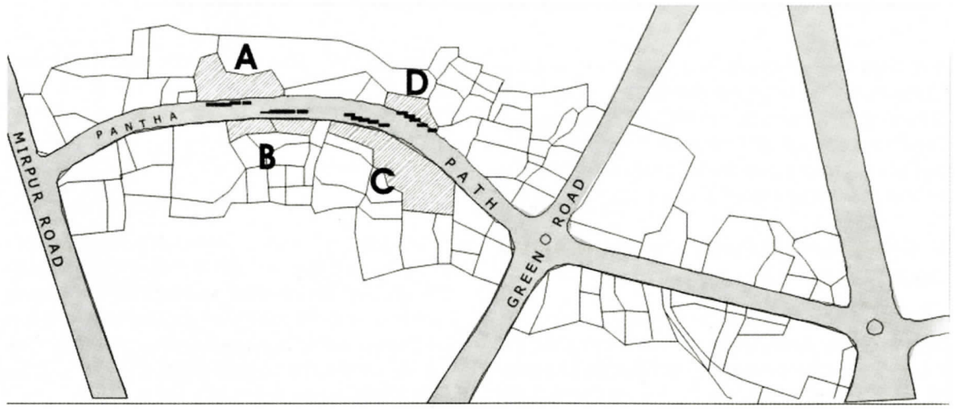


Figure: 5 Existing Road Layout of Panthapath and Surrounding in 2004. *Source: D.L.R office*

rounding areas are shown in figure 5. The following chart 01 represents the land use transformation of plots A, B, C, and D as well as their morphological evolution. This chart also exhibits the morphological transformation like plot division and changes of land use and erection of built forms in the selected plots from 1990 to 2007. However, the land use, land value and use of commercial spaces of study areas were found out by questionnaire survey which also determined the effect of transformation on their social and economic life.

It has been reported by the residents that the decision of Panthapath had been finalized before 1990 (some time after 1985), since then roadside small plots were amalgamated to form larger plots with the speculation of developing large scale commercial facilities. Hence, by 1990 most of the small plots were unified and formed undivided and larger ones in size. [First Column of Chart 1(a)] However, in 1996, after the development of Panthapath, those large plots were sub-divided in a number of plots as the previous conception of mega projects did not materialised due to lack of investment initiatives. Even the comparatively small plots (like road side plot D) were also divided into smaller parts. At present those plots are accommodating multi-storeyed commercial use and mixed use in the form of shops, corporate offices as well as hospital. These mega projects are being pushed in the economic plots of Panthapath in the dynamics of present land market and legislative weakness of the development controlling agencies (like RAJUK, DCC).

6.2. Transformation of Inner side Residential plots

Like the road side plots on Panthapath, the subsequent rows of plots in the inner part of Kalabadgan, Kathalbagan and Rajabazaar area had undergone spatial as well as social transformation after the development of Panthapath. As mentioned earlier, form the beginning, these areas were residential by nature. The following maps depict the pattern of transformation of residential plots. For Example area A1 and A2 of Kalabagan and Kathalbagan (Figure 6) is considered for this study. It had been revealed that during 1964, most of the inner side residential plots of this area were large in size. However, with the proposal of the insertion of the Panthapath, some large plots were divided under different owner. It is evident that mainly large plots (approximately one bigha[4] or more) in the inner parts of residential areas had faced such sub-division because of higher land value and need of residential plots with the densification of the area

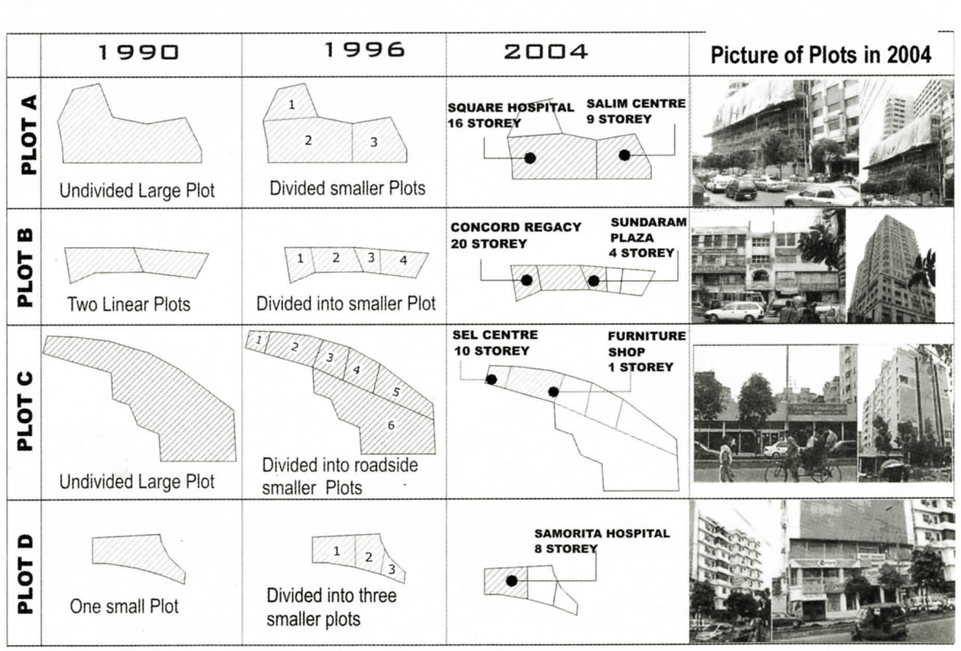


Chart: 01(a) Sequential changes and transformation of road side plot from 1990 to 2004
Source: Field survey 2004

Picture of PLOT 'A in 2004 (under construction)

Picture of PLOT A in 2007 (complete)

Chart: 01(b) Sequential changes and transformation of PLOT 'A' in 2004 and 2007.
Source: Field survey 2004 and 2007

(Figure 7a and 7b). It can be mentioned here that Kalabagan, Kathalbagan, Rajabazaar areas were always high valued spontaneous residential areas because of their position near Dahnmondi, the high class residential area of Dhaka.

In this process, from 1964 to 1984 (before the decision of Panthapath), most of the large plots in the inner areas were divided into small pieces (minimum 2.5 katha) for higher land price and to meet the need of owner. During this phase, here the changes were almost reverse and small piece of roadside land were combined to form a large plot for commercial and business development. On the contrary inner side residential plots were divided into smaller plot. (Fig. 7a and 7b). This process of parcelling did not continue further, but they were rarely amalgamated to accommodate large scale residential projects in the inner part of the areas.

6.3. Land Use Transformation

Beside the observational survey, responses from the plot owners were valued, as the society can best explain their inner viewpoints as well as the practical impact of planning beyond theory. To understand the land use transformation of surrounding plots in Panthapath, a non structured interview and questionnaire survey was conducted among the user of some randomly selected plots. The result of this survey is represented by the following graphs. Graph 03 represents the use of commercial spaces on both sides of Panthapath, where majority were mixed use developments; furniture shops, market strips and building under construction for similar purpose were in trivial position. Graph 01 represents the change of land use with time in percentage from which it can be observed that in past vacant land and residential uses was visible along Begunbari Khal, but at present commercial uses

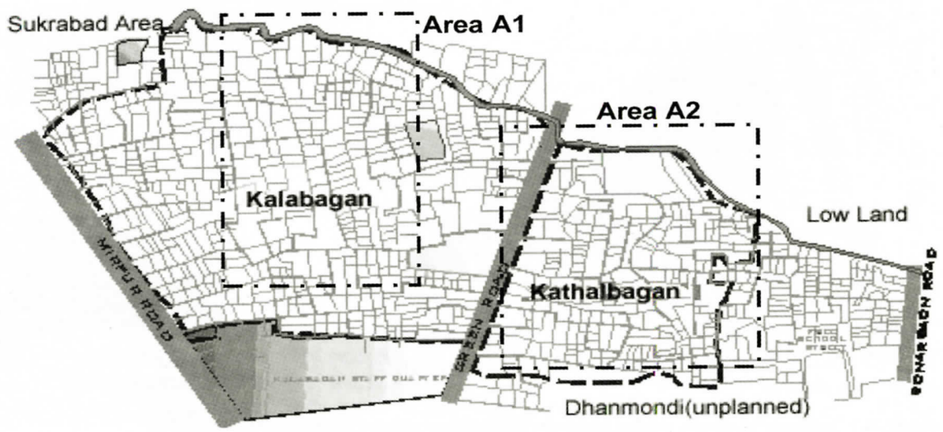


Figure: 6 Spatial Structure of Kalabagan and Kathalbagan area in RS map (1984).

