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Evaluation of Environmental Factors in Midrise Apartments. A Case of Capital Square Building in B-17 Islamabad

¹Dr. Ar. Omer Shujat Bhatti, ²Ar. Rashid Ali Khan, ³Ar. Aleena Sohail, ⁴Ar. Fahad Khan

Article Details

ABSTRACT

Keywords: Urbanization, Midrise Apartments, Worldwide demand for shelter and housing has grown significantly because of fast Environmental Performance, Housing population increase and urbanization especially since more than 50% of people now live in cities. Urban areas benefit from the implementation of midrise and high-rise apartments as a housing shortage solution because they use advanced construction materials and vertical development. These building structures achieve space optimization but they ignore local environmental factors and socio-cultural needs which results in occupant dissatisfaction. This research examines the environmental performance of midrise residential buildings in Islamabad, Pakistan through Capital Square B-17 in Sector B-17 which shows rapid urban development to determine occupant satisfaction regarding building comfort and ventilation alongside lighting conditions and safety practices. The research utilized both questionnaires and observational studies with 120 occupant participants to establish substantial users feedback. Thermal comfort along with acoustics provided acceptable results but failed natural lighting and cross-ventilation and poor indoor air quality integration led to reduced living quality in the explored towers. These shortcomings in the residential units did not deter occupants from staying due to the lack of housing alternatives and lower rental expenses. The authors recommend constructing better ventilated windows and installing fire alarms along with improved evacuation layouts and improved common areas. Future apartment development plans need to adopt environmental and user-centered design principles to produce sustainable housing solutions for fast-growing urban areas of Pakistan.

Dr. Ar. Omer Shujat Bhatti

Associate Professor, Dept. of Architecture, School of Architecture & Planning, UMT Lahore. omer.shujat@umt.edu.pk

Ar. Rashid Ali Khan

Assistant Professor, Dept. of Architecture, School of Architecture & Planning, UMT Lahore. rashid.ali@umt.edu.pk

Ar. Aleena Sohail

Lecturer, Department of Architecture, School of Architecture & Planning University of Management & Technology, Lahore. aleena.sohail@umt.edu.pk

Ar. Fahad Khan

Lecturer, Department of Architecture, School of Architecture & Planning University of Management & Technology, Lahore. ar.fahadkhan23@gmail.com

INTRODUCTION

Urbanization and expansion of population all across world has created shortage for land, food, shelter and housing. The cities are expanding and people were bound to move to cities for better livelihood opportunities including jobs, business, education, healthcare facilities, etc (Teo et al., 2018). This situation worldwide has created a lot of stress and pressure on the cities and urban centers since they have limited resources to cater for such large populations (Iqbal et al., 2023). It was observed 50 % of the world population started living in cities and urbanized areas since 2008. By 2020 this figure has passed 70% and is increasing. Hence cities are in great pressure to cater for these people (Lepkova et al., 2016).

In order to address these issues associated with urbanization and population increase, shelter and housing is a major aspect which needs to be taken care of. It has been observed in many countries including developed (i.e. USA, Japan, Germany, France, Italy, etc) and developing (India, Nepal, Taiwan, etc) that midrise and highrise building with small footprints and large occupancy areas have been a major source to resolve the issues of population shelter. These buildings are mainly categorized as apartments and dwelling units (Nguyen et al., 2018). Apartments have multiple units of similar types fulfilling the basic human needs of a house except they are not on ground floor and each floor has many units. This type of buildings became feasible after the industrial evolution and usage of advanced materials like concrete, steel and systems like post-lintel design of buildings (Khan et al., 2024). This evolutionary type of building not only was conceived for house dwellers but was also became accessible and usable for the other forms of buildings like offices, educational institutions, hospitals etc (Smrke et al., 2018). The design evolution has ever been since kept evolving and with limited footprint and extensively large area to serve the population, became a world acceptable option in almost every part of the world (Akadiri et al., 2012).

Pakistan is a developing country with one of the most populated country in South Asia. It has a diverse landscape of cities and regions with four seasons and multiple nations and historical back grounds through historical timelines (N. Ahmed et al., 2024). With rise in population, initially all major cities of Pakistan expanded but this phenomena lead to need of large scale infrastructure needs for water, sanitation, housing, shelter, roads, etc. It was then observed that in large scale cities like Karachi, Lahore, Peshawar, Rawalpindi, Multan, Faisalabad, etc this expansion is not feasible to manage large scale population through city

expansion. Same was applicable to one of the planned Capital cities of the world i.e. Islamabad (James, 2008). It is also under great stress to manage the large influx of population and providing shelter and housing to its people. As a result, it has been observed that planners and governmental bodies have opted for cities to have midrise and highrise buildings cater for this large scale urbanization and population needs. Since these planning and design configurations have been based on the perception and design considerations of the modern world, hence the aspects of local people and context were mainly missing (Giyasov, 2018).

As a result, since these buildings are developing and getting constructed in all major parts of the cities, there was a need to explore the people's perspective about these buildings and how far these have been able to satisfy their needs of shelter and protection (Bhatti et al., 2025). One of the major missing area not been explored in the local context was the evaluation of environmental factors i.e. sunlight, lighting, cross ventilation, humidity, indoor air quality, safety, accessibility, etc (Smrke et al., 2018). As a result it was need of the hour to explore these aspects and devise design considerations keeping inline the needs of the people (Zalejska-Jonsson, 2013).

Islamabad is one of the most fast expanding city of Pakistan. It was designed in an iron grid pattern as a planned Capital city of Pakistan. B-17 is one of the modern new sectors of the city going through fast expansion, development and construction phase (Bhatti et al., 2024). Capital Square is a recent housing apartments based multipurpose project developed and has mainly been occupied in recent time. With almost 10 floors dedicated for apartments and dwelling out of 15, it is one of the most recent development in the city. Hence it was an ideal case to be used as a sample to gather data for the research exploration.

Due to high rate of urbanization and rapid increase of population in cities and urban centers, there is a shortage of shelter and housing for the people all across the developing and developed countries. Pakistan is no exception with Islamabad as the capital city of the country. Since midrise buildings are one of the best solutions to these housing and population issue, they are getting developed all across the expanding sites of the city. There was need to explore the environmental aspects of the people living in these buildings to keep these buildings more livable and focus on the local climatic and environmental conditions to baseline the factors which could better contribute to the environmental issues faced by these occupants.

The research carried out with following major research objectives:

1. To document the existing environmental conditions of environmental variables including natural lighting, cross ventilation, humidity, indoor air quality, safety, accessibility and their impact on satisfaction of occupants in current conditions?
2. To document the major causes of building immediate occupancy and its environmental impact on the occupants?
3. To propose recommendations which can address these issues to achieve improved user satisfaction.

With lacking focus on the environmental parameters and reviewing only the economic aspects for building midrise apartments and settlements have resulted in people bound to occupy these units but were mainly unsatisfied due to poor environmental considerations in the local context of Islamabad. These buildings in future will be major solution to higher urbanization and large scale population issues, hence there was a need to explore the environmental issues faced by people living in these apartments to identify the major ones and then devise strategies and design interventions that could be proposed to address these issues for sustainable usage of these buildings in future.

