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TOWARDS A SUSTAINABLE BUILT ENVIRONMENT

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CONTENTS

EDITORS' NOTE

The first issue of JRAP in 2012 covers many interesting papers that range from revitalization of an institutional complex to the environmental assessment of educational facilities, linkage of energy consumption and institutional buildings, informal and formal transformations in a historic *sufi* landscape and the evaluation of a fashionable shopping street now impacted by a myriad of environmental factors.

A standard approach to foster appropriate change in the heritage context in developing countries is through incubating demonstration projects. Such attempts can be undertaken through focused professional input, cautious and accurate formulation of intervention, careful supervision and rectifications for periodic problems that emerge on the way. The restoration of NED City Campus can be considered as a worth emulating example for restoration exercises planned for public building complexes and other similar ventures. As the authors have documented and analysed, there remain many more challenges to be achieved in completion of later phases of restoration works due to administrative and financial constraints. Any restoration initiative is likely to face the same or similar muster of issues as illustrated in this paper.

The research on the environmental appraisal of school buildings in Islamabad is an important work that highlights the status of physical spaces and amenities. After developing an investigation construct, the paper extends background of assessment of chosen public school buildings and allied facilities. Such studies are also particularly useful for a diverse body of practitioners who are assigned to conduct either targeted evaluation studies or evolve typological characteristics around such premises for policy or programme purposes. While methodology of evaluation is normally dependent upon the objectives of such studies, there are many lessons that professionals may learn from this paper in respect to delineating a credible database for spaces for learning and other uses.

With rising populations, trends in expanded consumption of electricity and increased dependence on electro-mechanical systems for climate control, an exponential rise in the overall consumption of energy is experienced in the present times. Most of the cities in developing world are facing a rising gap between supply and demand of energy, Dhaka being one of them. The paper on energy consumption patterns in institutional buildings and climate profile in Dhaka city deal with various connected issues that are important for consideration during design and occupancy phases of such buildings. Outcome of the research reveal that reasonable difference can be made through careful design and implementation approaches.

Cultural and spiritual landscape in South Asia is embellished with many well known *sufi* shrine complexes. In Punjab in Pakistan where many shrines have existed, several of them since more than a millennium these contexts have become places of hope for the countless down trodden and folks facing any kind of affliction in life. Over the period of time, additions and alterations have taken place either to facilitate the stretching needs orother compulsions. It is often a crucial question whether the sanction of alteration or change has been acquired formally or the works were undertaken without any legal or administrative authority. The paper informs that often a very thin line separates the two domains.

The Tariq Road Axis in Karachi has been a prime shopping street since several decades. The periodic transformations, real estate pressures and changing administrative pre-conditions created many adverse environmental impacts. The paper is an attempt to address such issues through field documentation and analysis.

This issue of the journal also includes a book review.

Editorial Board

NED CITY CAMPUS RESTORATION
SETTING BENCHMARKS FOR CONSERVATION PRACTICES

*Anila Naeem**
*Sahibzada Farooq Ahmad Rafeeqi***

ABSTRACT

NED University of Engineering and Technology originated in 1922 from what is now known as its 'City Campus' or 'Old Campus' located in the hub of Karachi's historic areas. Shifting of university campus to its present location on University Road in 1975 led to the abandonment of this historic site for more than twenty years; adversely affecting the structures due to neglect and disuse. In 1997 NED City Campus was declared as a listed heritage of Karachi given protection under the Sindh Cultural Heritage Preservation Act 1994. In 2000, realizing its importance as an invaluable asset the NED university's Department of Architecture and Planning conceptualized the vision for restoring this campus and putting it to use; not only on grounds of its historic significance but also for reasons of sustainability, environmental enhancement and regeneration of historic fabric.

Restoration of NED City Campus is envisioned with an approach of minimal interventions and respect to the original setting, layout and materials of construction; closely following the international principles of heritage conservation. The approach is to achieve optimum utilization of campus premises primarily as an educational hub; but additionally introducing a variety of ancillary activities to facilitate extended usage of the property. Being an extensive undertaking the project is planned and being executed in phases; the first major phase being the restoration of 'Bai Puribai Becharbhai and Bercharbhai Raichand Block'. This paper gives an overview of this first phase, with a focus on interventions carried out to consolidate the existing structural members of the historic building.

1. INTRODUCTION TO THE INSTITUTION AND THE CAMPUS

Being the first educational institution of Pakistan producing local engineering graduates since 1922, N.E.D. University of Engineering and Technology initially started off as the "Prince of Wales Engineering College". In 1924 the institution was renamed (after Nadirshah Eduljee Dinshaw) as N.E.D. Engineering College and became affiliated with the University of Bombay. In 1947 the administration was taken over by

Figure-1: Location Map of NED City Campus.

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the University of Sindh and later in 1951 by the University of Karachi. N.E.D. finally achieved the status of a university in 1977; by this time all its academic activities were shifted from the university's original campus located at the junction of Maulana Din Mohammad Wafai (Strachan) Road and Mohammad Bin Qasim (Burnes) Road [Figure-1), to its present location.

1.1 The Campus and its Buildings

NED City Campus is a 1.67 acres trapezoidal plot, having several building blocks added to the site at different stages of its history [Figure-2]. Of these the two main historic structures built in yellow Gizri stone align along the two main roads; whereas four other smaller structures built in RCC are located in the inner core of the plot. Other than these structures of a more permanent nature, there were few shed-like constructions which were dismantled to clear up the site for required additional spaces planned to be built in the later phases of the project. The historic structures of the campus have a very modest architectural vocabulary; however a tall chimney at the junction of Mohammad Bin Qasim Road and Din Mohammad Wafai Road, is an imposing feature of the site that serves as a landmark for the area.

2. BACKGROUND TO THE RESTORATION PROJECT

NED City Campus being left abandoned and neglected for almost twenty years left a toll on its old structures, which underwent extensive deterioration. Realizing the campus's historic significance the university administrative decided to initiate an intensive restoration of the buildings and rehabilitate the entire campus again for educational activities. In the light of underlying, internationally accepted principles of conservation, particularly the Venice Charter (1964) and the Burra Charter (1999), the following general restoration guidelines were derived for the City Campus.

- Change in original layout to be kept to a minimum and to be allowed only if considered extremely necessary.
- All repairs in historic structures to be done with original

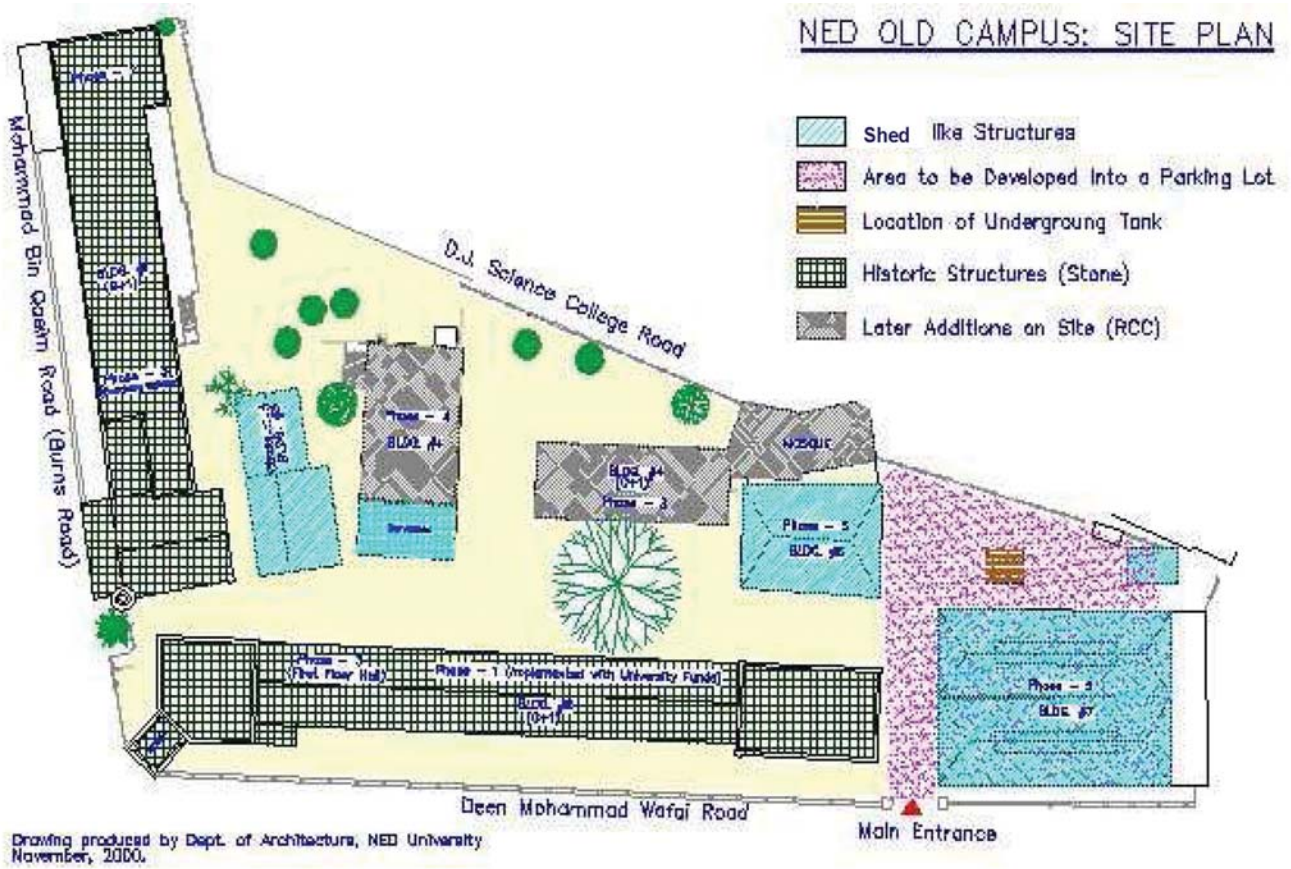


Figure-2: The site as documented before restoration interventions.

materials and techniques.
- Additions/changes in historic structures to be reversible and clearly identifiable; designed with sensitivity towards original layout and character of space.
- All later period additions on the lot to be considered as part of its historic development (however, those of a non-permanent nature with no architectural or historic significance and negatively impacting the historic fabric to be removed/ dismantled).

The overall site interventions give importance to existing architectural details; replicated for places where these have disintegrated due to lack of maintenance over the years. The areas between buildings are planned to be landscaped to create a micro climate that not only enhances the environment but also allows energy efficiency; allowing outdoor sitting spaces for the students and other visitors to relax and meditate. The guiding principle to be followed for selection of any new plantation introduced on site is to choose species that would help create vistas and frames for heritage structures, rather than blocking them and damaging them by voluminous growth. Among general interventions proposed for stone buildings; the most important is cleaning of stone façade, planed to be undertaken through a scientific method of internationally accepted standard, thus an opportunity to develop appropriate cleaning methods for historic stone façades, in the local context without damaging their original materials (unlike the general practice as prevailing in Pakistan).

Since start of 2005 academic session this historic premises has been exclusively taken over by architecture department and renamed as 'NED Department of Architecture and Planning Campus' (DAP-NEDUET).

The main objectives behind this restoration initiative are;
- To ensure that the campus is maintained as an architectural heritage site and historically significant landmark of the city.
- To ensure that NED City Campus is once again revitalized as an educational hub and properly utilized to its full potential.
- To undertake the restoration project as an exemplary exercise that could serve as a role model for similar projects in the city.

In addition to these primary objectives, a strong component of the project is "research and training" for which the worksite has provided opportunities of learning and hands-on experimentation, primarily for the entire team of professionals involved, and additionally for architecture students present on campus.

The proposed use of the campus after its restoration as the Department of Architecture and Planning has helped in retaining the original spirit of usage as a campus for professional education activity. However, the discipline of architecture being different from other engineering disciplines has resulted in incorporating some changes, but these are minimal. The large hall-like rooms in the original layout are efficiently converted into studio spaces; as their quality of space appropriately fits to studio requirements.

3. RESTORATION INTERVENTIONS

In view of funding limitations the project is envisaged with phase-wise development; priority in the first phase given to address immediate academic requirements for architecture students and faculty. Thus areas having severe structural damages (building #1 and #5) because of which they could not be put to use were taken up on priority basis. With completion of the first phase of project ample space is now available on campus to comfortably accommodate the routine activities of the department. The future phases are envisaged to further upgrade the campus standards and provide facilities for extra-curricular and research activities initiated within the department.

3.1 Restoration of Bai Puribai Becharbhai and Bercharbhai Raichand Block

Architect & Conservation Consultant: **Anila Naeem**
Structural Consultants: **Mushtaq & Bilal**
Contractor: **Beton Construction Company**
Year: **March 2006 - April 2009**

A major component of first phase works is the restoration of Bai Puribai Becharbhai and Bercharbhai Raichand Block (Building #1), which was in a severe state of deterioration, thus not in usable condition. Lack of maintenance due to abandonment, stretching over a long period of time had caused severe damages to the RCC structural members. The primary cause of deterioration was water penetration inside the building causing corrosion leading to serviceability issues and strength degradation of reinforcement and damage of other building materials. Restoration of this block included major structural repairs, re-doing damaged internal finishes including flooring and lime-plaster, repair and cleaning of all timber elements, restoration of defaced and disintegrated features, and provision of new elements required for proper functioning of introduced activities. The processes followed for major restoration interventions are briefly explained here.

3.1.1. Structural Works including consolidation of existing beams - columns and recasting of RCC slabs.

The most challenging intervention involved restoration and enhancement of the lost strength, stiffness and ductility of deteriorated structural members for the reasons already discussed in the above sections. A workable repair strategy can only be designed if causes and effects of involved deterioration process are well established. Compatibility of repair material with the existing material is also vital for durable repair. A careful investigation was undertaken for each component of the structural system and a well-designed repair strategy was then applied after establishing the desired choice of strengthening. The slabs in all cases were completely demolished and re-cast. The steps sequentially followed include; temporary strutting of beams followed by careful demolition of slabs using manual labor, and then measures for re-strengthening and re-casting structural members [Figure-3(a-f)]. Once the site was cleared of all debris the damaged base of all columns was re-strengthened by first extending their footing and then jacketing of columns with added reinforcement. The damaged portions of beams were then treated; first chiseling out the damaged concrete cover and then treating the reinforcement with anti-corrosion paints and finally applying the repair plasters using bonding admixtures and strengthening fibers mixed with cement and sand. After re-strengthening of the columns and beams the slabs were cast; and the mid-lofts designed using steel were added to increase floor area and achieve optimum utilization of voluminous ceiling heights. The structural repairs were followed by repairs of interior finishes. Giving due importance to original materials the damaged lime plaster of internal wall surfaces was re-placed with plaster of similar composition as that of original and in-situ c.c. flooring to recreate the effect of original flooring.

Figure-3(a-d): The restoration process cycle; (a) Deteriorated bases of the RCC column. (b) Temporary propping for relief of loads and chipping/ surface preparation of beams. (c) Reinforcement details for strengthening of lower half of columns. (d) The columns after jacketing; at curing stage.

Figure-3(e-g): (e) Repaired columns with mid-loft. (f & g) View of the space after completion.

3.1.2. Re-plastering of interior surfaces with lime plaster

The original lime plaster inside the building had been badly damaged due to seepage of rain water from window/ ventilator openings and roof slab. The extent of damage made it necessary to re-place it with new plaster. On removal of plaster layer cavities in masonry wall were also discovered. These were filled with lime mortar grouting before application of the new plaster. Lime plaster was prepared on site; following all the steps employed in traditional practice: dissolving the quick lime lumps in water, draining the dissolved liquid through wire mesh into pits dug in ground for slaking of lime - and left for two to three weeks, mixing the slaked lime with jute, sand and crush of lime stone for preparation of lime mortar and grouting, and finally application of lime plaster in two layers [Figure-4(a-f)]. Identification of an expert craftsman to deal with this specialized task took several months and trials to accomplish.

Figure-4(a-f): Lime plaster of stone masonry walls. (a) Removal of existing damaged lime-plaster. (b) Stone masonry walls as exposed after complete removal of existing plaster. (c) Making lime-plaster. (d) Applying the new lime-plaster. (e) Masonry walls before complete finishing of plaster surfaces. (f) Masonry walls after complete finishing of plaster surfaces.

3.1.3. Cleaning and repair of timber doors/ windows

All timber elements in the building were in a state of disrepair and damage, requiring specialized restoration procedure. For this purpose all door, window and ventilator shutters were dismantled, and tagged with numeric identification corresponding to their location [Figure-5(a)]. The accumulated paint layers were then cleaned following a three stepped process; applying a solution of caustic soda diluted in water with a brush on all surfaces to soften paint, then scrapping off the paint layers manually with metal scrappers, and finally smoothing of surfaces with fine sand paper [Figure-5(b-c)]. The original timber texture was enhanced with (matt) clear varnish applied in several coats till desired finish was achieved [Figure-5(d-e)].

Figure-5(a-e): Cleaning and polishing of timber works. (a) Tagging and numbering of door/ window shutters. (b) Application of solution to soften existing paint layers. (c) Scrapping of paint layers and smoothing of timber surfaces. (d) Polished finish of cleaned timber elements. (e) Final finished door panel.

3.1.4. Liberation of entrance portal and construction of new staircase

The modest architectural language employed in design of this historic stone structure makes use of few enhancing architectural features; entrance portal being one of these had a high degree of importance, thus had to be liberated from the later additions that defaced it completely [Figure-6(a-d)]. The external staircase (already being in a precarious condition) and masonry walls embedding the entrance portal were demolished to carve out the entrance portal. The stone surfaces of portal columns were cleaned of all paint layers and damaged cornices were repaired. The restored entrance portal now forms part of the terrace space that opens out from first floor studios [Figure-6(e)]. As a safety measure a new parapet of simple design was introduced around the terrace. A new staircase bearing a contemporary mark was

Figure-6(a-e): The entrance portal in building #1. (a) Entrance portal embedded inside later additions. (b) Removal of later additions. (c) The carved out entrance portal. (d) At the stages of repairs and re-cast slab. (e) The restored entrance portal at completion of works.

introduced inside the building. These new interventions are clearly identifiable as later additions.

The restoration of Baipuribhai Becharbhai Block was partially funded by a grant from the National Fund for Cultural Heritage and inaugurated on 17th April 2009 by the Governor of Sindh. The building presently accommodates four studios for undergraduate architecture students, and one studio for M. Arch students. In addition there are two smaller rooms being used as offices. The pitched roof space adjacent to the chimney reserved for 'NED Gallery of Historic Archives and Souvenir Shop' is the only space in this block that still awaits restoration works due to lack of available funds.

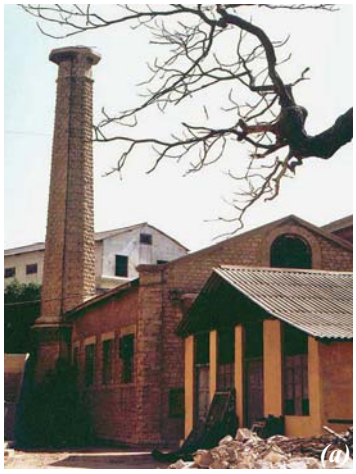
3.2 Other Interventions and Further Phases

Besides major restorations undertaken for Bai Puribai Becharbhai and Bercharbhai Raichand Block, there were a number of other works that required urgent attention; the restoration of timber pitched roof in Seth Fatehchand Khilwani Block (building #2) [Figure-7(a-e)], boundary wall on all three sides of the plot [Figure-8(a-b)], restoration of shed for tuck shop [Figure-9(a-b)], construction of new toilet blocks and the structural repairs in building #5. These works were accomplished as part of the first phase of the project. The second phase of the project includes construction of additional spaces for an auditorium, model-making/ carpentry workshops, materials laboratory, administrative/ faculty offices, basement parking, landscaping of outdoor spaces between buildings for use as sitting areas by students/ visitors and complete restoration of building#2. Interior works for exhibition hall, NED gallery, reference library and a few other spaces are also required to be taken up in the future. Proper cleaning and treatment of all stone façades using scientific methods is also planned, but could not be taken up due to funding constraints. A specific timeline for completion of the entire campus restoration cannot be envisaged as the implementation of proposed works is dependent on availability of funds; for which ongoing efforts on part of the administration are continuing.

Figure-7(a-e): The original timber pitched roof spanning over a large hall on first floor of Seth Fatehchand Khilwani Block (building #2) was in a highly dilapidated condition with most of its purlins infected with termite. Only the completely destroyed timber was replaced whereas all the original trusses were cleaned and treated with protective timber coating. The terracotta tiles were also re-used; only the damaged ones being replaced. Since the complete restoration of this space as an 'exhibition and display hall' is still on hold due to lack of funds it is becoming more and more difficult to keep the restored roof in a maintained condition.

Figure-8(a-b): Restoration works along the Burns Road boundary wall involved demolition of RCC slabs built along the space between the building and the wall. These spaces had been in disuse for many years and became a hideout for drug edicts; a menace now removed from the vicinity due to clearing of area and restoration of the wall.

Figure-9(a-b): A small shed restored to serve as a tuck shop. The open spaces around this structure are planned to be properly paved and landscaped for use as outdoor sitting areas.



March 2001

December 2004

November 2005

April 2010

Figure-10(a-d): The pitched roof and chimney room in Baipuribhai and Becharbhai Block; the only space in this block awaiting complete restoration and interior works to house the proposed 'NED Gallery of Historic Archives and Souvenir Shop'.

4. SUMMARY OF PROJECT ACHIEVEMENTS AND OUTCOMES

The restoration of NED City Campus buildings and putting the abandoned campus to purposeful use has not only ensured the survival of these historic structures into the future but on an environmental level the revival of academic activities on the premises has injected an impetus contributing towards rejuvenation of the historic neighborhood. Prior to its restoration, as an abandoned site the campus had become a hideout for drug addicts. This menace for adjoining residential neighborhood is now eradicated to a great extent by the efforts of a twenty four hour vigilant security service of the university posted at city campus.

For students of architecture, being placed in a heritage site, inculcates a sense of pride; additionally giving them an ideal opportunity to experience and be exposed to the real life issues of our inner city crisis. Bearing close affinity to the historic areas of the city helps develop an association and build connectivity with much that is being taught in relation to our built environments. Being placed within the city center however, brings with it challenges of infrastructure constraints and limitations; addressed at management level. These include dealing with long power break downs, shortage of water supply, flooding during monsoon rains due to backflow from choked drains, threats of graffiti and vandalism, etc. Over the years the university administration has gradually resolved some of these challenges by experimenting with alternate arrangements; solutions for remaining hurdles are constantly being sought.

The actual restoration processes and the adopted scientific approach created an opportunity to experiment and develop methods for restoration of various historic materials and revival of traditional techniques. From lime plaster to cleaning

of timber, in-situ cement flooring, strengthening of structural concrete, waterproofing of *khaprail* roofing; each task required innovative experimentation to achieve the desired standard. Managing this within the fixed rules of tendering and working with lowest bidder created extraordinary situations, challenges and delays. Credit here needs to be given to the contractor, who being an alumnus of the university did not treat this project as a regular undertaking and overlooked the profit margins to deliver quality work. The on-site experimentation for seeking solutions to various requirements has enriched the experiences of all associated professionally with the project. The results produced in the first phase now provide a standard benchmark to follow in future phases of the project.

5. CONCLUSIONS AND FUTURE DIRECTIONS

Since the projects' inception in 2000, the university and team of professionals involved have struggled to maintain quality standards; from documentation to analysis and developing the restoration proposal, to actual execution of proposed works there have been extensive efforts to overcome challenges posed due to the extraordinary nature of the project. The project can be seen as being placed in an ideal situation; the property owned by initiators of the project, backed by an educational institution that believes in excellence, and the availability of trained conservation professional on board. It probably is among the very few restoration projects in Pakistan where ample time was allowed for sound research and analysis to base restoration decisions; the execution of works is patiently monitored ensuring that lack of funds and pressures for early completion of the project do not result in compromising the merits of the master plan that was carefully developed to maximize on potentials of the campus as an important historic site, located within the hub of the city. The NED City Campus now not only provides a fairly comfortable academic environment to its students but has also helped instigate a positive impetus on an environmental scale, adding charged energies to its degenerating historic neighborhood. Painstaking efforts are being made to carry out the entire project on internationally accepted standards of conservation/ restoration so that it serves as a source of direct learning for future conservation projects, specially undertaken within the challenging circumstances of a public sector organization.

The successful completion of the project's first phase however, remains as its first milestone. Much of what is envisioned in the master plan to achieve optimum utilization of the city campus to its full potential still remains unaccomplished. The completion of the project in accordance to the vision en-framed in its master plan would only be possible if future policies and decision making remains consistent to what has been proposed and approved in the master plan.

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AN ENVIRONMENTAL ASSESSMENT OF PUBLIC PRIMARY SCHOOLS OF ISLAMABAD AND PROPOSED REMODELING FOR ONE SELECTED SCHOOL

Saima Iqbal*
Nomana Anjum**
Nazia Iftakhar***

ABSTRACT

Current research interest in sustainable built environment is compelling architects, engineers and designers to re-visit the existing buildings to evaluate them on environmental criteria and to assess if the building is conducive to accommodate the user needs. Such type of research, focusing on school buildings, has demonstrated that environmental features including thermal comfort, lighting, indoor air quality, acoustic and provision of open spaces, impact the performance of students and teaching staff both physically and psychologically. The paper discusses the state of government school buildings in Islamabad. Post occupancy evaluation technique has been adopted to evaluate the school buildings. Extensive case studies are carried out on five school buildings drawn from the existing Federal Government (FG) Schools (one each from the five sectors) on account of said environmental features conducive to student learning. The research is carried out in two phases; first phase comprises data collection through questionnaire surveys and observation sheets from students and teachers about their perception and satisfaction for various environmental features. In second phase the environmental meters had been used to record the temperature, lighting and acoustic levels in the selected schools. Findings from research have been compared with international and national standards, and directed to identify the inadequacies and design draw backs. The study has revealed that space standards are much below the international standards and existing classes are very cramped in most cases. There are also design flaws in lighting, thermal comfort and acoustics and essential facilities are either missing or are substandard in most cases. Finally, an attempt is made to remodel one of the five schools studied and identified as lowest in meeting the environmental features. The research concludes with recommendations applicable for remodeling of existing schools or for the construction of new primary school buildings.

