Breathing Spaces: Environmental & User Experience in Dhanmondi and Zigatola Multistoried Apartments, Dhaka, Bangladesh

Kowshik Ahmed*

Lecturer Department of Architecture, Southeast University, Bangladesh

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ABSTRACT

Dhaka's vertical housing boom has transformed everyday living, often at the expense of comfort and environmental quality. This study compares multistoried apartments in Dhanmondi's planned urban fabric with those in Zigatola's denser, organically developed context to understand how building orientation, height, and breathing spaces shape both indoor environments and resident well-being. Six units across varying floor levels and cardinal directions were examined through on-site temperature, humidity, and daylight measurements alongside resident surveys. Results reveal that open surroundings and generous inter-building spaces improve airflow, stabilize humidity, enhance daylight access, and lower cooling dependency conditions strongly reflected in residents' comfort perceptions. In contrast, units with little or no openness suffer heat buildup, dampness, and higher utility costs, reinforcing discomfort. The findings highlight that breathing spaces are not mere visual reliefs but essential microclimatic regulators, directly influencing health, satisfaction, and energy efficiency in Dhaka's high-density apartments.

"Keywords": Multistoried apartments, Breathing spaces, Thermal comfort, Urban microclimate, User perception.

Dhaka's built environment has undergone a dramatic vertical transformation over the past three decades, reshaping not only its urban skyline but also its microclimatic conditions. Among its diverse neighborhoods, Dhanmondi a historically planned residential area presents a relatively organized urban morphology, while Zigatola, its immediate neighbor, embodies denser, organically evolved settlement patterns. Both now host clusters of multistoried apartment buildings where concerns over thermal comfort and indoor livability are intensifying.

In tropical megacities, indoor thermal comfort is influenced by a complex interaction of temperature, humidity, air movement, and solar radiation, moderated by residents' cultural and behavioral adaptations (Koenigsberger, Ingersoll, Mayhew, & Szokolay, 1975; Fergus Nicol, 2012). In Dhaka, dense urban development and a lack of green spaces have exacerbated the urban heat island effect, resulting in increased indoor heat and discomfort in residential areas (Tariq & Poerschke; Khatun, Khatun, & Hossen, 2020; Rahman & Islam, 2024; Tabassum, Park, Seo, Han, & Baik, 2024). Building morphology, orientation, and the presence of breathing spaces—the open voids between structures play a critical role in determining airflow, daylight penetration, and heat dissipation (Oke, 1988; Emmanuel, 2005; Ng, 2009).

Residents' comfort perception, however, extends beyond physical metrics. It integrates psychological and social dimensions (Altman, 1975) where visual openness, daylight, and ventilation contribute to well-being (Woo, et al., 2021). In Dhaka, contrasting approaches to urban development and plot layouts across planned and organically grown neighbourhoods provide a meaningful basis for comparative analysis in urban studies (Ahmed, Hasan, & Maniruzzaman, 2014) (Islam, 2019).

This study focuses on three apartment buildings in Dhanmondi and one in Zigatola, surveying two units in each to integrate quantitative environmental monitoring with qualitative user feedback. The aim is to investigate how localized differences in spatial context affect both thermal performance and perceived comfort—laying the groundwork for further research into the role of breathing spaces in Dhaka's vertical housing.

LITERATURE REVIEW

Thermal Comfort in Tropical Urban Housing

Thermal comfort in tropical housing is a function of both climatic variables and adaptive behaviors. The adaptive comfort model (de Dear & Brager, 1998) emphasizes residents' ability to adapt through clothing, behavior, and environmental control. However, in dense tropical cities, limited cross-ventilation and heat retention can constrain adaptation (Frontczak & Wargocki, 2011). Urban heat island effects, now well-documented in Dhaka, further intensify cooling demands (Rabbani, Rahman, & Islam, 2011)

Indoor Microclimate and Building Morphology

Urban form and building configuration significantly influence indoor microclimates. Studies in Asian megacities confirm that plot setbacks, building height ratios, and orientation affect heat gain, airflow, and daylight (Oke, 1988; Prianto & Depecker, 2003; Emmanuel & Steemers, 2018). In Dhaka, compact and tightly arranged residential layouts where open, breathable spaces are limited tend to diminish natural ventilation and exacerbate indoor heat, thereby compromising thermal comfort (Sinthia, 2024).

User Perception and Social Dimensions of Comfort

Comfort perception merges measurable parameters with subjective experience. Psychological factors such as visual access to the outdoors, perceived privacy, and connection to open spaces influence residents' well-being (Altman, 1975). In tropical climates, residents often perceive thermal comfort not just based on temperature but through adaptive behaviors like improving airflow, showing that comfort is shaped by both environment and lived experience (Gou, Gamage, Lau, & Lau, 2018).

Dhaka's Vertical Housing Context

The Bangladesh National Building Code (BNBC, 2020) outlines structural and safety guidelines for high-rise residential construction, but practical enforcement varies between neighborhoods. In Dhaka, the clear layouts of planned neighborhoods differ greatly from the narrow, irregular streets of organic areas, affecting airflow and outdoor comfort highlighting how urban design impacts the environment people experience.

METHODOLOGY

A comparative case study with a mixed-methods approach was adopted to analyze variations in thermal comfort and user experience between two zones, Dhanmondi and Zigatola. Three multistoried residential buildings (two in the Dhanmondi zone and one in the Zigatola zone) were selected to represent different heights, orientations, and inter-building spacing patterns. Six units across vertical levels (low, mid, top) and cardinal orientations were surveyed. To ensure reliable responses, only apartments where residents had lived for at least one year and no longer than five years were included, allowing them to experience a full annual cycle without becoming desensitized to long-term discomfort.

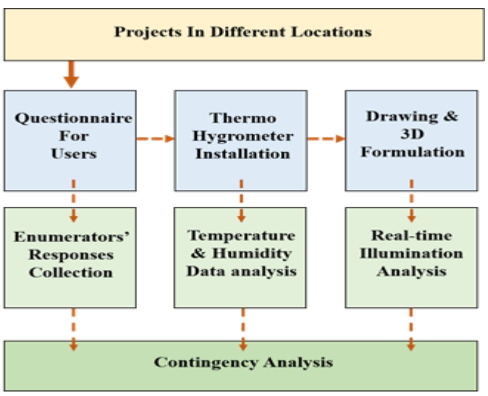

Figure 1: Analysis Methodology Diagram

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The study focused on a diverse range of Dhaka's residential settings, selecting only fully residential multistoried apartments to maintain consistency. Variation in construction period, materials, greenery, open space, and urban activity was considered to capture the city's complex microclimatic conditions. Indoor temperature and humidity were measured at different times of day using calibrated thermo-hygrometers, while illumination levels were assessed with lux meters and verified through 3D daylight simulations. User surveys documented perceptions of thermal comfort, airflow, seasonal changes, and psychological well-being. This mixed-methods approach allowed a holistic understanding of thermal comfort by combining quantitative environmental data with qualitative lived experiences (

Figure 1).

DATA PROCESSING AND ANALYTICAL FRAMEWORK

Building Inspection Process

For this comparative study, three multistoried residential buildings were purposefully selected to represent contrasting urban conditions two located within the planned Dhanmondi zone and one situated in the more organically developed Zigatola zone. Within these buildings, six individual apartment units were examined, strategically chosen to capture a variety of vertical positions (low, mid, and top floors) and cardinal orientations (east, west, north-west, and south-east). This selection ensured that both environmental variations and lived experiences could be assessed across differing heights, sun exposures, and surrounding spatial contexts, thereby allowing a nuanced understanding of how location within a building and neighborhood morphology influence indoor comfort and user perception.(Table 1).

Table 1:Selected Buildings and Unit Details

SI. No.	Project	Address	Location	Height (Floor Numbers)	Total Units	Surveyed Units	Build Year
01	6 Storied Residential Building	H-101, Dhaka-1209	Dhanmondi-Zigatola	06	12	02	1974
02	Shahana Vaban	67/2 /Ka, Zigatola. Dhanmondi Dhaka-1209		07	12	02	1994
03	Urban Shouthern Heights	H-30, R-14/A, Dhanmondi		13	55	02	2017
Total number of surveyed buildings			**3**				
Total number of surveyed units			**5**				

To streamline the identification of buildings and their respective living units, a coding system was adopted.

i. **Buildings**: Each project was assigned an alphabetical code, with the selected buildings labeled from A to C.

ii. **Living Units:** Units were coded based on both their vertical and cardinal positions.

Table 2:Vertical Location of The Units Coding & Unit Cardinal Location (CL) Coding

Unit Vertical Location	Category	Legend	Unit Cardinal Location (CL)	Legend
Top	Below Roof	Top	East	E
Middle	Below Top to Upper second floor	Mid	South	S

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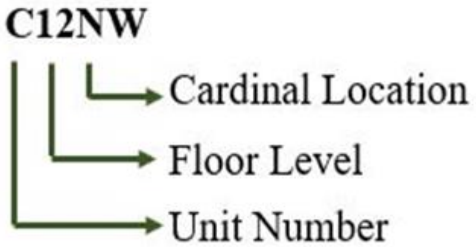
Lower	Up to the second floor	Low	West	W
			North	N
	Unit Vertical Location	**Numbering**		
	Ground	GF	South-East	SE
	First	1	South-West	SW
	Second	2	North-West	NW
	Eighteenth	18	North-East	NE

Vertical location was noted in two ways: by exact floor number (e.g., 1, 2, 3, with the ground floor marked as GF) and by a broader category of “Top,” “Mid,” or “Low” Cardinal orientation was indicated using the first letter of each direction, such as E for East or N for North, following the same format for other positions (Table 2). This system ensured a clear and consistent reference for all surveyed projects and units.