REVIEW OF LITERATURE

UNDERSTANDING THE CONCEPT OF HOUSING

The construction of residential shelters through housing serves as a fundamental social issue that creates usable living spaces including houses and other housing types under government management (Gillem et al., 2005). The construction industry supports economic development substantially because it makes up 10–20% of total economy activity and houses constitute the biggest value of rooms in residential ownership and mirror societal welfare through comfort requirements and cost-effectiveness and environmental regulations. The field of economics holds no consistent understanding of housing since different scholars including Smith (1776) describe it as a commodity and Ricardo (1817) considers it tangible while Jevons (1871) sees it as a fixed asset and Marshall (1890) characterizes it as capital or commodity based on use and Torgersen (1987) describes it as a "wobbly pillar under the welfare state" because of minimal state involvement when compared to health and education (Grimes & Orville, 1976; Torgersen, 1987). Housing definitions gradually adapted to socio-economic development patterns according to Webster's and Business Dictionary and Macmillan who describe housing as spaces where people dwell under legal regulations (Islam, 2012).

CLASSIFICATION OF HOUSES

Major form of housing classification is shown below in the Table 01

TABLE 01: HOUSING CLASSIFICATION

Type of housing classification	Characteristics
By housing type	Room in the apartment Apartment in multi-apartment residential building or non-residential building Multi-apartment residential building Family house Other
By housing size	One room One-room apartment Two-room apartment Three-room apartment, and more Family house Other
By housing amenities	Housing with all amenities. Housing with part of amenities Housing without amenities
By housing location	Housing in a city Housing in rural territory
By group of population living in the housing	Any resident Persons with low-income or other social group at risk
By type of housing ownership rights	State-owned housing Municipality-owned housing Natural person's owned housing Legal person's owned housing Other
By construction period of the housing	Housing build before World War II Housing built from 1945 to 1990 Housing built from 1990 until now
By energy efficiency indicators of housing	Minimum regulatory energy performance level allowed for new buildings Minimum regulatory energy performance level allowed for reconstructed or renovated buildings Almost zero energy consumption housing Other
By construction materials used in the exterior wall of the housing	Brick wall Wood Brick/panel Reinforced concrete / concrete Lightweight concrete Wood/masonry Other.

Source: (Inita Henilane,2016)

An apartment (also known as a flat) represents a standalone housing unit found within an extended building which has dedicated spaces for cooking, bathing, and entering the unit. The terminology for these units differs across regions where Americans call them apartments but

British residents use the term flat. However, the definitions may vary depending on architectural structure and local setting (Marmot, 1983; Piyush et al., 2016; Jabeen et al., 2015). Apartment buildings known as blocks of flats or residential towers serve as structures which accommodate many dwelling units from low to high rise buildings while offering mixed-use rooms such as shops and offices (Talpur et al., 2016). The definitions of flat versus apartment depend on building design and regional preferences as well as construction age while technical improvements like elevators and steel reinforcement made possible the evolution into high-rise apartments (Natasha et al., 2009).

PAKISTAN – HOUSING ISSUES AND CURRENT STATE

Rapid urbanization and population increase in Pakistan has created a massive shortage of homes since the available supply cannot satisfy the overwhelming demand (A. Ahmed, 2015). Apart from the 1987 National Housing Authority and the 2001 National Housing Policy establishment Pakistan has not made enough progress because of resource limitations (Mahar et al., 2019).

The housing system in Pakistan combines three main structures: pukka (permanent housing), katchi (temporary shelters) and semi-pukka (mixed construction). However, katchi abadis (slums) control most urban areas present in Pakistan (Shaikh et al., 2019). The 2005 earthquake together with the 2010 floods escalated the housing deficit by ravaging millions of homes while triggering emergency resettlement operations (Economics, 2018). The housing deficit continues to grow due to urbanization because low-income groups need 350,000 new units annually but formal supply falls short of meeting half the required demand. Katchi abadis together with illegal agricultural land subdivisions occupy this unmet demand (Malik et al., 2018). The combination of high land prices along with city center remoteness drives informal settlements to overbuild their properties which results in smaller homes with heavy overcrowding (Arif & Hamza, 2018). The situation has worsened to the point where inhabitants require public areas for sleeping which was previously unknown in Pakistan's urban areas (Fariha et al., 2018). House improvement loans together with technical guidance need to be provided to residents along with informal developers and contractors who pursue densification while existing credit facilities through banks and the House Building Finance Company Limited (HBFCL) fail to meet the required demand to address the 8.5 million housing backlog that grows by 200,000 units every year (Kumar, 2011). An annual ten-year budget of 100 billion Pakistani rupees exceeds significantly the 2017–18 budget allocation of 2.329 billion rupees for the

program to work effectively (Salman et al., 2018). Private company management of utilities and solid waste operations alongside toll road fees requires enhanced state regulations to reduce expenses and minimize exclusions that burden poor communities. The housing crisis in Pakistan will intensify because the nation lacks integrated reforms in financing and urban governance and policy systems. (Siddiqui & Mehfooz, 2017).

ISLAMABAD, CAPITAL CITY OF PAKISTAN – HOUSING ISSUES AND CURRENT STATE

Just like Pakistan as a whole, Islamabad the Capital city of Pakistan is no exception. It is also under sever stress to built more units for existing population and the upcoming ones as well. Total area of Islamabad is 906 SqKm in which 440.3 SqKm in Urban and remaining is rural. As per Capital Development Authority (CDA), Islamabad has existing 75,000 units while the existing demand was 125,000 units with an additional demand per year of 4,000 units (CDA,2008). Level of congestion in Islamabad is as per table 02 below:

TABLE 02: INDICES OF CONGESTION IN ISLAMABAD

Indices of Congestion in Islamabad		
Index	1980	1998
Persons per Housing Unit	5.7	6.2
Persons per Room	2.2	2.1
Rooms per Housing Unit	2.6	2.9
Housing Units with one Room (%)	23.5	16.0
Housing Units with 2-4 Rooms (%)	64.8	67.8
Housing Units with 5 or more Rooms (%)	11.6	16.1

Source: Population Censuses of Pakistan 1980 & 1998

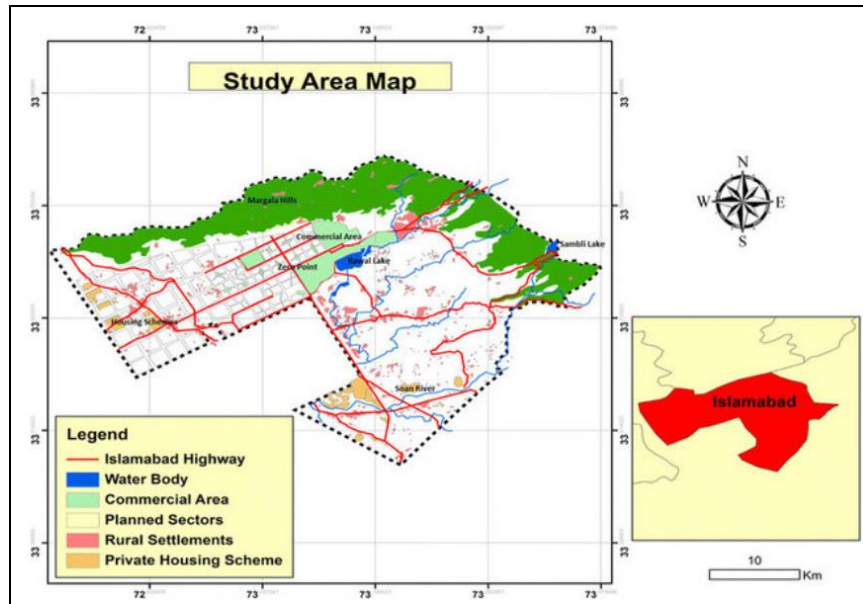


FIGURE 01: MAP OF ISLAMABAD WITH ITS MAJOR ZONING (SOURCE: ZEHRA ET AL, 2016)