Keywords: User-friendly architectural design, Sustainable building design, Environmental quality of school buildings, Conducive environment, Post Occupancy Evaluation.

1. INTRODUCTION

Historically, buildings were assessed and analyzed more for their shape, form and structural designs and less for their performance in relation to user needs. Similarly, the concern for ecological principles such as use of sustainable building materials, conservation of water and energy, use of appropriate technology, air and water pollution control measures and waste reduction and management strategies were ignored or overlooked for long (Vezzoli, 2003). According to Scheuer et al. (2003), for the last two to three decades the need for sustainable development is argued as a need for harmony among the environment, society and economy. It focuses on improving the quality of life for all without increasing the use of natural resources (Langston & Ding, 2001). Shah et al (2009) described ecological design principles which apply to all types of buildings and user friendly designs including all users of a specific building type. In the context of sustainable school environment the emphasis needs to be on design, planning and construction of any school considering that the physical facility influences the learning climate (PPRC, 2004) and also to minimize the environmental changes/ degradation in this process (Ohrenshall, 1999).

Bee (1985) argued that research studies on child development have established that young children's intellectual development is directly related with provision of stimulating learning environment in schools. Graca et al, 2007 described optimal learning environment as the one that includes thermal comfort, adequate ambience, noise control provision and physical facilities that directly help students to enjoy the learning process and help teachers to optimize the teaching

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experience. Children spend 40-45 hours per week in school environment, therefore apart from academic learning they are also expected to nurture their social, emotional and physical skills in the school environment. Pushkar et al (2005) argue, design requirements for a primary school as more than provision of well lit cheery class rooms. Designers must look into ancillary areas (such as toilets, play areas, dinning/ eating areas and extra curricular activities). There are also several design features discussed by Pere and Capeluto (2009) that are now being considered as important contributors towards better school performance for children and a sense of well being on the part of students, teachers and staff. These features include day lighting, acoustics, air quality, thermal comfort, attention to materials, and incorporation of natural elements such as trees, plants and landscaping (Orenshall, 2009).

The current research has an exploratory approach to evaluate environmental aspects of primary schools in a particular urban environment of Islamabad and investigate occupant's perceptions and behavior with reference to school buildings. As the urban population has increased manifolds and number of students in public schools has increased as well, therefore, to cater the needs of growing children, the provision of such facilities has to be re-established. The study is limited to evaluate the prevailing environmental conditions including light, acoustics, air movement, thermal comfort and space distribution in the existing schools. The values of these aspects are measured by the study of different design variables including orientation, openings, room size and other structural details as well as space allocated for different purposes. The objectives are to evaluate the existing physical conditions in the selected case studies according to international standards and thereby selecting the lowest rated school building for remodeling. The study is concluded with proposals for remodeling of existing primary schools securing favorable environment for children.

2. PUBLIC SCHOOL BUILDINGS IN ISLAMABAD

Schools in Pakistan are run both by public and private sector. The public schools are established to provide low cost education to masses. The private schools on the other hand are driven purely by commercial considerations. The private schools are not included in the scope of this study because the buildings of high cost school systems are usually designed according to the school system's standards and appear to meet most of the basic needs. On the other hand, the medium and low cost private schools are usually housed temporarily in the make-shift rented residential accommodations which are not designed to serve the purpose of a school building. The public schools, however, have the advantage of having their own dedicated buildings on large pieces of land which, despite scarcity of funds, allow the authorities to augment and expand the building accommodation to meet the growing demand. But often, these expansions and augmentations are compromised on quality and design of the building due to various constraints and pressures. The incumbent study therefore focuses on public schools because of their ownership advantage over private schools and the fact that any reorganization or modification could result in permanent impact and also has the potential for replication at other similar places.

Most of the public school buildings in Islamabad are 30 - 35 years old, and are based on the then assessed needs of population, prevailing building construction design and technology and academic systems [Figure-1]. However, the population of the city has now increased manifolds and the number of students in public schools has obviously increased as well. Currently, there are two types of public schools running in Islamabad including Model schools of Islamabad and Federal Government Schools of Islamabad operating in each sector of the city. Model Schools start from Grade 1 to Grade 10. They have adequate site area with proper school building and serve separately for girls and boys. The Federal Government Junior Model Schools cater Grade 1 to Grade 5. Federal Government Schools provide primary level education to large chunk of the local population. These however, are established in designed school buildings at adequate site area but evaluation and monitoring of these buildings suggests that they suffer from multiple environmental deficiencies and lack in providing favourable environment for children.

Subsequently, the study has highlighted the need and requirement for additional class rooms and allied facilities such as toilets, cafeteria, art rooms, in-house dispensary,

Figure-1: Federal Government School of Islamabad.

staff room, etc. Furthermore, introduction of new technologies such as computers and audio-video facilities makes it all the more important that they be made a part of the educational institution so that students can be at par with those students who are studying in the private schools and are well-versed with the advancements taking place at a national as well as global level. For all these additional needs spaces are to be allocated in future school designs [Figure-2]. In addition to this, appropriate sized play grounds with play items, gymnasium, and swimming pools (where appropriate) need to be added for the physical growth of children. Given all the financial and space constraints, it may be difficult to completely reconstruct an existing school. However, an effort could be made to modify it to the possible extent on the basis of available resources through reconfiguration, reorganization and augmentation/ expansion of the school's existing buildings to provide modern academic facilities as well as making it more environment and user friendly. Furthermore, public schools are large in number and follow a standard design pattern and therefore appropriate design recommendations can be replicated at other similar sites.

Figure-2: A High Cost Private School of Islamabad.

3. SCHOOL BUILDING MONITORING AND EVALUATION TECHNIQUES

Monitoring activities may commence from the design stage of a primary school building continuing to its performance up to full satisfaction of the users and the management. According to Langston (2001) monitoring can be described as the record of actual building performance of a particular project in a form that facilitates subsequent life cost planning and management activities. Post occupancy evaluation[1] (POE) technique has been adopted to evaluate the current schools' conditions. POE assesses how well buildings match users' needs, and identifies ways to improve building design, performance and fitness for purpose. Preiser and Vischer (2005) argued that the accommodation and activities of primary school buildings need to be examined in order to assess the full utilization of the provision made within the resource limits. The evaluation of school buildings may be seen with respect to building performance, users' satisfaction, management satisfaction as well as cost effectiveness (Sanoff, 2001). POE for particular situation of school environment is a short term process that seeks to identify major success and failures. The findings describe and explain the performance of the school building and after extensive findings, a recommendation for future takes place (HEFCE, 2006). Analysis can be drawn based on typical data collection which may lead to redesigning or remodeling of existing primary schools. A perfect use of primary school building accommodation is of prime importance in order to gain cost effectiveness. The school building performance on the basis of energy conservation measures is also to be considered (Milla & Pattison, 2003). Baird *et al* (1996) also concluded the optimum consumption of power and gas during working hours has to be given prime attention in order to make the facility cost efficient.

4. COMPARATIVE ANALYSIS OF ENVIRONMENTAL STANDARDS

Ministry of Housing and Works, Environment and Urban Affairs Division has prescribed a National Reference Manual on Planning and Infrastructure Standards as the 'National Standards' (PEPEC, 1986) that covers standards for all types of public buildings in Pakistan including primary schools. However, the prevailing international standards such as Time Saver Standard (TSS) (Chiara & Crosbie, 2001) and UNESCO Standards (UNESCO, 1969) also need to be reviewed to determine the adequacy of the primary school building requirements to a wider range. These standards do not provide same parameters for their application and can serve the purpose of guidelines only, while actual design parameters have to be determined in accordance with local climate and general environment of the region. For example TSS highlighted to improve the health and academic levels of young children for securing appropriate school

1 Post Occupancy Evaluation involves systematic evaluation of opinion about buildings in use, from the perspective of the people who use them.

environment through maximizing daylight and use of vibrant colors to provide psychological aid to learning, whereas, UNESCO emphasizes on bilateral light in classroom with windows up to ceiling height and shady trees outside to avoid glare. National Standards prefer the north-south orientation of classrooms to reduce solar glare. The acoustical conditions set out by TSS are based on circumstances of listener and suggest absorbing materials in corridors, whereas UNESCO and National Standards do not provide such details in this context. Thus, it is proposed to consult the international standards/guidelines where national standards are not available and adapt them for local needs. Table 1 shows the general applicable standards of relevant parameters.

5. RESEARCH DESIGN/ METHODOLOGY

Research has taken such conditions that are unavoidable for promoting a learning environment and physical development for the growing school children. All aspects and variables are interrelated. A figurative expression of the relationship of various aspects and variables undertaken for research is shown in [Figure-3].

5.1 Sampling

Population of study comprised of all the Federal Government Primary Schools of Islamabad. Random Stratified Sampling Technique has been adopted using Descriptive Survey to establish the basis of the study. Most of the schools under the Federal Directorate of Education (FDE) are built on similar pattern in terms of building materials, construction techniques, land size, layout and internal facilities. The research was designed to thoroughly investigate the buildings' design, its prevailing conditions, classrooms, and physical facilities for students, teachers and supporting staff. The research required significant time, along with monitory and logistical resources to accomplish the survey and generate remodeling proposal for each of its surveyed sample. Since the research was not funded externally, it was not possible to extend it to a large sample of schools. Therefore, the scope of the study was kept limited to 5 case studies of schools and one remodeling proposal. The sample was restricted to the public schools operating under FDE and the sample drawn comprised of one school each from five different residential sectors of the city depicting different economic levels.

S.No.	Standard (TSS)	
	Space required per student in classroom	1.2 m² to 2.5 m²
	Overall classroom size	2.6 m² to 3.5 m²
	Space for art and craft and other activities	5 m²
	Multipurpose hall accommodation	300 to 600 students
	Standard (UNESCO)	
	Desirable space for 25 students	6,070 m²
	Space for play area and academic activities	3.5 m²
	Minimum space required per pupil in classroom	0.93 m² to 1.4 m²
	Classroom ceiling height	3.05 m
	Illumination standard	107.64 Lux
	Ceiling and Walls color	Very light
	1 W.C.	50 boys
	1 Urinal	30 boys
	1 W.C.	25 girls
	1hand wash facility	25 pupil
	Standard (National Standards)	
	Primary school plot size	0.6 – 1.0 hectares
	Minimum tolerable site area	7.5 m² per pupil in existing building
	Minimum tolerable site area	10 m² per pupil in new building
	Number of students in single stream school	25
	Number of students in five streams	50
	Size of classroom	54 m²
	Space per student	1.1 m²
	Area for other curricular activities	1.1 m²
	Number of washrooms for 125 students	2
	Number of washrooms for 600 students	8
	Number of washrooms for 1250 students	10
	Recommended play field area	2.5 m² to 5.4 m² per student

Table-1: General Applicable Standards of Relevant Parameters.

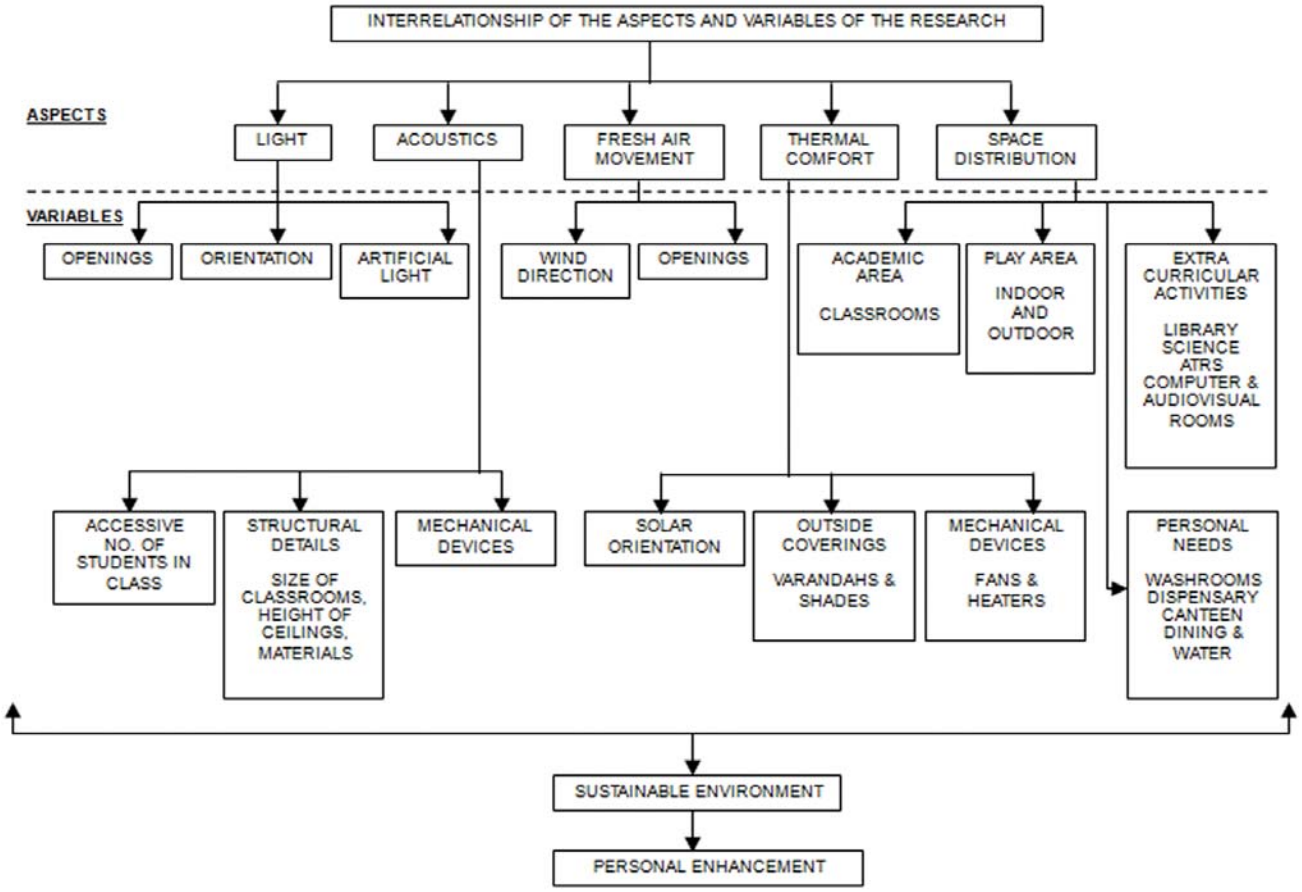


Figure-3: Graphical representation of interrelationship of the aspects and variables of research.

5.2 Procedure Of Study

According to PPRC (2004) recommendation for sustainable designs for schools, it has been outlined that optimal learning environment includes lighting, thermal comfort, adequate ambiance, noise control provision and physical facilities which directly help students to enjoy the learning process as well as help teachers to optimize teaching methods. Since no earlier study was available on school environments in Pakistan, a pilot study was carried out at ten schools in Islamabad and its periphery (semi urban). The pilot study was aimed at determining the types of schools to be studied and also to focus on environmental variables that may be negatively responded by students and teachers. The results of piloting lead to the decision of selecting the FG Schools in main sectors of Islamabad city for the reasons elaborated in section 2. The selection of environmental variables was based on five major aspects (light, acoustics, fresh air movement, thermal comfort and flaws in space distribution) studied in 10 schools selected for piloting. To assess the needs of the real users comprising of school staff and students, two questionnaires based survey forms were designed and the feedback of 10 staff members and 30 students from each school was sought. Questionnaires were designed on the basis of user's perceptions and behaviors studied earlier by built environment researchers (Zhang, Y. 2010). Students of classes four and five were included in the study sample and questions were designed considering the age of students. The questionnaires were also pretested before the actual survey. In addition, an observation sheet was filled by the researchers for each school for evaluation of building layout and design, and environmental features of the selected schools. The building with maximum deficiencies and gaps was selected for the remodeling proposal. Primarily, the TSS, and where required National Reference Manual on Planning and Infrastructure Standards, were used for the purpose of remodeling of the selected building. A comparative matrix was prepared to demonstrate the deficiencies and gaps in the existing building design and layout. A detailed revised plan of the parts of

building was also prepared to elaborate the remodeling proposal.

5.3 Research Instruments

Four types of tools were applied for the purpose of data collection:

- An Observation Sheet comprising a checklist was used for the evaluation of school buildings to determine the user-friendliness. (Survey Form - 1)
- Two Questionnaires, one for the students and the other for the teaching staff were used to find out user satisfaction. (Survey Form - 2)
- Photographs were taken and lay out plans of the five selected schools were acquired to assess the existing building conditions.
- Physical Surveys were conducted with the help of environmental meters for the assessment of classrooms.

SURVEY FORM - 1

A checklist in the observation sheet.

1	Name of the School
2	Location
4	Medium of Instructions
3	Gender
4	Total number of students
5	Total number of teachers
6	Total number of support staff
7	Number of streams per class
8	Average number of students per class
9	Site Area (m^2)
10	Space distribution (m^2)
11	Type of building
12	Academic space
13	Ancillary space details
14	Play areas
15	Unused area
16	Parking lot of school
17	Condition of building
18	Byelaws covering earthquake hazards
19	Byelaws covering fire hazards and alternate provision of staircase in case of emergency
20	Environmental factors a. School building orientation b. Thermal Comfort

6. CASE STUDIES

Besides a large number of privately owned primary schools, Islamabad has a total of 64 federally administrated primary schools located in various sectors. By adopting Random Stratified Sampling, five schools had been selected from different sectors as case studies. A detailed survey and data analysis of various environmental conditions has been carried out for the following selected schools:

1. Federal Government Junior Model School F-7/2 [case study-1 plans]
2. Federal Government Junior Model School F-8/2 [case study-2 plans]

SURVEY FORM - 2 (Information gatthering from the teaching staff)

1	Class room grade
2	Status of the teacher School Administrator Class In charge Any other
3	Qualification
4	Attitude towards environmental comforts
a.	Light conditions in the class rooms
b.	Ventilation conditions in the class rooms
c.	Thermal comfort (temperatures) in the class rooms
d.	Audiovisual learning
e.	Wash rooms
f.	Play ground
g.	Cafeteria
h.	Safety and convenience
i)	What do you think about the step rise of the staircase(s) with respect to students? What do you think about the slope of ramp(s) with respect to students?
j)	Building maintenance

SURVEY FORM - 2 (Information gatthering from the teaching students)

1	Class room grade
2	Age group of the parents
3	Qualification of the parents (highest amongst the two)
4	Attitude towards environmental comforts:
a.	Light conditions in the class rooms
b.	Ventilation conditions in the class rooms
c.	Thermal comfort (temperatures) in the class rooms
d.	Audiovisual learning
e.	Wash Rooms
f.	Play Ground
g.	Cafeteria
h.	Safety and convenience
i)	What do you think about the slope of ramp(s) with respect to students?
j).	Maintenance of usable area

Basic Information	F.G. JMS F-7/2	F.G. JMS F-8/2	F.G. JMS I-8/1	F.G. JMS E-7	F.G. JMS G-9/2
Year of Construction	1977	1983	1987	1987	2000
Type of Building	Double Storied	Single Storied	Double Storied	Double Storied	Double Storied
Site Area (m^2)	9,510	5,974	3,901	7,647	7,426
No. of Students	384	145	905	94	347
No. of Teachers	13	7	33	6	12
No. of Support Staff	5	7	7	7	9
No. of Streams per class	2	1	4	1	2
Average number of students/ class	40	30-35	50	14	40-45
Academic Area (m^2)	469	204	852	207	375
Play Area (m^2)	7,340	4,602	1,244	5,221	4,639
Ancillary Area (m^2)	406	355	1,586	484	152

Table-2: Basic information about school buildings.

3. Federal Government Junior Model School I-8/1 [case study-3 plans]
4. Federal Government Junior Model School E-7 [case study-4 plans]
5. Federal Government Junior Model School G-9/2 [case study-5 plans]

The primary school buildings under this study comprise of a good blend with respect to their age, type and size of buildings. The school buildings show a wide disparity between their site areas and uneven space distribution was also observed for academic, playing as well as ancillary usage. As a consequence, the rear boundary walls are either non-existent or insufficient which increases the danger of wild animals entering the premises. [Table-2] shows a compact description of the conditions in school buildings.

Figure-4: Distribution of Academic Space in F.G. JMS G-9/2.

7. FINDINGS

7.1 Space Distribution

Table-3 presents the distribution of spaces in school buildings. The average academic space per student provided in the buildings differs in each school and it is found below the standards. The classroom size is insufficient (F.G. JMS G-9/2) for present number of students per class [Figure-4]. Average class strength is much higher than the standard strength i.e. 20-25 students. The building plan in F.G. JMS F-7/2 appears inconsistent with respect to the available site area. Ratio between open space and built up space is inconsistent as few classrooms are built on ample ground space. The spaces provided for outdoor games and physical activities are also observed inappropriate. Open area provided for such activity is least in F.G. JMS I-8/1 i.e.14%. None of these schools have properly maintained play ground nor developed space to contain play items. Provision of ancillary spaces is also insufficient. No concept of multipurpose hall was observed except in F.G. JMS I-8/1. The staffroom facility also does not seem to be suitably provided as per social and psychological requirements recommended in studies of environmental quality considering socio-psychological aspects in buildings. These indicators reflect inadequate environmental quality in most schools.

7.2 Environemntal Considerations

The aspects of environmental quality measured in the present research include light, acoustics, fresh air movement and thermal comfort. Light meter (Model: LX-1102) is used to measure the light and sound level meter (TENMARKS Sound Level Meter, Model: TM-101) is used to measure the noise level in class rooms. The detail is provided in

Spaces	Space distribution	F.G. JMS F-7/2	F.G. JMS F-8/2	F.G. JMS I-8/1	F.G. JMS E-7	F.G. JMS G-9/2
Academic space distribution	No. of classrooms	11	5	20	5	10
	Area of classrooms (m²)	43	41	43	41	37
	No. of labs	-	-	-	-	-
	Avg. no. of student/ class	40	30-35	50	14	40-45
	Academic space/ student (m²)	1.08	1.17	0.86	2.93	0.82
Play area distribution	Play areas size	48%	70%	14%	92%	28%
	Play items	8%	16%	18%	17%	5%
Ancillary facilities	Multipurpose hall	-	-	1	-	-
	No. of washrooms	4	4	8	4	10
	Staff room	1	1	1	-	1
	Storage room	1	-	-	2	1
	Cafeteria	1	1	-	-	-
	Dining hall	-	-	-	-	-
	Corridors	2	2	6	2	4
	Open assembly area	1	1	-	1	-
	Staff quarter	1	1	-	1	-
	Guard cabin	1	-	-	1	-
	Parking area	Inside	Outside	Outside	Outside	Outside
	Lawn	-	1	2		

Table-3: Space Distribution

Environmental Considerations	Light adequacy					Acoustics		Ventilation and Air movement adequacy				Thermal Comfort			
	Light meter reading (LUX)	Day light (%)		Artificial light (%)		Noise level dB (A)		Ventilation (%)		Air movement (%)		Winter (%)		Summer (%)	
		By T	By S	By T	By S	classr ooms	corridor	By T	By S	By T	By S	By T	By S	By T	By S
F.G. JMS F-7/2	340.9	90	87	100	80	82.9	69.7	100	97	100	100	80	67	80	20
F.G. JMS F-8/2	360.7	86	100	86	97	74.2	63.3	43	47	43	30	57	80	57	50
F.G. JMS I-8/1	339.5	70	100	90	89	76.7	81.9	90	94	90	72	60	82	60	50
F.G. JMS E-7	401.8	100	100	86	41	71.9	71.4	86	100	86	100	57	100	100	41
F.G. JMS G-9/2	358.8	70	100	60	93	85.2	76.0	50	100	70	100	10	7	60	67
Average		83	97	84	80	76.4	71.6	74	88	78	80	53	67	71	46

Table-4: Environmental Considerations (S; student, T; teachers).

[Table-3]. The minimum standard of light meter measurement is 200 Lux. The table shows the range between 300 to 400 Lux which shows that there is no problem with respect to light deficiency. However, uniform distribution of light is not ensured. The noise problem in the classrooms seems to be caused by three conditions including the number of students, size of the classrooms and poor quality of electric fixtures installed. The noise level of classrooms measured through sound level meter is about 82 to 85 dB (A) against 40 to 50 dB (A). As per users' perception the fresh air movement in the classrooms appears to be sufficient except in F.G. JMS G-9/2 and F-8/2 as indicated in [Table-4]. In F.G. JMS F-8/2, bad smell was sensed, rising from an open waste drain adjacent to the building [Figure-5] whereas in F.G. JMS G-9/2, one side window openings make cross ventilation impossible [Figure-6]. Being located in cooler zone, Islamabad demands more attention to the thermal comfort during winter seasons because in peak summer season schools are generally having vacations. Generally, students and teachers showed their satisfaction with available heating facilities except in F.G. JMS G-9/2 where the heating facility is very limited. However, the existing system can be replaced by more safe and energy efficient heating system such as solar heaters and geysers.

Figure-5: Open drain adjacent to the classrooms in F.G. JMS F-8/2.

Figure-6: Inadequate ventilation in classroom in F.G. JMS F-8/2.

7.3 Facilities

The various provisions made available to the staff and the students in the form of play area, play items, washrooms/person are inadequate (refer Table-1). While facilities such as dining space, cafeteria or dispensary are absent in all schools as shown in Table-5. In F.G. JMS F-7/2 the play areas are not clearly marked and maintained [Figure-7]. Play area per student is 1.37 m² instead of 3.5 m² along with poor quality play items. Washroom provision has been made up to 96 and 113 students per washroom in F.G. JMS F-7/2 and I-8/1, instead of 25 students per washroom as shown in [Figure-8]. Unofficial canteens are being operated in few schools [Figure-9]. Mostly, schools do not offer safe drinking water and unhygienic contaminated tap water is the only choice for drinking except in two cases. (F.G. JMS F-7/2 and E-7 have provided filtered drinking water.)

Figure-7: Un-marked play area in F.G. JMS F-7/2.

Figure-8: Inadequate washroom facility in F.G. JMS F-I-8/1.

Figure-9: Un-official canteens in F.G. JMS G-9/2.