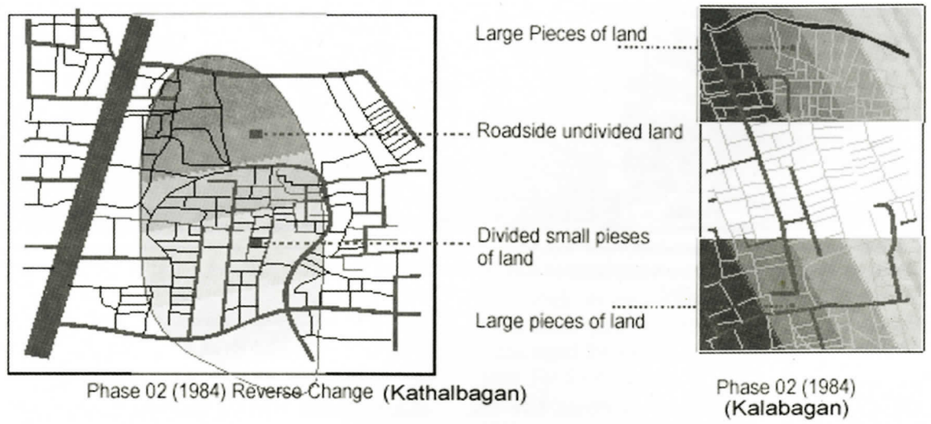


Figure: 7a. Transformation of inner side residential plot in Kathalbagan (A2) and Kalabagan (A1) Area, (1964); Source: Secondary data and Survey 2002.

are predominant. The growth pattern reveals that such transformation will further accelerate in future. It can be predicted that this transformation process may change the land use pattern and corresponding skyline of these plots and may evolve as an extended part of second CBD, Kawran Bazaar. However, one important aspect can be marked here that in the process of land adjustments, owners are seldom undertaking steps for amalgamation of small plot except before 1984. This may have strong relation with the economics of land market and the absence of development control in the context of city development.

From the present study, we also find that it is the central position, ease of communications and accessibility as being part of the global integration core has been transformed Panthapath as a commercial area and increased the land value higher from 1996. In 1997-1998 the land value reached the peak position but since 2004 the value is quite stable (Graph 02). The changing land value in Dhaka shows a maximum rate of increase in Dhanmondi in the last 50 years (Hossain, 2000) and the Panthapath might have an indirect effect of that phenomenon.

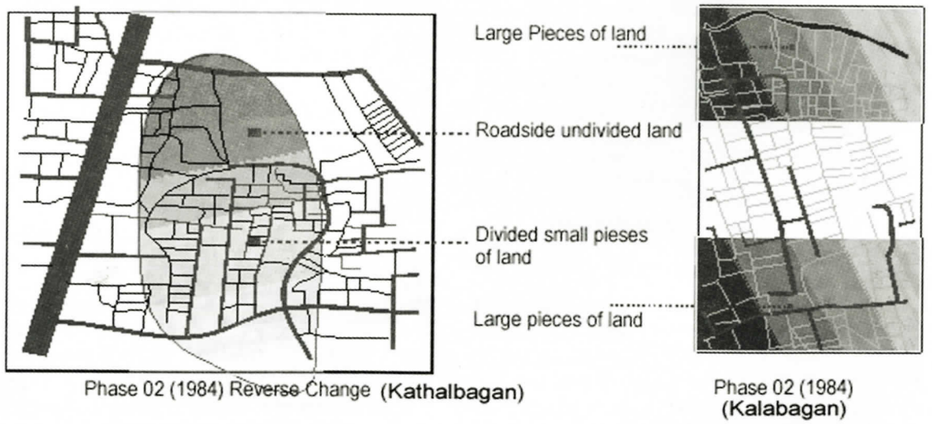
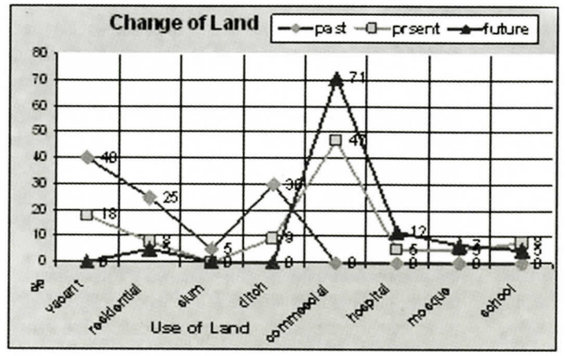
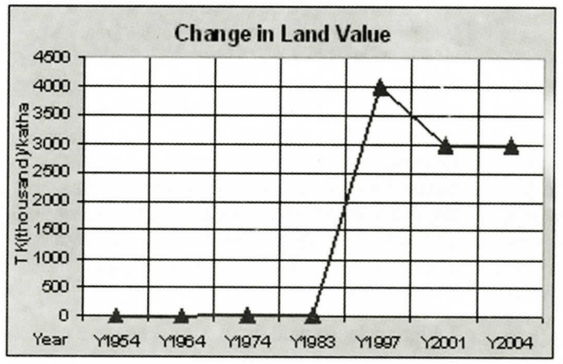


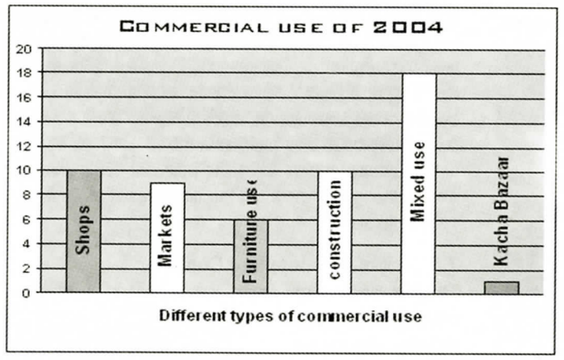
Figure: 7b. Transformation of inner side residential plot in Kathalbagan (A2) and Kalabagan (A1) Area, (1984); *Source: Secondary data and Survey 2002.*



Graph: 01
Change of Land Use
Source: Field survey 2004



Graph: 02
Change in Land Value
Source: Field survey 2004



Graph: 03 Commercial Use of land
Source: Field survey 2004

Besides these, the location of another CBD Kawran Bazaar also accelerated the morphology and transformation of Panthapath to be developed as commercial belt for the Dhaka city. Due to the change of land use and tremendous increase of land value, the road side plots were sub-divided into small but highly dense multi-storeyed structure (Chart 01).

From the survey of the study areas, it is also clear that there is a drastic change in the development pattern and built form. On Plot B, a four storey market building and a twenty storey mixed use and on Plot C one storey temporary furniture shops and a 10-storey office building is developed side by side. There is also a change in vertical land use as office space and other functions took place on top floor of the built form that is more than 15 or 20 storey high. Therefore, it is clear that total Panthapath is transformed as commercial and mixed-use area. Following discussion tries to unveil some of the major causes of the

transformation in order to predict the future situation as well as the possibility of applying development control to keep the liveability of inner plots as well as the plots along Panthapath.

7. Reason for Transformation:

From present study, it has been revealed that certain major morphological transformation took place with the insertion of Panthapath within the existing urban grid of Dhaka. This paper only focuses on the transformation of plots and their land uses, both in the inner part as well as at the outer edges of Kalabagan and Rajabazaar areas adjacent to Panthapath. The following discussion tries to unveil the reasons behind the transformation and morphological changes from waterways to the road. For analysis, the emerged spatial pattern along with the users' responses are considered mainly.