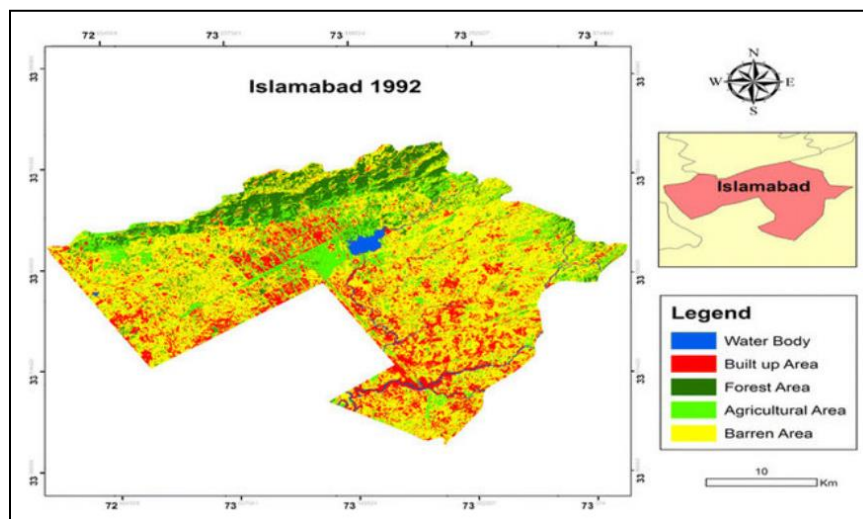


FIGURE 02: MAP OF ISLAMABAD WITH ITS MAJOR LAND FORMS IN 1992 (SOURCE: ZEHRA ET AL, 2016)

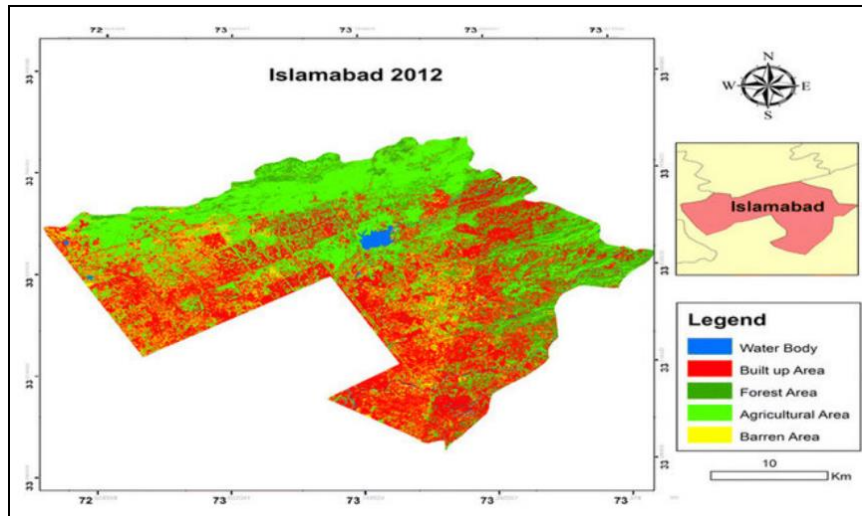


FIGURE 03: MAP OF ISLAMABAD WITH ITS MAJOR LAND FORMS IN 2012
(SOURCE: ZEHRA ET AL, 2016)

According to a recent research carried out by Zehra et al., 2016, In Islamabad city and its surroundings, change in land use has been observed and new developments (agriculture, commercial, industrial and urban) are emerging every day as shown above in the figure 01-03. Thus, the rationale of this study was to evaluate land use/cover changes in Islamabad from 1992 to 2012. Quantification of spatial and temporal dynamics of land use/cover changes was accomplished by using two satellite images, and classifying them via supervised classification algorithm and finally applying post-classification change detection technique in GIS. The increase was observed in agricultural area, built-up area and water body from 1992 to 2012. On the other hand forest and barren area followed a declining trend. The driving force behind this change was economic development, climate change and population growth. Rapid urbanization and deforestation resulted in a wide range of environmental impacts, including degraded habitat quality.

It is believed that improvement in the performance of residential buildings with regard to social, economic, and environmental sustainability will encourage a greater sense of responsibility and place a greater value on the welfare of future generations (Baig et al., 2019). According to Mateus and Bragança as well as Zhang et al., the development and application of building sustainability measurements and benchmarking methods are solutions that promote a more sustainably built environment. Ding argues that environmental building assessment methods significantly contribute to achieving the goal of sustainable development within

construction (Teasdale-St-Hilaire, 2013).

Hence the targeted variables for environmental evaluation through engagement of the occupants in the selected apartments of Islamabad mainly will include the following as per based on the study conducted by (Kim & Dear, 2013) as a baseline. These are:

1. Temperature.
2. Air quality.
3. Amount of light.
4. Visual comfort.
5. Noise level.
6. Sound privacy.
7. Amount of space.
8. Visual privacy.
9. Building cleanliness.
10. Building maintenance.

The evaluation was based on using these parameters through questionnaires using 5 point Likert scale and researcher's observational study to evaluate these parameters. The mechanism to conduct research, collect data, its analysis, inferences and research recommendations were further discussed in research methodology.

RESEARCH METHODOLOGY

The methodology for the research exploration primarily was based on the literature review and its exploration. It was devised through multiple exploration done during the review of the literature. In order to make it achievable, the research was broken further down to phases and steps to make each one a different and clear to devise actions to complete it. It was ensured that these parts were connected in a sequence to complete the process helping not only complements the other but also integrates the overall research target to be achieved in the most efficient and effective manner within the targeted timeline. It was important to devise the methodology to ensure these steps were followed as per devised and results may be gathered and compiled as per the requirement of the research exploration.

Therefore the overall project was broken down into these major requirements.

1. Devising a tool to collect data on the basis of the review of literature.
2. Documentation of the selected building and its multiple areas explored.

3. Data collection.
4. Data analysis.
5. Proposing design improvement measures and interventions.

In order to explore the user satisfaction of the apartment buildings with respect to the environmental parameters mentioned above, following steps were followed as shown below in the research design.