Environmental Considerations	Light adequacy					Acoustics		Ventilation and Air movement adequacy				Thermal Comfort			
	Light meter reading (LUX)	Day light (%)		Artificial light (%)		Noise level dB (A)		Ventilation (%)		Air movement (%)		Winter (%)		Summer (%)	
		By T	By S	By T	By S	classr ooms	corridor	By T	By S	By T	By S	By T	By S	By T	By S
F.G. JMS F-7/2	340.9	90	87	100	80	82.9	69.7	100	97	100	100	80	67	80	20
F.G. JMS F-8/2	360.7	86	100	86	97	74.2	63.3	43	47	43	30	57	80	57	50
F.G. JMS I-8/1	339.5	70	100	90	89	76.7	81.9	90	94	90	72	60	82	60	50
F.G. JMS E-7	401.8	10 0	100	86	41	71.9	71.4	86	10 0	86	100	57	100	100	41
F.G. JMS G-9/2	358.8	70	100	60	93	85.2	76.0	50	10 0	70	100	10	7	60	67
Average		83	97	84	80	76.4	71.6	74	88	78	80	53	67	71	46

* Safe drinking water (Filtered), ** Unsafe drinking water (Tap Water)

Table-5: Facilities and comfort (S; students, T; teachers).

Figure-10: Well maintained condition of school buildings.

7.4 Maintenance

Table 6 shows the satisfaction of teachers and students with respect to maintenance of school buildings as shown in [Figure-10]. School management and staff seem generally satisfied except for the condition of washrooms that are highly neglected.

7.5 Safety and Convenience

Table-7 shows the opinion of teachers and students regarding safety and convenience. In F.G. JMS I-8/1 teachers and students complain about very narrow staircase. When staircase measured against the number of students and its

Building Conditions	Class rooms (%)		Wash rooms (%)		Ancillary spaces (%)		Overall building condition (%)	
	By T	By S	By T	By S	By T	By S	By T	By S
F.G. JMS F-7/2	80	60	0	3	60	97	100	83
F.G. JMS F-8/2	100	100	71	50	100	93	100	97
F.G. JMS I-8/1	80	100	30	28	90	100	80	61
F.G. JMS E-7	100	100	43	59	100	100	100	94
F.G. JMS G-9/2	90	97	10	20	90	97	80	87
Average	90	91	31	32	88	97	92	84

Table-6: Maintenance of buildings (S; students, T; teachers).

Safety and Convenience	Glass material used		Height of parapet wall		Height of boundary wall		Fire hazards		Earthquake hazards		Staircase width		Height of riser	
	By T	By S	By T	By S	By T	By S	By T	By S	By T	By S	By T	By S	By T	By S
F.G. JMS F-7/2	100%	87%	No access	No access	20%	10%	Non existent	Non existent	Non existent	Non existent	100%	20%	100%	77%
F.G. JMS F-8/2	86%	100%	No access	No access	14%	0%	Non existent	Non existent	Non existent	Non existent	N/A	N/A	N/A	N/A
F.G. JMS I-8/1	90%	89%	40%	No access	60%	0%	Non existent	Non existent	Non existent	Non existent	40%	0%	100%	80%
F.G. JMS E-7	100%	100%	No access	No access	57%	6%	Non existent	Non existent	Non existent	Non existent	N/A	N/A	N/A	N/A
F.G. JMS G-9/2	100%	100%	No access	No access	20%	3%	Non existent	Non existent	Non existent	Non existent	10%	0%	70%	93%
Average	95%	95%	-	-	34%	4%	-	-	-	-	50%	7%	90%	83%

Table-7: Adequacy of safety and convenience of school buildings (S; students, T; teachers).

use at break-time and closing time it turned out to be less in width and confirmed user dissatisfaction [Figure-11]. In F.G. JMS G-9/2 the stairs towards the play area are unsafe [Figure-12]. General condition and height of boundary wall appears to be unsatisfactory as shown in [Figure-13]. No typical arrangement has been made so far to counter disaster situations.

8. ANALYSIS

Due to lack of funding and its appropriate utilization almost all public schools have no provision of designing new blocks or extension for any other facility. The provision to maintain the available facilities is also missing. The proper maintenance of the open spaces by plantation or proper landscaping is highly desirable to ensure more conducive environment. However, for maintenance of grassy play grounds, shady trees as well as floral plants, a regular watering system is

Figure-11: Insufficient width of staircase in F.G. JMS I-8/1.

Figure-12: Unsafe stairs towards the play area F.G. JMS G-9/2.

Figure-13: Insufficient height of boundary walls in F.G. JMS F-8/2 and F.G. JMS I-8/1.

Figure-14: Lack of provision of daylight in F.G. JMS F-8/2.

Figure-15: Non uniformity of light in classrooms of F.G. JMS G-9/2.

desired. As there is a scarcity of water in water supply system in Islamabad; therefore there is a need to look for other alternates such as rainwater harvesting. Keeping in view the sudden variations in weather it seems quite essential that a multipurpose hall should be provided in each of these schools. There is no properly designed cafeteria or dining space observed in these schools along with no concept for provision of store room as the excessive material is observed dumped in washrooms. It is desirable to provide north daylight for classrooms. In F.G. JMS F-7/2, I-8/1 and E-7 adequate light is available whereas in F.G. JMS F-8/2 only six classrooms have this facility because of L- Shape setting of the building [Figure-14]. In F.G. JMS G-9/2 bilateral light is missing due to blocked north side as shown in [Figure-15]. There is a lack of community awareness for the provision of washrooms in regard to their number and location which is a significant factor for environmental conduciveness.

8.1 Rationale for Remodeling

The first phase of study pointed out the environmental problems in the selected schools of Islamabad. Comparative analysis of these results identified one of the schools (F.G. JMS G-9/2) having most environmental problems as explained in section 7.1 and 7.2. Hence, this school was chosen to propose the remodeling options at the second stage of research.

8.2 Guidelines for Remodeling of the Existing Schools and Construction of New Buildings

The extensive review of relevant literature as well as analysis of the survey data assembled in respect of five schools has facilitated to set out the following guidelines for the purpose of development of new schools or remodeling the existing ones securing conducive environment for the children.

- The number of students per class should range between 25 to 35 students ensuring the provision of academic space at the rate of 1.2 m^2 per student.
- The advisable number of stream per class is three.
- An overall play area recommended should be three times the covered area. The developed play space per student should be 3 to 3.5 m^2.
- The play grounds should be properly oriented with respect to sun direction. A proper landscaping of all the open spaces around the school buildings must be made. Cafeteria and dining space for about 100 students at a time also needs to be properly located.
- Ideally, each school should have multipurpose hall, a library and a reading room.
- Owing to current education policies provision of additional space for science, computer, arts and audio visual aid laboratories also need to be considered.
- The admirable standard to be adopted for well maintained washrooms is 25 students per washroom.
- The condition of light particularly in the classrooms demands more attention. The bilateral window openings must be provided ensuring full penetration of north daylight at the height of student's desk level.
- All sorts of acoustical inconvenience particularly with

respect to electric fixtures, excessive number of children as well as the type of building material used should be given due consideration to secure proper learning environment.

- Fresh air movement and ventilation are fundamental aspects of providing suitable classroom environment. Issues of suffocation and stuffiness in the classrooms because of excessive number of students have to be properly taken care of.

- Keeping in view the fact that Islamabad is located in relatively cooler zone where the winter season conditions prolong. Properly designed energy saving heating equipment must be provided in sufficient numbers.

- An emergency staircase in each block must be provided with the minimum width of 5 feet between handrails (as recommended by TSS) for exit in case of earth quakes and fire hazard.

- To combat seismic hazards all the new school buildings or additional units built for remodeling must be constructed in frame structure using hollow bricks.

- The safety and security of children must be given priority by building entire boundary wall of at least 2.5 meters height and reconstruct the staircases with standard flight sizes.

- The environmental considerations should be adopted in the light of local prevailing conditions. However, UNESCO standards may also be adopted in certain cases where national standards are not elaborated for finer details.

- The construction of additional blocks should be synchronized with the existing building. A synchronized system of primary school buildings' evaluation and monitoring with respect to their performance accomplishing users and management satisfaction needs to be adopted.

- The remodeling or redesigning of the primary schools has to be based on building performance evaluation.

9. REMODELING OF EXISTING F.G. JMS G-9/2 BUILDING

The scope of remodeling envisages making alterations in the existing building as well as constructing new blocks to provide suitable accommodation for all activities in a healthy environment. It may also involve development of open areas to form regular play grounds.

9.1 Alterations Proposed in Existing Building

A dire necessity has been assessed with respect to provision of more academic space to combat the need for existing number of children. The chances to provide more academic space are only possible through constructing the new block founded on the lowest level along with minimizing the environmental distractions. Proper daylight may be secured through making new window openings in existing classrooms [Figure-16]. The entrance hall can be lit up by window opening in the blind wall of school office. A multipurpose hall can be sited at a level 1.6 meters below ground level by raising a part of its area from 2.4 meters. The use of energy efficient equipment needs to be emphasized to ensure thermal comfort in the learning areas (such as solar heaters and geysers). At the same time irrigation of trees, flower beds and play ground can be attempted by adopting rain water harvesting system.

9.2 Improvements Proposed for Environmental Upgrade

The improvements in the environmental conditions as well as air movement in existing building will be attained by making alterations. Openings in blind walls by providing windows having the same size as the existing ones can solve the darkness problems in certain areas. All proposed alterations are shown in Figure-16. The central washroom placed in the office room has been shifted for window construction to allow day light exposure. Another window is to be constructed in the office room to gain day light and fresh air movement. A new washroom along with a kitchenette is also proposed for teaching staff [Figure-17]. To obtain day light in the classrooms row of windows are proposed on the verandah side. In order to enhance the lively environment bright color shades are proposed to be applied on doors, windows and interior walls. Proposed windows will help to gain thermal comfort during summer. In winter, provision of energy efficient and safe heating system has been proposed. Tag boards installed on the back walls of classrooms and textured paint can reduce acoustic distractions.

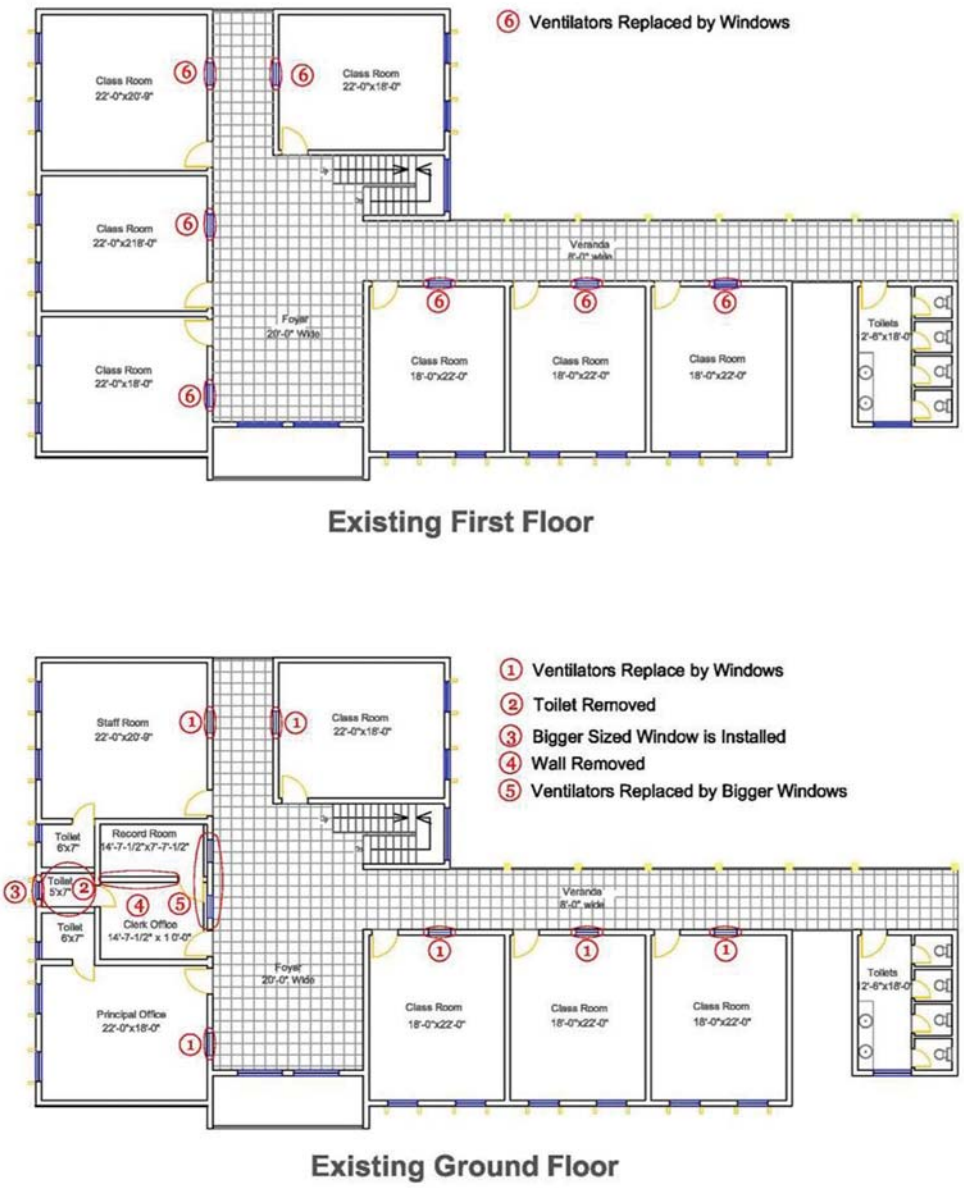


Figure-16: Alterations Proposed in Existing Building Plan.

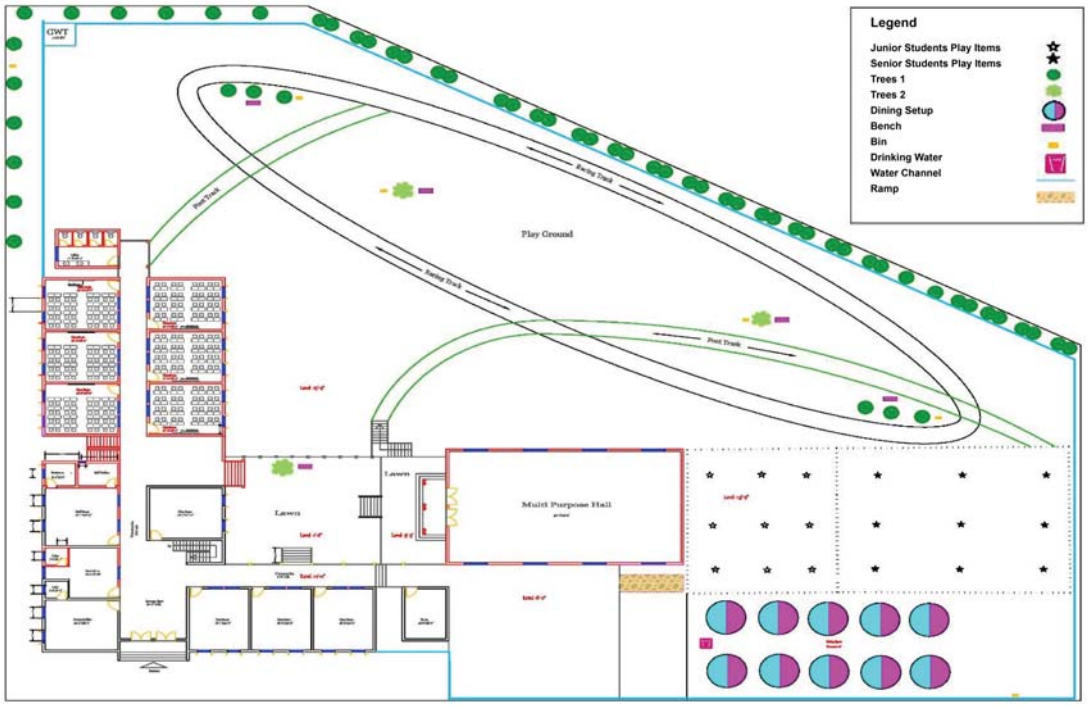


Figure-17: Remodeled Lower Ground Floor Plan.

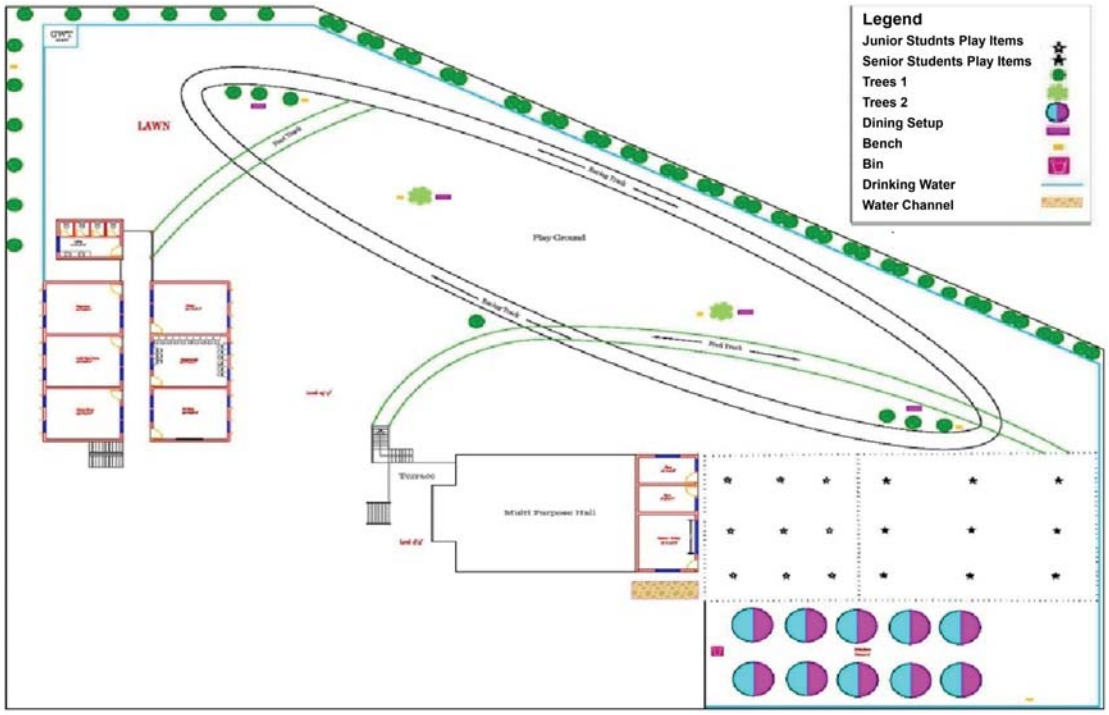


Figure-18: Remodeled Upper Ground Floor Plan.

9.3 Proposed Remodeling in the Play Area

The natural landscape of the area is very attractive having different ground levels. Two lower terraces have been proposed to be designed as lawns [Figure-18]. In the proposal existing stairs towards play ground has also been improved for safety and convenience of the children. A play area has also been proposed to be designed by installing play items for 5 to 8 year and 9 to 11 year children [Figure-19(a-b)]. Provision of racing track and installation of benches and bins will improve the usefulness of the area. Plantation of new shady trees has also been proposed to improve thermal comfort and reduce the external noise. A dinning area for about 100 students has been laid out adjacent to the proposed cafeteria [Figure-20].

Figure-19(a - b): Proposed playing facility for children-I.

Figure-20: Bird's eye view of the proposed layout showing dining area.

9.4 Proposed Extensions In Building

The construction of a new double storied block containing additional five class rooms to accommodate more sections to reduce number of students to 30 [Figure-18]. A kitchenette and washroom are also proposed adjacent to the staff room with redesigned staircase connecting the upper ground floor with lower ground floor and first floor [Figure-21]. All missing ancillary spaces are suggested in lower ground floor.

Two set of washroom blocks containing four toilets have been added to facilitate students and reducing number of student per washroom to 22. Construction of multipurpose hall of 260m² has been proposed to cater indoor plays in summers, assembly in extreme weather and other school functions [Figure-22]. All construction shall be made in frame structure with locally available hollow bricks [Figure-23] to provide safety against earthquake hazards.

Figure-21: Stairs towards the playground and new block.

Figure-22: Existing building in centre with new block and multi-purpose hall on right and left sides.

Figure-23: Locally available red bricks on exterior walls.

10. CONCLUSIONS

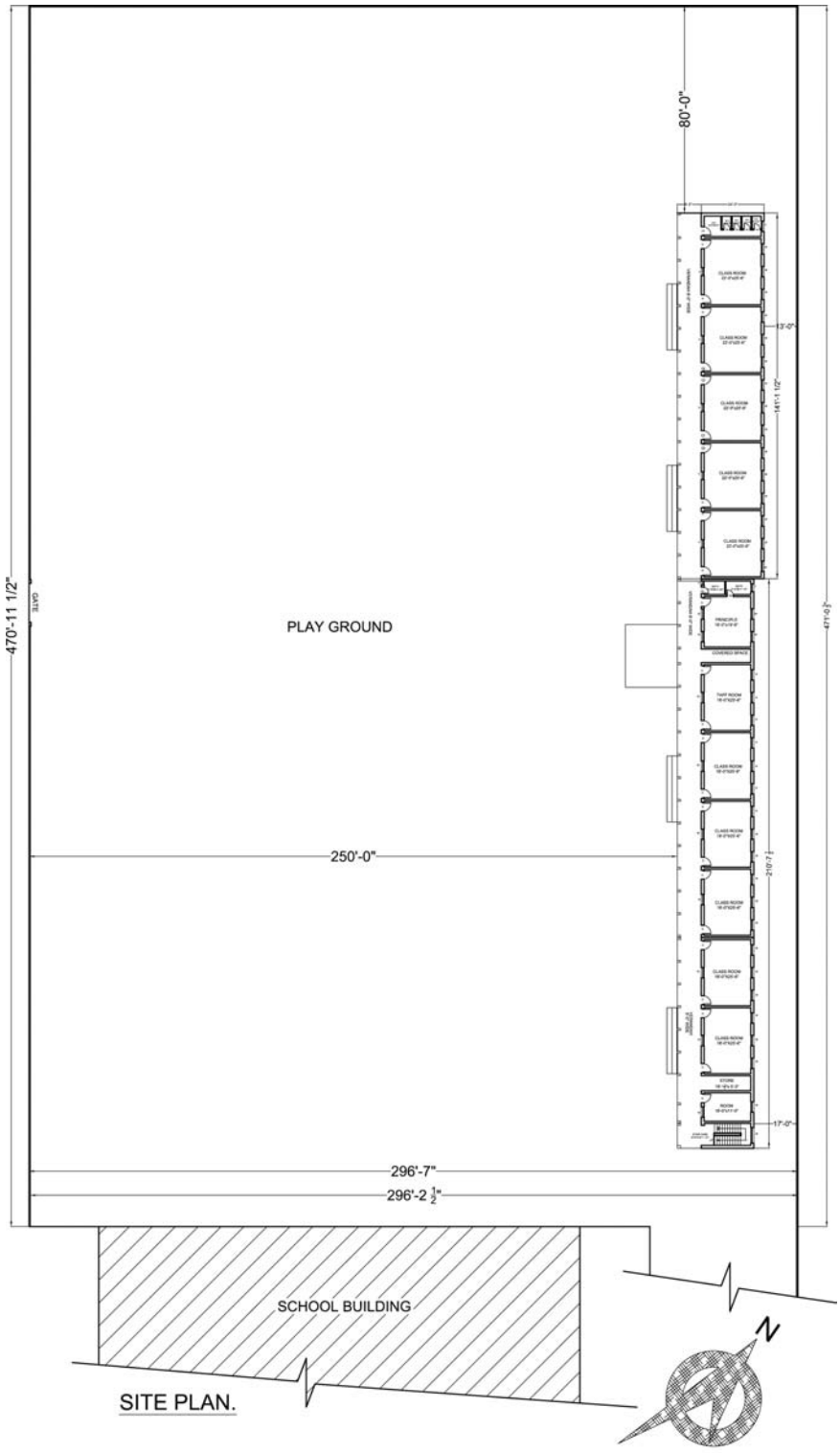
Employing the Post Occupancy Evaluation technique, the study on Federal Government Private Schools in Islamabad concludes that most schools lack on providing the adequate teaching and learning environment for students and teachers. The main reason for not complying with the students and teachers needs at present is the time-frame as the schools studied were constructed 12 to 30 years back according to perhaps then assessed needs. Over the period the strength of students has increased manifold in the schools under reference. Demand for additional facilities such as computer labs, IT based library and well equipped play grounds is emphasized in new educational policy. These aspects are neglected in the schools studied in spite of open spaces available in the school premises for building extensions.

On the environmental account the perception about thermal comfort is negatively responded by students and teachers for the months of May/June and September mainly due to overcrowded classes and absence of cross-ventilation in some cases (FG JMS G-9/2). During winters most schools are provided with gas-heaters except (FG JMS G-9/2) where complaints were high from both groups of respondents. However, recently due to energy crisis there is load-shedding of gas in peak season that is from December to March and this requires futuristic planning for alternative energy sources such as solar gas heaters. For day light adequacy as all the school buildings are having sufficient open spaces all around therefore perception about availability of daylight and objective measurement with Lux meter has revealed less problem. However, in some buildings particularly FG JMS F-8/2, FG JMS G-9/2, students and teachers have expressed glare problem and uneven distribution of light throughout the class. As for acoustics, the perception of students and teachers has revealed problems mainly due to over crowding, sound of old ceiling fans and noise from adjacent classrooms. This is further assessed and confirmed through sound meters placed in different locations in the class rooms.

Finally, the school with most complaints from teachers and students and least on checklist developed by researchers and assessed through environmental meters was selected for remodeling to enhance the environmental quality and to meet the current educational needs. Moreover, futuristic sustainable design approach is used to propose the rain water harvesting for landscaping and installation of solar geysers for heating in winters. The current study being first on environmental assessment of schools in Islamabad had been limited in its scope to assess the state of schools covering the students/teachers perception on a few variables. Objective assessment is restricted to Light meter and Sound meter identifying some design flaws. Future studies can be carried out with more detailed systematic assessment with advanced environmental meters studying the indoor and outdoor temperature variables, noise penetration and sunlight. Leadership Energy and Environmental Design (LEED) Standards can also be employed for future research to develop design guidelines in the local context. Comparing the National Standards with UNESCO and TSS, it is proposed to revise the National Standards to include environmental features/aspects in the design guidelines to attain better environmental quality in schools.