7.1 Densification and Expansion of Urban areas

The part of Begunbari Khal which remained low land and served as water retention area and drainage channel since a long period of time became an arterial road of Dhaka, Panthapath, in the process of densification and expansion of the exiting city. It can be considered as a case of natural infiltration of the urban areas with the growing demand of city dwellers. The natural depression was suddenly acquired and developed as a transverse connection in the urban morphology of Dhaka. It was assessed that if the connection of flowing water was maintained from Begunbari Khal to Dhanmondi Lake then an important road should be developed on Government Khas land. This was the basic idea for developing one of the major transverse roads Panthapath by maintaining the flow of water channel in box-culvert.

7.2 Concentration of Communication

In any urban system, the movement pattern is essentially guided by the configuration of the street grid which phenomenon is termed as 'Natural movement'[5]. In addition, in any urban space the configurational property that assumed to be associated with different degrees of functional importance are important enough to have significant effect on movement pattern and the distribution of built form attractor (B.Hiller, 1992). This theory primarily justifies the morphological transformation that appeared along Panthapath during last decade.

As Dhaka lacks shortage of east-west connectors or transverse arteries and Panthapath did the same, therefore, the morphological transformation of the urban grid of Dhaka with the insertion of Panthapath is very significant. From the very beginning Panthapath became part of the spatial integration core thereby played an important role in Dhaka's movement pattern as being part of the shortest possible routes of the whole city, supported by the theory of Space Syntax. Thus the spatial position of the road ensured the greater accessibility to the surrounding areas. As a result this road holds concentration of circulation, in so doing the demand for higher order functions along the road became undeniable.

7.3 Central Location

According to Hiller, configuration may have an effect on both through-movement and to-movement in urban grids, which are independent of built form attractors. Logically the presence of attractor can influence the presence of people, but it cannot influence the fixed configurational parameter, which describes its spatial location. The transformation of the Panthapath as a major commercial street within a very short period of time perhaps had been preferred by the geographical centrality of the area. It's central position within the city geometry confirmed the proximity to the Second CBD, Kawran Bazaar, and high class residential area of Dhanmondi. Moreover, the availability of surrounding residential areas , like Kalabagan, Rajabazar, Dhanmondi, and commercial area like Kawran Bazaar, Farm gate etc. within the catchments area made this area to be potential for developing as a commercial road with non-residential activities. All these locational aspects exerted multiplier effect[6] on the transformation process of Panthapath.

7.4 Financial Benefit

Accessibility to adjacent plots from a major thoroughfares usually generates the business and commercial activities because their increased land value. Thus financial benefit of the location as well as spatial position accelerated the morphological transformation of Panthapath. The owners of the surrounding residential plots were agree to sell or developed their plots as a mixed-use high rise for better financial return. Thus the adjacent community as well as the land owners get the direct result of it's financial potentiality.

7.5 Lack of Development Control

The process of morphological transformation at plot level unveils an important issue of uncontrolled development pattern in the spontaneously grown areas of Dhaka. Here we find large scale building projects are being erected in plots which are relatively small for those developments. This is true both for commercial as well as residential plots. As a result mega projects, like hospitals and mixed use are being constructed in the plots which can not sufficiently accommodate all the service facilities. Besides in the residential part, plots are being overbuilt and no open spaces are left for the community, even the residents of the houses. All over the area, the resultant effects of densification phenomenon is vigorously alarming.

8. Conclusion:

In the conclusion, it can be stated that the location of Panthapath in the urban grid has the crucial effect on it's morphological transformation. Some locations have more potential than others do, because they have more multiplier effect and this will depend on the structure of the grid and how they relate to each other. As Panthapath gained the credit to be located in the central part of the city, some higher order activities (commercial functions) of the city invaded in this area. Higher densities of development take the advantage of accessible space and act as multipliers on the basic pattern of natural movement.

With the shifting core of Dhaka city Panthapath is evolved and urbanized with time and the after effect of transformation is visible on immediate side of the road. It has been found out that ease of accessibility and communication accelerates the mode of development pattern and transformed the state from residential to commercial zone. Thus the roadside plot, land use and land value is ever changing with these transformations. It's impact was also visible in the inner part of the residential areas where initially the morphological transformation of plots showed a reverse process. However, in all parts, subdivision and densification is the ultimate representation.

It can be concluded that in any commercial zone the configuration works as a more dominant influence on movement. As commerce and shopping depends on natural movement and attracts more people for trade and commerce thus Panthapath was developed as one of the most important transverse commercial belt with in the urban grid. The road was evolved for the need of communication and movement. Thus natural movement attract commercial uses to be developed here, and that is why residential zone transformed to the mixed-use commercial zone.

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End Note :

[1] An earlier version this paper has been presented by Ms. Farhana Ferdous in 1st Urban Design International Congress (UDIC1), Isfahan, Iran, 4-6th September 2006. The present content of the paper has been updated with substantial adjustment for the journal.

[2] 'Space syntax' takes an urban layout of a city or part of it and analyses the available routes to decide which are better integrated within the network and therefore easily accessible to the public. This graphical representation of Syntactic analysis is a key in determining the pedestrian movement; land use, density and land value. Space Syntax is pioneered among the newly proven techniques for regenerating urban areas through urban design. It is a design tool that predicts patterns of pedestrian movements in towns and cities by using axial lines as representations of urban systems. It allows factors such as 'connectivity', 'integration', and 'permeability' to be objectively measured. This allows the impact of design proposals to be forecast in advance, for example in terms of how these will affect existing patterns of pedestrian movement, space use, economic vitality, and safety. (Hillier and Hanson, 1984).

[3] The theory of Space Syntax defines the degree of spatial order, which exists in organic and planned layouts, by analysing their spatial configurations. In this theory, ***integration*** is a spatial measure accounting the relative depth or shallowness of any spatial system as seen from any particular point within it. The set of most integrated street are collectively known as global integration core for a city (Hillier and Hanson, 1984).

[4] 1 katha = 720 sq ft., 20 katha =1 bigha.

[5] Natural movement is the proportion of observable movement along line that is produced by the structure of the grid rather than the special attractor. The theory of Natural movement proposes that the distribution of the built form, which generate and attract movement in an area, will be determined by the grid configuration itself. (B.Hiller, 1996).

[6] Every location within the urban grid has a crucial effect. Some locations within city have more potential than others because they have more of a multiplier effect and this will depend on the structure of the grid and how they relate to it. Such locations will therefore tend to have higher densities of development to take advantage of this and higher densities will in turn to have a multiplier effect.

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Prospect And Exigency For Regenerating Natural Waterways Of Urban Bangladesh : Focusing The Case Of Buriganga

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Abstract

Rivers set the stage that helped Bengali society and culture to flourish. Presently the rivers especially near urban centres are to face relentless intimidation since the insistent thrust of present days' urban reality makes things more intricate. Issues like unplanned development, rapid urbanization, ecological hazards, unlawful encroachment and overall negligence are sufficient to challenge the very origin of both the socio-cultural and ecological foundation once laid by these rivers. This situation demands immediate response, utmost concern and offers ample scope of study to help ensure sustainability of these already disrupted urban settlements.

The contribution of rivers in shaping the character of urban areas in Bangladesh thus needs to be re-thought. Rivers are expected to be in their natural shape and composure; they need to be re-acclaimed, re-generated, their state re-vitalized and role re-defined in light of the historic contribution they made through ages. This paper specifically aims to identify the impacts caused by degeneration of rivers in urban Bangladesh mentioning a number of cases of degradation. This shocking revelation has further been elaborated by looking closely into the case of river *Buriganga* in Dhaka city.