Following this coding process, a unit was named “C12NW,” which represents the unit from building “C” on the 12th floor in the “northwest” Cardinal direction (Appendix 1)

Environmental Data Collection & User Experience Surveys

Temperature, humidity, and illumination levels were measured in primary living spaces using calibrated thermo-hygrometers [HTC-2 (AD-01)] and lux meters. Digital 3D daylight simulations, though.“Shadedat (Beta)”, a plugin of “Sketchup” 3d modeling software, validated annual natural light



distribution patterns (

Appendix 2). Data collection spanned different times of day to capture diurnal variations.

Six living units with varying vertical levels and cardinal orientations were examined, with each internal space positioned differently based on its location within the building. For each unit, temperature and humidity were measured to capture both outdoor conditions and the indoor living environment.

i. **Outdoor data:** Readings at different heights and orientations helped assess how sunlight, wind, and surrounding structures influenced external conditions.

ii. **Indoor data:** Key spaces such as bedrooms, family living areas, and dining rooms were monitored, with their orientations noted to understand how placement within the building impacted thermal comfort.

By linking outdoor environmental variations with indoor conditions, this method offered a thorough understanding of the thermal behavior of the units and their responsiveness to orientation and spatial configuration. Structured questionnaires captured residents’ views on thermal comfort, airflow, and seasonal

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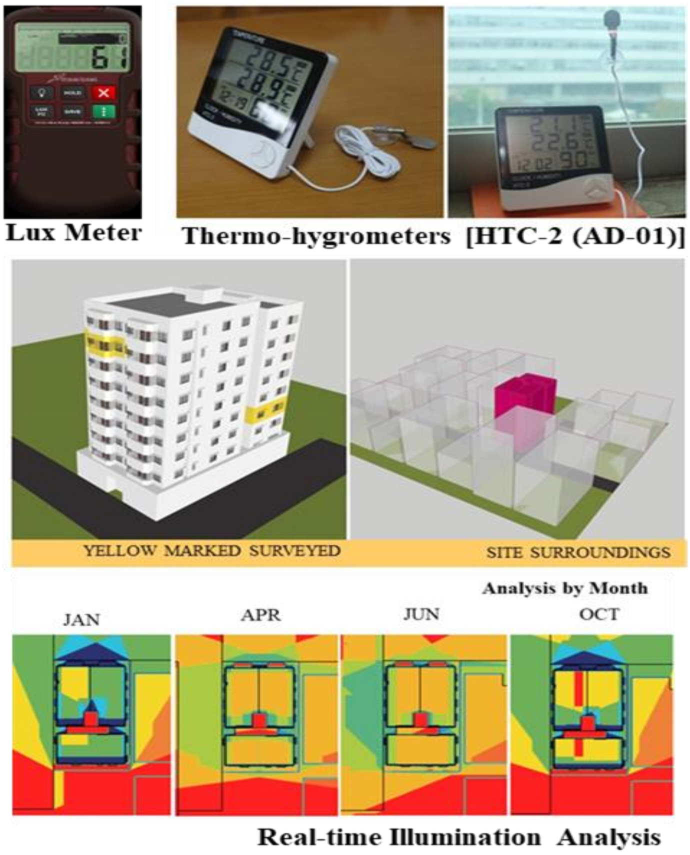
changes, along with how these factors affected their daily life and overall well-being (



Segments	Room Cardinal Location	Legend	Remarks
01	East	E	Most of the openings of the room in the East part of the unit
02	South	S	Most of the openings of the room in the South part of the unit
03	West	W	Most of the openings of the room in the West part of the unit
04	North	N	Most of the openings of the room in the North part of the unit
05	Central	Central	No openings are there. Mostly placed almost at the central position of the unit
06	South-East	SE	Most of the openings of the room in the South-East part of the unit
07	South-West	SW	Most of the openings of the room in the South-West part of the unit
08	North-West	NW	Most of the openings of the room in the North-West part of the unit
09	North-East	NE	Most of the openings of the room in the North-East part of the unit

Appendix 3). Comparing responses from the two residential zones revealed clear spatial and climatic contrasts, showing how differences in building design and environmental context shaped residents' comfort levels and psychological experiences.

Statistics Analysis

Inter-Space Temperature Variation (ISTV) and Inter-Space Humidity Variation (ISHV) were calculated for each unit. Comparative analysis correlated these with building spacing, orientation, and user feedback to highlight zone-specific patterns. For authenticity and accuracy, firstly, the indoor-outdoor temperature and humidity of the individual projects are identified using the thermo-hygrometer, which is verified in two simple ways:

i. **One-hour focused Investigation:** A monitoring device was positioned on the third floor of a six-story building in Zigatola, Dhaka, to evaluate its performance. Temperature and humidity were tracked at short, regular intervals over an hour to examine how accurately the instrument responded to rapid environmental fluctuations (Figure 2).

ii. **Ten- and Fourteen-hour Investigation:** To capture daily climatic fluctuations under typical Bangladeshi conditions, temperature and humidity were monitored over longer and shorter daylight periods, with readings taken every thirty minutes to track gradual changes (Figure 2).

All measurements were taken in an enclosed setting. The device was moved between points, and readings were recorded after brief stabilization to ensure accuracy.

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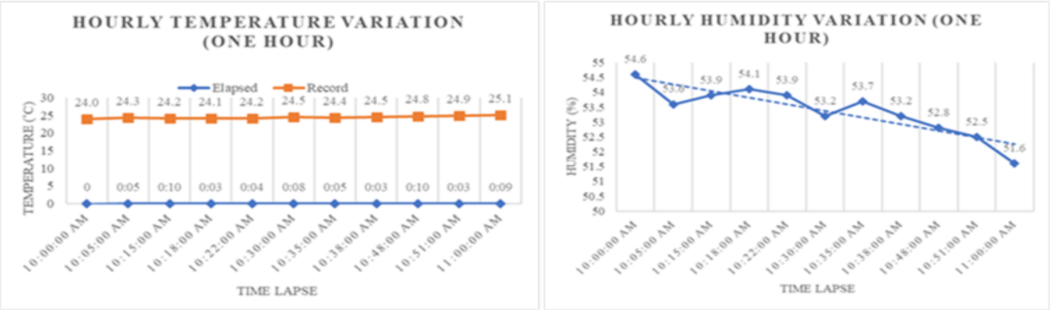
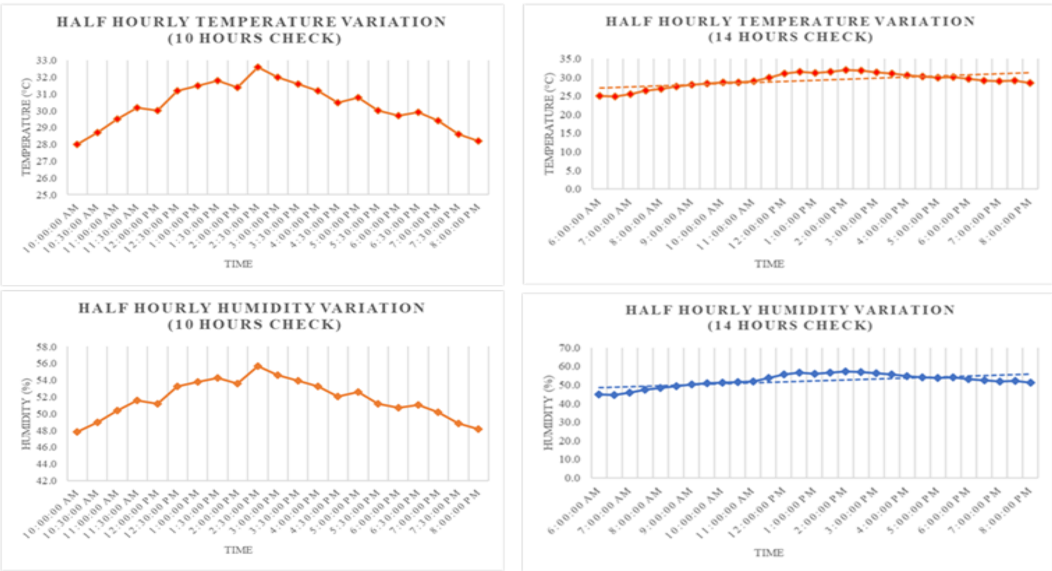
One-Hour Temperature & Humidity Variation & Inspection Summary



Outdoor Temperature	28˚C (± 2˚C)
Outdoor Humidity	48% (± 2%)
Longest duration in same temperature	0:10 minutes [24.3˚C & 24.8˚C]
Shortest duration in same temperature	0:03 minutes [24.1˚C,24.5˚C & 24.8˚C]
Longest duration in same Humidity	53.90%
Quickest variation of humidity	±0:03 minutes [± 0.2 %]

Humidity and Temperature & Inspection Summary (10 hours-14 hours)



Outdoor Temperature (All Day)	**28˚-34˚C**
Outdoor Humidity	**60% (± 2%)**
Maximum Indoor Temperature (within 30 minutes)	**32.6˚C**
Minimum Indoor Temperature (within 30 minutes)	**28.0˚C**
Maximum Humidity (within 30 minutes)	**55.65%**
Minimum humidity (within 30 minutes)	**48.14%**

Outdoor Temperature (All Day)	**27˚-33˚C**
Outdoor Humidity	**56% (± 2%)**
Maximum Indoor Temperature (within 30 minutes)	**32.0˚C**
Minimum Indoor Temperature (within 30 minutes)	**24.8˚C**
Maximum Humidity (within 30 minutes)	**57.34%**
Minimum humidity (within 30 minutes)	**44.44%**

Figure 2: Hourly Humidity and Temperature & Inspection Summary

Individual Project Details

Three residential projects located across the Dhanmondi-Zigatola zone were examined, with each building documented along with its immediate surroundings and the investigated units.