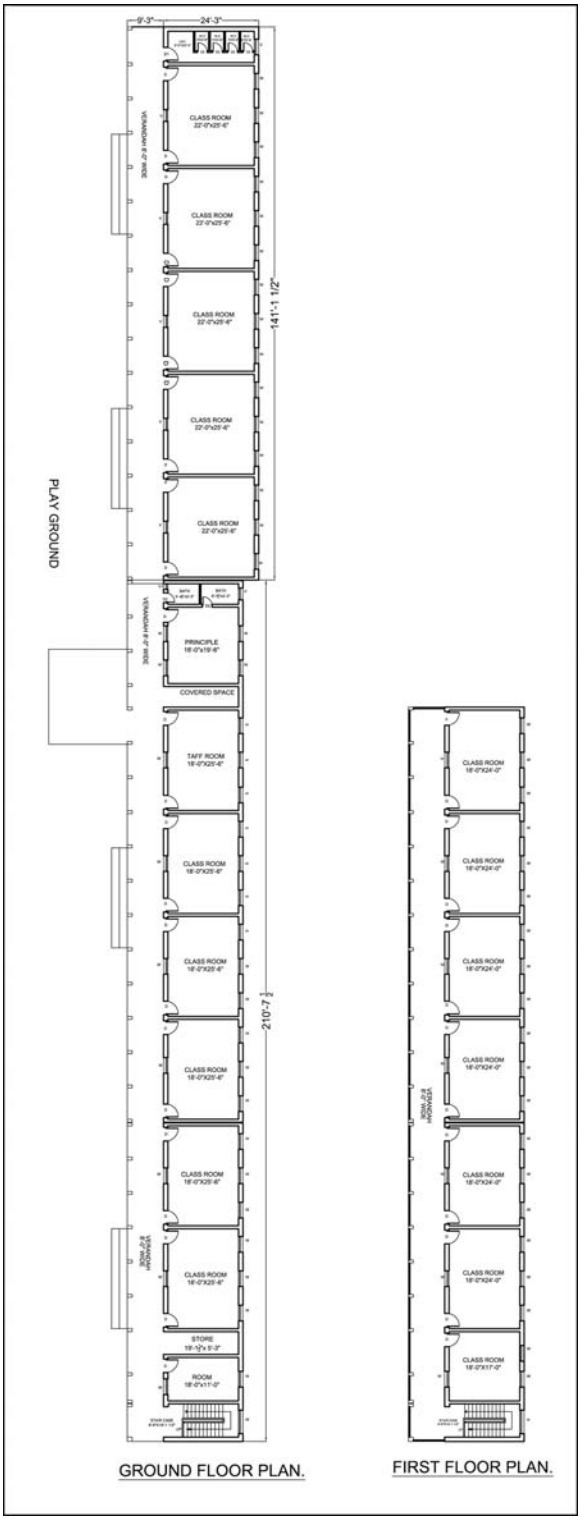
SITE PLANS OF THE SELECTED SCHOOLS

Case Study - 1: F.G. JMS, F-7/2

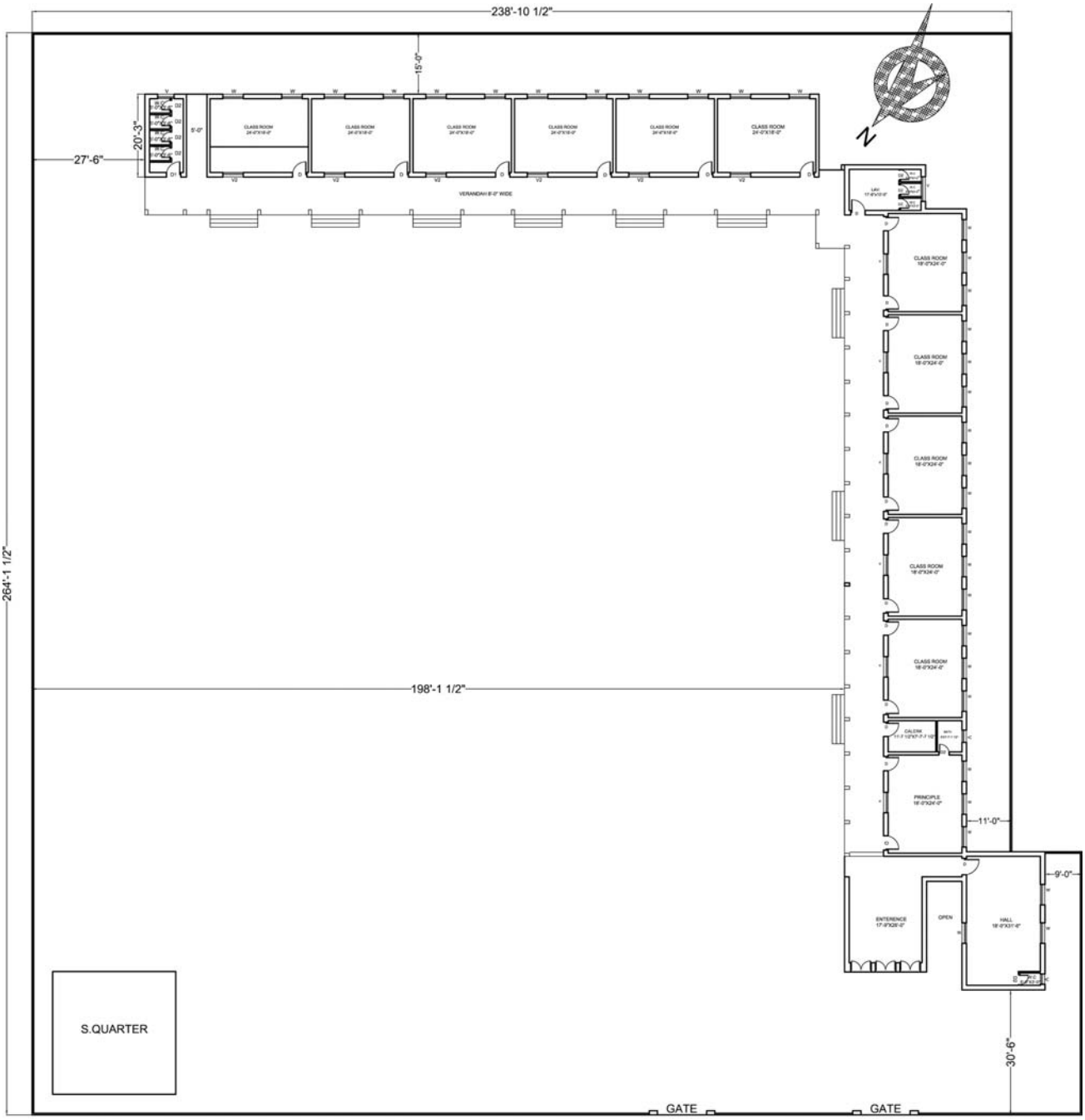


SITE PLAN.

Case Study - 2: F.G. JMS, F-7/2 (Ground Floor and First Floor Plans)

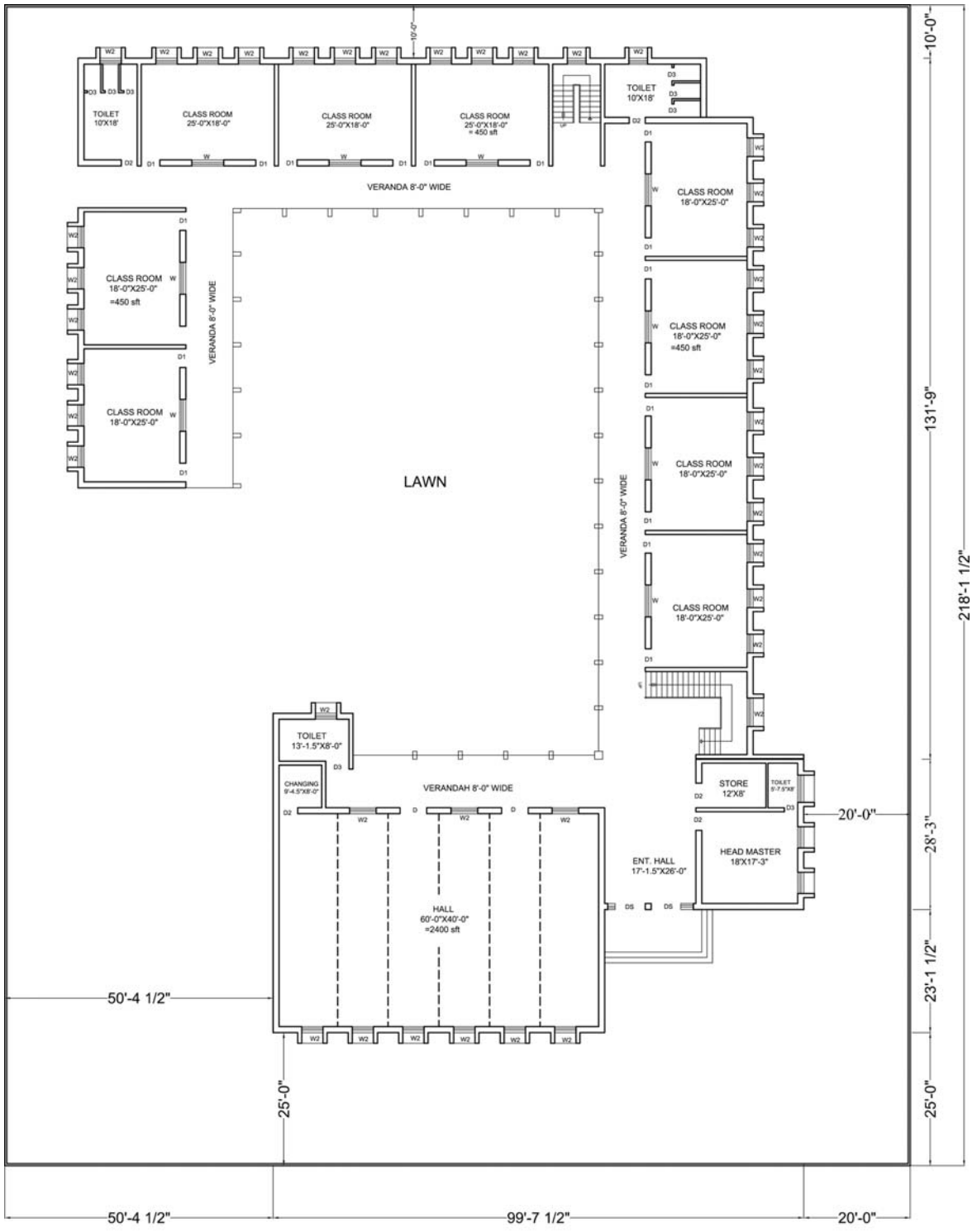


Case Study - 3: F.G. JMS, F-8/2



GROUND FLOOR PLAN.

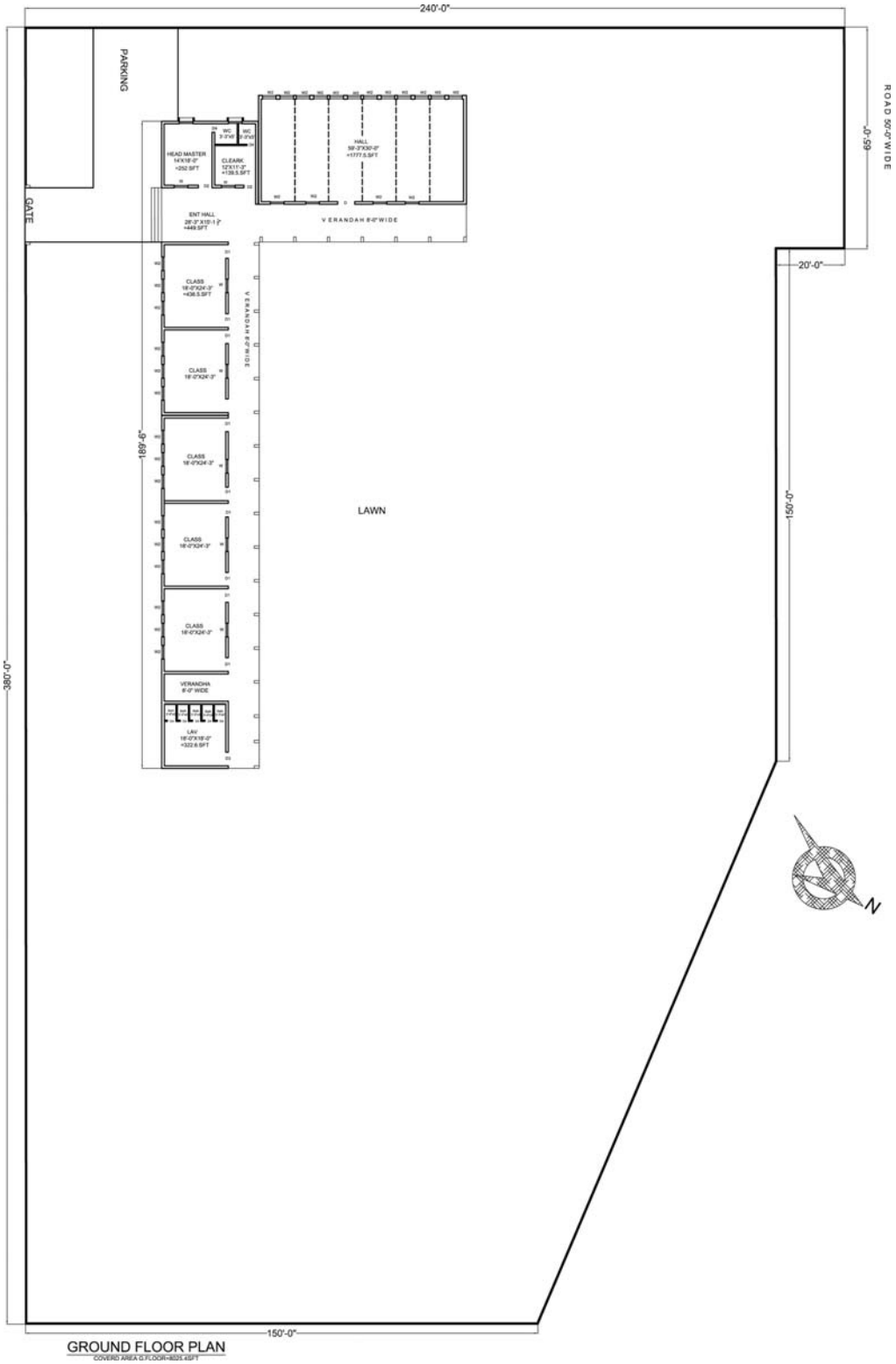
Case Study - 4: F.G. JMS, I-8/1



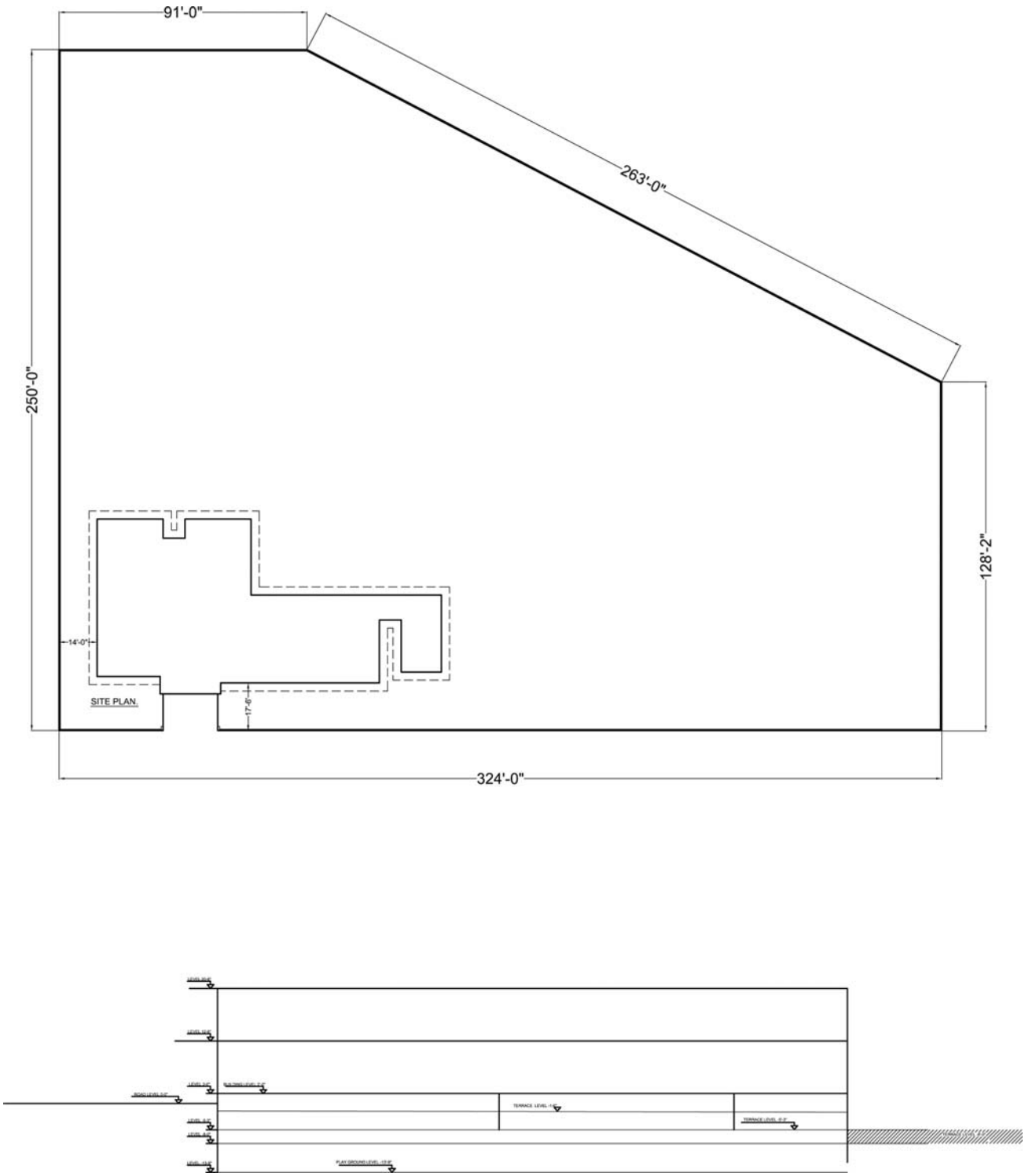
GROUND FLOOR PLAN

COVERD AREA G.FLOOR=12438.5 SFT

Case Study - 5: F.G. JMS, E-7

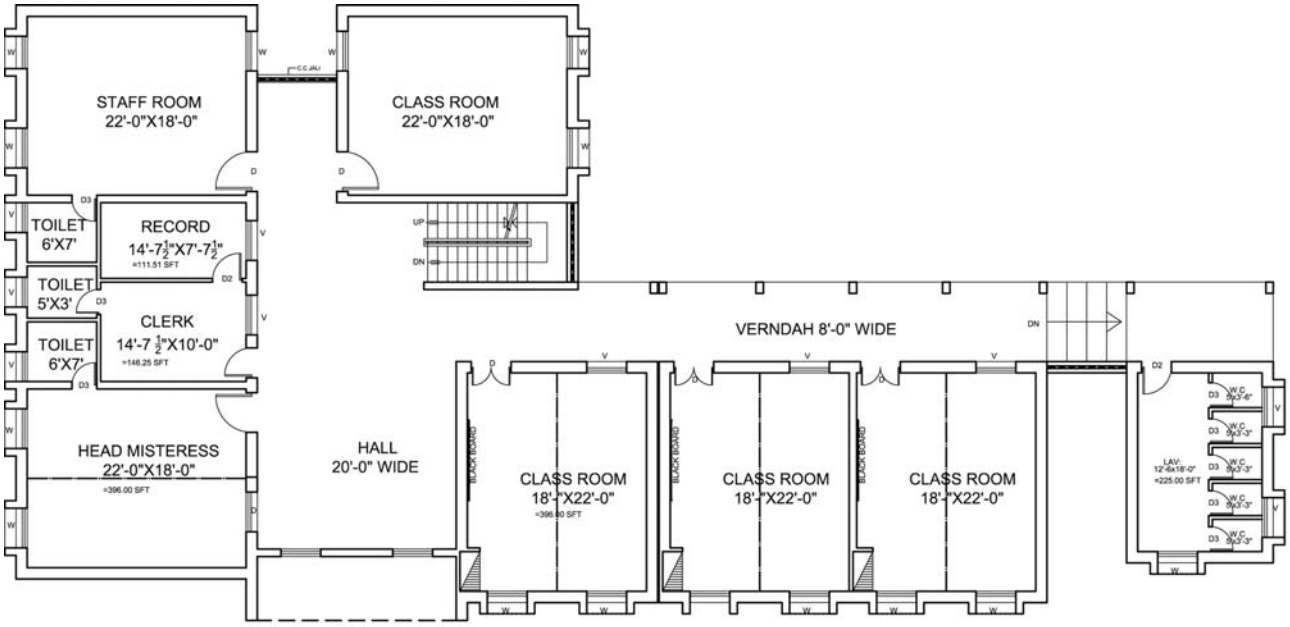


F.G. JMS, G-9/2 (Layout plan and section plan)

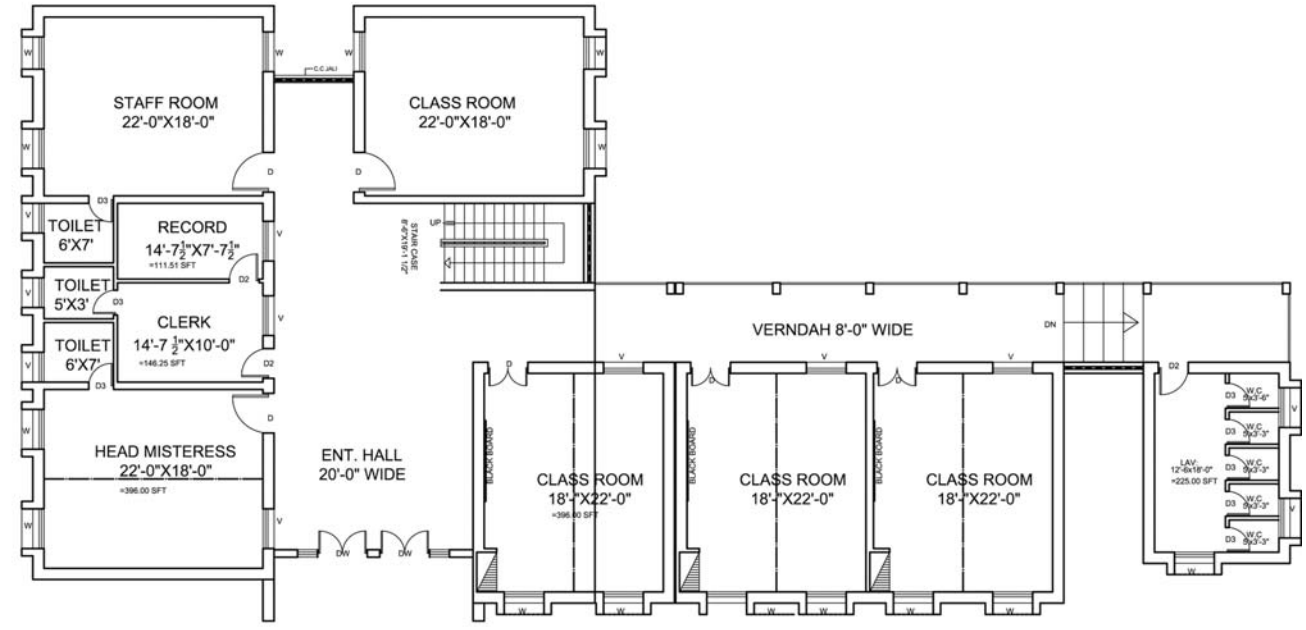


Levels in school selected for remodeling.

First Floor & Ground Floor Plan: F.G. JMS, G-9/2



FIRST FLOOR PLAN.



GROUND FLOOR PLAN.

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AN INVESTIGATION ON RELATIONSHIP BETWEEN ENERGY CONSUMPTION OF HIGH RISE INSTITUTIONAL BUILDINGS AND THE CLIMATE OF DHAKA CITY

*Md. Yousuf Reja**
*Amreen Shajahan***

ABSTRACT

Growth in population, mounting demand for building services and comfort levels, along with the rise in time spent inside buildings, assure the upward trend in energy consumption of large scale public buildings in Dhaka city. For this reason, energy efficiency in buildings is a prime objective today for energy policy at regional, national and international levels. This paper devotes to discuss the holistic utility bills analysis method for investigating and analyzing whole building energy consumption of public buildings with special emphasis on private sector institutions in a tropical region like Dhaka city. Correlations between operational records of energy consumption of three institutional buildings and the meteorological data including monthly mean outdoor dry-bulb temperature (To), and relative humidity (RH) of Dhaka city have been derived. The findings of the study reveals that the overall building energy consumption is highly dependent on climate, building design characteristics including internal layout, orientation, fenestration and site configurations, and ownership. The analysis of such kind of model is especially useful for building managers and owners to track energy use during pre-retrofit and post-retrofit periods and to reduce building operational costs in the tropical region.

Keywords: Energy consumption, Institutional buildings, Utility bills, Heat gain, Meteorological data.

1. INTRODUCTION

Dhaka, the capital of Bangladesh and one of the world's fast growing mega cities accommodates more than 13.1 million people within its 1,353 square kilometer area (BBS, 2003; UNEP, 2005). According to the most recent UN estimate, its population will reach 16.8 million by 2015 (United Nations, 2006). The population is growing by an estimated 4.2% per year, one of the highest rates amongst Asian cities (Mcgee and Terry, 2006). With very limited resources and very high urbanization rate, Dhaka is going to face greatest challenge ever to reach standards of sustainability and minimum emission level. Growth in population, increasing pressure for building services, and enhanced comfort levels, together with the rise in time spent inside buildings, assure that the upward trend in energy demand will continue in the future. Thus built environment is an important factor for the increment of per capita CO_2 emission despite being responsible for only 0.15% of global CO_2 emissions (EIA, 2006; 2008). For this reason, energy efficiency in buildings is today a prime objective for energy policy at regional, national, and international levels (Lombard et al. 2008, pp 394-398).