Key words

Waterways, urban Bangladesh, re-generation, Buriganga

Introduction

As evident in history, almost all civilizations flourished alongside rivers for the purposes of useable water, better communication and agriculture. Bangladesh is a large delta positioned in the womb of the great *Ganges-Yamuna* basin criss-crossed by numerous waterways, both large and small to form an arterial network. There is no such land in the world that is comprised of so many rivers, ditches, ponds, creeks and low floodplains[1] defining the way of life of its inhabitants. This is why Bangladesh is better known as a *riverine* country – *'nadi matrik'* as locally called i.e. rivers playing the role of a mother (life giver) for the entire civilization. In course of time, these rivers gave birth to numerous ports (*ghat*), market places (*bazaars*), newer settlements, administrative/political centres, military stations etc. Simultaneously, businesses flourished in some locations, many centres declined and some got time-honoured as rivers determined their fate. Over the years, the songs, verses, poems - the elements of literature, have been enriched and surely influenced by this way of *riverine* life. Here, rivers laid the very foundation for an agrarian society and are responsible for most cases of well and woe of each individual residing. Rivers, therefore, helped formulate the culture for Bangladeshi population and could easily be termed as one of the most important element of its heritage; surely they kept hold of the sustainability[2] for human settlements in this country.

Meanwhile, the prevailing scenario in urban Bangladesh is not very promising since the role of rivers both as 'elements of cultural heritage and of nature' is under serious threat. Following the path of economic development, its major cities like Dhaka (and also minor ones) are unceasingly growing. To accommodate this rapid urbanization, supporting infrastructure (like buildings, streets, water pumps, sewer lines etc.) is growing at a quick pace as

well. Shear insensitivity in the name of development adds to this situation and waterways which once helped grow these towns and cities are being invaded, filled in, and encroached; those which are still surviving at a dismal state are now used as mere drains to carry off all the pollutants and waste that these very towns and cities produce. Natural events like sedimentation and manmade affairs like withdrawal of upstream water at the border have additionally affected the already disrupted waterways and aggravated the scenario further. This is how these 'elements of cultural heritage and nature' have turned down at established urban centres like Dhaka to put sustainability at stake. Keeping the prediction of the World Health Organization (WHO) in mind that over half of the world's entire population is going to live in cities by year 2005 (WHO, 2000) and also the fact that at this rate Dhaka will grow to become the world's second largest metropolis (UNHABITAT, 2005), it is of utmost concern that this natural heritage need to be immediately looked after. As this hyper-urbanization trend has already taken toll of these waterways, the issue of regeneration evidently comes into the scene and demands this catastrophe to be taken into immediate considerations.

From 'Urban Regeneration' To 'Regeneration of Waterways'

Regeneration is a combination of institutional, economic and social enhancements through physical rehabilitation. It combines the analytical and practical skills of environmental, engineering, transportation, planning and design professionals to assess the constraints and opportunities of a site (Wikipedia, 2006). Synonymous terms like redevelopment, restoration, preservation, revitalization etc. often accompany regeneration as they are considered essential parts of it. On the other hand, urban regeneration is considered as the transformation of an urban precinct or community that has displayed the symptoms of environmental, social and/or economic decline. It imparts new life and vitality into an ailing community or area to ensure sustainable and long term improvements to local quality of life that includes economic, social and environmental aspects (Evans et. al., 2004). In biologists' perspective, typical restoration goals for waterways include pollution remediation, improvement of habitat for specific species, aesthetics and increased productivity of fisheries (Casagrande, 1996). On the other hand, US Environmental Protection Agency (EPA) describes 'waterways' regeneration' as promotion of partnerships among all organizations to reduce pollution loads, restoration of ecological integrity (improvement of events like fish passage, water quality, brown fields, sedimentation, forest coverage, flood damage and wetland acreage), improvement of access to rivers, enhancement of public and private participation, and development for recreational use (Anon, 2006). The definition of urban river regeneration, therefore, aims to address the previously discussed 'symptoms of environmental, social and economic decline' and also 'long term improvements to quality of life' considering all urban realities of present day.

In the 1992 Rio Declaration, one of the key policies stated, *"Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature"* (WHO, 2000). It is true that the rivers and waterways are not the primary means of communication anymore these days; neither do they supply that much they used to. But, it is not sensible for today's towns and cities to turn their back to 'once life-givers' and disregard their contributions. There is nothing we are doing to conform to the Rio declaration - the sheer negligence for waterways is already showing us signs of both ecological and social degradation (flooding or fall of ground water level, dilapidation of river front's spatial quality etc.). At this defining moment, as the definition suggests, regeneration 'is' the rational way out. It is time now to appreciate, scrutinize and contemplate on what we already have, followed by a sensitive, well thought-out and logical clarification regarding anew appraisal and improved use of waterways; only such a situation is likely to bring in an affable atmosphere for a sustainable urban development.

Objective And Methodology

In light of the discussions made above, the author wishes to find out the following:

- Current state of Bangladeshi rivers (especially urban) by identifying problem areas that threat regeneration.
- Potential policy framework that might come beneficial in this particular form of regeneration.

This work is based mainly on literature survey; the subsequent discussions will try to assess the degree of impact on rivers with reference to three broad areas: society, economy and environment[3] followed by problems that threat regeneration. Here, the specific case of *Buriganga* River will be elaborated to check on these three areas. Newspaper references will be frequently conferred to find out the latest on rivers and other waterways. Additional information on similar rivers and waterways in other areas of Bangladesh will also come up wherever they will be felt necessary.

Fig.1 : Pollution in Buriganga
Source: Ahmed, 2007

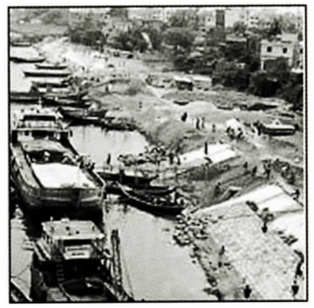

Fig.2 : Encroachment (south of first bridge)Source: Ahmed, 2007

Fig.3 : Road on Dholai Khal, 2006
Source: Ahmed, 2007

Identifying Problem Grounds : Social Impacts And Management

Dhaka is now the capital and the largest city in Bangladesh. It became a tactically important place for the *Mughals* for being beside a river network including the *Buriganga*. Like many other cities, Dhaka played the part of a transitional point for many business ventures as history suggests. Not to mention times earlier than the 1960's, 50 canals (*khal*), both natural and man made, with a combined length of 256 km criss-crossed the city (Tawhid, 2004). Presently, it is difficult to think of *Dhanmondi, Gulshan*, *Baridhara*, or *Uttara*[4] areas as being anything other than absolute jungles of residential apartment blocks swarming with schools, coaching centres, private universities and clinics. There were once lakes and canals running through the city areas like *Segunbagicha*, *Purana Paltan*, *Gandaria*, *Narinda*, *Rampura* and *Bashabo*[5] which can only be traced on maps these days (See fig. 4 & 5 to compare) [6]. To put a count to it, about 250km^2 of watersheds around the city surrounded by the rivers *Buriganga* and *Shitalakhya* have either been encroached upon or dried up (Khan, 2005). These waterways used to be as well as channels for natural drainage of surface water. *Buriganga*, concurrently, established the active frontage for all kinds of public activities and development to take place. The riverfront, thus, constituted the cultural and economic corridor of Dhaka; it used to be a vibrating waterfront delighting the citizen as an incessant source of aspiration. At present, these seem more like fairy tales.

The sad interpretation of the true contribution of waterways and their value as components of heritage is possibly the most prized ground that we are fast losing. We are probably hiding from our future generation. Most of the children, youth and even adults living in the comparatively newer parts of the city are utterly unaware of the fact about which might be the historical part of the city that marked the beginning of the city they are living in. It is very much impossible for them to grasp by noticing *Buriganga's* overall composure, surrounding environment, its present size and even by the colour or smell of the water (fig. 1& 2) that merely flows through. As time went by, *Buriganga* became a meagre entity and turned out to be the backyard of the city. Now, amongst the domination of machine in our prevailing society, in the midst of all these artificialities, we are restraining our young ones from this truth – it is near, yet it is so far away!