Building A (H-101)

A six-story structure in Zigatola with two units per floor, oriented south and divided into east and west sides. It is bordered by a three-story building to the south and a five-story building to the east, with open

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spaces to the north and west. Units “A3W” and “A2E” were studied (

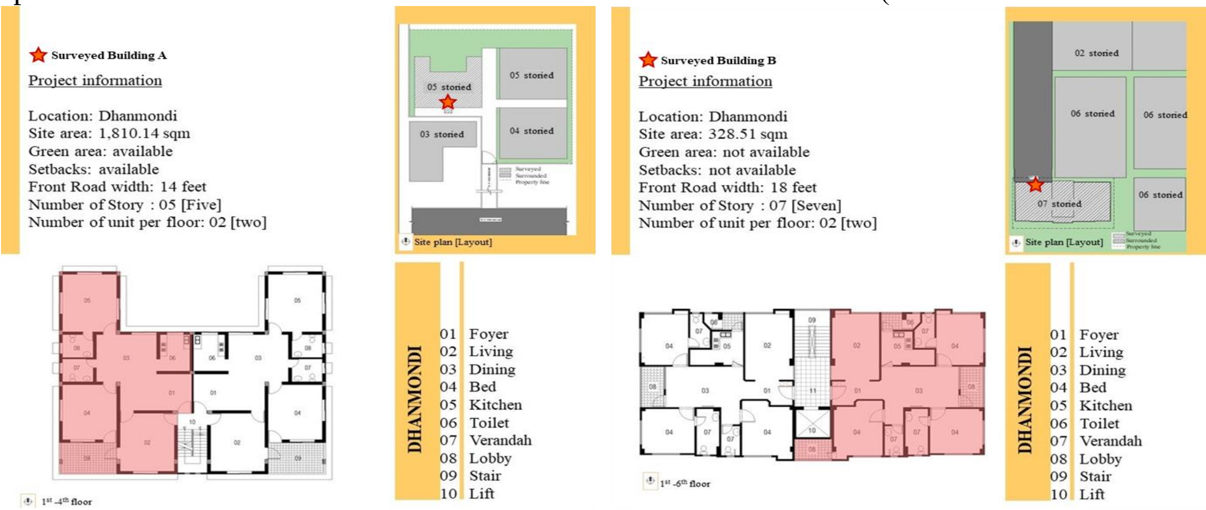

Figure 3).

Building B (Shahana Vaban)

A seven-story building in near Zigatola, Dhanmondi, surrounded by six- and five-story structures. The lower levels are enclosed by adjacent buildings, while limited open space exists at the upper levels. Two units per floor are arranged east and west. Units “B5W” and “B3E” were investigated (

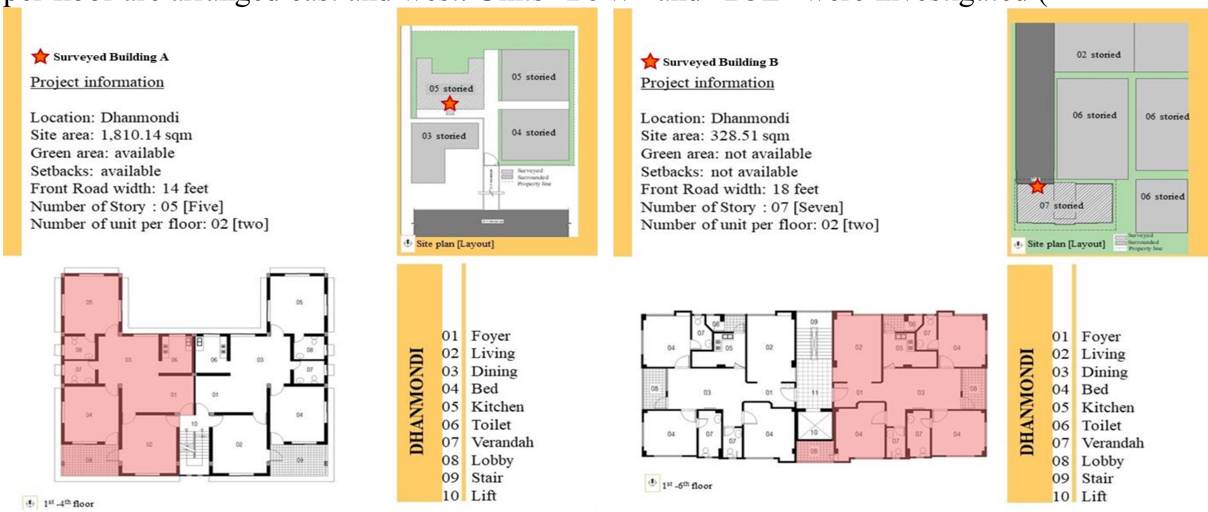

Figure 3).

Building C (Urban Southern Heights)

A thirteen-story building opposite Bangladesh Medical College Hospital in Dhanmondi, with five units per floor. The north-facing entrance opens to a 50-foot-wide road, while other sides have open breathing

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spaces. Community and emergency facilities are included. Units “C12NW” and “C3SE” were examined (

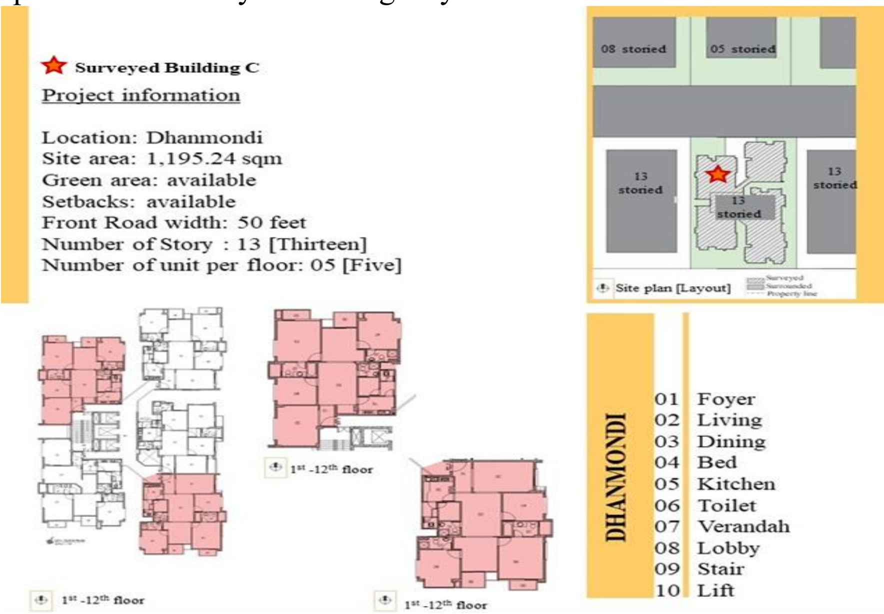


Figure 4). This selection included a variety of building heights, orientations, and spatial contexts across the two residential zones.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VII July 2025