Due to rapid urbanization, huge population growth and economic advancement, urban developments have ignited a widespread construction boom introducing high-rise to the city landscape which is in turn impacting the city's energy consumption [Figure-1]. In view of the limitation of land space coupled with ever growing demand for higher studies and number of students, institutional buildings specially private universities have been put up to the multi-storied building blocks, which is increasing the energy load.

The climate of Dhaka is characterized by high temperatures, high humidity, heavy rainfall and marked seasonal variations (Mourshed 2011). According to Koppen–Geiger climate classification Dhaka's climates is classified as Aw or tropical wet and dry (Kottek et al. 2006). The energy demand from a building is influenced by a large number of variables ranging from weather parameters (e.g., temperature solar radiation, wind, moisture content of air, etc.) to the characteristics of the building (e.g., envelope, form, shape, materials, construction, etc.), its occupants (e.g., occupancy, activities, etc.) and its systems (e.g., type, performance,

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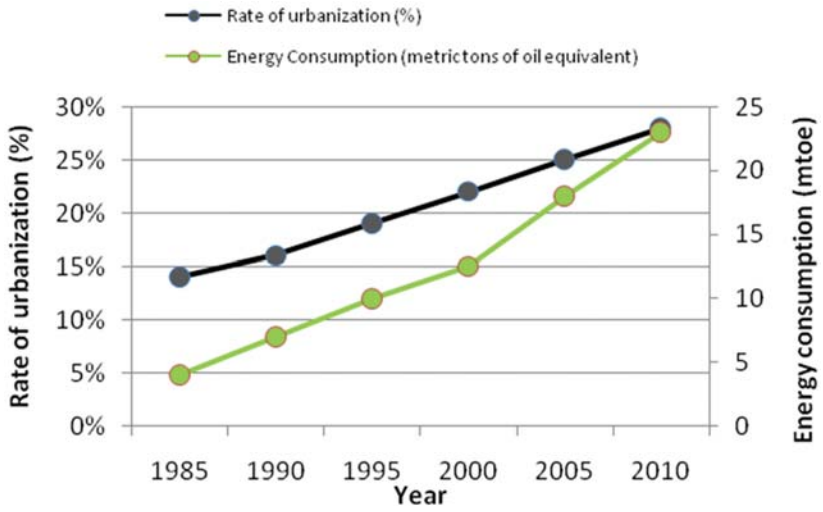

Figure-1: Energy Consumption versus Rate of Urbanization. (Source: BP Statistical Review, 2010)

control schedules etc.) (Mourshed 2011). Whereas, the facades or envelopes of the recent construction of tall office buildings in urban areas of Dhaka city have been designed without any respect to the interdependency between outdoor and indoor climate (Ahmed 2003). Thus, fenestration and building envelope design has been found to be the most significant factor affecting energy use in high-rise buildings in the tropics (Muhammad et al. 2005). Eventually, this ill planning is leading towards immense energy consumption.

Dhaka city has experienced a constant gap between power generation and the growth of inhabitants, thus the supply of basic services never met with requirements [able-1] (Moinuddin 2010). Though Dhaka city consumes 41.22% of the total generated electricity, but only 20–25% of total population of the city is enjoying the benefits of electricity directly (Khundakar 2010). And the per capita availability is only 120 kW h per annum (GoB 1991). Energy is therefore recognized as a critical input parameter for national economic development of Bangladesh. Tall buildings, in general, consume more energy than low-rise buildings. Therefore, their 'carbon footprints' are bigger. The high-rise buildings have approximately 60% more energy embodied per unit gross floor area (GFA) in their materials than the low-rise buildings (Ali and Armstrong 2008). Thus remarkable increase of energy consumption is a repercussion of rapid urbanization and economic development which in turn affects the building sectors' and people's life style. Energy efficiency is defined as decreasing the use of energy per energy service without substantially affecting the level of these services (UNISE 2000). In this regard, appropriate energy consumption in terms of electricity usage for building operation should be methodically analyzed to establish a correlation between climate, building design characteristics including internal layout, orientation, fenestration and site configurations, and ownership. Aiming for a reliable electricity demand analysis, this research concentrates on holistic utility bills analysis method for the high rise institutional buildings of Dhaka city. Lessons from this research regarding changes in electricity use with time, different location and varied situations can yield future power policy and will help building managers and owners to track energy use during pre-retrofit and post-retrofit periods for making building energy efficient.

Service Category	Service Provider	Demand	Supply	Shortage
Power Supply (in Dhaka City Corporation only)	DESCO	450 Mega Watt	290 Mega Watt	150 Mega Watt
	DPDC	950 Mega Watt	500 Mega Watt	450 Mega Watt

Table-1: Scenario of Power supply provided by city authority compared to existing demand in Dhaka city according to the number of inhabitants (Moinuddin 2010)

2. PROBLEM STATEMENT

Bangladesh, having one of the least per capita in power generation (176 kWh in 2008) in the world has already appeared as a country of power crisis, and therefore, frequent load shedding takes place in Dhaka city (The Daily Star 2010). Dhaka has a daily shortfall of 2,000 megawatts of power, which is half of the entire country's average daily production (Energy Daily, 2010). Due to this increasing demand, the country is facing shortage of electricity, gas and water, which in turn is making the city unsustainable day by day. At present this demand supply gap and load shedding have increased [Figure-2]. Massive power outages, particularly during peak summer, have become a regular feature in the capital city for a number of years, where on an average, a typical Dhaka household experiences power failure for about three hours per day (Akter 2008). The general daily power deficit in Dhaka ranges between 450 and 500 MW per day, which reaches up to 1,800 MW during summer (DESA 2006). During the summer period, due to high indoor temperatures, dependency on electricity among city dwellers has increased, thus widespread power interruptions caused disruptions in daily activities. High rise buildings are among the worst perpetrators in urban areas when it comes to energy consumption and carbon emission, with outdated heating, cooling and lighting systems (The News Today 2011). In addition to that, the widespread use of electric motors in air-conditioning, chillers, pumps, air compressors, and lifts in building systems and motor energy use represents well over half of all electric energy used by industrial, commercial, and institutional facilities (Saidur 2009). Therefore, it is evident that Bangladesh will require more electricity in future as a consequence of many factors affecting the future demand, like population growth, on-going social changes, and the restructuring of the Bangladesh economy together with the expected technological development in building sector (EIA 2010).

3. RESEARCH METHODOLOGY

The study is an attempt to investigate the association involving the energy consumption of high rise institutional building mainly private-sector universities and climatic data of Dhaka city, with the following objectives:

- To develop a relationship between the monthly electrical energy consumption of three high-rise private sector universities with correspondent weather data of Dhaka city.

- To investigate the inherent relationship between the energy consumption of selected buildings with their respective physical features like, internal layout, orientation, fenestration and site configurations.

In this research three institutional buildings were selected among all the high rise private sector universities in Dhaka metropolitan area. One of them was designed primarily for institutional purposes but the other two were for commercial use. This research explored a simple approach to estimate how energy is consumed in a building using information from monthly electricity bills from January, 2009 to December, 2009 from the zonal office of Dhaka Electric Supply Company Ltd (DESCO) and Dhaka Power Distribution Company Ltd (DPDC). As electricity is the only energy used in these private universities, so the electricity

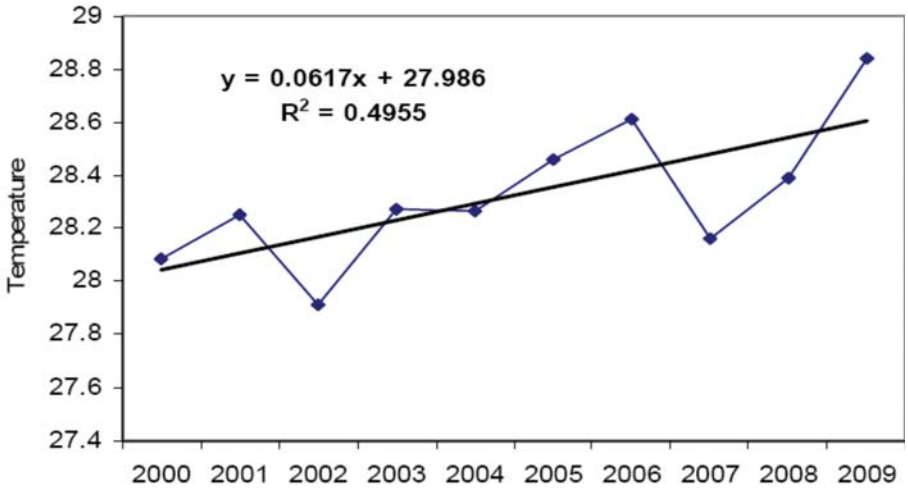

Figure-2: Power demand-supply gaps and load shedding (BPDB 2006)

Institutional Building	Address	Storied	Building Area (m^2) Approx.	Air conditioned Area (m^2) Approx.	Naturally Ventilated Area (%)
1. Ahsanullah University of Science & Technology(AUST)	Plot: 141-142, Tejgaon I/A, Dhaka.	10	39370	26102	33.7 %
2. Khalique Tower (Prime Asia University campus-01)	Road 17, Banani C/A, Dhaka	16	4820	3800	21.2%
3. Star Tower Ltd (Prime Asia University campus-02)	12 Kamal Ataturk Avenue North South, Dhaka.	17	7590	6510	14.2%

Table-2: Introduction to three case-studied institutional buildings
(Source: Field survey by authors)

usage is the only energy measurement factor. The corresponding weather data of that period, such as outdoor dry bulb temperature (To), relative humidity (RH), are collected from the zonal Met Office in Dhaka. Moreover, the data of average wind speed, and precipitation (PP) also have been collected to find a relationship with average relative humidity.

Physical features of these three high rise institutional buildings have been collected through rigorous field survey and photographic survey [Table-2]. Data has been obtained from observations, documentation and interviews.

For data analysis, statistical analysis has been done using Microsoft Excel 2007 so as to find the relationship which increased the validity and reliability of the findings.

4. ANALYSIS AND DISCUSSION

The total energy consumption of a building is that required to support all energy consuming end-uses, inclusive of the losses due to appliance and system efficiencies. To evaluate the performance of energy consumption in a building, there are two major methods: simulation method and statistical analysis method. As the topic of interest of this research is on high-rise institutional buildings, mainly the private sector Universities, so the statistical method of analysis has been used for analyzing energy consumptions.

4.1 Introduction to Investigated Buildings

4.2 Analyzing Microclimatic Condition

The sky view factor (SVF) is often used to describe urban geometry (Upmanis 1999; Svenson 2004, pp 201-211). By definition, SVF is the ratio of the radiation received (or emitted) by a planar surface to the radiation emitted (or received) by the entire hemispheric environment (Watson and Johnson 1987, pp 193-197). It is a dimensionless measure between zero and one, representing totally obstructed and free spaces, respectively (Oke 1988).

The SVF variations have impact on microclimates and the importance of SVF in relation to other central parameters such as thermal admittance is also important. Surrounding buildings in Dhaka are at very close proximity to plots. Hence, buildings constructed get shade form existing landmasses in almost all cases. Buildings, however, do not get shade from surrounding trees due to the absence of green spaces. The above mentioned criteria does not directly generate reductions in energy use. Instead, they provide air movement for ventilation and help to keep buildings cool through the shade provided by surrounding buildings. Microclimatic features of three case study buildings are shown in [Figure-3].

Figure-3: Microclimatic Features of Three case studied buildings (Source: Field survey. Google earth)

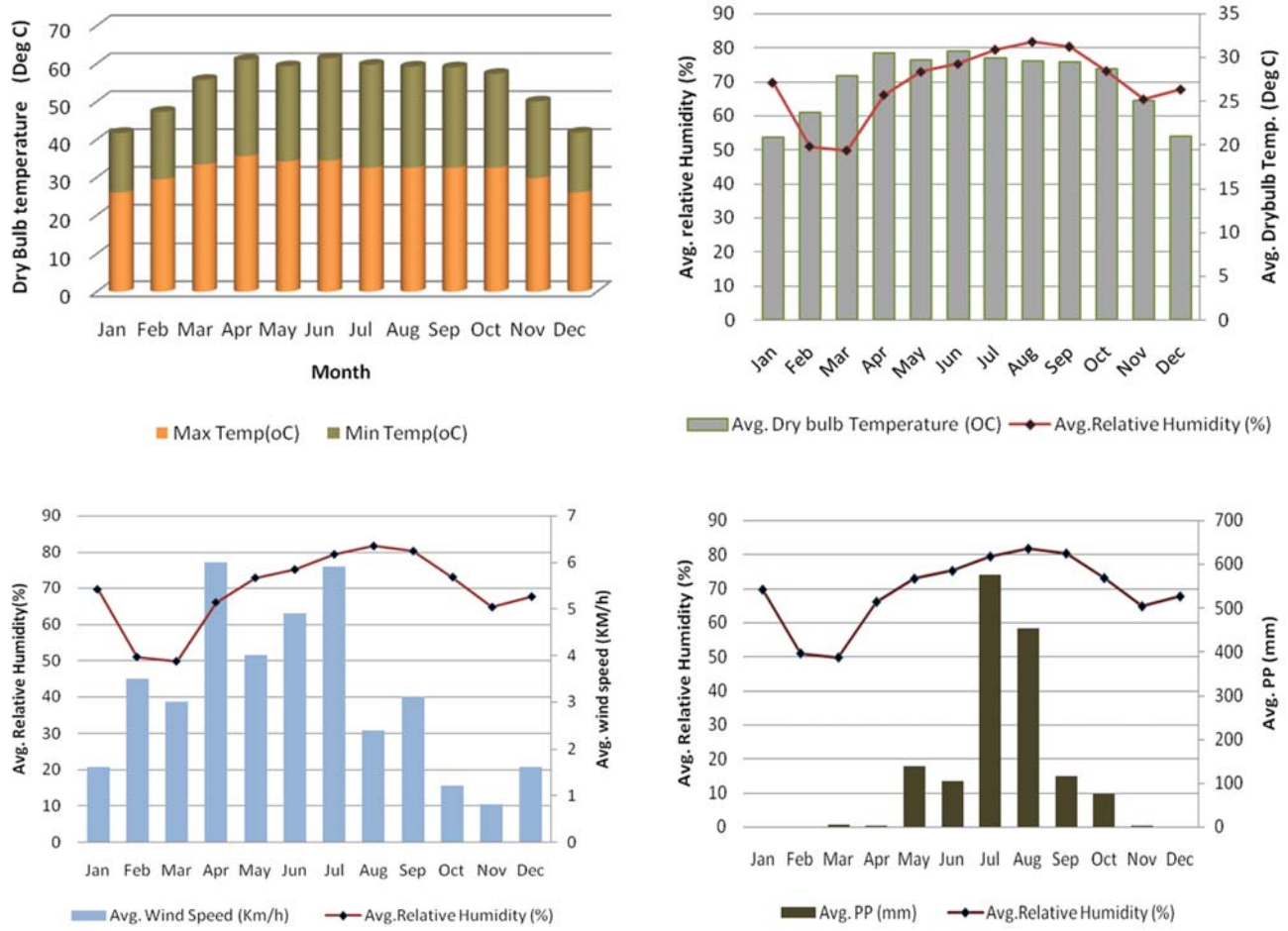

Figure-4: Correlation among Mean Air Temperature and other Monthly Climatic Data of 2009 (Source: Bangladesh Meteorological Department, 2009)

4.3 Electricity Consumption Scenario

By analyzing various meteorological data of year 2009, a relationship among dry bulb temperature and relative humidity has been established [Figure-4]. Along with these, an investigation has been carried out to find out a relationship with average relative humidity (%) and both average precipitation (mm), and average wind speed (km/h). From the figure it has revealed that average ranges of dry bulb temperature are found to be higher from March to October in this year. Again a strong correlation has been established between dry bulb temperature and average relative humidity. The relationship between average relative humidity and average wind speed in the same year showed a moderate correlation. But from August to September, there is a negative relationship between average relative humidity and average precipitation (mm).

4.3.1 Utility Bill Analysis with Meteorological Data

Through analyzing the energy consumption data with the meteorological data, it revealed that the electrical energy consumption is high during March to August than the rest of the year for the three selected buildings [Figure-5]. Again the same scenario is visible for the total billed amount (in BDT) for electricity consumption.

For both cases, the energy (electricity) consumption per unit area (m^2) of Khalique Tower (Prime Asia University campus-01) is always higher as it has glazed curtain walls at southern and northern sides.

Again though the total yearly energy consumption of Ahsanullah University of Science & Technology (AUST) is higher than other two but the amount of energy consumption per square meter is the lowest due to having

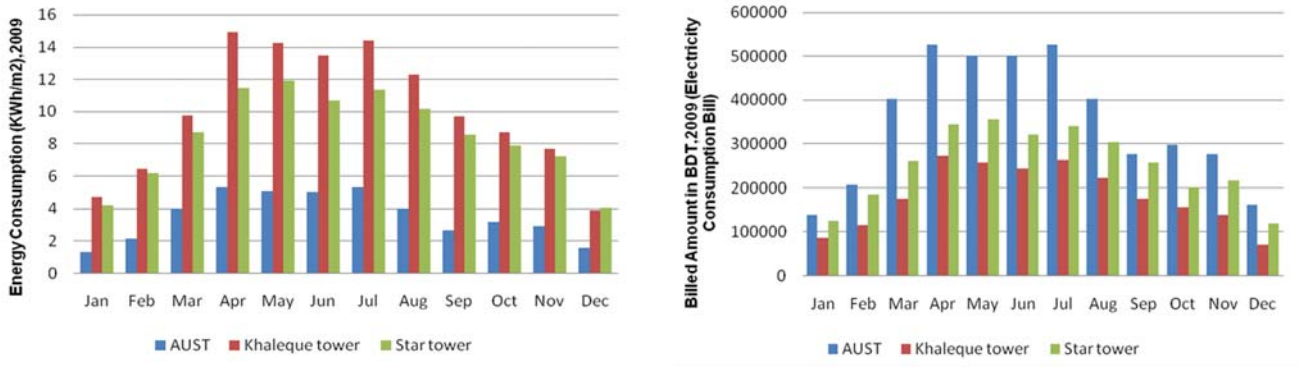

Figure-5: Energy Consumption Data per Month, for the Year 2009

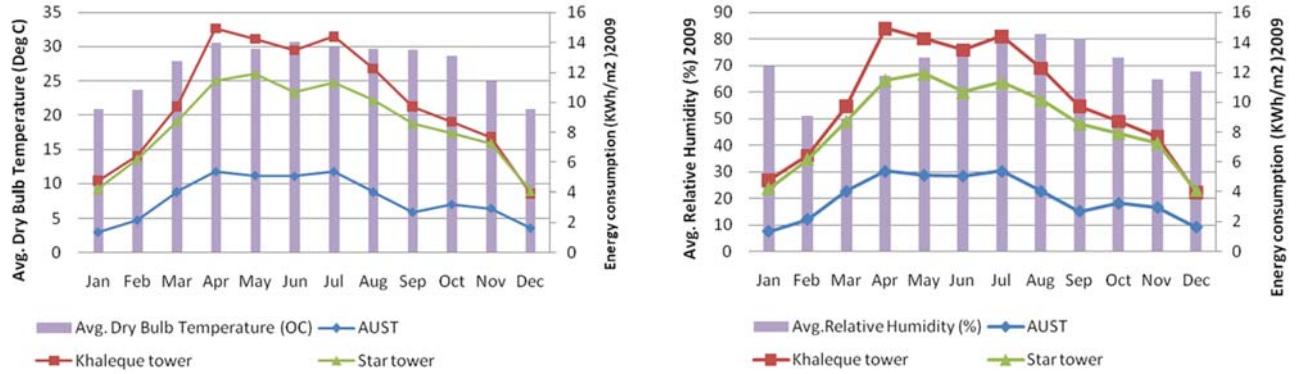

Figure-6: Relationship between Meteorological Data and Energy Consumption Data, Year 2009.

highest percentage of naturally ventilated area in comparison to other two institutional buildings [Figure-6].

From the [Figure-6], a positive relationship is revealed through this analysis. There is an impact of climate on energy consumption of high rise institutional buildings of Dhaka city, as similar increase or decrease in energy consumption correlating the fluctuation of curves of average dry bulb temperature (To), and relative humidity (RH).

4.3.2 Statistical Analysis

The calculated results from utility bills showed a good correlation with climatic data of the year 2009 [Figure-7 & 8]. It is evident from the analysis that the energy consumption of all three case study buildings showed a stronger positive correlation with dry bulb temperature than the average relative humidity.

To justify the above comparative analysis with some definite numeric outcome, some statistical analyses like correlation, F-test, T-test and Linest [Table-3] is done among the detail monthly record of meteorological data and electrical energy

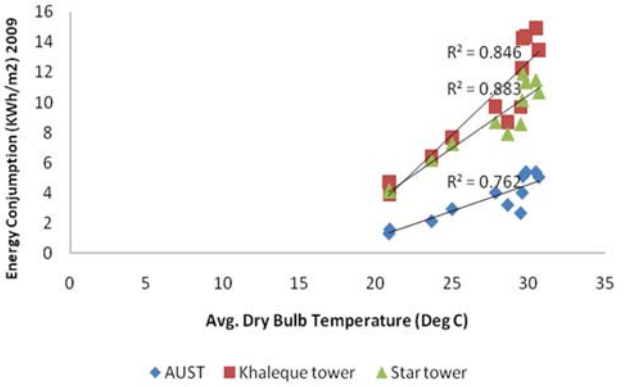

Figure-7: Regression Analysis between Average Dry Bulb Temperature and Energy Consumption Data, Year 2009.

consumption data of the studied area for the year 2009 with the help of 'Microsoft Excel' software. Here, 'F-test' function is used to determine whether these two types of data have different variances. 'T-test' is done to determine probability associated with these data, whereas 'Linest' is done to calculate some linear values that best fits these data. The value of R properly justifies this above mentioned

Met. Data type	Highest Correlation with Energy consumption 'R'	'F test' with Energy consumption	'T Test' with Energy consumption	Digression with Energy consumption (LINEST)
Average Dry bulb Temp Deg C	0.94	0.22	0	2.2
Average RH (%)	0.39	0	0	4.3

Table-3: Statistical Analysis of meteorological data and energy consumption and the results, Year 2009 (Source: Met Data and DESCO, DPDC and MS Excel, 2007)

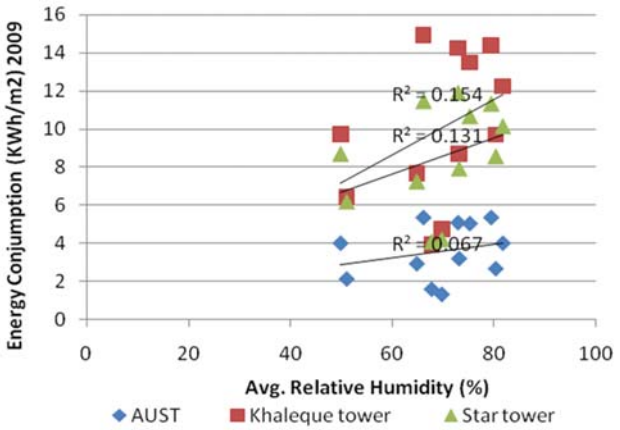

Figure-8: Regression Analysis between Average Relative Humidity and Energy Consumption Data, Year 2009.

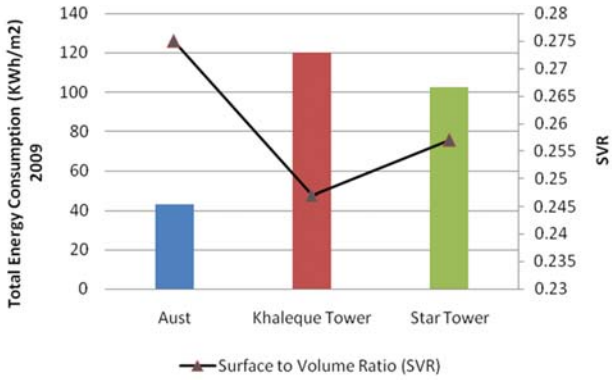

Figure-9: Comparative analysis between energy consumption data and surface to volume ration of three buildings.
(Source: DESCO, DPDC and Field survey).

statement. The highest correlation (R=0.92) showed between the energy consumption of 'Khaleque Tower' and average dry-bulb temperature. Along with that, both 'AUST' building and 'Star Tower' showed the highest values of 'R', which is 0.87 and 0.94 consecutively. Whereas, the value of 'R' between average relative humidity and energy consumption for each of these three buildings are lower than their respective average dry bulb temperature. The value of 'R' between average relative humidity and energy consumption of 'AUST', 'Khaleque Tower' and 'Star Tower' is respectively 0.26, 0.39, and 0.36.

4.4 Comparative Analysis of Energy Consumption and SA:V Ratio

The greater the surface area, the more is the heat gain/ loss through it. So, small surface to volume ratio implies minimum heat gain or minimum heat loss. To minimize the losses and gains through the fabric of a building, a compact shape is desirable. In tropical region, S/V ratio should be as low as possible as this would minimize heat gain. This might not necessarily minimize the S/V ratio. Further, the materials of construction should be such that they do not store heat. Surface to volume ratio shows an almost reverse or negative correlation with the total energy consumption [Figure 9]. Though the energy consumption per unit area is smaller for Ahsanullah University of Science and Technology (AUST), but it has the highest S:V ratio. This shows that there are other parameters or variables like orientation of the building, fenestration, user behavior etc. to guide the total energy consumption of a building.