The need to understand values associated with natural resources is another phenomenon which is frequently overlooked during the process of policy development (Kellert and Clark, 1991). In Bangladesh, equity in use, impartiality in benefit sharing and justice in maintaining partnerships have been seldom present during this process. In addition, the opinions of people who live near the area questionable were seldom taken into consideration because most of the decisions are made on a table, usually from a considerable distance away from the actual scene. A project taken by Dhaka WASA (Water and Sanitation Authority) in 2000 titled 'Rehabilitation of *Dholai Khal*' describes that in 1964, *Dholai khal* was filled in for carrying out development works without really considering its overall effect on socio-cultural environment (Tawhid, 2004). Nobody was asked for, no questionnaire was prepared to conduct any survey - it has been a prime example of what has just been discussed above (see fig. 3). Development of public policy thus always demands an understanding of human perceptions and values in order to ensure that policies are effective and justified; it is particularly important for restoration projects in urban areas where many people are likely to be affected.

Management is another vital aspect for every urban development scheme; it defines the role of various users and designates responsibilities to each of them. The

Fig.4, Buriganga, 1914
Source: www.bdix.net, 2007

Fig.5, Buriganga, 2006
Source: www.bdix.net, 2007

Fig : .6, Waste dumping, Sadarghat
Source: Ahmed, 2007

major players for management are undoubtedly local authorities that work in a collaborative manner and put rules and into practice. In the case of *Buriganga*, these agencies have failed significantly even in the presence of written rules where it is prohibits any change in nature without prior approval of the government (Ferdousi, 2004). Again, groups of scholars and environmentalists (BAPA, 2002) and even foreign researchers (Mark, et. al. 1996) often point fingers towards the lack of co-ordination between the agencies like Dhaka City Corporation and WASA for failing to prevent the unlawful or execute tasks protected by laws and regulations. These groups also found that the potential stakeholders to the rivers have often been bypassed, neglected and usually kept apart from active participation in the areas like policy development or impact assessment (BAPA, 2002). The tragedy remains that the decisions have always been implemented on those bunch of people, who without knowing or contributing anything, are to face the harms of the scenario; over the years, in this manner, these people have been suffering the consequences of the fallacy.

Impacts On Health and Economy

Rivers historically played and still plays a lion's share in building up and support the economy of Bangladesh. Over the years, four major sectors are being blessed with contributions from these waterways namely agriculture, fishery, useable water and navigation (Rahman et. al., 1994). If agriculture is excluded from this discussion as being secondary component not affecting an urban scene directly, the program for regeneration of urban rivers must still take the remaining three sectors into account. Now, to commence with fisheries, like many other rivers in the country, the *Buriganga* also used to produce a considable amount of protein that the citizens of Dhaka would possibly require (Khan, 2007). Presently, the river has reached a stagnant position with black, slimy, stinking water due to continuous dumping of untreated wastes; the flow of water is now almost non-existent. Similar stories have also been recorded of rivers like the *Shitalakhya* at Narayanganj (Anon, 2001) and *Rupsha* in Khulna (Khan, 1993). The following table : 1 shows cases of degradation associated with the water quality of *Buriganga* River:

Transport accounts for about 8% of GDP and water navigation for about 15% of total transport GDP (WB, 2005). Transportation using river route is still cheaper than carrying loads using a land route (Islam, 2007). But it is still felt that the full toll has not been taken from the river navigation sector. For an urban area like Dhaka, waterways have never really been thought of as an alternative means of mass transit as observed in European cities like Amsterdam or Venice. There have been talks of circular waterways around Dhaka city to lower the traffic loads on streets and add to mass rapid transit system in order to cut down travel time and expenses (Anon, 2007); but, it never really took any effect in reality. In addition, the required depth for navigation has also condensed alarmingly. According to the classification prepared by Bangladesh Inland Transport Authority (BIWTA), class-I routes should have the least available depth of 3.9m; but their surveyors found depths lower than that at various navigation points in river-ways surrounding Dhaka city (Islam, et. al., 2006) to challenge regeneration.

Environmental Impacts

Buriganga is getting polluted over the years causing serious environmental degradation affecting the capital. The pollution problem is the outcome of both natural events and human interventions. Lack of adequate pollution control measures has played its part too. The natural reasons include hydraulic and morphological changes in the rivers around Dhaka (and also with the whole country). For Dhaka, gradual sedimentation in the *Buriganga-Turag-Balu-Lakhya* river systems reduced the carrying capacity of the channels, causing no-flow condition during the dry season. Besides, the Feeder Rivers from the source do

Table, 1: Showing various types of risks associated with degradation of water status in Buriganga River.

Types of degradation	Status
Fall of subsurface water level	Tube wells are dug up to a depth of over 100m in various regions of Dhaka; pumps are being sunken 10 to 20m deeper every year (Khan, 2005). In the Dhaka City Corporation Area, ground water level has fallen by 20m in the last decade alone. Water is now essentially being mined from the aquifer underlying Dhaka city (BBS, 2004) and creating vacuums beneath the subsurface to leave buildings vulnerable to earthquake.
Deficit of water supply	Invariable deficit of 18-20% from actual demand through the years 2000-2003; situation is not to change a great deal since replenishment is virtually impossible due to fall of water flow in *Buriganga* (WASA, 2005).
Health hazards	Skin rashes and diarrhoea are common for the inhabitants living by the river *Buriganga* (Khan, 2007).
Level of Oxygen	Oxygen in the river is close to zero for which its marine life has depleted (Hossain, 2005).

not receive flow due to drying up of the off-takes in the dry season. Heavy sedimentation at the off-take and river reaches is the major environmental problem impeding sustainable development regarding *Buriganga* (Hossain, 2005). On another hand, human activities and interventions include encroachment on the river beds, floodplains and low lying areas, sewage and solid waste disposal, unsatisfactory sanitation condition, industrial waste disposal and scattered development of slum areas in Dhaka city. In July 2001, BIWTA prepared a list of 309 illegal establishments by *Buriganga*. However, environmental activists asserted that the illegal structures might be as high as 5,000 (Tawhid, 2004). Recent information shows that the encroachers have reconstructed about 200 new structures, demolished previously (Alam, 2006). The following table: 2 shows some facts on waste/toxic disposal scene into *Buriganga*:

Seasonal inundation or water logging due to heavy rainfall is a regular calamity that our cities and towns face rather frequently; it is hard to forget the devastating floods of 1998 or the water logging of September 2004 in Dhaka (See fig. 9) (Tawhid, 2004). Since the *Buriganga* has been intruded, canals within the city already being claimed or encroached and natural water bodies at the city fringes gradually eaten up, Dhaka has certainly became a big basin with no outlet. The presence of circular embankments around the city also added to this situation and rather curious means like pumps are now used to remove water from this basin in times of water logging. This is only a makeshift solution and at the same time quite insensible one which clearly overlooks the root cause to this situation.