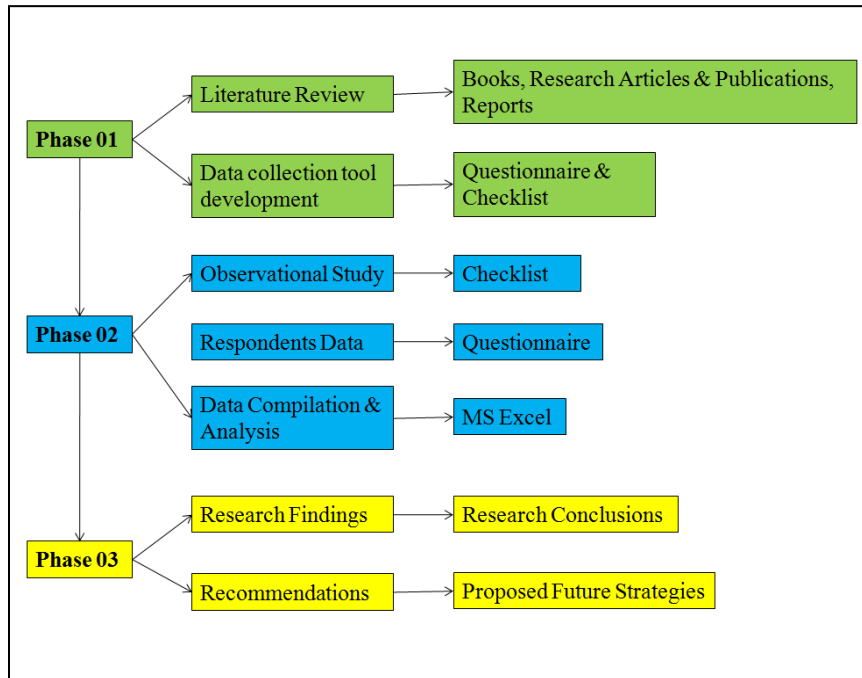


FIGURE 04: FLOW CHART

Targeted population of the research exploration mainly included the occupants and people living in the midrise apartment buildings within Pakistan. These apartment buildings were getting build all across the country in major cities and urban centers and hence the targeted population was very large extensive to cater far. Hence sampling technique was used to enable feasible research exploration. With keeping in view of the constraints of time budget and accessibility, selected floors of apartment buildings in a complex was selected to gather data from the occupants of the building. The data was collected once and was not repeated. In order to have a true representation of the population, sample size was optimized in the selected apartments to get maximum number of feedback from the users of the selected building. Sample size within the setting was 100 which represented almost 1/3 of the existing building complex. In order to proceed ahead with data collection from the selected building Convenient sampling was used as

a sampling technique to facilitate the occupants and the researcher since all occupants were not comfortable to share information and those who agreed were then further interviewed to gather data. For multiple phases, following below table shows the tools used:

TABLE 03: RESEARCH PHASE MULTIPLE TOOLS

S.No	Phase / Step / Tool	Description
1	Phase 01 – Step 01	Questionnaire development through Review of Literature
2	Phase 01 – Step 02	Photographs, Images, Manual Measuring scales, Autocad
3	Phase 02 – Step 01	Questionnaire
4	Phase 02 – Step 02	MS Excel for data compilation
5	Phase 02 – Step 03	MS Excel for data analysis and averages

DATA COLLECTION & ANALYSIS

The process of data collection got initiated with meeting the administration at the selected building & apartments in B17. The meeting with the administration was done in April, 2022. The meeting was held at the administration office set up in the apartments vicinity close to the water supply and central mosque facility. They were briefed about the projects as an academic activity and shared the ongoing tasks and work done so far.

Shared below is the location, context and overall accessibility of the selected building followed by observational study by researcher.

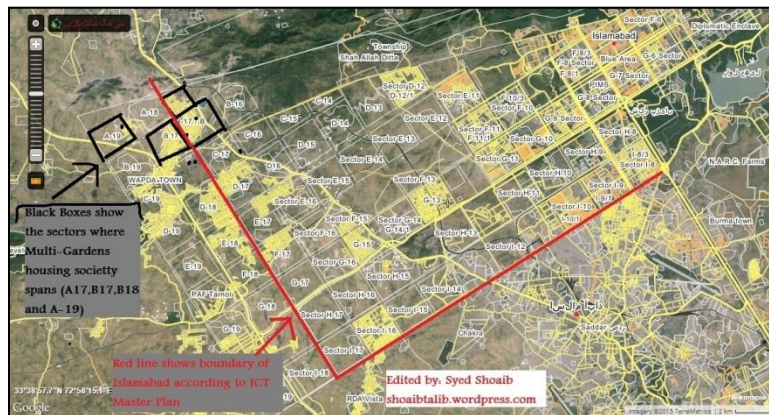


FIGURE 05: LOCATION OF SECTOR B-17 IN ISLAMABAD

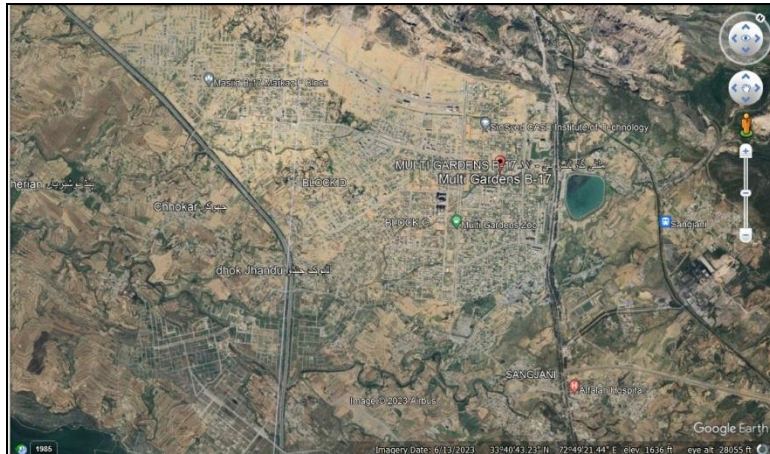


FIGURE 06: SECTOR B-17 WITH HOUSING SECTORS & UNITS

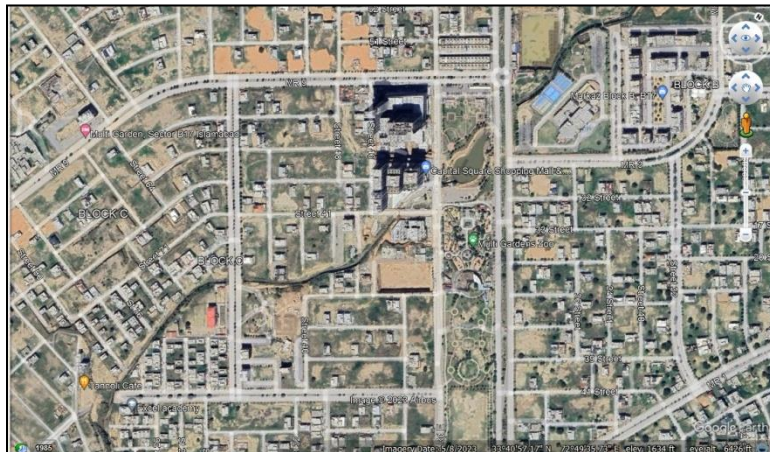


FIGURE 07: LOCATION OF THE SELECTED BUILDING IN THE MAIN MARKAZ / CENTER OF SECTOR B17

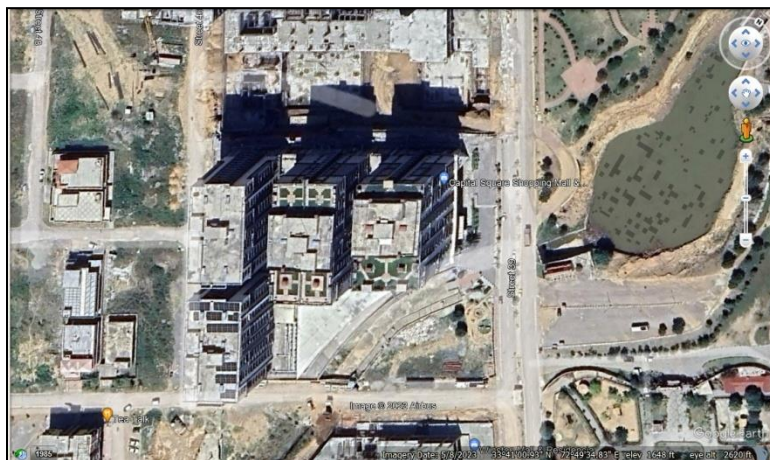


FIGURE 08: MAJOR FOUR APARTMENTS BLOCKS ALONG WITH CAPITAL SQUARE MALL



FIGURE 09: PERSPECTIVE VIEW OF BUILDING COMPLEX (COURTESY, SUNSHINE MARKETING, 2022)