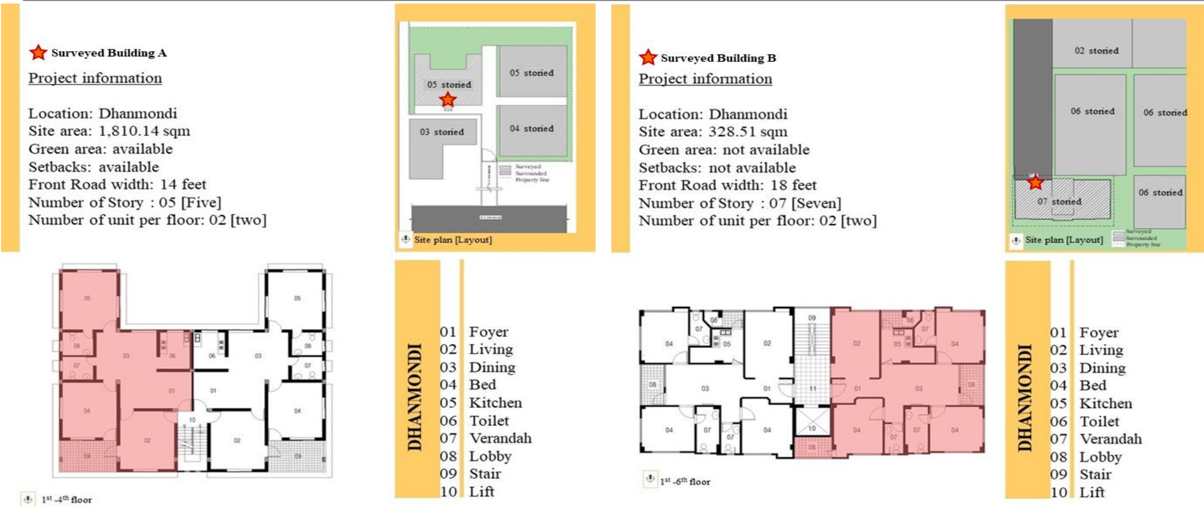


Figure 3: Building A & B with Surveyed Units

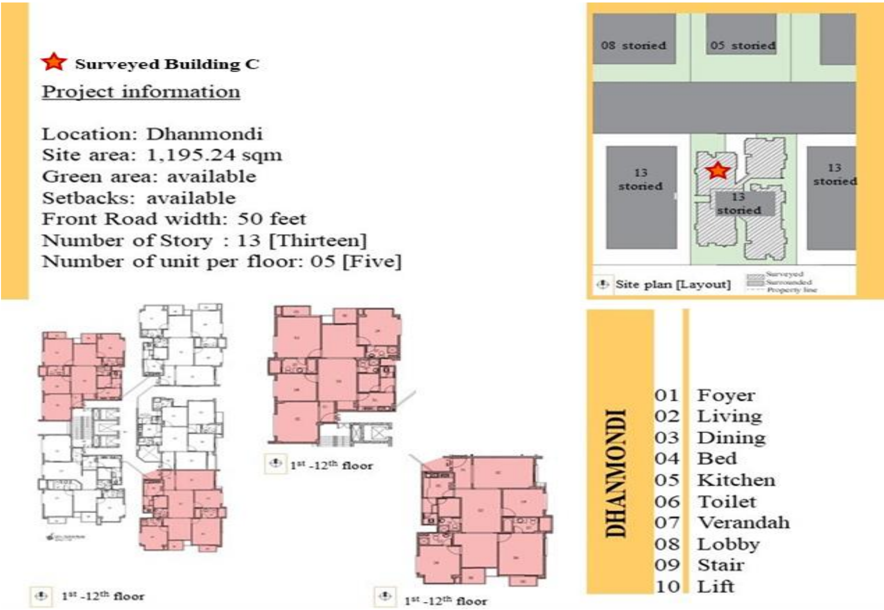


Figure 4: Building C with Surveyed Units

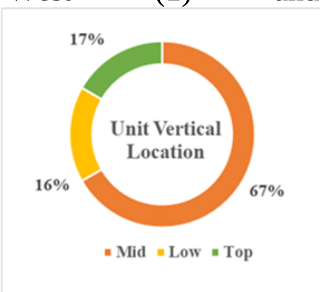
DISCUSSION AND VERDICTS

As there were six different units in three individual projects investigated, all the vertical and cardinal locations of the projects were observed. In this investigation, most of the units (04) of the project were vertically located in the "Mid" section, and most of the units were in the East (2) and West (2) parts in cardinal direction. Others in the North-West (1) and South-East (1) (

Unit Vertical Location	Category	Legend
Top	Below Roof	Top
Middle	Below Top to Upper second floor	Mid
Lower	Upto second floor	Low

Unit Vertical Location	Number	Total Survey Utits
Mid	4	6
Low	1	
Top	1	

Se No	Cardinal Location	Legend	Number of Units
01	East	E	2
02	South	S	0
03	West	W	2
04	North	N	0
05	South-East	SE	1
06	South-West	SW	0
07	Noth-West	NW	1
08	Noth-East	NE	0



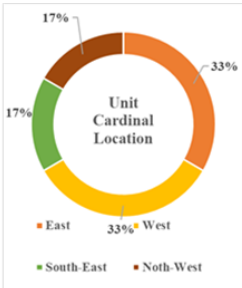


Figure 5).

Climatic Data Comparison

All living spaces within each unit were thoroughly examined to analyze room-by-room temperature and humidity. The investigation was carried out in two phases. In the first phase, data from each room were collected and recorded, followed by identifying the maximum and minimum temperatures within each unit to determine the hottest and coolest spaces. This process, termed Inter-Space Temperature Variation (ISTV), categorized temperature differences as “Considerable” (0.5–0.8°C), “Negligible” (0.1–0.2°C), and “Average” for values in between (

Temperature Variation	Category	Legend
0.5-0.8	Considerable	Con
0.3-0.4	Average	Ave
0.1-0.2	Negligable	Neg

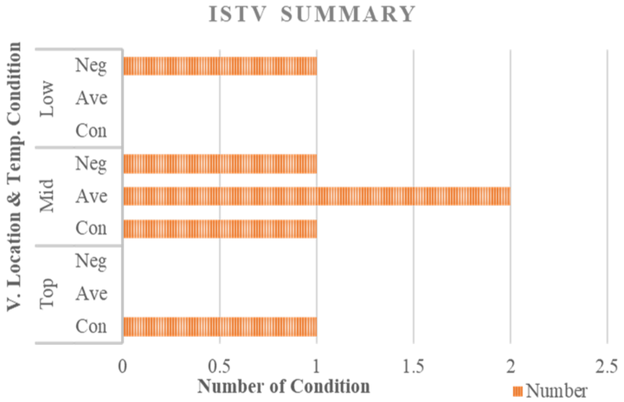
Category	Number	Total Survey Utits
Con	2	6
Ave	2	
Neg	2	

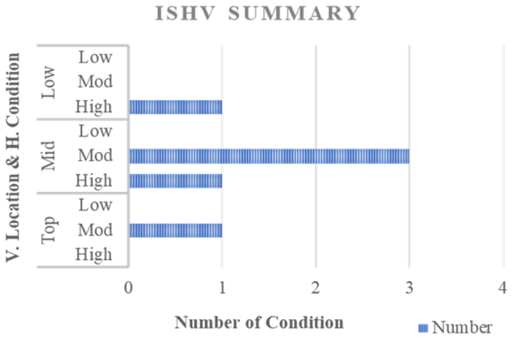
V.Location	Temperature Variation Condition	Number
Top	Con	1
	Ave	0
	Neg	0
Mid	Con	1
	Ave	2
	Neg	1
Low	Con	0
	Ave	0
	Neg	1

Humidity Variation	Category	Legend
3%	High Variation	High
2%	Mid Variation	Mod
1%	Low Variation	Low

Category	Number	Total Survey Utits
High	2	6
Mod	4	
Low	0	

V.Location	Humidity Variation Condition	Number
Top	High	0
	Mod	1
	Low	0
Mid	High	1
	Mod	3
	Low	0
Low	High	1
	Mod	0
	Low	0





Cardinal Temperature Condition Map			
Cardinal Location	Temperature Condition		
W			
NW			
E			
SE			

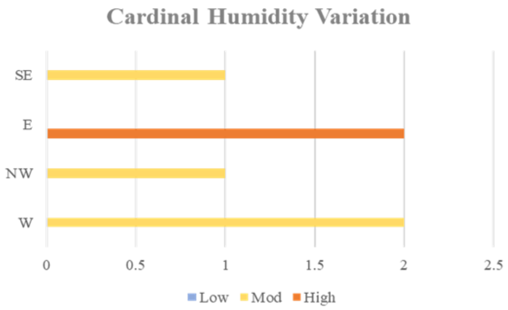
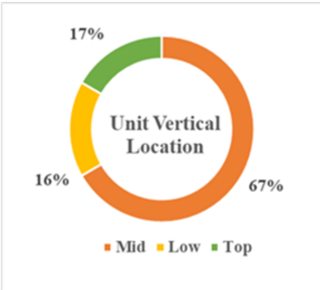


Figure 6). The second phase focused on mapping the vertical and cardinal positions of these hottest and coolest rooms to better understand how spatial orientation influences indoor thermal conditions.