4.5 Comparative Analysis of Energy Consumption and Percentage of Naturally Ventilated Area

It is evident from [Figure-10], that if the percentage of naturally ventilated area increases, the energy consumption decreases. According to the scope of study and its observations, analysis and results, it is clear that there is very little effort and apparent initiatives to design and build

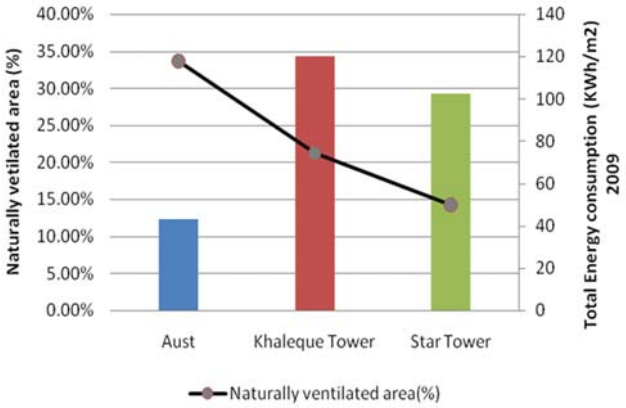

Figure-10: Comparative analysis between energy consumption data and percentage of naturally ventilated area of three buildings. (Source: DESCO, DPDC and field survey)

institutional buildings with a prior plan for substantially lower energy consumption. Thus diagnosis and analysis for building energy consumption as the first step of building energy saving project, is the most important to improve the management of building energy.

5. CONCLUSION

The growing trend of building energy consumption in Dhaka city will continue during the coming years due to expansion of built-up areas and associated rising trend of energy needs. Energy in the form of electricity is used in buildings to operate equipment for the safety, efficiency and comfort of its occupants and users. This indicates an alarming situation for future of Dhaka. Thus an effective initiative should be taken to supervise the building energy consumption scientifically.

Careful architectural design can contribute to a reduction in a building's energy consumption and thus improve its performance. Passive design measures incorporating local climatic parameters and surrounding site conditions can play an important role in improving indoor thermal conditions, which will eventually reduce the overall energy consumption of respective building. Therefore, energy efficiency supervision system composed of five basic systems, which are, energy consumption statistics, energy audit, energy-efficiency public notice, energy consumption ration and price rising for over ration for large-scale public (Jin et al. 2007, pp 19-22) is essential. The analysis of such kind of model is especially useful for building managers, owners to track energy use during pre-retrofit and post-retrofit periods and to reduce building operational costs in the tropical region. Thus to achieve a safe, comfortable, healthy and productive environment, a seamless integration and collaboration among various professionals is required.

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INFORMAL & FORMAL DEVELOPMENTS ON THE PREMISES OF SUFI SHRINES IN PUNJAB

*Ghafer Shahzad**

ABSTRACT

Built environment of Muslim shrines in the province of Punjab, Pakistan is incessantly changing. This phenomenon is gone faster from the year 1980 onward with the re-construction of Data Darbar Complex[1] in Lahore. It has set new trends for extension of Sufi shrines and their attached buildings, under administrative control of the Auqaf & Religious Affairs Department, Government of Punjab[2]. This paper focuses the process of development works taken up on the premises of Muslim shrines in Punjab. For convenience, the developments in the built environment of Sufi shrines have been categorized into two main heads i.e. Informal & Formal. Informal developments are contributions of the both; devotees and the gaddi nashins, whereas Formal developments are carried out by the administrative department i.e. Auqaf, after going through the process of proper designing and construction. The impetus and motives behind such interventions and additions vary in nature depending upon the Sufi, location and scale of shrine, number of visitation, income received, political standing etc. Studying these Informal and Formal developments, a modus operandi was devised based on the data available with the Punjab Auqaf Department and the mutawallies. After identifying such shrines in Punjab, studies were carried out to reach the conclusions. Transformation of such sacred spaces was sensitively evaluated to trace out the changed ambience of newly constructed shrines. Finally, the impact of these informal and formal developments on the socio-religious and built environment of shrines has been delved.

Keywords: Shrine, environment, interventions, heritage, restoration, sacred space, mosque, waqf properties.

1. INTRODUCTION

Archival records, site visits and situation analysis of the burial places of Sufis belonging to various *Sufi* orders in Punjab reveal that the built environment of shrines is continuously transforming into a new version since past few decades. This transformation is occurring in both ways, Informal and Formal. Informal Developments[3] are initiated or carried out on the premises of shrine complex as and when required or demanded by the visitors, devotees, religious organizations[4], government authorities, and politically influential persons. Annual Development Programme (ADP) of the *waqf* administration encompasses Informal Developments[5] which are planned on annual basis. Such development schemes are conceived and planned by the Engineering Directorate[6] of *waqf* department. These development schemes are administratively approved and technically sanctioned by the competent authorities[7] before floating the tenders in print media for open tenders. Such schemes are executed, following the prescribed government procedure as laid down by the Communication and Works Department (C & W), Government of Punjab, through their enlisted contractors.

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1 Hazrat Ali Hujwairi commonly known as Hazrat Data Gunj Bukhsh migrated from Ghazni, Afghanistan and settled in Lahore in the early decades of 11th century CE.

2 Auqaf Department was established in 1960 under Waqf Properties Ordinance 1959 (revised in 1979) to look after and administer the waqf properties. It is headed by Secretary/Chief Administrator with six directorates (Finance, Estate, Administration, Health, Religious Affairs and Projects) at head office and 13 number Zonal Offices in Punjab.

3 Informal developments include additions, alterations, repairs, reconstructions and restorations in the built environment of Sufi shrines..

4 Anjuman-e Khuddam-e Awliya, Tanzeem Tahafuz-e Mazarat, Religious Purpose's Committees etc.

5 Informal Developments include construction of lavatory & ablution blocks, rooms and verandas, shoe-keeping areas, guest rooms, dispensaries, shops, madrassahs, etc.

6 Engineering Directorate comprises Director Projects (BPS 19), three Executive Engineers (BPS 18), eight Sub Divisional Officers (BPS 17), twelve Sub Engineers and one post of Deputy Director Architecture (BPS 18).

7 Administrative Approval is accorded by the Secretary/Chief Administrator Auqaf and Technical Sanction is given by the Chief Engineer/Director Projects Auqaf.

There are some cases when designing of shrine complexes are conceived holistically and master plans are prepared and implemented[8]. Such cases have been classified here as formal developments. For large scale development projects, Federal or Provincial governments are involved who direct the *waqf* administration while providing the funds for execution of shrines. Such schemes, for their architectural designing are announced in the print media for open competitions among the architects. Design Selection Committees constituted for the purpose finally select the best architectural design proposals, keeping in view certain pre-defined criteria and parameters.

2. MODUS OPERANDI

To gauge the nature of physical changes and interventions made in the built environment of shrines, Annual Development Programmes (ADP) of *waqf* administration for the last four years[9] was taken and a development scheme [Refer Table-1] was derived for study and analysis. There are two types of shrines found in Punjab i.e. flat-roofed and domed (Mumtaz, 1985a). The buildings on the premises of shrine performing various functions were categorized into various typologies for mutual comparison, based on year-wise development. The development budget for these four years was also compared. The development scheme gives real trends regarding the nature and pace of transformation of the built environment of shrines during last few decades.

Development scheme is further based on the following assumptions;

1. For informal developments, *waqf* administration prepares plans every year to re-construct, repair, and restore the dilapidated individual buildings of shrines, attached mosques, public amenities, water supply arrangements, commercial buildings, verandas and rooms, courtyard flooring, boundary walls etc.

2. The number of re-constructed mosques in the precincts of the shrines is increasing as compared to the number of re-constructed shrines. This indicates the deviation of the focus of *waqf* administration from its core objective of taking care of the shrines under their administrative control and providing the basic facilities to '*zaireen*' (visitors).

Type of Interventions	Nature	Year 2006-7		Year 2007-08		Year 2008-09		Year 2009-10	
Building Type	Renovation	Number of Development Schemes							
Shrine		3	12	5	13	3	15	4	9
	Reconstruction	9		8		12		5	
Mosque	Renovation	8	26	9	28	10	34	9	22
	Reconstruction	18		19		14		13	
Veranda/ Room	Renovation	4	16	3	12	0	7	0	9
	Reconstruction	12		9		7		9	
Public Amenities	Renovation	10	28	18	45	11	38	13	29
	Reconstruction	18		27		27		16	
Commercial Buildings	Construction	-	22	-	16	-	18	-	10
Courtyard Flooring / Boundary Wall	Construction	-	14	-	17		13	-	8
Water Supply Arrangement	Water Pumps	12	13	8	9	10	12	6	7
	Tube Wells	1		1		2		1	
Total Number of Schemes		131		140		137		94	
Budget Allocation		290.39 Million		237.03 Million		185.42 million		175.67 million	

Table-1: Development Scheme Based on Annual Development Plans of Auqaf Department (fiscal years 2006-07, 2007-08, 2008-09, 2009-10).

8 Shrine complexes of Hazrat Ali Hujwiri, Baba Bulleh Shah, Imam Bari Sarkar etc are few examples of Formal Developments as were conceived and designed holistically by the architectural consultants and funded by the Federal and Provincial governments.

9 Annual Development Budgets for the years 2006-07, 2007-08, 2008-09 & 2009-10 were taken for framing of Development Matrix (Table 01). Period 4 years was taken as any large scale development scheme is spread at the maximum over four years in financial provision.

3. Construction of commercial buildings i.e. shops, offices etc at the open *waqf* land in urban areas has become top priority of the *waqf* administration. The objective is to generate money from such urban rental properties.

After identifying the shrines and mosques under administrative control of the *waqf* administration[10], either newly constructed or renovated, visits were made to analyze the situation. Meetings were held with the '*gaddi nashins*', administrators and '*mutawallies*' to trace out the construction activities performed during last twenty years. The changing trends of the built environment were studied by making photographic or graphic documentation [Refer Figure-1, 2, 3 and 4].

3. INFORMAL DEVELOPMENTS

According to the development scheme based on the annual budget for the last four years, along with the site visits and physical verifications, informal developments on the premises of shrine comprise following building types;

3.1 Re-construction of Shrines

Shrine is a key building structure on the premises of *waqf* property around which charisma of life (based on the rituals and ceremonies) happens. In pursuance to the *Waqf* Properties Ordinence 1960 and Special Premises Preservation Act 1985, shrines being historical and cultural buildings have been placed under two heads;

1. Shrines where *waqf* organization has full administrative control and responsibility for the maintenance and reconstruction of old buildings.
2. Shrines included in the list of protected monuments where only Archaeology Department has the mandate for restoration.

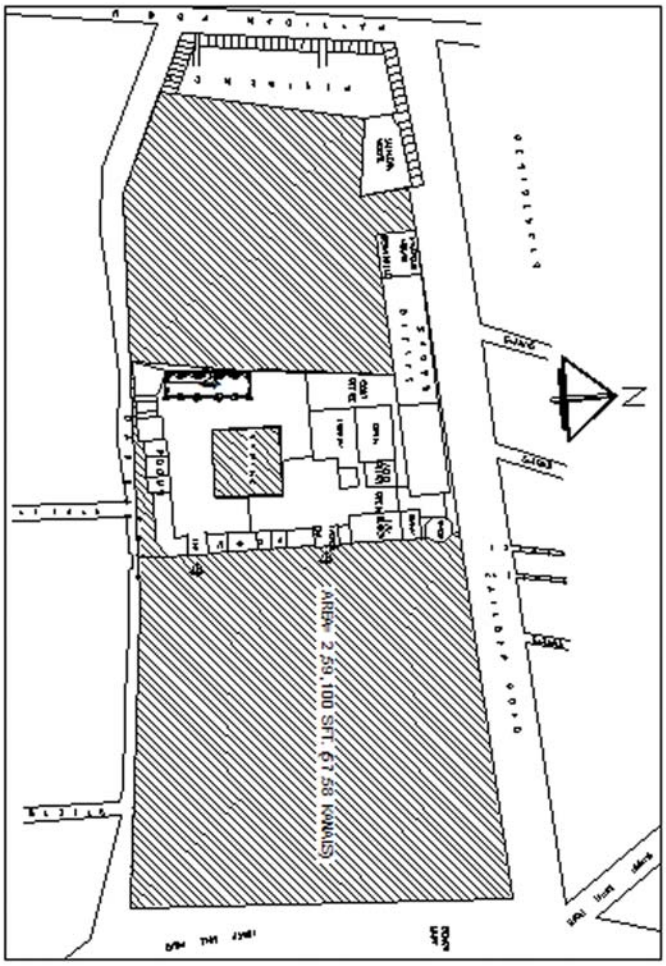

Figure-1: Informal Development and Expansion of Data Darbar Complex.

10 Auqaf department maintains and administers 530 shrines in Punjab.

Shrine buildings are re-constructed, repaired, restored, added, altered and extended on regular basis to fulfill the requirements and demand of visitors[11]. For less popular, less visited shrines, re-construction is carried out on the same footing of the previous building. In case, if land is available, larger size shrines along with ancillary buildings are constructed to provide more space to the visitors. The shrine complex of Hazrat Ali Hujwiri [Figure-1] was initially spread over 3125 sq. yard[12] but during the period of General Muhammad Zia al Haq, President of Pakistan, its area was extended to 29000 sq. yard[13] and more than 33333.33 sq. yard built-area has been added in the complex[14]. This tremendous change in the built environment has discontinued the old incremental development practice and created a new trend in the tradition of khanqah construction in the Indian Subcontinent.

Baba Farid was buried in his hujra where he took his last breath. His house was turned into *khanqah*. Later on a small mosque, rooms, ***verandas***, were added and a small burial place transformed into a *khanqah* [Figure-2]. The area of shrine premises of *Baba* Farid Pakpattan was 11600 sq. yard along with 12 commercial units and 5412 acre *waqf* agricultural land when it was taken over by the *Auqaf* Organization in 1960. The land towards the western and southern sides of the shrine of *Baba* Farid was acquired[15] by the *waqf* organization to expand the boundaries of the shrine *Baba* Farid and create a new entrance from the Sahiwal Road to facilitate the devotees [Figure-3]. During construction and expansion, various old structures like Burj Nizamai, Burj Sabiri and Burj Jamali[16] were demolished although having heritage and historical value. There was an old mosque of *Tughlaq* period on the premises of shrine *Baba* Farid which was demolished in 1999 C.E. when construction of new mosque started in compliance to the directions of the then Prime Minister.

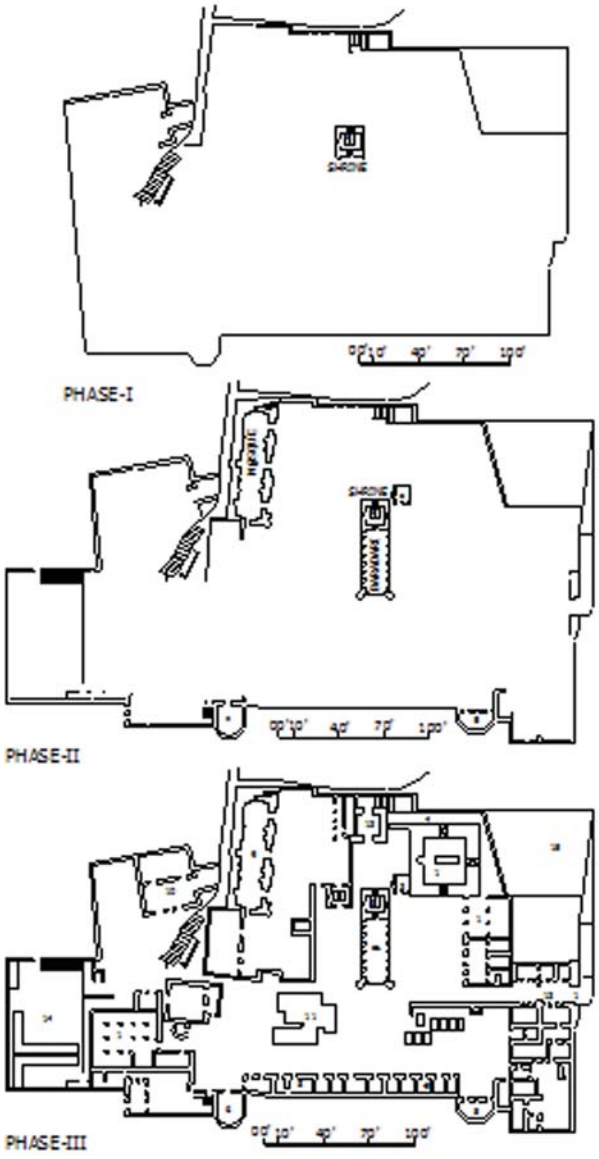

Figure-2: Three phases of Informal developments at the old shrine of Bâbâ Farîd

11 In the past years (from 1993 to 2012), shrines of Hazrat Badshahn Khoshab, Sakhi Saiden Sherazi, Baba Bulleh Shah, Abdul us Salam Chishti Bara Bhai Masroor, Sialkot, Hazrat Qutab Shah Wali Narowal, Hazrat Suleman Paras Jhelum, Hazrat Pir Maqbool Muftian Dina, Jhelum, Hazrat Shah de Taaliyan Rawalpindi, Hazrat Pir Ghaib Shah Rawaat, Baba Shah Jamal Shaikhupura, Ghoray Shah Lahore, Baba Kamal Chishti Kasur, Hazrat Bibi Pak Damanan Lahore, Hazrat Syed Turat Murad Lahore, and many others have been reconstructed during last twenty years.

12 Shahzad, Ghafer (2012) Muslim Shrines in Urban Settlements Sang-e Meel Publications Lahore p.143

13 Shahzad, Ghafer (2007) Data Darbar Complex-Taamer say Takmeel Tak, Sang-e Meel Publications Lahore

14 Data Darbar Complex was conceived and designed in 1980-81 and completed in 1999. It took almost 20 years to complete the project because of non-availability of funds from the provincial and federal governments.

15 A patch of land measuring 1 *kanal* 16 *marlas* at the rear of the old mosque was purchased by spending an amount of Rs 3.0 million in the year 1997. More land was acquired towards southern side to give direct approach to the shrine from Sahiwal Road.

16 Burj Jamali was dedicated to Hazrat Jamal al-Din Hanswi, Burj Nizamai dedicated to Hazrat Nizam al-Din Awliya' and Burj Sabiri to the Shaykh 'Ala' al-Din 'Ali Ahmed Sabir of Kalyer Sharif. These three Sufis were khulafa of Baba Farid.

Senior experts, who were members of a committee constituted by the Governmnet of Punjab, criticized this action in a strong manner.

Similarly, the old shrines included in the list of protected monuments were demolished and re-constructed without taking permission from the committee. Every year, waqf administration plans to re-construct the old dilapidated buildings (which are not included in the protected enlisted monuments) of ten to twenty shrines in number, keeping in view the annual budget constraints and the demand of public and public representatives. The old dilapidated shrines are re-constructed on top priority basis. The usage of modern building materials and construction techniques has transformed the shrine into modern form and aesthetics [Figure-4]. This has started changing the visual and aesthetical value of the built environment of shrines. Being associated with the old building form, devotees resist such demolition and re-construction.

3.2 Re-construction of Attached Mosques

Historical studies inform that mosque has never been an essential component of a shrine complex or khanaqah[17]. In the earliest shrine of Khaliq Walid, a musalla Mehrab has been found in the western wall (Khan, 2003a, Hasan, 2001a). It is created as an elaborate arched recess in the centre of outer wall (Khan, 1991a). From the outset, a small defined space in the western wall of the Chishty shrines was earmarked for performance of prayer (Khan, 1990a). At the shrine of Baba Farid, a small prayer space i.e. Masjid Nizam al-Din Auwliya (Khan, 1990b) was present that still exists. During the Tughlaq period, a large mosque was constructed towards western side of the shrine Baba Farid (Khan, 1990c) which has been now replaced by a big Jamia Mosque (1999-2005). After death of the *Sûfî* when visitation increased in number, need of a large size prayer hall was realized, but its scale remained smaller and shrine kept on holding its key position on the premises.

From year 1990 CE onward, a trend for construction of a big jami'a mosque was introduced when a large mosque was constructed on the premises of shrine of Hazrat 'Alî Hujwiri [Figure-5]. It completely changed the socio-religious and built environment of the shrine complex. Continuing the trend, new mosques were constructed at the shrines of

Figure-3: Newly constructed Entrance from Sahiwal Road to the shrine of Bâbâ Farîd.

Figure-4: Newly constructed shrine of Baba Bulleh Shah (2005-07) at Kasur.

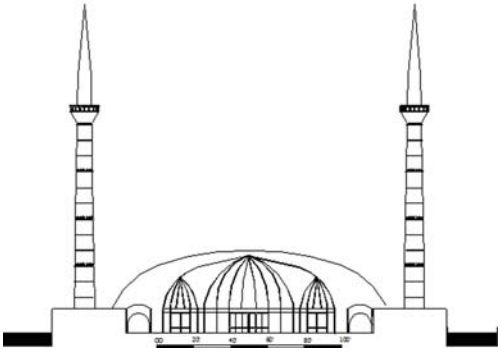

Figure-5: New Mosque Data Gunj Bukhsh.

17 At the shrines of Baba Farid, Bulleh Shah, and Madhu Lal Hussain, mosques were constructed later on.

Baba Farid [Figure-6] Baba Bulleh Shah, Shah Hussain, Hazrat Sakhi Saiden Sherazi etc. These modern Jami'a Mosques have introduced other functional components like lavatory, ablution, air conditioning system, parking etc. Today, it has become difficult to segregate the boundaries of mosque and shrine in a complex.

It was not problematic when mosque was constructed for the need of za'ireen. The trend of construction of a large size mosque with tall minarets on the premises of shrine created a strong impact on the physical and religious environment of the shrine complex. Table 02 gives a comparative study of the newly constructed and old demolished mosques, attached to the shrines in the province of Punjab during last three decades. Today, the spiritual ambiance[18] of shrines is at stake after dominancy of the mosque attached to a shrine complex.

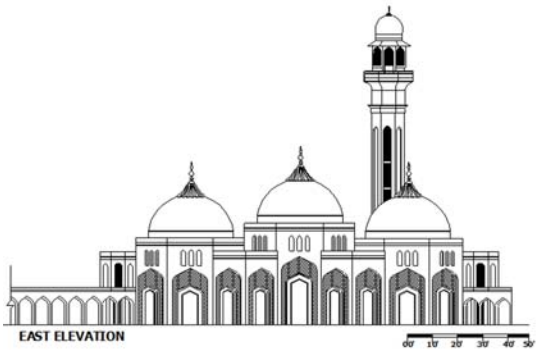

Figure-6: New Mosque Baba Farid.

Every year, waqf administration plans to re-construct 20 to 30 mosques attached to the shrines (Refer Table 02).

Name of Mosque	Size of Prayer Hall	Location	Minaret Height	Enlisted / Protected	Year of Construction
1. Mosque Hadrat Ali Hujwiri: Lahore					
Old Mosque	85'X18'	West of shrine	38'	Protected	19th Century
New Mosque	120'X80'	West of shrine	190'	_	1989
2. Mosque Baba Bulleh Shah: Kasur					
Old Mosque	38'X14'	S.W. of shrine	_	Protected	19th century
New Mosque	80'X40'	S.W. of shrine	88'	_	2004
3. Mosque Baba Farid: Pakpattan					
Old Mosque	76'X21'	West of shrine	_	Protected	14th century
New Mosque	130'X54'	West of shrine	98'	_	2005
4. Mosque Sakhi Saiden Sherazi: Choa Saiden Shah					
Old Mosque	34'X18'	East of shrine	_	_	20th century
New Mosque	76'X38'	N.W. of shrine	78'	_	2007
5. Mosque Hadrat Abu al-Khair Nau Lakh Hazari: Shahkot					
Old Mosque	24'X12'	S.E. of shrine	_	Protected	20th century
New Mosque	34'X18'	S.E. of shrine	42'	_	2010
6. Mosque Shah Hussain: Lahore					
Old Mosque	38'X16'	West of shrine	38'	Protected	16th century
New Mosque	63'X40'	West of shrine	88'	_	2010
7. Mosque Hadrat Noshah Ganj Pak: Runmal Sharif					
Old Mosque	26'X16'	S.W. of shrine	_	_	20th century
New Mosque	42'X22'	S.W. of shrine	42'	_	2010
8. Mosque Pir Ahmad Qatal: Jalalpur Pirwala					
Old Mosque	48'X22'	S.W. of shrine	_	Protected	18th century
New Mosque	48'X22'	S.W. of shrine	_	_	2003
9. Mosque Miyan Muhammad Bukhsh: Mirpur					
Old Mosque	26'X14'	N.W. of shrine	_	_	20th century
New Mosque	60'X60'	N.W. of shrine	73'	_	2006

Table-2: Comparative study of newly constructed and old demolished mosques attached to the shrines. (Source: Punjab Auqaf Department)

18 The Spiritual ambience of a shrine is mainly based on performance of rituals, ceremonies, beliefs, 'urs celebrations etc related to the Sufi and his order.

The trend of re-construction of a large size jami'a mosque is alarming and is changing the socio-religious and built environment of shrine altogether. Socio-religious environment of shrine complex is becoming more Islamized rather than Islamicate. This trend has also encouraged the demolition of the old mosques [Figure-7, 8 and 9] which were enlisted-protected in terms of Punjab Special Premises (preservation) Ordinance 1985. According to the information given in the Table 02, six enlisted-protected mosques in the Punjab have been demolished and reconstructed.[19]

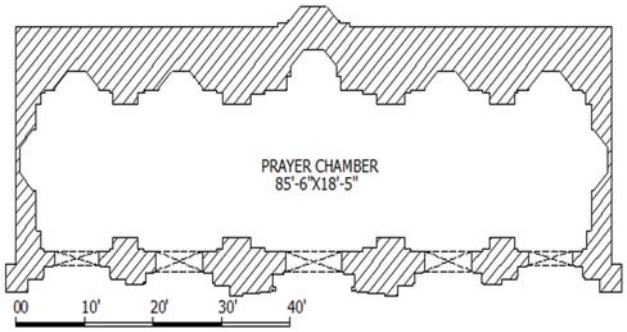

Figure-7: The plan of old mosque Hazrat Ali Hujwiri demolished in 1986.

3.3 Public Amenities & Commercial Buildings

Public amenities include construction of lavatory and ablution blocks and water supply arrangements on the premises of shrine complex. Every year, thirty five to forty development schemes are approved under head of public amenities in the Annual Development Programme of waqf administration. Every body entering the shrine essentially needs to purify with water for *taharat* and *wadu*. These facilities are essentially required to be located at the entrance of a shrine complex. Their presence has changed the physical environment in areas near entrance [Figure-10]. Provision for shoe-keeping area is also getting importance.