FIGURE 10: PERSPECTIVE VIEW OF BUILDING COMPLEX (COURTESY, SUNSHINE MARKETING, 2022)



FIGURE 11; OUTDOOR SITTING AND OPEN SPACES



FIGURE 12: CENTRAL PASSAGE

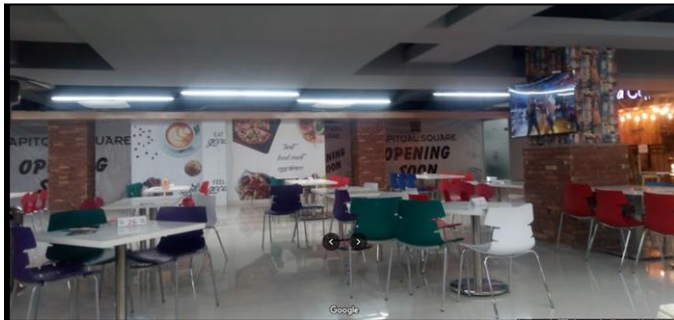


FIGURE 13: INDOOR CAFETERIA

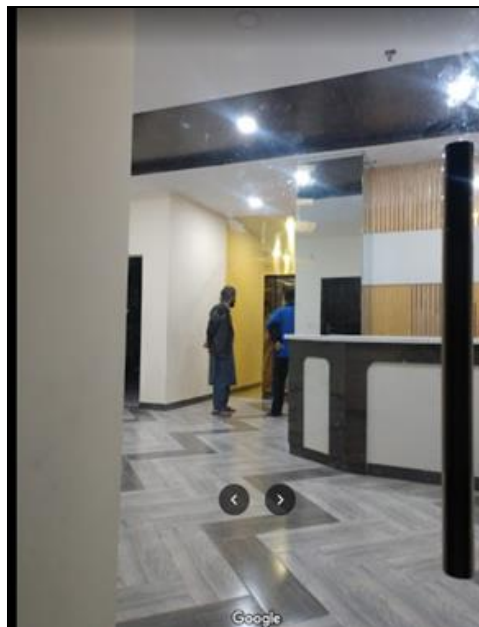


FIGURE 14: CORRIDOR LOBBY TO THE APARTMENTS AND LIFT AREA



FIGURE 15: INTERIOR OF A ROOM WITH ATTACHED BATH AND DRESS NEXT TO MAIN WINDOW – TYPICAL APARTMENTS LAYOUT CONFIGURATION WAS FOLLOWED



FIGURE 16: INTERIOR OF A ROOM WITH ATTACHED BATH AND DRESS NEXT TO MAIN WINDOW – TYPICAL APARTMENTS LAYOUT CONFIGURATION WITH ACCESS DOOR VIEW