Keeping *Buriganga* in mind and looking at other rivers in Bangladesh, there awaits a shocking picture; researchers warn that the river system of Bangladesh might die out (Rashid, 1998). Water Development Board (WDB) officials inform that 25 rivers, parts of which have already turned stagnant, will dry up completely in a few years since their route length shrank from 24,000km to 3,800km. The rivers declared dead are *Narasunda* (Kishoreganj), *Bhubaneswar* (Rajbari, Faridpur), *Bibiyana* and *Shakha Barak* (Habiganj), *Palang* (Shariatpur), *Burinadi* (Comilla, Brahmanbaria), *Harihar* and *Mukteswari* (Jessore), *Hamkura* (Khulna), *Morichap* (Satkhira), *Bamni* (Lakshmipur, Noakhali), *Manos* (Bogra), *Baral* and *Chiknai* (Natore, Pabna), *Hisna* (Kushtia), *Musakhan* (Rajshahi, Natore) and *Bhairab* (Kushtia, Meherpur, Chuadanga, Jhenidah, Jessore, Khulna, Bagerhat). The rivers marked as near-dead are *Karatoa* (Panchagarh, Nilphamari, Rangpur, Bogra, Sirajganj), *Ichhamati* (Pabna, Manikganj, Dhaka, Munshiganj), *Kaliganga* (Kushtia, Jhenidah, Magura, Narail, Pirojpur), *Kumar* (Kushtia, Magura, Faridpur, Jhenidah, Madaripur), *Chitra* (Narail, Chuadanga, (Jhenidah), *Bhadra* (Jessore, Khulna), *Someshwari* (Netrokona) and *Nabaganga* (Narail) (Roy, 2005). The zone wise evaluation also conforms to this statistics; in north, the *Mahananda* basin is frequently flooded and

Table, 2: Various types of toxic/waste disposed into the Buriganga

Types of waste	Statistics
Tannery industries	21,600m^3 of liquid toxic, dumped everyday from the 185 tannery industries of *Hazaribagh* (Hossain, 2005).
Other industries	12000m^3 of untreated waste, dumped from the *Tejgaon* industrial area; in addition, 35,000m^3 of untreated highly toxic industrial waste, dumped daily from industries other than *Hazaribagh* (Hossain, 2005).
Heavy metal	On any given day, presence of heavy metal near the first China -Bangladesh friendship bridge measures like this (tolerable limit for drinking pr escribed by DoE is presented within bracket) , Al: 3.27(0.2), Cd: 0.014(0.005), Cr: 0.036(0.05), Hg: 0.0021(0.001), Se: 0.001(0.01), Zn: 0.56(5) (Anon, 2007).
Sewer lines	40% of total untreated waste , from the 500km long sewerage lines produced by more tha n 12.5 million people of Dhaka city, dumped in the river each day (Hossain, 2005).
Oil spills	Spilling out of oil from hundreds of vessels navigating the river (Hossain, 2005).
Human waste	Human waste is thrown from the 46.5% of the total latrines in Dhaka city hanging by the river (Anon, 2007).

Fig.7, Padma, recent picture
Source: www.photoeye.com, 2007

Fig.8, Gorai, recent picture
Source: www.deme.be, 2007

Fig.9, Dhaka floods, 200
Source: images.google.com.bd, 2007

also subject to droughts (Rashid, 1991); the mighty *Padma* is also drying up fast alongside small rivers and tributaries (fig. 7). At present, more than 40, out of 53 rivers and tributaries totally dry up in January every year in the northern region (BSS, 2006). In south, once major rivers, the *Gorai* (Anon, 2001) and *Kapotakhya* (Kabir, 2005) are drying and many others are in the process (fig. 8). In south-west, four rivers have already dried up and 20 others are destined to this fate (Das, 2005). In the east, rivers are under threat of facing desertification (Anon, 2005).

Indication On Policies

Despite all the degenerating consequence of rivers, a sustainable city is deserved in the end. Such a city must be multifaceted, sympathetic to nature and well designed in terms of public spaces and buildings. Responsive regeneration, that is why, would only help raise the quality of sustainable environment within the city. In a similar accent, Simonds (1983) states, *"We human beings need and must have once again in our cities a rich variety of spaces….we also must have order….an order as organic as that of the living cell, the leaf, and the tree….and combines the best of the old with the best of the new….such a city will not ignore nature."* But it is tragedy that the natural waterways have been neglected over the years at many urban scenes like Dhaka although they held and still holds tremendous potential of becoming resources for both community and economy. If harnessed, they are certain to present significant opportunities for neighbourhoods to grow around them. Against all these conditions, a plan could be aimed at the creation of an *Ecopolis*[8] towards the policy framework for a safe environment with more recreational space, presence of nature and commerce to pertain overall economic development:

Social Well-Being And Governance

Appreciation of river as an element of heritage and a maker of history through advocacy, education and participation in various demonstrations on awareness raising.
Sustainable environment for the future generation; a cityscape abandoned with natural features that reminds citizens of its culture and heritage.
Psychological development through recreation; harness potentials of river(water)fronts for socialization of citizens.
Ensuring river for everyone; people adjacent, general citizens, businesspeople depending on rivers.
Inter-sector and co-ordinated approach towards addressing the problem of regeneration.
Partnership development (involvement of stakeholders in the policy making process).
Overall management to look after the consistency and continuity of adopted policies and their implementation.

River Related Economy

Development of prosperous harbour near CBD without hampering any stakeholders' interest (range will vary from the interest of a small child to the fisherman or boatman who earns his living using the river).
Use river for income generation and poverty eradication (incorporation of people living around the waterways).
Enhanced use of river both as sources of fish and as route for waterborne navigation and transportation.

Environmental and ecological issues

Remediation[9] and immediate restoration of waterways with environmental significance; illegal establishments, encroached banks are to be retained; silted up beds to be dredged.
Raise awareness level of citizens towards a clean and healthy river.
Implication of urban forestry[10] as counter measure

against erosion and to hold back soil humidity.
Refurbishment of previous connections to other rivers and streams and set up new ones if possible.

Design Aims[11]

Vibrant waterfront districts and neighbourhoods with activities.
Permeability[12] of the area (both visual and physical) to relate to surrounding districts.
Priority for pedestrian movement and good traffic control.
Extension and treatment of public open spaces adjacent and connected with river(water)fronts.
Encouraging movement and activities around public areas.
Sympathetic landscape to fit and serve specific context.

Conclusion

Today, rivers and wetlands are amongst the most threatened ecosystems worldwide. As an effect, restoration of rivers and wetlands has emerged as a global concern as well as a flourishing business venture. Bangladeshi rivers especially deserve regeneration and re-appraisal simply because they would not only bring in monetary benefits but would also ensure a touch of 'green' also in our already 'brown' urban precincts. Now, we are on the verge of asking ourselves, would we rather have cities that we treasure as the progenitor of our civilization, as engines of economic development, and as culturally rich habitat for man or cities that are no less than ongoing nightmares for anyone who would reside or visit there, or even contemplate from apart? The above study tried to depict the current state of natural waterways near Bangladeshi urban centres like Dhaka. The study shows that we are at complete denial about what is currently happening to them, to our 'mega-cities' and also about the fact that the situation is not getting better by any means anywhere. We have accepted our cities as places which help earn money at the expense of heritage; but we probably failed to recall the value of the term 'heritage' and its contribution in making of a 'humane-society'. Probably we have not done our best yet since we have not used up or looked into all that is available around us. If we acknowledge the need for 'living' cities, and identify the resources of our historic environment, many of our urban problems are sure to be resolved. This is the moment of truth, this is our preference – we can actually choose to turn our urban nightmares into treasured dreams once and for all.

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End Notes :

1 Bangladesh has 700 rivers and major canals covering 6% of the country's entire area which have a combined length of 22,755km.

In addition, major standing water bodies cover 1,922km^2 of land area let alone other privately owned water bodies (BBS, 2002).

2 Sustainability means using the existing resources in the finest possible way. It is, economising of all resources including material,

economic, human and cultural. A sustainable development should be able to meet the requirements of the present without compromising the ability of future generations to meet their own needs.

3 According to United Nations, society, economy and environment are the basic components for a liveable habitat (UN, 1998).

4 Prime residential areas of the city – *Dhanmondi* is the older residential area while the rest are comparatively new. The similarity

lies in all of them being crowded now with commercial & other developments and devoid of the sanctity they used to have initially.

5 These areas are mainly adjacent or beside the older part of the city.

6 The circles on maps mark *Bangshal* in old Dhaka. Arrows in fig. 4 used to be the canal excavated by the *Mughals*, absent in fig. 5.

7 According to the Environmental Quality Standard (EQS) of DoE, a minimum value of dissolved oxygen (DO) 4mg/l is considered

acceptable for fisheries and aquatic life to sustain.