Unit Vertical Location	Category	Legend
Top	Below Roof	Top
Middle	Below Top to Upper second floor	Mid
Lower	Upto second floor	Low

Unit Vertical Location	Number	Total Survey Utits
Mid	4	6
Low	1	
Top	1	

Se No	Cardinal Location	Legend	Number of Units
01	East	E	2
02	South	S	0
03	West	W	2
04	North	N	0
05	South-East	SE	1
06	South-West	SW	0
07	Noth-West	NW	1
08	Noth-East	NE	0



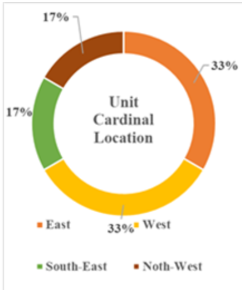


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Figure 5: Unit Locations (Vertical and Cardinal)

Temperature Variation	Category	Legend
0.5-0.8	Considerable	Con
0.3-0.4	Average	Ave
0.1-0.2	Negligable	Neg

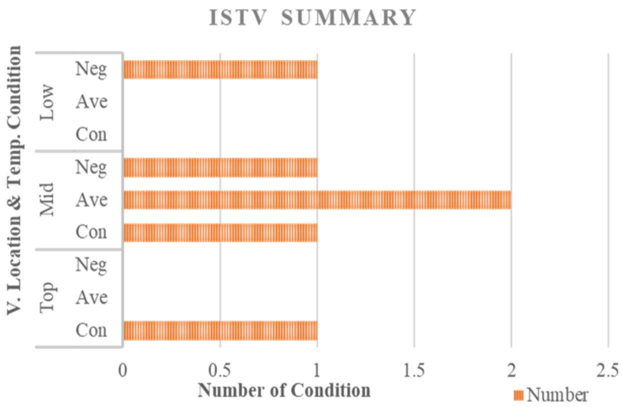
Category	Number	Total Survey Utits
Con	2	6
Ave	2	
Neg	2	

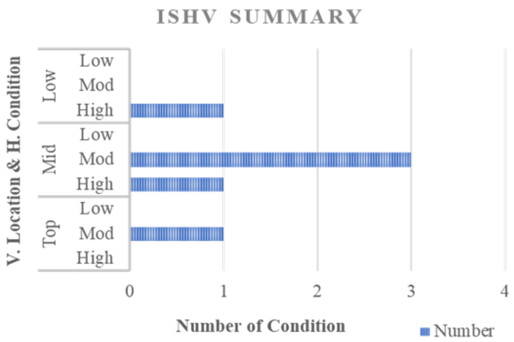
V.Location	Temperature Variation Condition	Number
Top	Con	1
	Ave	0
	Neg	0
Mid	Con	1
	Ave	2
	Neg	1
Low	Con	0
	Ave	0
	Neg	1

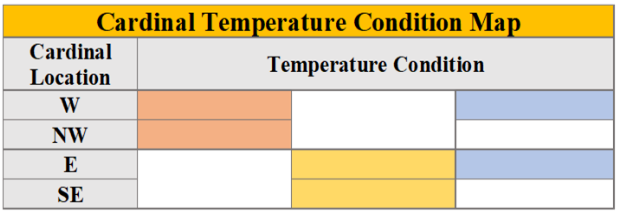
Humidity Variation	Category	Legend
3%	High Variation	High
2%	Mid Variation	Mod
1%	Low Variation	Low

Category	Number	Total Survey Utits
High	2	6
Mod	4	
Low	0	

V.Location	Humidity Variation Condition	Number
Top	High	0
	Mod	1
	Low	0
Mid	High	1
	Mod	3
	Low	0
Low	High	1
	Mod	0
	Low	0







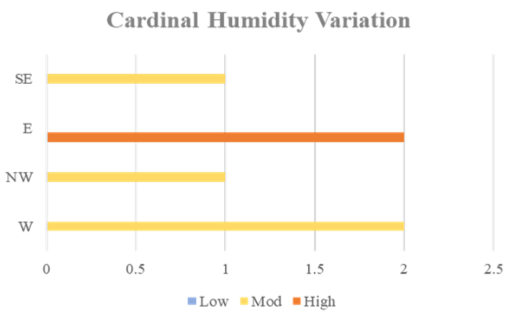


Figure 6:Temperature & Humidity Variation Data

Following this system among six (06) units, two (02) units were found as "Considerable", among which most are located in the West and North-West in cardinal direction. Among these, one is at "Mid" and the other is at "Top" in the vertical direction. From the other units, two (03) are in the "Mid", in which two (02) are under "Average", and the rest of two (02) are in both "Mid" and "Low" in vertical under the

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"Negligible" category (

Temperature Variation	Category	Legend
0.5-0.8	Considerable	Con
0.3-0.4	Average	Ave
0.1-0.2	Negligable	Neg

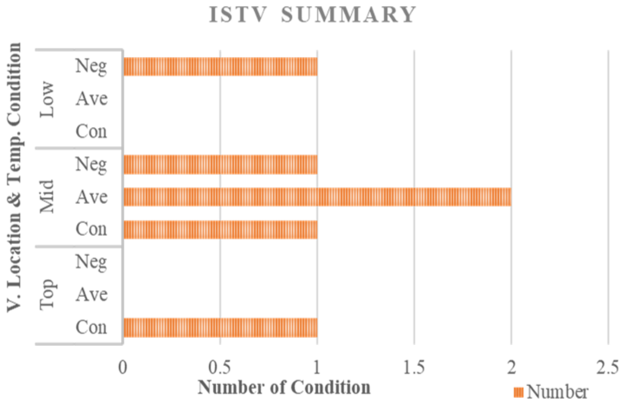
Category	Number	Total Survey Utits
Con	2	6
Ave	2	
Neg	2	

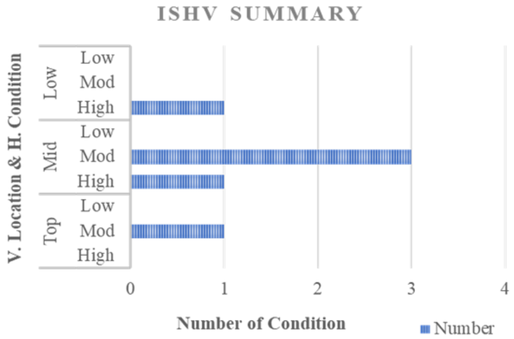
V.Location	Temperature Variation Condition	Number
Top	Con	1
	Ave	0
	Neg	0
Mid	Con	1
	Ave	2
	Neg	1
Low	Con	0
	Ave	0
	Neg	1

Humidity Variation	Category	Legend
3%	High Variation	High
2%	Mid Variation	Mod
1%	Low Variation	Low

Category	Number	Total Survey Utits
High	2	6
Mod	4	
Low	0	

V.Location	Humidity Variation Condition	Number
Top	High	0
	Mod	1
	Low	0
Mid	High	1
	Mod	3
	Low	0
Low	High	1
	Mod	0
	Low	0





Cardinal Temperature Condition Map			
Cardinal Location	Temperature Condition		
W			
NW			
E			
SE			

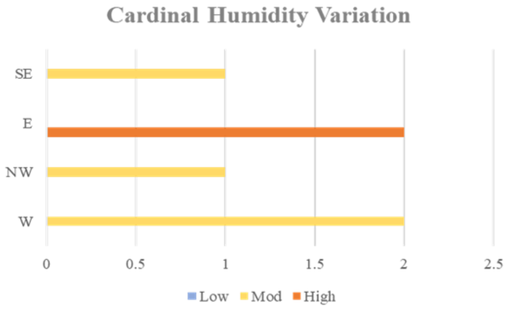


Figure 6). Similarly, humidity data were analyzed through a process termed Inter-Space Humidity Variation (ISHV). Variations between rooms were classified as "High" for differences of 3% or more, "Low" for differences of 1%, and "Mid" for values in between. This helped identify how humidity levels shifted

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VII July 2025

across different spaces within each unit (

Temperature Variation	Category	Legend
0.5-0.8	Considerable	Con
0.3-0.4	Average	Ave
0.1-0.2	Negligable	Neg

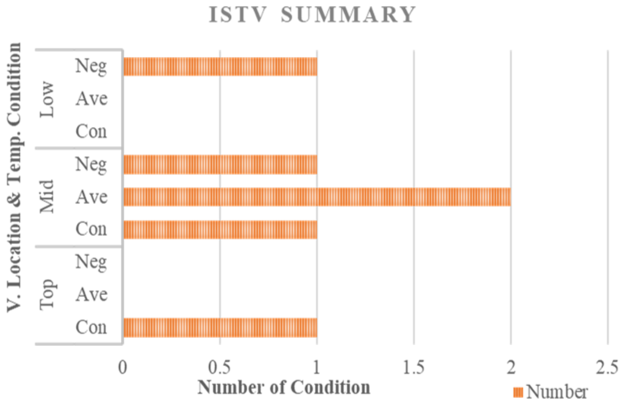
Category	Number	Total Survey Utits
Con	2	6
Ave	2	
Neg	2	

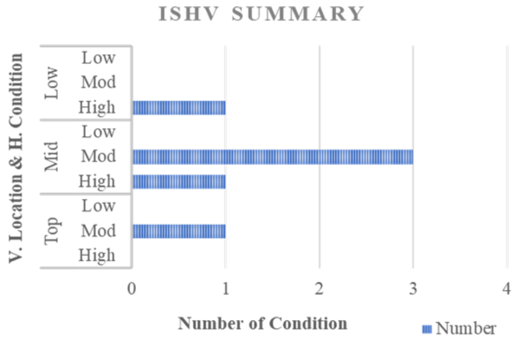
V.Location	Temperature Variation Condition	Number
Top	Con	1
	Ave	0
	Neg	0
Mid	Con	1
	Ave	2
	Neg	1
Low	Con	0
	Ave	0
	Neg	1