FIGURE 17: INDOOR OPEN KITCHEN SPACE



FIGURE 18: MAIN CENTRAL LIVING SPACE OF THE APARTMENT FROM ACCESS CORRIDOR



FIGURE 19: AN INSIDE PICTURE OF AN EMPTY ROOM TO BE OCCUPIED

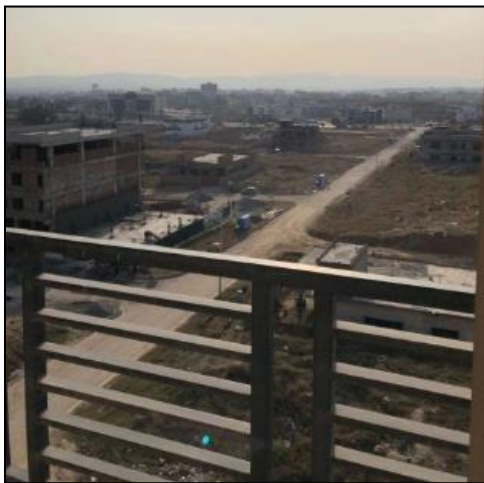


FIGURE 20: VIEW FROM TERRACE AT 6TH FLOOR



FIGURE 21: CENTRAL LIVING SPACE OPENS UP INTO TWO ROOMS - TYPICAL

FLOOR PLAN



FIGURE 22: WASHROOM INTERIOR

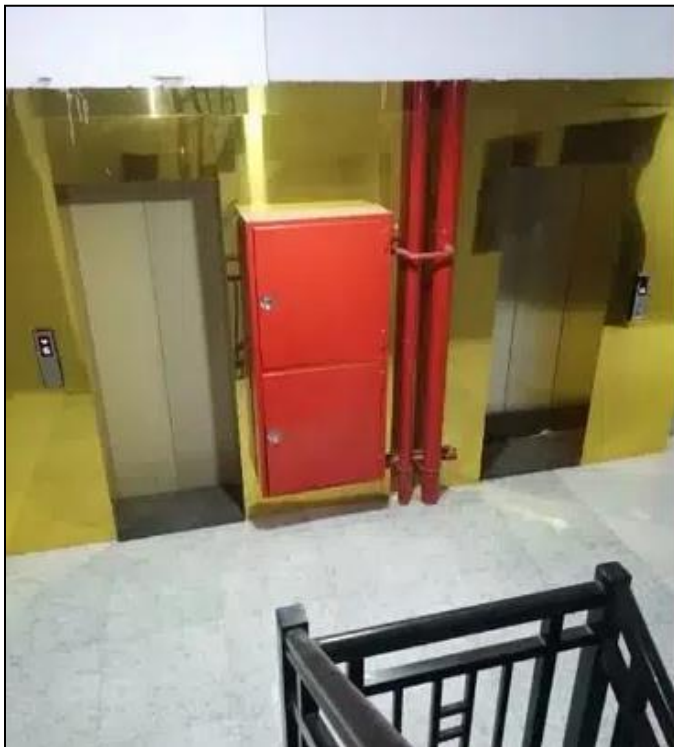


FIGURE 23: CENTRAL CORRIDOR LIFT CORE AND SERVICES CORE



FIGURE 24: VIEW FROM TOP FLOOR TERRACE

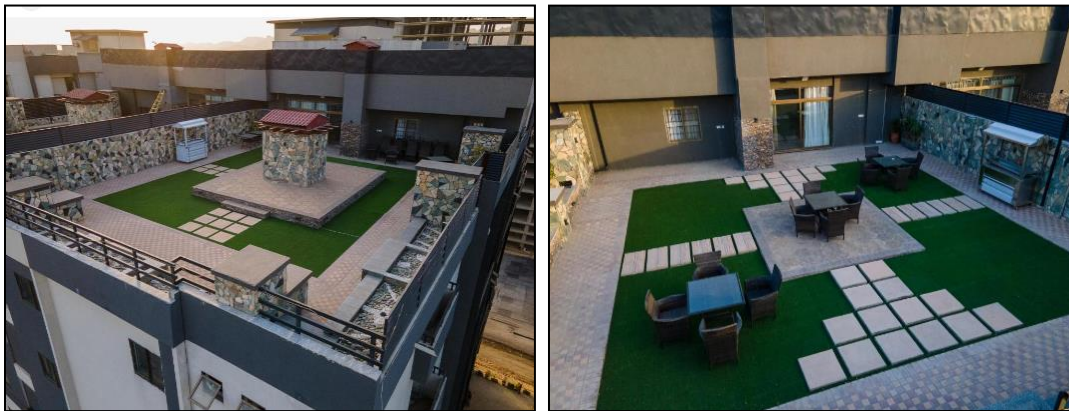


FIGURE 25: ROOF TOP VIEW

As per the observational study and the site visit, it was evident that the selected building lies at the centre of the main Markaz of the sector B17. The site was accessible from multiple roads and has extensive road network along the three sides and different accessible routes were provided for inlet and exit of the vehicles for parking as well as drop points were provided. There was ample parking available with respect to the mall, however the number of parking in the basement available for apartments were less as compared to the applicable standard defined by the Capital Development Authority (CDA) within the premises of Islamabad.

The main Apartments for access through staircase as well as lift from the multiple floor basement and ones in the main corridor, these have multiple staircase and apartments along with all the apartments based floors flows which starts from the third floor onwards upside. During the visit multiple blocks as well as multiple floors were explored an observational study along

with photography was done in the similar way as the questionnaire was filled from multiple respondents on all of these observational floors and apartments. One respondent from the administration always accompanied the researcher to ensure that data collection follows the strict defined protocols as per defined / allowed by the administration and hence limited scale photography was done during the observational study as well data collection. Respondents data collection is shared in the next section.

Based on the observational study it was clear that the buildings was well managed and maintained yet the environmental variables associated with cross ventilation as well as natural light were not majorly address in the design of the building. However allied parameters of noise and hygiene were kept intact and were found to be comparatively better managed as compared to observational study done by the researcher in allied or similar apartment buildings previously. Keeping in line with the process defined and the followed research methodology, respondents data collection was initiated along the way with the observational study to manage the time and accessibility to the respondents and the endusers of the multiple blocks of apartment buildings. Collected data along with observational study from multiple blocks and floors is tabulated along and shared below:

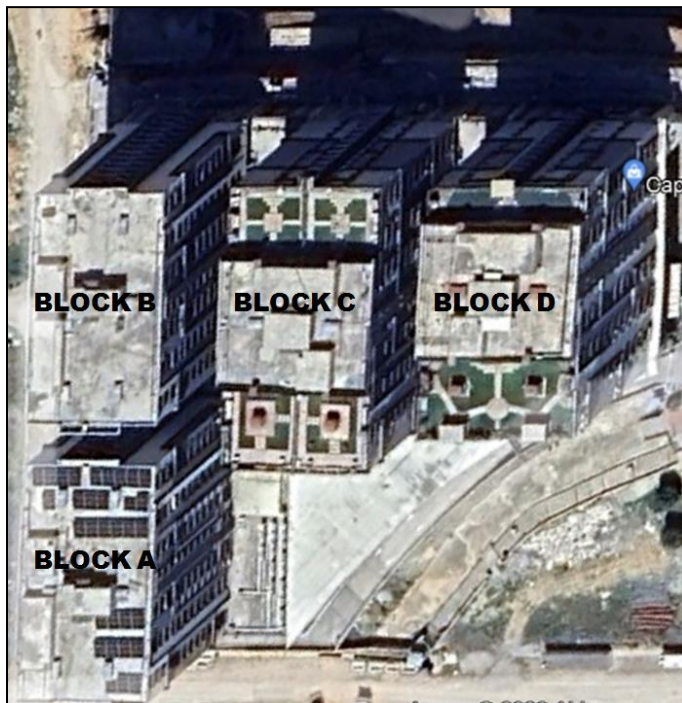


FIGURE 26: BLOCK WISE DISTRIBUTION FOR DATA COLLECTION EASE

TABLE 04: BASIC DEMOGRAPHICS

	Block A	Block B	Block C	Block D	G. Total
Male	22	24	21	26	93
Female	3	8	12	4	27
Total	25	32	33	30	120

As shown above in the table 04, all four blocks were visited along with multiple floors and the sample count was 120 with 93 Males (77%) while 27 females. Each one person represented one family. Average family size ranged between 5-7 while average age of the respondents ranged mainly between 24-38. Based on the respondents data, following major information was extracted. Thermal comfort and air quality were mainly marked neutral, lighting fall into highly unsatisfactory range, acoustics was found to be in satisfied range, internal layout varied between unsatisfaction to neutral, furnishing and flexibility of usage fall into neutral to unsatisfaction and same was for the cleanliness and maintenance. Overall it was found to be in the satisfaction range for respondents with respect to environmental variables explored.

The detailed analysis with respect to each variable is shown below:

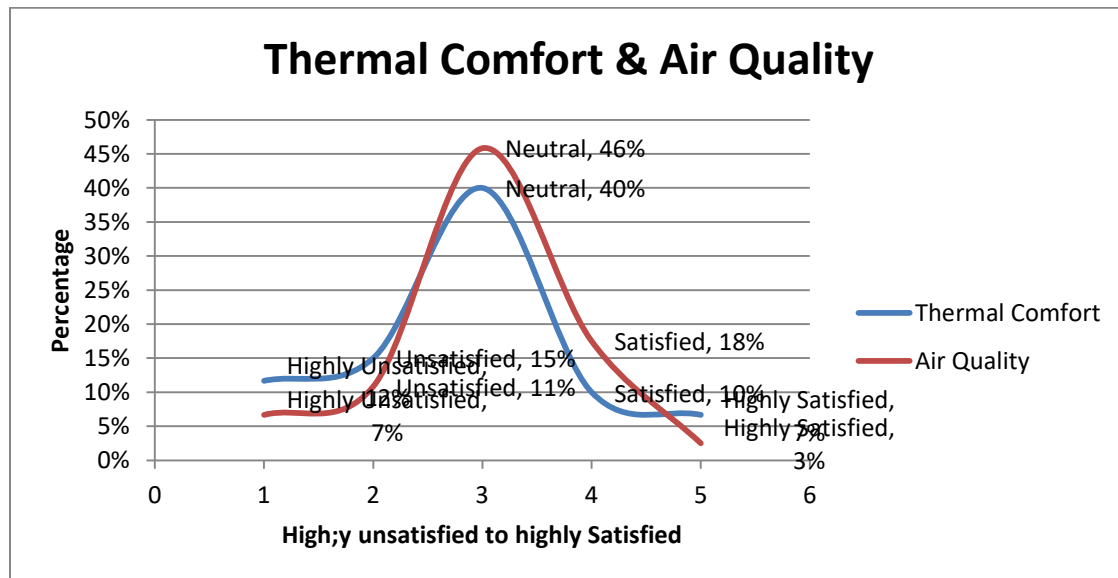


FIGURE 27: THERMAL COMFORT & AIR QUALITY

As shown above in figure 27, the overall bell curve of data distribution shows that both variables fall into satisfaction category as per responded by the end users. With addition of height to these apartments and helping managing cross ventilation through openings on all inside and outside walls enabled better thermal comfort and air quality through enhanced ventilation.