1 Concept of settlements where urban agriculture, urban forestry, urban bio-diversity conservation, and building design to save

energy and material and these become important considerations.

2 Removal of pollution or contaminants from waterways for the general protection of environment.

8 Care and management of tree populations in urban settings for the purpose of improving the urban environment

9 Intent or purpose; efforts towards achieving a goal in an urban scenario as defined by the social scientists (UN, 1998).

5 Relates to the way that a design suggests where people can and cannot access within a city.

Protibesh
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International Seminar: Architecture For Economically Disadvantaged

Bangladesh University of Engineering and Technology, (BUET), Dhaka, Bangladesh

A two day long International Seminar on 'Architecture for Economically Disadvantages' (aed) had been organized by the Department of Architecture, Bangladesh University of Engineering and Technology on 23 – 24 March 2007. The seminar was held in the Council Bhaban and the event was sponsored by Grameen Phone, Bangladesh. The Seminar was inaugurated by the Vice Chancellor, BUET, Prof. Dr. M.M. Safiullah. Mr. Kafil H. S. Muyeed, Director, New Business Development, Grameen Phone was attended as Special Guest and the Keynote Speech was delivered by Prof. Dr. Nizamuddin Ahmed, Head, Department of Architecture, BUET.

Fig-1 : Pushed out or pulled in: home is by a filthy Dhaka street (Source: Keynote Speech, Prof .Dr. Nizamuddin Ahmed)

Background : Economically Disadvantaged refers to people deprived from most of the basic needs of human life, who are subjected to substandard living condition. Considering the global population, only a few are solvent; while millions remain economically disadvantaged living mostly in Asia and Africa. A considerable percentage of population of the developed countries also falls into this category. Cities act as magnets to pull the poor from the rural areas but not all are that fortunate; social injustice rampart in both areas. Major problems of our cities are population density, incompatible land use and pressure on urban facilities while that in the rural areas are unemployment, lack of modern facilities and recurring natural disasters. As a result, any Third World country is plagued by poverty. The most visible characteristics are homelessness and temporary shelters. Living at the losing end of the system, they cannot avail the built environment that they need. Within the realities of life, they remain deprived from minimal facilities and to them mere survival is a challenge. Addressing disparity providers have a great role to enable them as opposed to helping them to avail the benefits of architecture/ built environment. Grameen Bank put forward such a solution to the world. We the Architects, and the allied professionals (like planners, economists, environmentalists and engineers) along with the civil society must come forward to support humanity with their respective knowledge and expertise. Moreover, in driving the economical system the decision makers and political leaders must have some vision to deploy the resources intelligently.

Despite poverty and exploitation, even with centuries of deprivation, people as social and human entities are still largely intact. This is a factor of crucial importance to their future development. We need to share the experiences and disseminate the intelligent ideas from their end coupled with our expert know -how to make this world livable for the economically disadvantaged. As organizers the Department of Architecture had set some objectives to achieve through this cherished interaction of scholars and professions.

Specific Objectives of the Seminar was, in reference to the economically disadvantage,
1. Defining Architecture and its role;
2. Identifying the appropriate technology to build a viable Architecture;
3. Motivating the providers to build a sustainable Architecture;
4. Rearranging the Architecture of a locale to make it livable.

Sub-Themes of the seminar were selected as Energy and Environment; Gender and Socio-Cultural Issues; Habitat and Homelessness; Health and Sanitation; Human rights and Legal status; Income generation and Affordability; Land use and Encroachment; Living pattern and Life styles; Policy and Planning; Power, Politics and Governance; Recreation and Community facilities; Safety and Security Issues; Transport and Communication; Technical and Spatial Aspects.

Keynote Speech: The Keynote speech tried to define the 'economically disadvantaged' people within the demographic range. A very brief but realistic description of their Architecture is the excellence of the paper. It also identified the role of Architects' in the society and the level of

their contribution to the focus group. It addressed that 'The life and living' of such a large population with interrelated and intricate societal, cultural and economic aspects requires extensive and comprehensive study to do justice to the theme of this seminar that indicates a new-found commitment to evolve an outreach programme to benefit the disadvantaged millions through architecture and the service of the architect. There is need for continued research in this area if it mean business at the meeting of minds that was enthusiastic and passionate about the poor'. At the very outset of this seminar the speaker urged upon this gathering of thinkers to ponder over the need to set up a research centre at BUET in the name and style of arcED – Architectural Research Centre for the Economically Disadvantaged. In the spirit of constructive research centres the outputs of arcED may be usefully employed to serve communities under similar distress elsewhere. Establishing similar centres in other countries and regions will further fulfill the architect's obligation to the vast majority by way of international networking.

Fig -2 : Aranya Township, Indore, India

Fig -3 : Paradise sustained: rural house of Bandarban 2007
(Source: Keynote Speech, Prof .Dr. Nizamuddin Ahmed)

Technical Sessions: The Seminar had been arranged in Six Technical Sessions on Habitat and Homelessness; Living Pattern and Life Styles; Income Generation and Affordability; Policy and Planning; and Technical and Spatial Aspects. Twenty five papers had been presented during these sessions among which thirteen were contributed by local researchers, academicians and practitioners and eight papers were presented from different international institutions and research organizations. Initially at the response of the Call for paper in November 2006 some 46 abstract were received, among which 35 Abstracts were accepted from different corners of the world. After receiving the full papers, twenty five of them were selected and finalized in the process of review conducted by a group of learned individuals both from profession and academia. A Proceeding (ISBN 984- 300-000347- 0) had been published containing the valuable papers focusing on different Architectural, Planning and Structural issues of the built forms used by and dedicated to the economically disadvantaged group. Dr. Farida Nilufar, Associate Professor of the Department of Architecture, acted as the Editor of the publication.

First Technical Session – 'Habitat and Homelessness' - was Chaired by Prof. Dr. Md. Shahidul Ameen, Department of Architecture, BUET and the honorable Critique was Ar. Bashirul Huq, Bashirul Huq and Associates, Dhaka. Mr. Patrick D Rozario, Lecturer, Department of Architecture, BUET, had performed as the Rapporteur of this session. Four papers were presented by Dr. Kapila Silva and Andrew Broderick (USA); Prof. Dr. Qazi Azizul Mowla and Mohammad Sazzad Hossain (Dhaka); Prof. Dr. Fuad H Mallick and Khondaker Hasibul Kabir (Dahak); Gouri Shankar Roy and A.K.M.Kausarul Islam (Khulna). The session included a lively discussion on the ideas of students regarding the structure for the poor (USA). Two papers discussed about the housing situation in Bangladesh and the last one concentrated on the cognitive approach to define the perception of home-stead by the rural poor.

Second Technical session was also on the same Sub-Theme i.e 'Habitat and Homelessness' which was Chaired by Dr. Bijaya K. Shrestha, Head of Departmen', Post Graduate Department of Urban Design and Conservation, Khwopa Engineering College, Bhaktapur, Nepal. The honorable Critique was Ar. Harun Ur Rashid, Professor, Department of Architecture, NSU, Dhaka; and the Rapporteur was Bayezid Ismail Chaudhury, Assistant Professor, Department of Architecture, BUET. Authors were Tanya Karim (Dhaka), Mujtaba Ahsan and Prof. Dr. Mahbubur Rahman (Dhaka), Prof. Utpal Sharma and Bhavesh Mehta (India), Prof. Dr. Zebun Nasreen Ahmed (Dhaka), Yasmin Ara and A.K.M. Sirajuddin (Dhaka). Here changing role of architects as well as the changing scenario of housing had been reflected. Papers also shed light on livability in rural areas. The most significant was the presentation of Arayna Project in India explaining it's design and planning features.