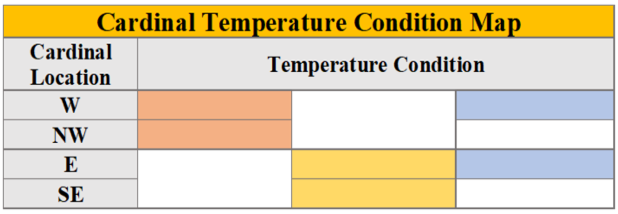
Humidity Variation	Category	Legend
3%	High Variation	High
2%	Mid Variation	Mod
1%	Low Variation	Low

Category	Number	Total Survey Utits
High	2	6
Mod	4	
Low	0	

V.Location	Humidity Variation Condition	Number
Top	High	0
	Mod	1
	Low	0
Mid	High	1
	Mod	3
	Low	0
Low	High	1
	Mod	0
	Low	0







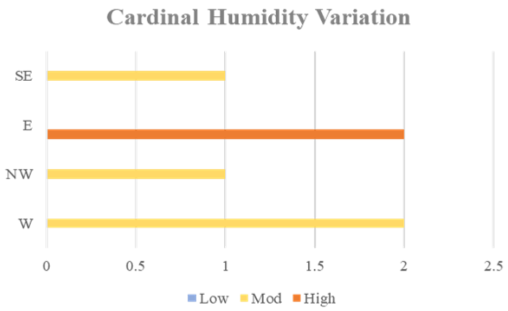


Figure 6).Following this system among six (06) units, two (02) units were found with high humidity spaces, which were located at the middle (01) and lower (01) parts of the buildings, where cardinal location does not matter, but the vertical location impacts. Others are in moderate condition.

User and Enumerators' Data Collaboration

From the opinion of the user of individual units, an annual experience data chart was prepared. A summary of their responses regarding the climatic situation of their living spaces represents the condition of their living state. It is observed that among six (06) living units, four (04) unit users are getting satisfactory airflow throughout the year, and they observe more comfort than other users. Along with these, most of the users used to feel warm in "May" with the moderate experience in "Summer" (

Figure 7). Most users who feel comfortable or live in a moderate situation are living in units where they have satisfactory open spaces around the building, which enhance proper ventilation of the unit. In some cases, partial spaces or urban windows also allow a comfortable situation in lower-level living units. Following these responses and enumerators collected data analysis summary, it is also observed of having most of the "Coolest room" is at the "North" or "Central" cardinal location of the units, and "Warmest room" at the "West" or related to the west in the cardinal location. This result is similar to the response from the individual users. Additionally, among the six (06) units, users of four (04) units find their living environment healthy, and it is found that those units contain open spaces surrounding them. Unit with partially open surroundings is in a compromised living situation, and the rest found it unhealthy with no open surroundings.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VII July 2025

Coolest Room	
Category	Number
Living	5
Bed Room	1

Warmest Room	
Category	Number
Bed Room	5
Living	1

Coolest Month	
Name	Number
December	2
January	4

Warmest Month	
Name	Number
May	4
June	2

Living State	
Category	Number
Healthy	4
Compromised	1
Unhealthy	1

Coolest Room	
Cardinal Location	Number
S	1
N	3
Central	2

Warmest Room	
Cardinal Location	Number
W	2
SW	2
NW	1

Summer Experience	
Category	Number
Moderate	3
Comfortable	2
Discomfortable	1

Winter Experience	
Category	Number
Moderate	1
Comfortable	4
Discomfortable	1

Air Flow Experience	
Category	Number
Satisfactory	4
Average	1
Dissatisfactory	1

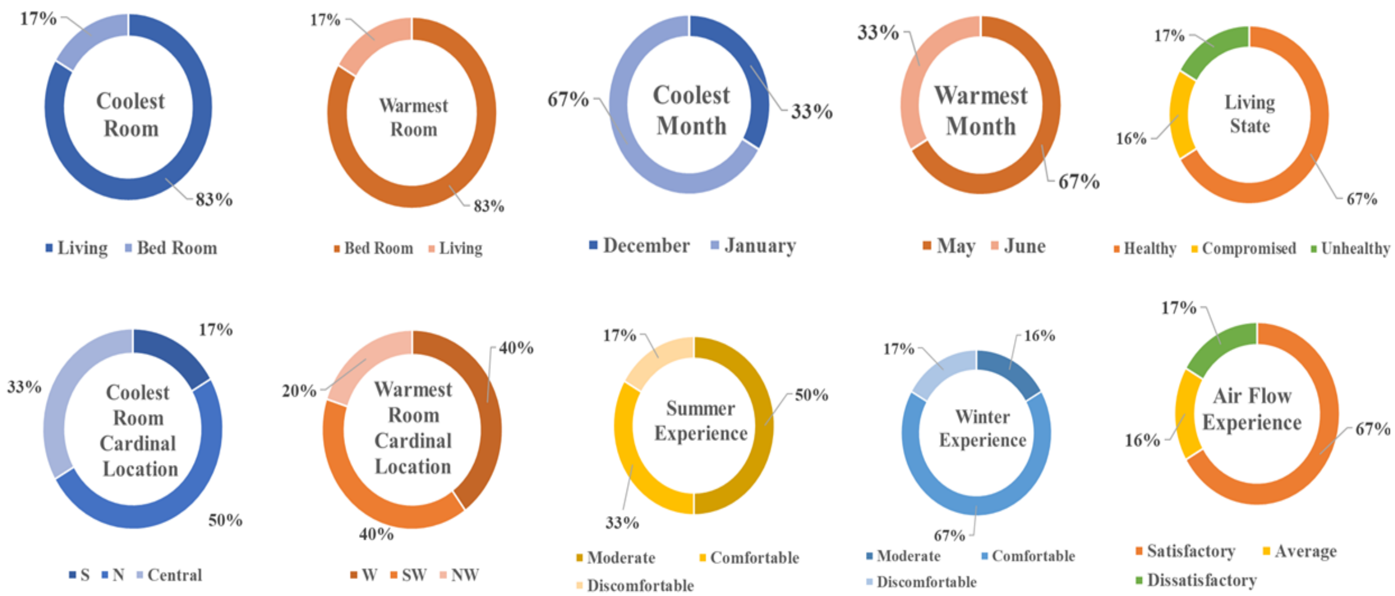


Figure 7:Annual Climatic and Unit Internal Living Experiences

Real-Time Illumination Analysis

After analyzing residents' perceptions of their living conditions, annual natural light distribution patterns were simulated using Shadedat (Beta), a plugin for SketchUp 3D modeling software. The simulation, conducted at three-month intervals, identified consistently illuminated spaces and surfaces throughout the year. These results closely aligned with residents' feedback, confirming the correlation between user-reported

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VII July 2025

experiences and the modeled daylight performance of the building (

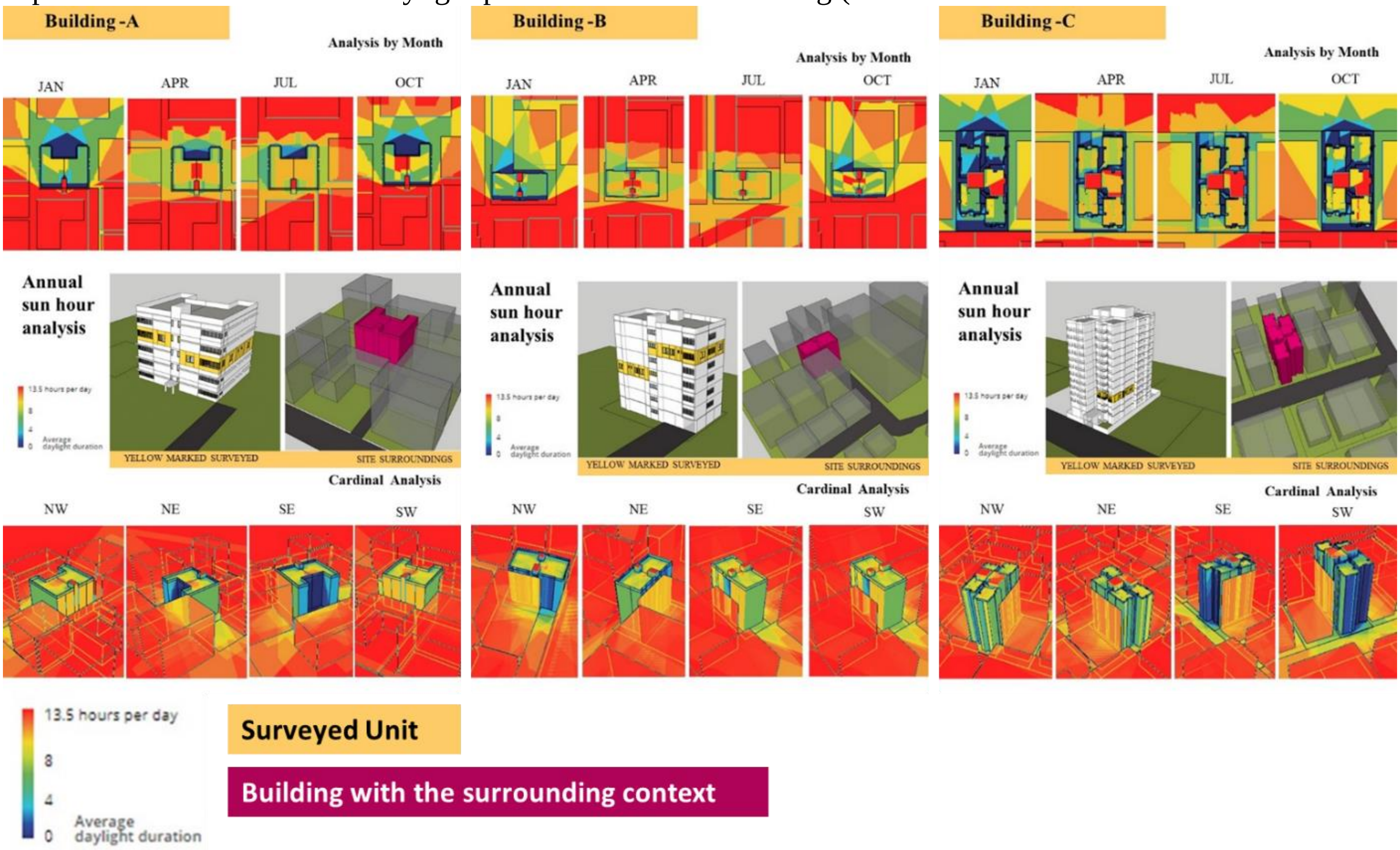


Figure 8).