Figure-8: Tughlaq Period Mosque Baba Farid demolished in 1999

These buildings are constructed only to fulfill the functional need and their aesthetical value is ignored. These structural additions are very important because of their prime location

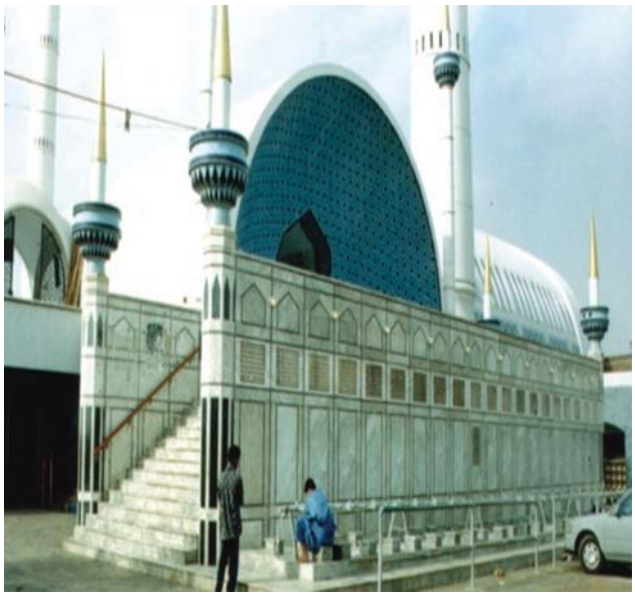

Figure-10: Entrance/Wazu Place at shrine Hazrat Data Gunj Bukhsh

Figure-9: Mosque Abu al-Khair Nau Lakh Hazari Shahkot demolished in 2008

19 According to the Punjab Special Premises (preservation) Ordinance 1985, no one can reconstruct, add or demolish any structure within circle of 200 feet all around the enlisted protected monuments. Such action is punishable.

as visitors interact with these spaces first while entering the shrine premises[20]. Similarly, for water supply arrangements, a room for tube-well and structure for overhead water reservoir[21] demand attention for their proper location and design of building form.

Waqf administration is always interested in exploiting the commercial potential of the open waqf land in the urban areas. Their point of view, for its best utilization is to construct shops or office buildings for rental purposes. At the outer periphery of waqf land, such shops are constructed.[22] Shrines have been confined in the narrow rows of shops and sometimes, even their main entrances are not visible from the outside.[23]

Another trend is to rent out the space temporarily for Sunday's and Friday's shops.[24] Waqf Organization collects a handsome amount from the rents of these temporary shops or commercial units every month.[25] These commercial activities, either permanent or temporary, influence the physical and spiritual ambiance of the shrine complex.

Adding of small building components like verandas, rooms, courtyard flooring, etc on the premises of shrine complex is a regular feature of the Annual Development Programme (ADP) of waqf organizations. Visitors often demand such facilities and they also give donations for such construction. Every year, waqf administration approves twenty to thirty such development schemes in their development budget [Refer Table-1]. As little importance is being given to these requirements, such additions have no visual relation with the existing building forms. These additions appear out of place and uncongenial on the premises of the shrine complex.

4. FORMAL DEVELOPMENTS

The holistic approach for re-construction of a shrine complex[26] is the recent phenomenon. It started with the design competition of Data Darbar Complex in the year 1981. Previously only informal developments were carried out either by the waqf department or the *mutawalli*s. Data Darbar Complex conceived by the architectural consultant[27] introduced new concept for master planning of the shrine complex in Pakistan [Figure-11] based on institutional building designing approach. First time, a big *jami*'a mosque was added in a shrine complex under direction of the then President of Pakistan in 1981. The architectural features were kept modern and new building materials were used for its building form[28]. It was a first deviation from the traditional construction and decoration techniques far case of shrine buildings.

In Data Darbar Complex, for the first time new components in shrine complex were introduced i.e. car parking in basement, air-conditioning plant, sama'a hall in semi basement, seminar hall, library, police post, lost & found center, office for *jahez* (dowry) committee etc. Architectural design approach of Data Darbar Complex influenced other shrine complexes like Barî Imâm Sarkâr Complex, Miyân Muhammad Bukhsh Shrine Complex, Baba Bulleh Shah Shrine Complex etc. This new concept has totally changed the socio-religious and built environment of the shrine. Construction of a big mosque has encouraged the daily, weekly, monthly and annual ceremonies in the prayer hall parallel to the shrine.

On great public demand and keen interest of the Federal and Provincial governments for expansion of frequently

20 Wadu place, Taharat Khanas and Shoe-Keeping areas were not taken into consideration while designing the Data Darbar Complex, Baba Farid Complex, Baba Bulleh Shah Complex etc. Their later addition has created many visual and functional problems.
21 The over head water reservoir of 20,000 gallons is placed in the entrance area of the shrine of Baba Farid Pakpattan.
22 On the periphery of newly constructed zaireen complex and mosque at shrine of Madhu Lal Hussain Lahore, the shops are constructed for rental purpose. Similarly, when zaireen complexes at shrines of Sakhi Sarwar Dera Ghazi Khan and Baba Farid Pakpattan were constructed, shops were also built.
23 The passage to the shrines of Hazrat Bibi Pakdamana Lahore and Pir Abdul Razzaque Makki Sharif Lahore are flanked with shops in a way as no one can see the entrances to these passages giving access to the shrines.
24 At the shrines of Hazrat Diwan Chawali Mushaikh Burewala, Imam Ali al-Haq Sialkot, Shah Shams Subzwari Multan, Shah Kamal Lahore etc, the open lands attached to the shrines are rented out for Friday's and Sunday's temporary shops.
25 Waqf Organization collects almost 28% of its annual income under head of rents from the commercial units.
26 The term Shrine Complex is used for khanaqah as in modern days, the addition of various new components has transformed it into a new form.
27 Naqvi & Siddique Islamabad based consultants designed Data Darbar Complex Lahore
28 Prayer Hall is a large size arch with internal size 80'X120', constructed in RCC structure with inverted beams and hanging roof double slab. Other materials are Aluminum frame with safety glass in façade, stainless steel cones at minarets, ceramic tiles made in factory, alloy for grill, wrought iron and marble.

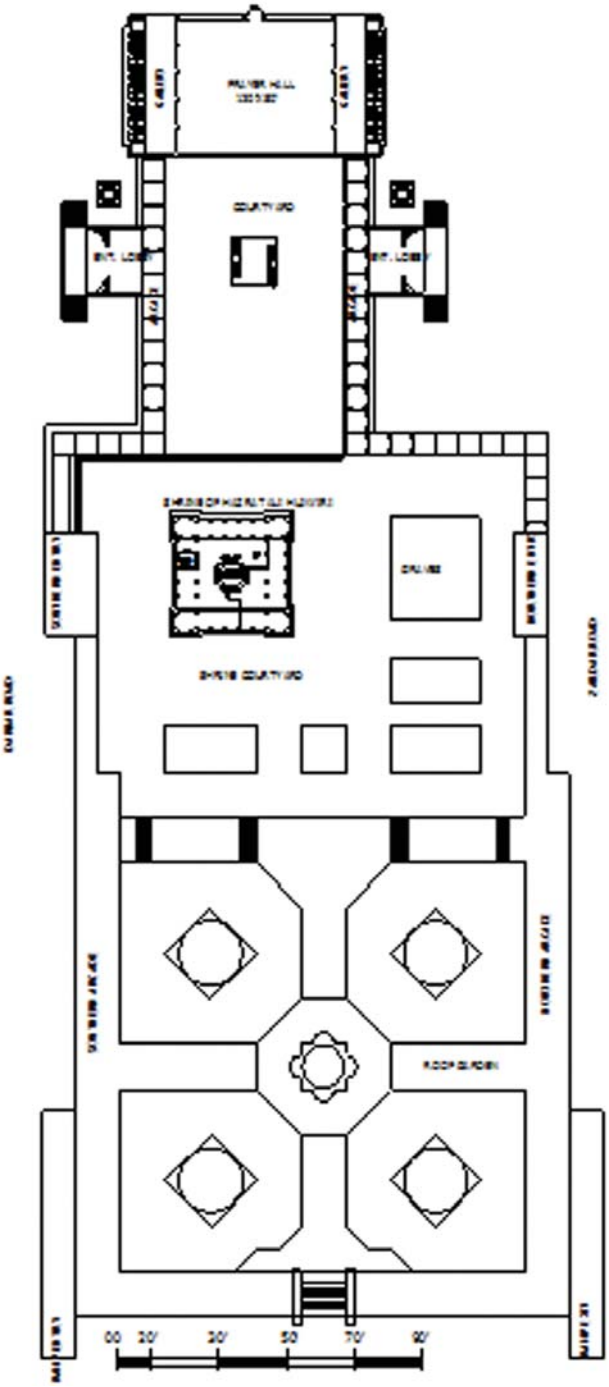

Figure-11: Master plan of Data Darbar complex Lahore (1981-1999).

visited shrines of the *Sufi*s, private land adjacent to the waqf properties is acquired under Land Acquisition Act 1894. For Data Darbar Complex, Baba Farid Complex etc, adjacent private land has been acquired. Waqf Department pays the price of land according to the prevailing market rates. For such forced land acquisitions, the owners sought help from the High Court and Supreme Court for their defense but the need of public being a top priority, their cases were dismissed. In recent years, waqf administration has planned to acquire land for expansion of shrine of Bibi Pak Damana Lahore and Shah Daula Daryai Gujrat. Such additional land changes the physical environment within the premises as well as outside the waqf property. The commercial value and land-use pattern of the Lower Mall Lahore changed, for case of expansion of Data Darbar and of Sahiwal Road for case of expansion of Baba Farid complex Pakpatten.

5. CONDITIONS FOR FORMAL & INFORMAL DEVELOPMENTS

After taking the administrative control of shrines in 1960 by the waqf administration, the speed of formal and informal developments on the premises of khanaqahs increased. Before that, mutawallies and gaddi nashins were not interested in spending the money received from offerings of devotees on construction and expansion of the khanqahs. Rather they sold the attached waqf land to make the money out of it. The cash income received from the shrine was distributed among the mutawallies under mutually agreed system and no amount was spent on providing facilities to the visitors. Auqaf being an autonomous body meets its expenditures from the waqf income and most part of it is spent every year on up-gradation, reconstruction and restoration of shrines and its attached buildings.

The shrine of Baba Bulleh Shah, Shah Hussain, Abdul Salam Chishti Bara Bhai Masroor, Sakhi Turt Murad and many more were comprising of simple rooms and on demand of public and by the pressure of politically influential persons, these have been reconstructed by the waqf administration. The main approach road of Baba Farid khanqah was very narrow and with steep slope. It was essentially required to find out some solution. The northern door was reserved only for the family members of the gaddi nashin, hence a new entrance from the Sahiwal Road was introduced. For case of Shrine Hazrat Ali Hujwiri, it was desire of Zulifqar Ali Bhutto in year 1975 to extend its premises up to the extents of Lower Mall Road. The present design was approved by the design selection committee headed by then President of Pakistan as Chairman in 1981. Data Darbar Complex took twenty years to complete and governments subsequent

provided funds for its construction. Its foundation stone was laid down by the President General Zia ul-Haq and complex was inaugurated by the then Prime Minister of Pakistan in 1999.

Construction of shrine complex of Waris Shah was initiated as a policy matter laid down by the Government in early years of 1970's when Chief Minister Punjab took initiative. It completed in ten years. For the case of Baba Bulleh Shah Complex Kasur, it was direction of a military official deputed for looking after the affairs of district Kasur, to reconstruct the shrine and mosque along with other attached facilities in 2002. The funds were provided by the provincial and federal governments. Zaireen Complexes at the shrine of Hazrat Sakhi Sarwar in Dera Ghazi Khan and Khawaja Ghulam Farid Kot Mithhan were constructed on the pressing demand of gaddi nashins and expenditures were borne by waqf administration. In year 1995-96, re-construction of the shrine of Hazrat Bibi Pak Damanan was initiated in pursuance to the direction of the then Prime Minister of Pakistan when she approved the design of new mosque Baba Farid and sanctioned Rs 120.00 million for its construction. For expansion of the shrine of Hazrat Bibi Pak Damanan, a parliamentarian succeeded in obtaining fund allocation for the required works during fiscal year 2011-12. In short, these formal and informal developments have been introduced on the premises of Sufi shrines by the rulers through public funds, by gaddi nashins or devotees through waqf administration.

6. CONCLUSION

The formal and informal developments on the premises of waqf properties have transformed the socio-religious and built environment of the shrines into a new idiom. Construction of new building structures not only changed the physical environment but also developed new inter-relationships between various spaces occupied for performance of rituals and ceremonies. These new spatial configurations have set new patterns for flow of zaireen and spiritual ambiance of the shrine. Today, newly constructed shrines have different physical and spiritual ambiances as compared to those shrines which have not yet undergone such changes in context of their socio-religious and built environment.[29]

The construction of large size mosque has become a dominating component on the premises of shrine. Its religious differentiation divides the space into two, one for shrine ceremonies and other for the mosque- related rituals. The areas where new large size mosques were constructed, such shrines have become mosque complexes instead of shrine complexes. The parallel performance of the shrine-related ceremonies and mosque-related rituals has inter-mingled the spatial configuration of the shrine complex. This confusion has damaged the unique and identifiable ambiance of the shrine. There was a time when visitors were used to come only for the Sûfî but now, they visit shrine for saying their daily prayers in the mosque attached.

The performance of ceremonies and rituals at the shrines is no more in the hands of mutawallis and gaddi nashins. The shrines and their related activities including the collection of endowments, awarding the annual contracts of waqf agricultural lands, collection of rents from waqf properties, leasing out land in Punjab is administratively controlled by the Government of Punjab through its Auqaf & Religious Affairs Department. The socio-religious and built environment of shrine is continuously changing with the passage of time, according to the requirements of the zâireen. Visitors think that to participate in the ceremonies and rituals performed at shrine are their main objective of visitation. The functional buildings are added on the premises of shrine complex to facilitate the za'ireen.[30] These buildings if constructed properly are not a threat to the ambience and identity of the shrine. However, the new evolving trend of re-construction of a big Jâmi'a mosque dominating the shrine is a cause of architectural concern.[31] This has encouraged the trend among public of performing their prayers in a mosque preferably attached to some Sufi shrine.[32]

29 Mostly the shrines in the south Punjab like Dai'ra Din Panah, Pir Ahmed Qatal, Pir Aadil, Hazrat Sakhi Sarwar, Hazrat Shah Rukn-e Aalam, Makhdome Jahanian Jahangusht, Jalal al-Din Surkhposh, Mahboob-e Subhani etc have experienced minimum changes in their socio-religious and built environment.

30 For example, seminar hall, library, air conditioning systems, police sub-station, lost and found centre, industrial school for women etc are added.

31 In the last decade of 20th century, Punjab Government has constructed large-scale mosques at shrines of Hazrat 'Ali Hujwiri Lahore, Baba Bulleh Shah Qasur, Shah Hussain Lahore and Baba Farid Pakpattan.

32 It has been observed that numbers of people coming to say their prayer are far less in Badshahi Mosque as compare to the mosque attached to the shrine of Hazrat 'Ali Hujwiri at Lahore.

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SHOP GREEN: A CASE STUDY OF TARIQ ROAD AXIS IN KARACHI

*Yasira Naeem Pasha**

ABSTRACT

The emerging concern for urban environment is currently one of the most essential ingredients of urban design theory. A commercial activity within the extents of the modern city dwells in one such environment.

The post-industrialization era has served severe limitations on the natural development of commercial activities, retailing being one of them. Today, the rather unusual transformation of retail activity has been largely endorsed on accounts of ease and comfort. However, this change has surfaced various shortcomings in terms of sustainability.

This study aims to explore an existing retail activity in the context of Karachi. The main objective of the study is to find ways to upgrade the environment of the area in which this retail activity exists. The study aims to achieve this without subscribing to the insensitive and inorganic design solutions prevalent in contemporary times. The study also aims to develop a prototype which can serve other commercial spaces within the precincts of the city and beyond. Providing convenience of use to various stakeholders involved remains at the core of the study.

The study derives a theoretical foundation through a focused literature review. Examples from other contexts are also referred. The study essentially comprises both qualitative and quantitative data which are carefully extracted from personal observations, structured questionnaires and visual documentation.

***Key Words*:** Environmental upgradation, Commercial space, Retail activity, Pedestrian circulation, Traffic congestion.

1. INTRODUCTION

Environments can be perceived as envelopes enclosing various physical and virtual activities around the world. Acting as containers, these environments need to be appropriately defined with respect to the activities they support. There are several methods by which this can be achieved. Upgradation of an already-defined environment is one of these methods.

Since the 19th century industrial revolution, continuous expansion and evolution of technological environments have dominated proceedings leading into contemporary times. In the process, physical and socio-cultural environments have significantly suffered, resulting in inadequate commercial settings across all urban hemispheres. In order to set right or improve this situation, the issue of environmental degradation needs to be promptly and competently addressed.

"Environmental degradation relates to the deterioration of the environment, both in terms of quantity and quality. It has many forms and can occur naturally or through human processes." This basic understanding of environmental degradation forms the basis for arriving at the concept of environmental upgradation.

Built environments commonly found in the constantly expanding cities of the developing world present a mingling of commercial and residential spaces. Each of these distinctive spaces carries a tendency to degrade the other. Furthermore, non-availability of facilities such as common underground infrastructure, fewer parking spaces, and lack of greenery are just some of the factors which account for the degradation of physical and socio-cultural environments in these cities. In an effort to stand shoulder to shoulder with the so-called exemplary cities, such as Dubai, the use of non-indigenous materials and unsustainable methods of development have been widely accepted. Consequently, advantages of sustainable development have been almost entirely overlooked.

Sustainable development is development that meets the needs of the present without compromising the ability of

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future generations to meet their own need. This mode of human development has been largely disregarded in the development of commercial spaces such as Tariq Road, located in the heart of the Pakistan port city of Karachi. Although the term "sustainability" has been widely identified as the core ingredient of contemporary urban design, its transition from theory to practice is yet to be fully realized. Concerns over environmental degradation of commercial spaces are on a rise. Contradictory to satisfying such concerns purely through mechanical means, various non-mechanical strategies can be employed for reaching more pragmatic and sustainable results. Environmental qualities of a given commercial space, such as Tariq Road, can be effectively enhanced along these lines.

2. SOME THEORETICAL INFERENCES

The theory of imageability by Lynch (1960) can be used as a constructive tool for the upgradation of a given environment. According to this theory, imageability is the quality of a space or object which creates strong mental imagery. This makes the space more prominent, powerfully structured and user-friendly.

Shopping areas act as integral units of our environment. Consistent with the needs of time, these functional units should not only be structured but also upgraded in accordance with potential environmental concerns, changing pace of movement and scale of new construction.

This concept of conscious design is proposed keeping in view the context of Tariq Road. Accordingly, the process of Context Sensitive Design (CSD) is taken into perspective. Context Sensitive Design is defined as a theoretical and practical approach to design that takes into consideration the needs of the users, the neighboring communities, and the environment. It involves careful planning, consideration of varying perspectives, and tailoring designs to particular project circumstances. CSD also uses a collaborative, interdisciplinary approach that includes early involvement of key stakeholders to ensure that public transportation projects are not only moving safely and efficiently, but are also in harmony with the natural, social, economic, and cultural environment.

CSD requires an early and continuous commitment to public involvement, flexibility in exploring new solutions, and an openness to new ideas. Community members play an important role in identifying local and regional problems and solutions that may better meet and balance the needs of all stakeholders. Early public involvement can help reduce expensive and time-consuming rework later on and thus contribute to sustainable urban development. Such an approach can redefine inhospitable commercial settings as places to linger, relax and cherish.

Both the above mentioned theories are taken into consideration in an attempt to redefine the environment of Tariq Road. Environment here is perceived as a shell encompassing all ingredients of what constitutes a sustainable development [Figure-1].

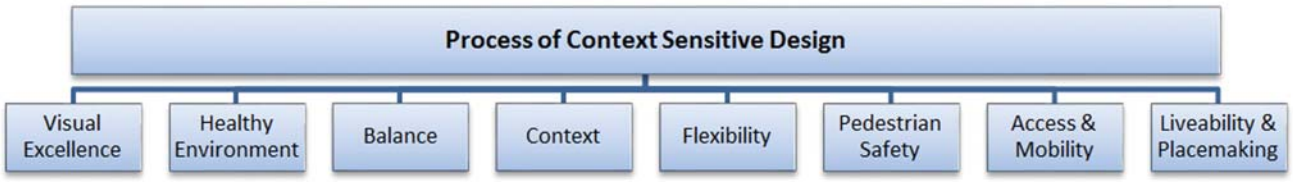

Figure-1: Process of context sensitive design - An illustration
Source: Author

3. KARACHI: A BRIEF

The area that now consists of Karachi was originally composed of a group of small villages including Kolachi-jo-Goth and the fort of Manora. It was in 1729 that Kolachi-jo-Goth was transformed from a fishing village into a trading post when it was selected as a port for trade with Muscat and Bahrain. By early 20th century, Karachi transformed into a city with railroads, churches, paved streets, courts and many commercial centers as well as a magnificent harbor built by the British.

In 1947, Karachi was made the capital of the new nation of Pakistan. Its growth accelerated as a result of its new status. Being the capital, Karachi became a focal point for the new nation and this added to its status as a cultural centre in this part of the world. Although the capital later moved to Islamabad, Karachi remained the economic centre of Pakistan, accounting for a large portion of the GNP of the nation. With the passage of time, the city has evolved with respect to a high rate of urbanization. Many new locations have been added to the city in the form of both planned and unplanned additions.

4. SIGNIFICANCE OF THE STUDY

In general, the study signifies the use of commercial spaces in accordance with environmentally acceptable standards. It introduces ways to bring about a change in existing shopping trends by redefining the environment of Tariq Road.

The phenomenon of commercial space is studied within the unique context of Karachi and more specifically, within the context of Tariq Road. Various social relationships and problems within this area are identified and understood. Issues pertaining to the quality of commercial space, its use, the users and their needs are investigated and addressed. With the passage of time and implementation of such a proposal, the model can be employed for the improvement of other commercial spaces in the city and beyond.

5. INFERENCES FROM CASE STUDIES

The core idea behind the selection of precedent studies is to identify problems common to commercial activities. Although various studies have been conducted on Tariq Road, the problems identified with the help of these case studies are indeed unique in nature.

The two case studies taken into consideration are the MG Road in Banglore, India, and the Istiklal Avenue in Istanbul, Turkey. The findings of the case studies can be summed up as follows:

- The social, environmental, and other relevant characteristics of the two commercial spaces can be compared to those of Tariq Road in terms of changes in geographical patterns. Hence, it can be concluded that the general needs of the user in each context is more or less the same.

- The pattern of retail activity in both instances is the same, which is to walk and shop. Although vehicles can be used to reach specific destinations, the primary mode of transportation remains pedestrian.

- Both commercial spaces are also treated as interactive spaces. The act of window shopping remains common to both. Similarly, Tariq Road can also be developed into a social hub adding to the economy of the city.

- In both instances, it is observed that users can easily adapt to pedestrian-bound movement in place of vehicular-bound movement, provided that the environment is inviting and comfortable.

- The solutions proposed for the upgradation of both the environments are similar in nature [Figure-2].

6. OBJECTIVES OF THE STUDY

- To upgrade the environment of the specified commercial space in order to make it user-friendly and sustainable.

- To develop a shopping environment without subscribing to the insensitive and inorganic design solutions prevalent in contemporary times.

- To develop a prototype which can serve other commercial spaces within the precincts of the city and beyond.

7. RESEARCH METHODOLOGY

The research methodology adopted involves an in-depth analysis of the selected case studies. The following tools were employed to collect the relevant data:

- Extensive surveys of the specified area

- Questionnaires for various stakeholders involved.

S. NO.	AREA	LOCATION	PROBLEM IDENTIFICATION	PROBLEM IDENTIFICATION	PROBLEM IDENTIFICATION
1.	MG Road Pune Banglore	India	▪ Traffic congestion ▪ Low sales ▪ High thermal conditions ▪ High pollution ▪ Change in the landuse ▪ Center of attraction converted into malls ▪ No interactive spaces to enjoy	Pedestrianization	▪ High thermal comfort ▪ Low congestion ▪ High sales ▪ Less pollution ▪ Tourist hotspot
2.	Istiklal Street Instanbul	Turkey	▪ Massive migration from rural areas ▪ Large scale movement of wealthy class ▪ Change in the land use ▪ Traffic congestion ▪ Low sales ▪ High thermal conditions ▪ High pollution	Pedestrianization	▪ High thermal comfort ▪ Low congestion ▪ Less pollution ▪ Tourist hotspot
3.	Tariq Road Karachi	Pakistan	▪ Change in land use ▪ High pollution ▪ Traffic congestion ▪ Low sales ▪ High thermal conditions ▪ Center of attraction converted into malls ▪ No interactie spaces to enjoy	1. *Conventional solution:* Pedestrianization with change in traffic plan. 2. *Radical Solution:* Underpass for public transport along with pedestrian ground level with change in traffic plan	▪ High thermal comfort ▪ Low congestion ▪ Less pollution ▪ Tourist hotspot

Figure-2: Comparative analysis.

- Review of visual documentation.

- Review of available literature.

Initially, research questions provide the way forward. This is followed by the collection of data. Observations and questionnaires account for primary data. Secondary data is gathered from documentation including government publications and past research.

Results are evaluated following the collection of data from questionnaires. This is later arranged in the form of bar graphs for comparative analysis. The results are further analyzed to provide recommendations for the final set of solutions and proposals.

A frame of analysis is also developed based on the following set of considerations:

- Analysis of qualitative data

- Conversion of quantitative data into tabulated format

- Development of cause and effect relationship

- Research findings

- Proposal

8. TARIQ ROAD

Tariq Road has a considerable impact on the urban environment and social life of Karachi. It is extremely popular amongst the masses and accounts for one of the busiest commercial spaces in the city.

The section of Tariq Road selected for environmental upgaradation can be divided into two zones:

- Starting from the Liberty Signal, turning to the South-East towards Jheel Park, and including Jheel Park itself.