On the second day of the Seminar the third Technical Session was held on 'Living pattern and Life styles'. The honorable Chair Person was Prof. Dr. Zebun Nasreen

Fig - 4 : The Inaugural Session

Ahmed, Department of Architecture, BUET. Ar. Mubasshar Hossain, President, IAB acted as critique and Rashed Iqbal, Lecturer, Department of Architecture, BUET, was the Rapporteur: Authors were Gauri Bharat (Singapore), Prof. Bijon Bihari Sharma & Rumana Asad (Khulna), Prof. Dr. Mahbubur Rahman (Dhaka) and Md. Ashikur Rahman Joarder(Dhaka). The discussions in this session forwarded that the real need is to develop economically viable solutions which people understands and can call their own. The issues should include health and sanitation, environment, economy, space, form and material.

The fourth Technical Session was on 'Income Generation and Affordability' for which Chair Person was Ar.Samin Ara Hasan, Department of Architecture, BUET, and the Critique was Ar. A.S.M Ismail, Chief Architect, Department of Architecture, PWD. Tarek Haider, Lecturer, Department of Architecture, BUET, worked as the Rapporteur. Authors were Shilpi Roy, Tanjil Sowgat and Dr. Khan Rubayet Rahaman (UK & Khulna), Sheikh Serajul Hakim and Sk. Kabir Ahmed (Khulna), Dr. Gulsan Ara Parvin and Ms.Fariya Sharmeen (Dhaka), Tanjil Sowgat and Shilpi Roy (UK & Khulna). The issues dealt with are revitalization, and regeneration of urban areas, income generation, economic sources and improvement of the urban poor. Cases were presented on Khulna and a different context of Sunderban was included.

The fifth Technical Session was on 'Policy and Planning' for which the Chair Person was Prof. Khaleda Rashid, Department of Architecture, BUET. Dhaka and the Critique was Prof. Dr. K. M. Muniruzzaman, URP, BUET, Dhaka and the Rapporteur was Fahmid Ahmed, Lecturer, Department of Architecture, BUET. Authors were Dr. Khan Rubayet Rahaman, Md. Zakir Hossain, Md. Ashiq-ur-Rahman and Sadia Afrin (Khulna & Sweden), Bushra Shamsad and Sadah Shamsad (China & Dhaka), Imon Chowdhooree and Kanu Kumar Das (Dhaka) , Arifa Akter Shumi (Dhaka). The discussions were focused on Housing policies; infrastructure development, slum upgradation and implementation mechanism by public and private partnership. The focus of Imon's paper was to assess the possibilities of mass transport for efficient and sustainable mobility. The last paper of this session tried to assess the impact of Second Bridge on Buraganga on the economically disadvantaged group.

The last Technical Session was on 'Technical and Spatial Aspects' in which the Chair Person was Prof. Utpal Sharma, Dean, School of Planning & Public Policy, CEPT University, Ahmedabad, India and the Critique was Ar. Khadem Ali, Architekton (Pvt) Ltd, Dhaka. The Rapporteur was Mahmudul Anwar Riyaad, Assistant Professor, Department of Architecture, BUET. Authors were Dr. Bijaya K. Shrestha (Neapl), .Prof. Khairul Enam and Md. Afzal Hossain (Dhaka), Milinda Pathiraja and Paolo Tombesi (Australia) and Salma A. Shafi (Dhaka). The paper of Dr. Shrestha has depicted the case of housing for the poor in Nepal. Prof. Khairul proposed an affordable solution for the urban poor of Dhaka. On the other hand, Ar. Sahfi depicted a model from Cox's Bazar.

The Concluding Session was conducted by Prof. Dr. Nizamuddin Ahmed, Head, Department of Architecture, BUET as Chair person. The Invited Speaker was Prof. Dr. A. M. M. Safiullah, Vice Chancellor, BUET. Dr. Farida Nilufar delivered the overview on the Seminar. The technical summery tried to identify what was done and what remained to be done after the seminar. The major observations during the process of reviewing, and editing and presentations were shared. At the outset, department of Architecture tried to reach all sectors, who were dealing or thinking of the economically disadvantaged people of the world. The department had received a number of papers from Architects, Planners, Urban designers and allied professionals in response to the call for paper. The organizers tried to knock the doors of the policy makers, the govt. agencies, the NGO's, who are indeed active or needs to be active in the field. However, it was important to mention that the organizers could not get any response from those who are virtually dealing with the poor- their dwelling and the rest of their living environment. It was expressed that the outcome of this seminar might attract the providers and policy makers and also the researchers who are involved in this field in real life. Through this event in BUET, it was hoped that the department had been able to generate a wave of thought and this wave might help the target group who were in the scholarly focus for two day long seminar.

In oppose to the generally perceived thought that the

architects mostly serves the fortunate of the society, this seminar had put the creative minds of architects for the other half of the society – the poor- who are rarely their-clients. The architects are aware of the socio-spatial need of the poor, their economic and mental state. At large, they are concern about the total environment and living condition of the majority of the society, i.e. the economically disadvantaged people in our context. What is lacking in this ground is that the immense academic and practical progress in related fields in Bangladesh as well as in other parts of the world are less shared and not being communicated to a large number of Architects and allied professionals. In a way, many of them are trying to make the world beautiful for the poor ignoring their mental, behavioral, functional needs and most importantly their economic status. It has been found that some practitioners take the challenges to provide physical design solutions for the poor without thinking about their priorities and intentions to attain the 'houses'. Moreover, shelter is not the only problem of the poor, they are also deprived of other community facilities and appropriate considerations in other public buildings as human being. These notions have limited the involvement of the architects and engineers who are engaged in the building industry. In other words the professionals are also neglecting the 'cause' of the poor.

This seminar can be considered as platform to understand what is the present state of 'Architecture for the economically disadvantaged'? It can be concluded that the present state of Architecture for the economically disadvantaged is suffering from the following problems:

- Appropriate Technological solution are rarely establish and thereby adopted. Except a few papers, this seminar seriously lacks in fresh and genius ideas to use appropriate technology for the poor.

- It has been also uncovered that Indigenous material and techniques are less searched off by the researchers to provide alternative solution to the poor.

- It was found that Architects, as such, are less associated with design solutions for the economically disadvantaged.

- Academic exercises/ researches and practical experiences are rarely dissipated among the professionals, the providers and the target groups.

- The experts generally agree that it is not physical design per se, but the overall socio-economic, political and cultural situation that inhibits people from accessing housing. Definitions of 'house' or 'shelter' are rarely understood by the designers from their (i.e. users') perspective.

- Poor's needs for 'home-based income generation' are rarely recognized. It is also found out that less efforts have been undertaken for the improvement of the affordability of the target group.

- Lot of statistics have been generated in this seminar which might help to write more papers, but it is believed that time has come to take active measures and to be involved with the target group in real terms.

- Moreover, it has been evident from the presentations that many disintegrated efforts are being undertaken by different professionals, government agencies and NGO's, which needs to be taken care off under a unique umbrella from a technical university like BUET.

What remains to start after the seminar? The life and living of the economically disadvantaged, therefore, requires extensive and comprehensive study to do justice to the theme of this seminar that indicates a new-found commitment to benefit the target group through architecture and the service of the architects and allied professionals. It indicates a need for continued research in this area if it is really wanted to keep this spirit alive. It is therefore urged upon this technically enlightened community to realize the need to set up a research centre at BUET in the name and style of arc-ed - Architectural Research Centre for the Economically Disadvantaged, as proposed by the honorable key note speaker, Professor Dr. Nizamuddin Ahmed.

Organization of Seminar :

Prof. Dr. Nizamuddin Ahmed was the Convenor of the Seminar who is also presently holding the post of Head of the Department since August 2006. The Conveners of different committees were Dr. Farida Nilufar (Technical Committee); Dr. Nasreen Hossain (Registration & Hospitality Committee); Mr. Atiqur Rahman (Publication & WEB Committee); Prof. Dr. Nizamuddin Ahmed (Finance Committee). Mrs. Shameem Ara Hasan performed as the General Secretary of the Organizing Committee.

Added Events: On the occasion of the Seminar an Exhibition of Student's input, a Cultural Programme and a Film and Slide show took place in the Department of Architecture.

Contributed by
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