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VII July 2025

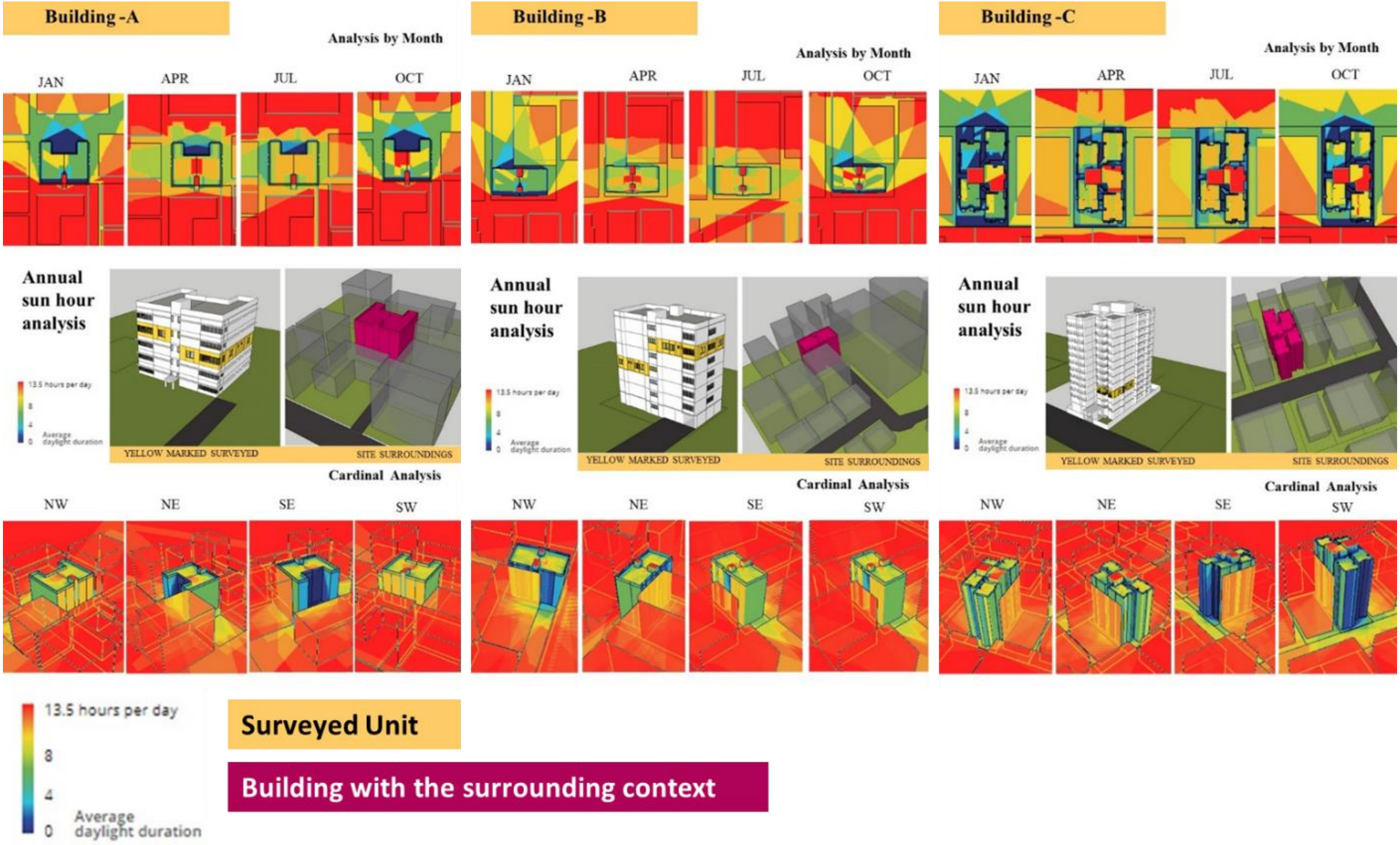


Figure 8: Real-Time Illumination Analysis

Supportive Physical State

Based on the final stage of analysis, a comparative assessment was conducted to explore the relationship between the availability of open space around the surveyed units and their physical conditions specifically focusing on dampness, wall stains, and utility costs. The findings revealed a clear trend: units surrounded by adequate open space consistently showed lower utility costs, including electricity and water consumption. This suggests more efficient natural ventilation and daylight access, reducing the need for artificial cooling and lighting. These units provided a more comfortable and cost-effective living environment.

Two of the surveyed units exhibited moderate utility costs. One of these was surrounded by open space, while the other had only partial openness, indicating that even limited exposure to open surroundings can have a moderately positive effect. However, the unit with no surrounding open space recorded the highest utility costs, pointing to poor ventilation and lighting conditions that likely contributed to a greater reliance on mechanical systems ultimately reducing the quality of living.

In addition, physical deterioration in the form of wall stains and dampness was observed in the units with either partial or no surrounding openness. Conversely, all four units with ample open space were free from such issues. This further emphasizes the importance of spatial openness not just for thermal and visual comfort, but also for maintaining healthier, more durable indoor environments. Together, these observations underscore the critical role of building orientation, spacing, and environmental context in shaping both the

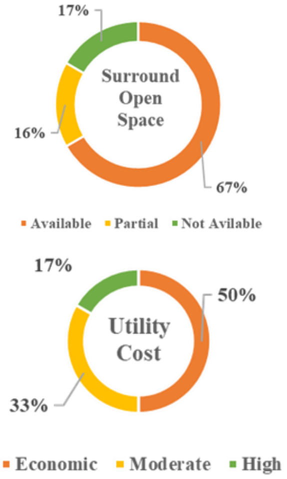
ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VII July 2025

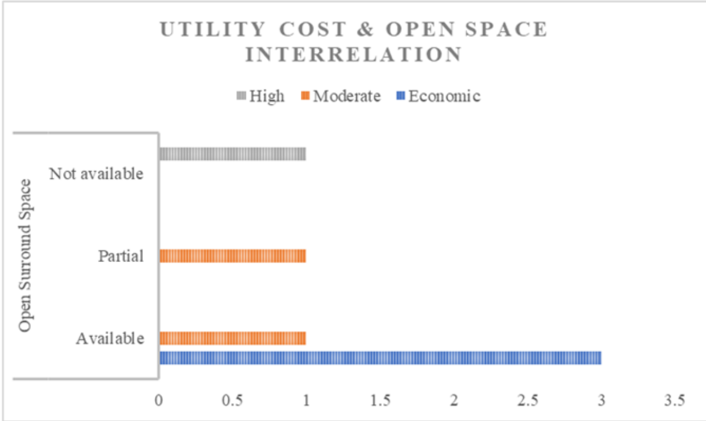
lived experience and physical performance of residential units (

Open Space	
Category	**Number**
Available	4
Partial	1
Not Avilable	1

Utility Cost (Electricity, Water)	
Category	**Number**
Economic	3
Moderate	2
High	1

Utility Cost (Electricity, Water)	
Category	**Perimeter (tk)**
High	>4000/-
Moderate	2500-4000/-
Economic	<2500/-





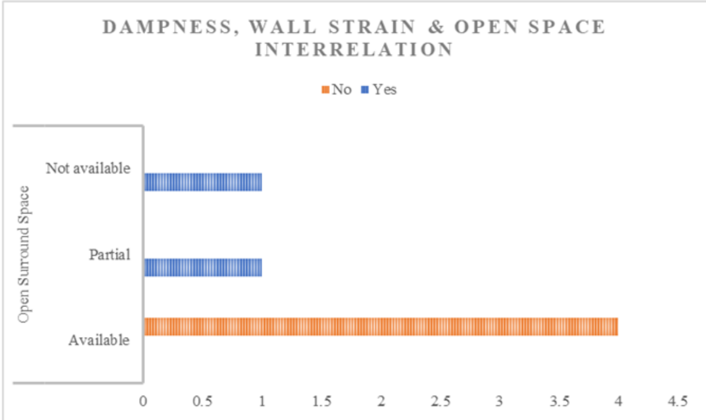


Figure 9).