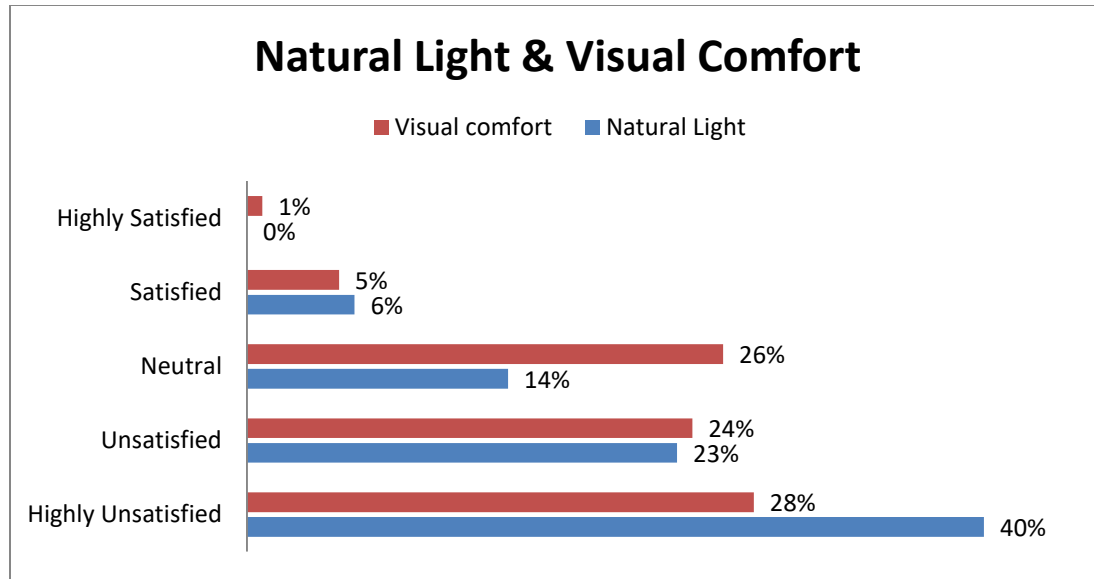


FIGURE 28: NATURAL LIGHTING & VISUAL COMFORT

As evident from the figure 28 above, natural light and visual comfort was mainly into the highly unsatisfied range. One of the key factors was the poor and small size of the openings and their orientation as well. The basic thumb rule for apartment room of 1/4th of the total room space to be dedicated for openings to light were not followed.

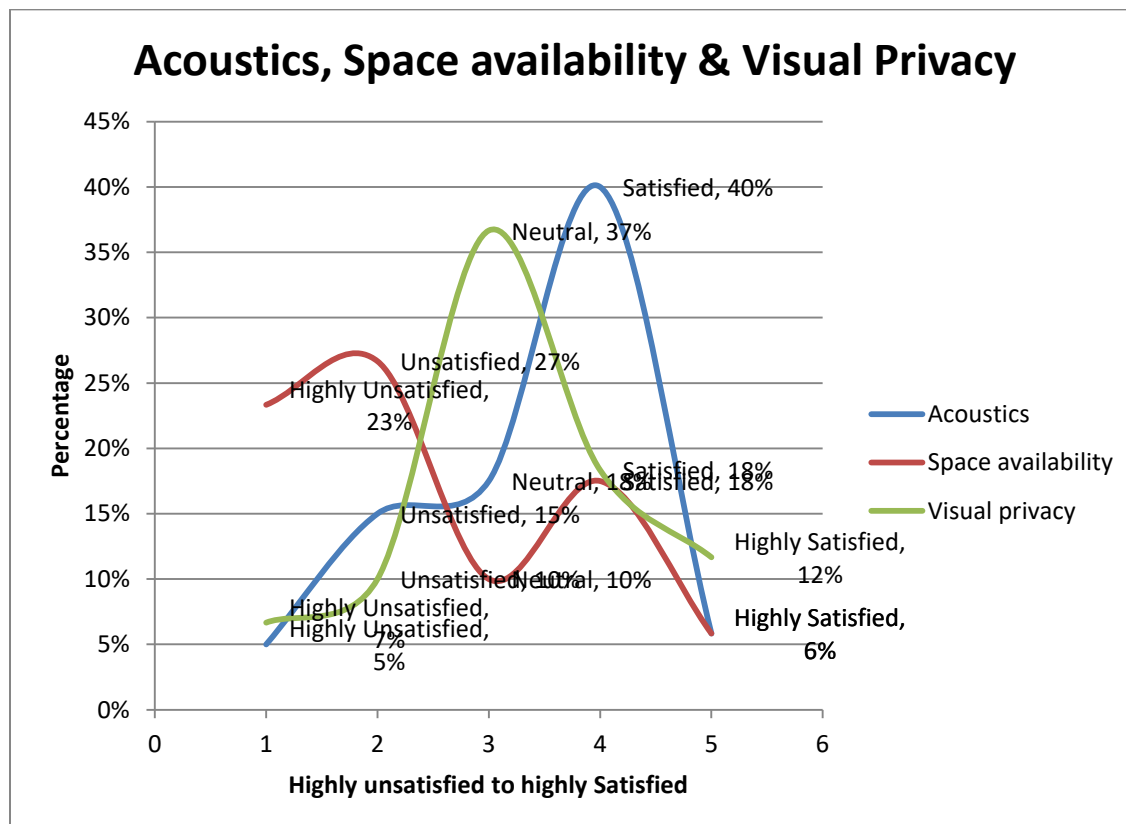
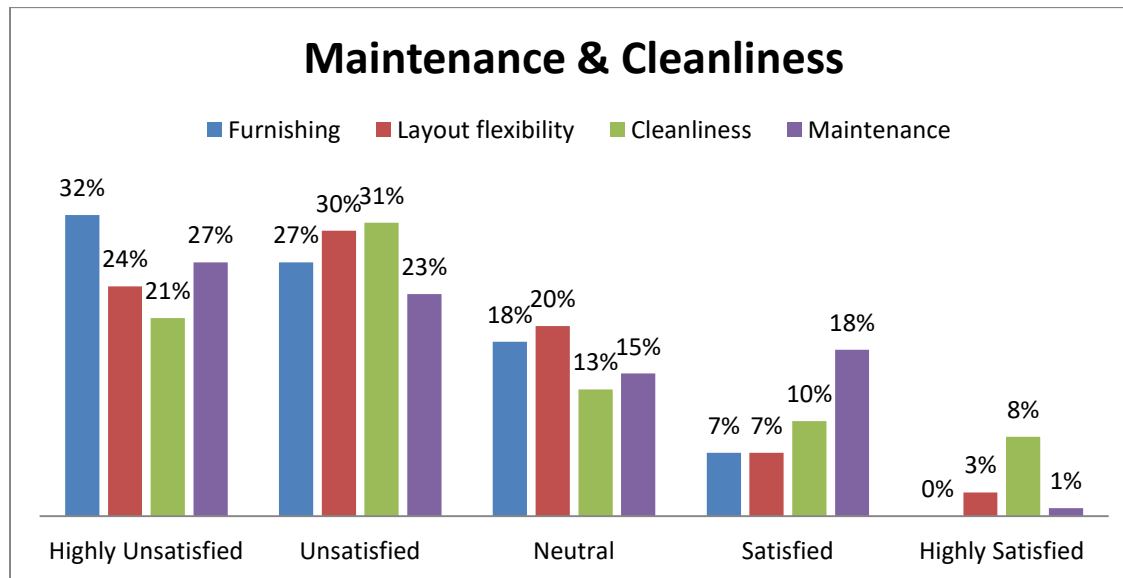