- Going straight from the Liberty Signal down towards the roundabout at the intersection with Sharah-e-Quaideen (Allah wali chorangi).

The surroundings of the commercial space can be defined by:

- Kashmir Road to the North-West

- Jheel Park to the South-East

- Shaheed-e-Millat Road to the North-East

- Sharah-e-Quaideen to the South-West

9. SITE CHARACTERISTICS

9.1 Location

Tariq Road is a 100 feet wide street with shops on both sides. Apart from its basic morphological composition, it is a cluster of streets forming an intricate network. Acting as one of the major strategic roads of the city, it is connected to the Bahadurabad Roundabout in the North-East, where the commercial activity starts.

9.2 Accessibility

The site is accessible from all sides. A mesh of secondary streets can be found along each side of its length. This accessibility is further reinforced by all kinds of public transport available at and adjacent to the area.

9.3 Vehicular Traffic Flow

The vehicular traffic flow accounts for the major activity during the day transforming the street from a commercial activity zone to a major circulation artery. Space for expansion of the street is no longer available.

9.4 Link with City Nodes

The commercial space is connected to major areas such as PECHS and SBahadurabad, Saddar, the popular business district and city center, is located nearby. Some of the city's major hospitals are also located in the vicinity [Figure-3].

10. OBSERVATIONS BASED ON QUALITATIVE DATA

10.1 Shopping Malls' Atmosphere

The atmosphere within the shopping malls located in the area is rather inviting. These malls offer comfortable shopping environments, spaces for entertainment, and well-designed dining areas. They provide a fair account of the needs of the user - of what is considered acceptable and what is not.

10.2 Availability of Vacant Land

Vacant plots of land in the area can support various functions which can further enhance the environmental quality of the commercial space.

10.3 New Construction

New construction in the area fails to address the requirements of the commercial space. This insensitive approach to design needs to be reversed in order to establish a more coherent image of the area.

10.4 Building Facades

Glass facades in the area appear to be gaining popularity amongst various retailers. This recent development needs to be carefully addressed with respect to questions pertaining to high energy consumption[Figure-4].

10.5 Haphazard Vehicular Traffic Flow

The vehicular traffic in the area is composed of both private and public means of transportation. Unavailability of parking spaces contributes to unusual patterns of traffic movement [Figure-5].

Figure-3: Map showing link with major city nodes.

10.6 Prolonged Traffic Jams

Unusual patterns of traffic movement result in prolonged traffic jams in the area. This condition is further aggravated by numerous temporary and permanent impediments along the streets.

10.7 Lack of Pedestrian Movement

Dominated by vehicular traffic, the character of the area is by no means conducive to pedestrian circulation. Infringed walkways ensure that pedestrian movement is reduced to a minimum. The importance of visiting customers as prime stakeholders is clearly underestimated.

10.8 Use and Misuse of Plots

Although the vacant plots in the area are authorized for commercial use, they are subjected to partial or complete misuse. They can be strategically transformed into parking spaces in pursuit of improving both vehicular and pedestrian circulation.

10.9 Mixed Use of Plots

Despite the commercial nature of the area, buildings are constructed to serve both commercial and residential purposes.

10.10 Lack of Landscape Elements

The area exhibits an absence of planned landscape elements. Dominated by man-made structures and congested vehicular traffic flow, the area remains deprived of both hard and soft landscape. This condition significantly dampens the aesthetic qualities of the area.

11. TRAFFIC COUNT

The statistics related to traffic characteristics indicate that the intensity of vehicular traffic increases gradually at the stroke of mid-day. These statistics also indicate that the vehicular traffic flow in the area is predominantly composed of personal vehicles. Other modes of transport including buses, wagons, rickshaws, etc. also access the area throughout the day.

The high percentage of personal vehicles accessing the area for shopping purposes contributes to road-side parking which, in turn, contributes to frequent and prolonged traffic congestions.

The statistics also show that in the peak traffic hours of the day, pedestrian counts are not negligible. These pedestrian counts also increase with the increase in vehicular traffic at the mid-day. It is also observed that vehicle/pedestrian ration stands approximately to 1. The current pattern of movement in the area dictates more space for vehicles and very less for pedestrian, whereas a major portion of it is occupied by hawkers. This contrast needs to be addressed by different means [Figure-6].

12. IDENTIFICATION OF PROBLEMS

One of the major problems identified in the area is the absence of planned parking spaces. Frequent and prolonged traffic jams caused by haphazard parking patterns on either side of the street are a common sight during peak hours. Mass numbers of vehicles carelessly parked along the street also contribute to the increase in temperatures during the

Figure-4: Roundabout.

Figure-5: Parking at Tariq road.

TOTAL 16 HR TRAFFIC		PEAK HOUR TRAFFIC						VEH/PCU RATIO
Veh.	PCUs	Morning(1100-1200)			Mid-day (1200-1300)			
		Veh.	PCU	%	Veh.	PCU	%	
98,592	93,082	7,378	6,507	7.48	8,204	7,503	8.32	1.059

TRAFFIC COMPOSITION		
	COMPOSITION	
MODES	TOTAL	PERCENTAGE
1. Motor Cycles	21,668	21,98
2. Cars / Jeeps / Suzuki	55, 188	55.98
3. Rickshaws	7,127	7.23
4. Ford Wagons	3,270	3.32
5. Mini Buses	5,628	5.71
6. Buses /Trucks	4,707	4.77
7. Trailers	188	0.19
8. Pedal Cycles	729	0.74
9. Animal / Men Carts	87	0.09

Figure-6: Traffic count at Tariq road.
Source: Traffic Engineering Bureau. KDA, Karachi. A survey report January - February 1993.

day. It has been observed that visitors are generally reluctant to walk along the street in such pitiable conditions. In contrast, they are willing to walk long hours in well-resourced environments such as those found in shopping malls. Therefore, it can be safely concluded that lack of proper parking facilities combined with traffic congestions, poor air-quality, noise pollution, infringed walkways, etc. have simultaneously contributed to the environmental deterioration of Tariq Road.

According to a survey report prepared by the Traffic Engineering Bureau, Karachi, about 60% of people visiting Tariq Road use personal vehicles. Another study related to the commercialization of roads in Karachi reveals the adverse impacts of the resulting increase in traffic volumes across the city. Survey of the roads closely linked to Tariq road revealed that a large number of respondents (83%) were of the view that the traffic volumes have increased to a great extent as a result of increasing commercial activities in these areas. The figures were fairly consistent for all other roads in the vicinity, with the highest percentage recorded along Khalid Bin Walid Road (90%). The study also revealed that over 90% of the respondents considered poor air quality and increase in noise pollution to be the most damaging consequences of increasing traffic volumes in these areas.

In order to analyze the patterns of traffic movement and their impacts, the area was divided into 14 segments. Each of these was sequentially analyzed and conclusions were drawn. Here it must be emphasized that the roundabouts in the area were studied separately owing to their strategic physical locations. For instance, the Liberty Roundabout is one of the most prominent landmarks in the area since it is positioned at the intersection between Allama Iqbal Road and Tariq Road. It also serves as a connecting node when heading towards the Jheel Park [Figure-7 & 8].

13. WALKABILITY INDEX KARACHI

In July 2009, the Urban Resource Center along with students from Indus Valley School of Art and Architecture, Karachi, and the National College of Arts, Lahore, voluntarily carried out a survey in an attempt to determine the Walkability Index in Karachi. The survey was conducted using the

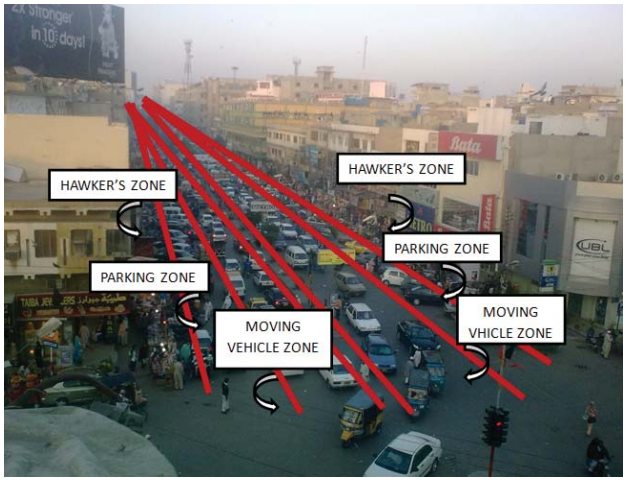

Figure-7: View of the area from Liberty roundabout.

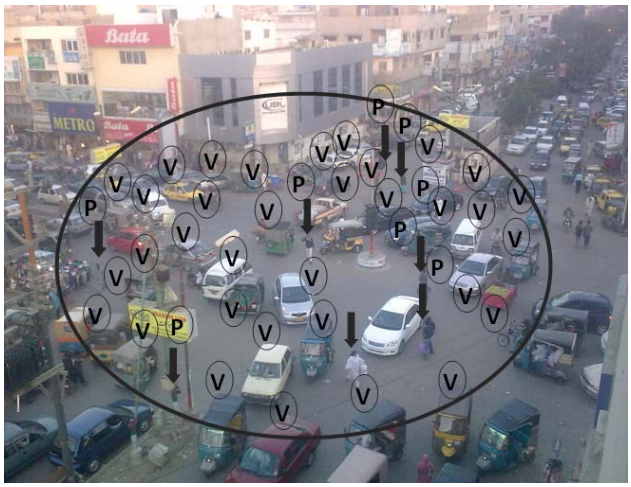

Figure-8: View of Liberty roundabout.

Global Walkability Index (GWI), a standardized field survey tool developed by the World Bank. This index was designed to evaluate the quality of pedestrian environment in a city. The objective of the survey was: (a) to popularize the concept of walkability as an important aspect of sustainable urban development, and (b) to mobilize all stakeholders to work with the concerned authorities in order to improve the pedestrian infrastructure of the city.

The survey was carried out in four commercial/residential areas of the city, namely Clifton, Tariq Road, Gurumandar and NIPA. Each of these areas measure 250,000 square meters and cover 36 main roads with a combined length of 20.58 kilometers. The survey was conducted during early evenings when traffic congestion and crowding on public transport is at its highest. The main findings of the survey were:

- The Walkability Index of Karachi (50) measured much lower than that of Bangkok (121).

- The Walkability Index of Tariq Road proved to be much higher than those of the other three areas. This was mainly because Tariq Road attracts the highest number of pedestrians and comprises a relatively better quality of pedestrian infrastructure. However, the score remained much lower than that of Bangkok.

Poor quality of sidewalks, crosswalks, and lack of accessibility for the physically impaired proved to be the major factors which contributed to the low score. The picture reveals three clearly distinctive zones. No space for pedestrian movement can be identified.

The picture reveals massive traffic congestion at Liberty Roundabout. Irregular patterns of vehicular and pedestrian circulation can be seen.

14. IMPORTANT FINDINGS OF THE SURVEY

This section only provides the selected information derived from the field survey.

14.1 Problems on Tariq Road

64% of the users identified the absence of planned parking facilities as the major problem in the area. 44% highlighted traffic congestion whereas 34% pointed towards inadequate pedestrian facilities. 38% considered lack of greenery to be a major setback to the environment. Mass presence of hawkers, lack of appropriate eating spaces, and lack of law and order were classified as some of the other problems in the area [Figure-9].

14.2 Choice of Movement

72% of the users acknowledged the enhancement of pedestrian movement as the major tool in the upgradation of the environment. 12% called for the improvement of vehicular circulation whereas 16% called for the enhancement of both forms of public circulation [Figure-10].

14.3 Suggestions pertaining to the enhancement of shopping environment

58% of the users suggested the addition of a parking plaza to enhance the shopping environment. 46% of the users suggested a pollution-free environment; 44% suggested the elimination of illegal encroachments; 40% suggested the improvement of aesthetics; 22% suggested the maintenance of law and order; and 2% recommended better layouts for the shops [Figure-11].

15. REFERENCES FROM STRATEGIC PLAN KARACHI 2020

The environment of a given commercial space can be greatly enhanced by the curtailment of vehicular traffic movement together with the facilitation of pedestrian movement. This can also lead to the possibility of adding more commercial activities in the area. Initially, only the study area can be stripped of vehicular traffic. Later, the process can be replicated on a much wider scale.

Defining measures must be taken to improve the transit facilities in the area. These may include:

- Reforming parking strategies
- Enhancing sidewalks and crosswalks
- Introducing pedestrian malls
- Establishing zones for hawkers
- Removing illegal encroachments
- Defining bus routes
- Introducing shuttle services
- Exploring mass transit options
- Introducing parking terminals along the periphery
- Improving intersections
- Installing and relocating traffic signals
- Re-arranging traffic movement pattern
- Improving linkages to radial and ring roads
- Restricting animal-driven carts

16. THE PROPOSAL

As concluded previously, the environment of Tariq Road is defined by irregular patterns of vehicular traffic movement. Recurrent traffic congestion has considerably degraded the environment of the area making it unfavorable for shopping and leisure.

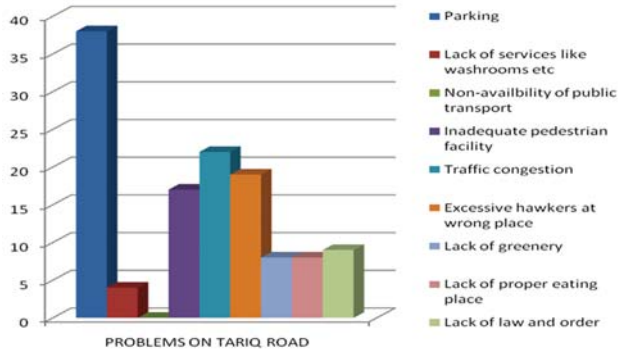

Figure-9: Problems at Tariq road.

Figure-10: Choices of movement.

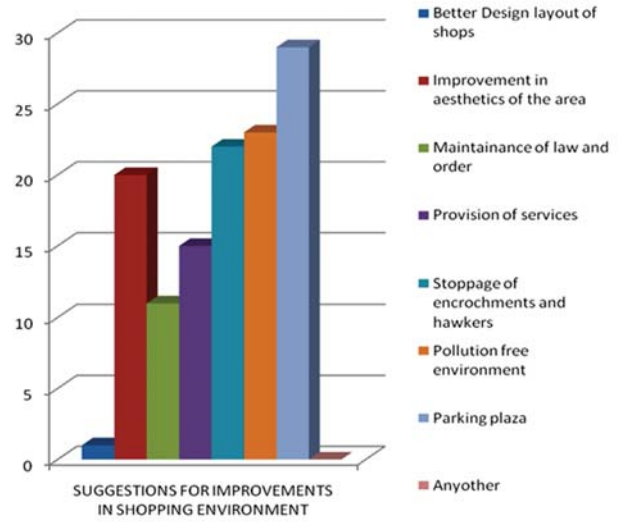

Figure-11: Suggestions for improvement.

Figure-12: Three-phase process.

The proposal for the environmental upgradation of Tariq Road is largely derived from the theories of Imageability and Context Sensitive Design. The two case studies referred have also played an important role. The proposal can be summed up by the following set of measures:

- Providing a pedestrian thoroughfare in the selected area
- Providing a parking plaza within the premises of Jheel Park
- Providing space for hawkers in the currently misused vacant plots of land
- Providing a new traffic plan for vehicles approaching the area
- Providing an emission-free shuttle service which is to be maintained by the retailers [Figure-12]

16.1 Benefits

- Unobstructed views of the various shops along the street can facilitate both the retailers and the customers
- Reduction in air and noise pollution
- Organized arrangement of spaces for parking, hawkers and shopping
- Comfort and security for all stakeholders involved

16.2 Implementation Plan for Pedestrianization

Sudden changes to urban environments may not be widely acceptable to the stakeholders as opposed to gradual changes. Therefore, the pedestrianization of Tariq Road is proposed as a three-phase process.

16.3 Proposed Traffic Plan

The new traffic plan can be divided into two distinct approaches, both of which can be overlapped in order to fully serve the environmental upgradation tactics.

16.3.1 Conventional Approach

In this approach, the vehicular traffic flow heading towards Tariq Road will be redirected. This will result in a car-free Tariq Road which can then be transformed into a pedestrian street.

The new traffic plan for the area will include:

- Traffic from Shaheed-e-Millat will be directed towards

the proposed parking plaza at Jheel Park via Siraj-ud-Daula Road.

- Traffic from Sharah-e-Quaideen will be directed towards the proposed parking plaza at Jheel Park via Dr. Mehmood Hussain Road.

- Tariq Road will be closed for vehicular traffic at Sharah-e-Quaideen and Shaheed-e-Milat Road [Figure-13].

Figure-13: New traffic plan - Conventional approach.

16.3.2 Radical Approach

This approach considers the construction of an underpass along the existing length of Tariq Road. While the underpass will be used for vehicular circulation, the upper or ground level will be used for pedestrian circulation. It is well understood that the translation of current vehicular pattern on to another level can lead to similar traffic problems. Therefore, the following is proposed:

- The underpass will serve the public transport system alone and facilitate one-way traffic flow only.

- Three major junctions, namely Bahadurabad Roundabout, Liberty Roundabout and Allah Wali Roundabout, will serve to connect the two levels [Figure-14].

Figure-14: New traffic plan - Radical approach.

16.4 Proposal for Hawkers Zone

Vacant plots in the area are proposed for the relocation of hawkers. Such a proposal has been previously welcomed in other commercial spaces of the city such as Meena Bazaar. The City District Government will be responsible for instructing and managing the hawkers in these newly defined zones.

16.5 Proposal for Parking Plaza

Proposal for structured parking facility is not new to Tariq Road. It has been previously incorporated in the commercialization plans outlined for the area. The facility was planned within the premises of Jheel Park. However, plans to convert the entire park into a massive parking area are abandoned. Instead, a parking plaza is proposed to be constructed within a relatively small portion of the park. This will ensure that the integrity of the park is maintained for maximum public use [Figure-15, 16 & 17].

It can be safely said that by re-organizing traffic and creating appropriate room for pedestrian spaces and providing desirable number of parking stalls, reasonable upgradation in the shopping environment can be achieved.

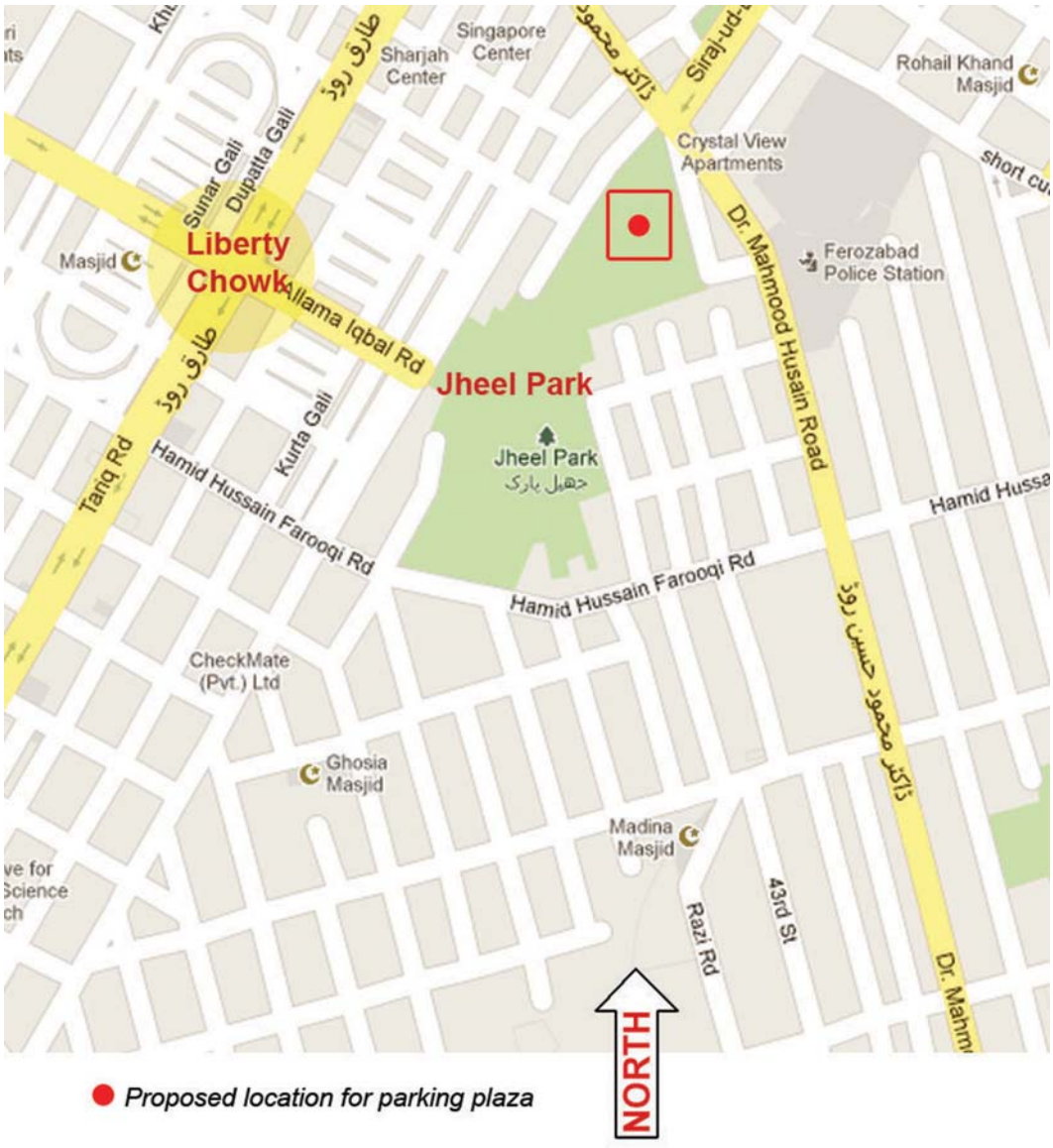

Figure-15: Area proposed for the construction of parking plaza.

Figure-16: Existing view of Tariq road.

Figure-17: Proposed view of Tariq road.

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BOOK REVIEW

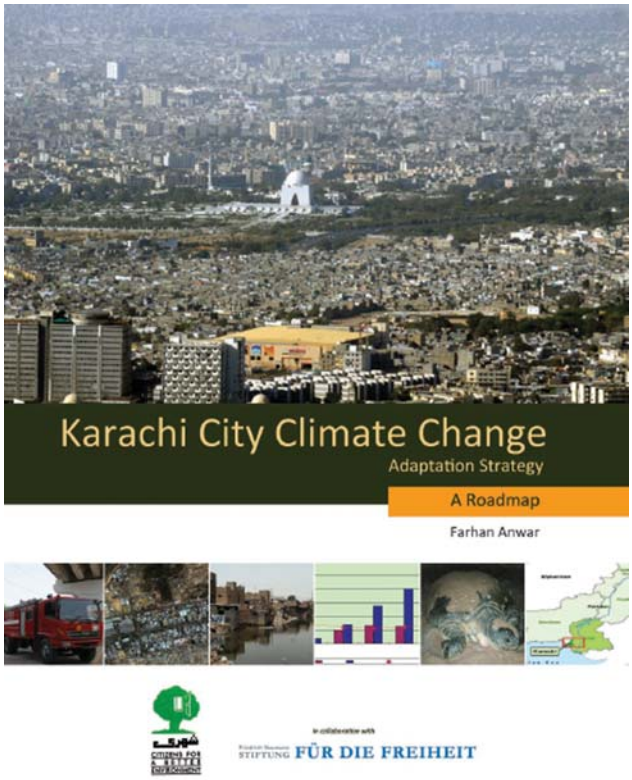
KARACHI CITY CLIMATE CHANGE – ADAPTATION STRATEGY A ROADMAP

Farhan Anwar*

A Review by
Sami Chohan, Lecturer Department of Architecture and Planning, NED University of Engineering & Technology, Karachi.

The global climate is changing. The world is becoming warmer and warmer. Extreme weather conditions are now becoming a norm as we move further into the 21st century. Increase in tropical cyclones, heavy rains, rising sea levels, flooding and extended periods of drought stand testimony to this. It is now widely accepted that the phenomenon of urbanization - cradled by the age of industrialization - has significantly contributed to rapid changes in weather patterns across the world. It is also widely accepted that certain detrimental impacts and consequences of such rapid changes may eventually become irreparable.

Today, as the world is witnessing unprecedented levels of urbanization, efforts to meet the challenges of climate change are gaining momentum throughout the developed world. However, as pointed out in the *report* authored by Farhan Anwar, a leading figure in the discipline of urban and regional planning in Pakistan, more than 90% of the global urban population growth is cropping up within developing countries. As it stands, these countries now account for nearly three-quarters of the global urban population. Ominously, the *report* further reveals that it is precisely the developing countries which are least equipped to adapt to the possible impacts and consequences of climate change. Pakistan is one of these countries. With almost half the population expected to reside in urban areas by the year 2030, Pakistan is gearing up to display the highest level of urbanization in South East Asia. When placed in context of climate change, such staggering figures are bound to surface new and multifaceted urban development challenges across the country. Astoundingly or not, the *report* informs us that the official *Climate Change Policy* for Pakistan does not take into account the intricacies of the urban framework in meeting the challenges of climate change.



Consequently, the *report* provides a much-needed roadmap for developing a more "comprehensive" climate change adaptation strategy. From the very outset, the *report* calls for the urgent need to integrate the various intricacies of the urban framework in order to effectively respond to the challenges of climate change. This meticulously crafted roadmap begins with identifying the various possible climate change scenarios confronting the city of Karachi - the largest and by far the most complex urban center of Pakistan. Within the context of urbanization along with political, social and financial shortcomings, it identifies the consequences of various possible climate change scenarios the city may

* Engineer / Urban Planner Farhan Anwar, Member SHEHRI.

encounter. In turn, critical people and assets at probable risk are also documented. Governmental, institutional and technological barriers standing in the way of enhancing the adaptive capacity of the city are discussed. At the end, a list of actions for strengthening the resilience of Karachi in context of urbanization and climate change are presented.

Supported by Shehri-CBE, a local Non-Governmental Organization, and Friedrich Naumann Stiftung, a foundation for liberal politics based in Germany, the publication is bound to stimulate further discourse on the subject. It also lays the foundation for initializing a process of developing comprehensive and effective climate change adaptation strategies for various other urban settings in the country.

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