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VII July 2025

Open Space	
Category	Number
Available	4
Partial	1
Not Avilable	1

Utility Cost (Electricity, Water)	
Category	Number
Economic	3
Moderate	2
High	1

Utility Cost (Electricity, Water)	
Category	Perimeter (tk)
High	>4000/-
Moderate	2500-4000/-
Economic	<2500/-

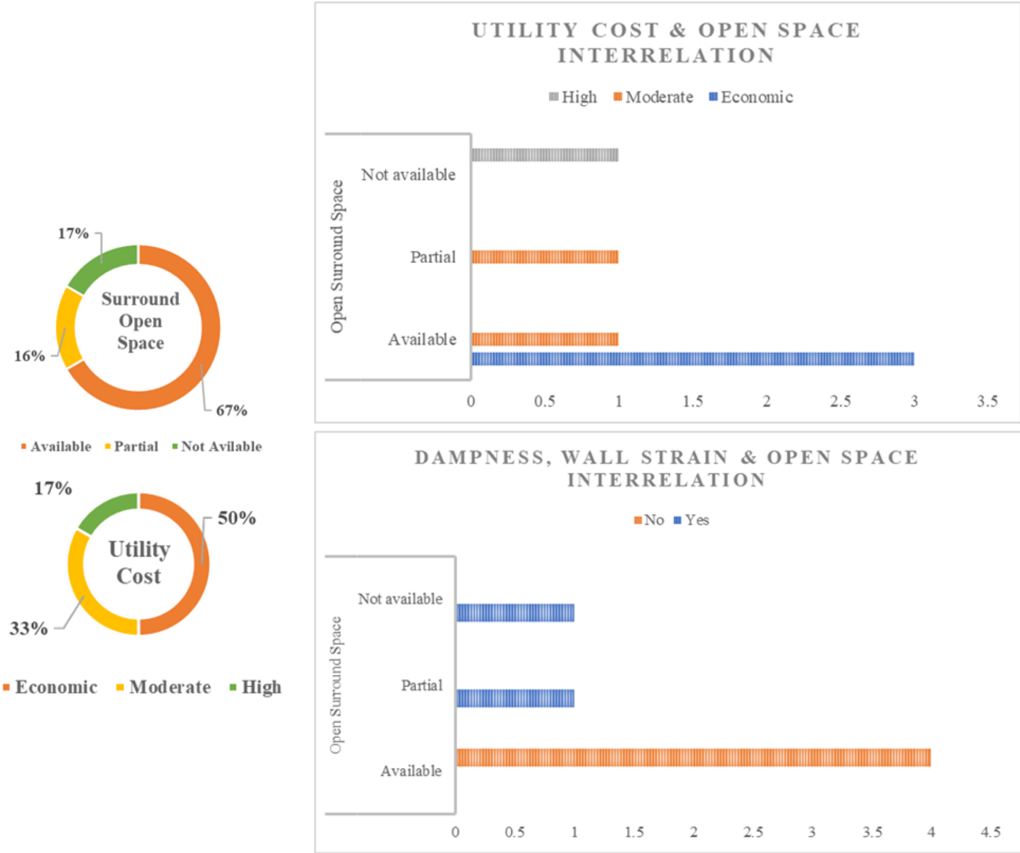


Figure 9: Sample's Physical State Analysis

Comparative Environmental Findings

The environmental assessment identified significant differences in thermal comfort and daylight exposure between the two neighborhoods. Units in Dhanmondi generally exhibited better natural ventilation and daylight penetration due to wider inter-building spacing and more favorable orientations, whereas Zigatola units faced challenges related to limited openness and increased heat retention. Temperature variation patterns also correlated strongly with cardinal directions and floor levels, impacting residents' comfort and energy use.

Comparative User Perception Patterns

Survey data revealed that residents in Dhanmondi reported higher overall satisfaction with their indoor environment, citing better air flow and natural light as key factors. In contrast, Zigatola occupants frequently expressed concerns over dampness, wall stains, and limited ventilation, which negatively affected their comfort and utility costs. The perception of environmental quality closely matched the measured physical parameters, illustrating how design deficiencies translate into lived experiences.

CONCLUSION

This comparative study reaffirms that the environmental quality and overall user satisfaction in Dhaka's multistoried residential buildings are deeply shaped by site-specific variables particularly the availability of open space, building orientation, and spacing between structures. Units with greater openness consistently demonstrated lower utility costs, better ventilation, and fewer physical issues such as wall stains and dampness. In contrast, those with limited or no surrounding open space experienced higher environmental stress and maintenance concerns, indicating a compromised living experience.

These findings emphasize the need for urban housing strategies that move beyond mere density maximization. Thoughtful integration of open spaces, solar orientation, and inter-building setbacks can significantly enhance microclimatic conditions and support healthier, more resilient living environments. As Dhaka continues to grow vertically, future housing policies and architectural practices must prioritize environmental responsiveness not only to ensure comfort and habitability but also to promote long-term well-being and sustainability for its urban population.

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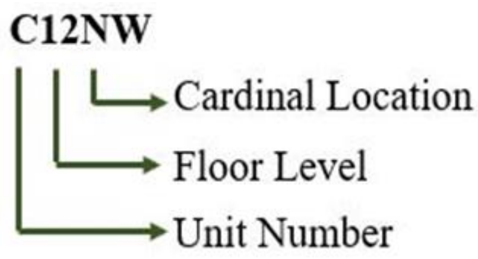
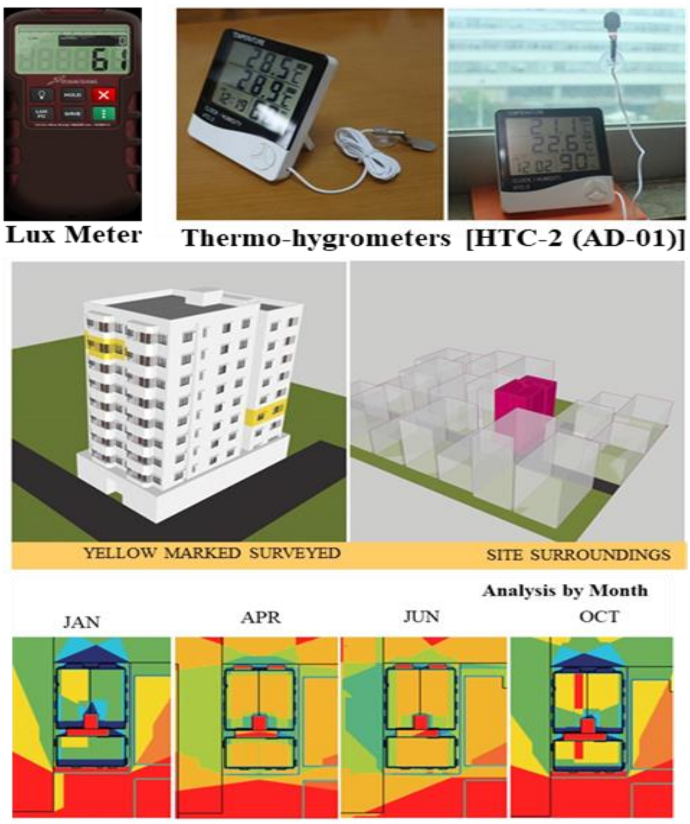
ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VII July 2025

APPENDICES

Appendix 1: Project Unit Coding System



Appendix 2: Lux meters, Thermo-hygrometer, Real-time Illumination Analysis & Cardinal Location of Spaces



Real-time Illumination Analysis

Segments	Room Cardinal Location	Legend	Remarks
01	East	E	Most of the openings of the room in the East part of the unit
02	South	S	Most of the openings of the room in the South part of the unit
03	West	W	Most of the openings of the room in the West part of the unit
04	North	N	Most of the openings of the room in the North part of the unit
05	Central	Central	No openings are there. Mostly placed almost at the central position of the unit
06	South-East	SE	Most of the openings of the room in the South-East part of the unit
07	South-West	SW	Most of the openings of the room in the South-West part of the unit
08	North-West	NW	Most of the openings of the room in the North-West part of the unit
09	North-East	NE	Most of the openings of the room in the North-East part of the unit

Appendix 3: Sample Data Collecting Format & User's Living Condition Statement Sample

Building Details (Name_ Location_ Number of Floors)									
Space Detail				Environmental Data					
				External			Internal		
Unit Type	Date	Time	Space	Temperature (°C)	Humidity (%)	Light (lux)	Temperature (°C)	Humidity (%)	Light (lux)
A3W	dd/mm/yy	10:00am - 12:00pm	Living	0	0	0	0	0	0
			Dining				0	0	0
			Bed 01				0	0	0
			Bed 02				0	0	0
Max							0	0	0
Min							0	0	0
Average							0.0	0	0

Environmental Living Condition													Physical			
SN	Unit	Vertical Location	Coolest Room		Warmest Room		Coolest month	Warmest month	Summer Experience	Winter Experience	Air Flow	Living State	Open Space	Dampness	Strain on wall	Utility Cost (Electricity,
			Function	C.L	Function	C.L										
01	A3W	Mid	Living	S	Bed Room	S										
02	A2E	Low	Living	S	Bed Room	E										