FIGURE 29: ACOUSTICS, SPACE AVAILABILITY & VISUAL PRIVACY

As shown above in the figure 29, three variables explored included Acoustics, Space availability and visual privacy. Acoustics ranked higher amongst the three with mainly falling into the Satisfaction range followed by visual privacy with neutral values. However, spatial availability had two peaks with higher peak mainly into the Unsatisfaction range while other peak was towards satisfaction. Here the data dispersion was mainly caused due to lack of perception of space amongst the endusers. For some of the sample, considering an apartment building it was ample to have rooms with standard applicable sizes while those who have been living in houses and have shifted to apartments have completely different and opposite opinion towards space availability being too less and uncomfortable.

**FIGURE 30: MAINTENANCE & CLEANLINESS**

As shown in figure 30, four aspects were explored i.e. furnishing capability, layout flexibility, cleanliness and overall maintenance of the facility. Furnishing mainly fall into highly unsatisfaction category with 32%, layout flexibility with unsatisfaction category, cleanliness into unsatisfaction category and overall maintenance also into highly unsatisfactory category. These issues clearly show that overall design lacked the integral operational component at the design stage and later was not followed up by the operation and management team.



FIGURE 31: OVERALL SATISFACTION

As shown in the above figure 31, the overall satisfaction with respect to the end users data for environmental variables had two peaks with Unsatisfied 27%, 23% highly unsatisfied and 18% satisfied. This clearly show that people though have been able to occupy the space and apartments, yet their quality of life and environment is not up to desired standard.

DISCUSSION

As shared above based on the respondents data as well as observational study, environmental variables explored have not been highly ranked by the end users of the buildings and the respondents. It highlighted concern related to the second objective of the study that since thin building was not that much environmental friendly, why it got occupied is very less time and is still extensively occupied on almost all the major floors visited. One question with open ended discussion based answer was kept in the questionnaire for this purpose. The response varied from multiple respondents but there were mainly three reasons. One of the most critical reason that was reported by the respondents that when the building was allowed to be occupied, it was one of the very few buildings in the sector B-17 to get occupied with respect to available apartments as well as built houses in its context. Hence it was one of the only options that people had back at that time to make a choice for since optimizing the space available towards utilization in the form of true occupancy in the selected building.

With respect to higher occupancy, it was also observed that most of the apartments were rented out and were not mainly used by the owners of the apartments. This also highlighted that

these apartments though have higher occupancy rate yet most of their owners don't live there and the ratio of owners living in these apartments was comparatively low while exploring or discussing with the respondents. Another major reason which was observed by the researcher towards choices of dwelling or shelter in sector B-17 was the rent of the space. Apartment was always a better choice as compared to a house portion or complete house which are almost twice the cost of the apartment rent. Apartments with respect to build houses have lower rent as compared to other built houses in the local context of the markaz. As a result, people preferred to opt for a cost effective solution and since not many houses or cost effective rentable spaces were available these apartments got occupied immediately.

A few of the respondents did also responded that since they have already lived in apartment buildings developed by the same builder who built this building has the new that the quality of the work will not be compromised enhance the overall quality of life or space would be sufficient enough for immediate occupancy. With reference to the impacts that the end users face because of immediate occupancy, following major observations have been reported by the respondents. It was reported that initially they do face issues of vertical movement because of the poor maintenance of the lift system. It was also reported that initially availability of basic amenities as well as medical or allied facilitation in the markaz was missing. Hence people have to move out from the main building and the markaz of other sectors and sub-sectors of Islamabad city to get medicated or avail medical attention in different times. With immediate occupancy, the issues associated with having apartment floor space shared along with other apartment did created privacy issues for those who previously have been living in either house portion or separate houses. Though these issues were not of significant impact to the life of the people living in the apartments but it is important to understand that these missing availability of the key amenities reduces quality of life and their missing could lead to poor satisfaction of the apartment and the dwelling itself

Based on the observational study, some of the major factors of environmental variables which were not part of the design included poor lighting, indoor air quality, cross ventilation, as well as thermal comfort. Based on the respondents data, it was evident that observational study and respondents data correlated and most of the environmental variables were either ignored or poorly incorporated into the design of the apartment buildings. It can be concluded that these environmental factors or variables need to be enhanced with respect to the user satisfaction so

that these occupied apartments could have better quality of life in the long run for the end users. Along with the explored, variables other aspects which have been highlighted or observed which need attention included planning emergency evacuation, disaster management, waste management and overall first aid facility available to the end users.

RESEARCH FINDINGS

With the help of literature review and historical data, the overall design of the apartments were explored with respect to the environmental parameters. Later using onsite observational studies, data collection from respondents living in these apartments and data analysis of the gathered data helped in evaluation of the environmental performance of the building with respect to thermal comfort, air quality, lighting, noise, overall cleanliness, maintenance and allied occupancy issues.

Occupants perceptions about the environmental variables were explored using the data collected from questionnaires. These parameters were briefed to the respondents and later their data was collected. The overall analysis showed that the people have good understanding of most of the environmental variables since they are exposed to them and have concerns / issues associated with them. Immediate occupancy issues were also reported. With the help of proposed recommendations, better users satisfaction could be achieved as shared ahead.

RESEARCH CONCLUSIONS

Following were the major conclusions of the research exploration:

1. Sample size was 120 with 77% male representation.
2. All four blocks were explored with reference to the selected environmental variables at multiple floors.
3. Thermal comfort and cross ventilation was found to be in satisfactory range.
4. Natural lighting and visual comfort was missing.
5. Acoustics in the apartment was also in satisfactory range.
6. Internal layout and its allied environmental aspects were in the partial satisfaction range or neutral range.
7. Same was the case for cleanliness and maintenance.
8. Overall environmental variables were either completely ignored or partially integrated in the design.
9. It resulted in poor satisfaction of the end users and the respondents.

10. Yet the building with multiple apartment blocks and floors was mostly occupied during research exploration which raised the concerns towards its occupancy.
11. Once explored, multiple reasons were identified which contributed to its higher occupancy rate.
12. While it allowed occupancy, no other major apartment building was available or ready for occupancy.
13. There were very less completed houses or house portions, hence people opted for it.
14. Apart from the above two major reasons, one of the economic factor was the comparatively lower rent of an apartment as compared to a single house or portion of a house in sector B17.

RECOMMENDATIONS

All major windows height and depth should be increased. Make all the windows open-able to allow natural light and ventilation. Windows opening in central corridors need to have frosted sheet installed but can be from floor level to lintel level beam.

All terraces must have higher height grills. They are a major threat to any one unable to stand heights and may topple over. Allow portions of the roof to be used for common apartments owners since they are only available for roof top suites. Develop dedicated evacuation plans and opt for drills. There was also no fire detection system deployed inside of the apartments, it should be provided. Enhanced the cross ventilation and provide mechanical means where necessary.

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