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User-Centered Passive Design Strategies for Sustainable Lowrise Housing Karsana District in Abuja

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ABSTRACT

This article examines user-centered passive design strategies for the development of sustainable low-rise housing in Karsana District Abuja, Nigeria. In a region characterized by a hot-humid climate and increasing energy demand, passive design offers a cost-effective approach to improving indoor comfort, consequent atmospheric pollution and reducing reliance on mechanical cooling. Using a survey of residents across selected low-rise estates in Abuja, the research identifies key user preferences for ventilation, shading, insulation, orientation, and daylighting. Findings reveal that natural ventilation and shading are the most valued strategies, with over 70% of respondents prioritizing them for comfort and energy efficiency. Insulation, building orientation, and daylighting were also strongly supported, reflecting user awareness of energy related benefits. However, barriers such as low awareness, higher upfront costs, and limited technical expertise hinder widespread adoption. The study opines that integrating user preferences into housing design not only enhance acceptance and functionality but also aligns with sustainable urban development goals in Nigeria. It concludes with policy making recommendations and proposing design guidelines that combine climate-responsive strategies, local materials, and user priorities to create adaptable, affordable, and sustainable housing estates in Abuja.

Keywords: *Passive design, Strategies, User preference, Low-rise housing, Sustainability, Policy making*

INTRODUCTION

Climate-responsive and sustainable residential design in Nigeria has garnered increasing attention in recent years, particularly with respect to passive cooling strategies that leverage natural forces like wind, shading, and thermal mass to improve indoor comfort with minimal energy use (Obamoh, Udeala, & Obamoh, 2025). In low-cost and low-rise housing contexts, such as those in Abuja, integrating passive features not only enhances thermal performance but also supports affordability and sustainability. Counting among the most actively studied themes, building orientation, shading, insulation, and natural ventilation consistently emerge as effective passive techniques that can reduce indoor temperatures by up to 5 °C and lower energy consumption by approximately 30% (Ibrahim, ElNafaty, & Udale, 2024; Kalu, Ogunnaike, & Eze, 2025).

In the specific case of Abuja, overheating in low-income residential buildings remains a pressing issue. Adaji's (2017) field study showed that passive interventions such as roof and wall insulation combined with shading could reduce indoor maximum temperatures by more than 5

°C, offering substantial cooling load and cost savings. Complementary findings have shown that passive strategies can bring living spaces closer to comfort thresholds, enhancing occupant well-being without recourse to mechanical cooling (Adaji, Adekunle, & Watkins, 2020; Adaji, 2017).

However, much existing research focuses primarily on technical performance rather than the human dimension. There is a notable gap in understanding how **user preferences** including priorities for natural ventilation, daylighting, shading, insulation, and orientation can inform and enhance passive design strategies. Locally grounded, user-centered design is critical for ensuring that low-rise housing in Abuja is not only climatically effective but also socially acceptable and feasible within market constraints. Therefore, this study aims to bridge that gap by investigating how residents expressed preferences can be integrated into passive design approaches tailored to Abuja's climatic, cultural, and socioeconomic context. By aligning design interventions with user priorities, the study seeks to promote the development of affordable, comfortable, and sustainable low-rise housing that resonates with both environmental and occupant needs.

RESEARCH METHOD

This section outlines the approach employed in conducting the study, organized under several subheadings: the method of data collection, population of the study, and sample size.

Study location

The research was conducted in selected low-rise housing estates across Abuja Municipal Area Council (AMAC) and Bwari, representing diverse socio-economic groups and varying levels of housing development. Abuja's hot-humid climate makes it an appropriate case for investigating passive design interventions.

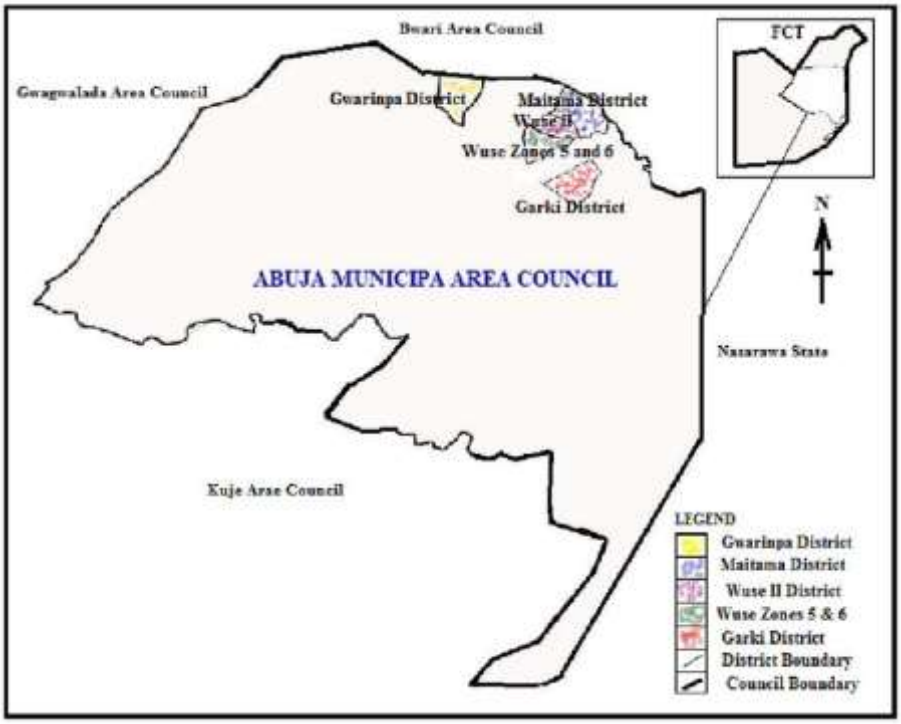

Figure 1. Map Showing Six Districts in Abuja Municipal Area Councils of FCT Source: https://www.researchgate.net

Method of Data Collection

The study adopted a quantitative research design using a descriptive survey approach. This design was chosen to enable the researcher to collect measurable data on user awareness,

satisfaction, and preferences regarding passive design features in low-rise residential estates. A structured questionnaire was used to gather data from residents, providing an effective means of capturing user opinions and behavioral tendencies in a standardized manner.

Population of Study and Sampling

A stratified random sampling method was used, with strata based on district location and housing typology in Abuja (Gwarinpa, Lokogoma, Lugbe, and Kubwa). The total population was estimated at about 2,000 housing units. Using Yamane's formula (1967) at a 5% margin of error, the required sample size was calculated to be approximately 333 respondents, ensuring statistical reliability.

Sample Size and Sampling Technique

A stratified random sampling technique was employed to ensure representation across the selected districts. The strata were based on location (district) and housing typology (low-rise estates). The sample size was determined using Yamane's formula (Yamane, 1967) to ensure statistical
reliability:

$$n = \frac{N}{1+N(e)^2}$$

Where:

n = sample size *N* = total population size

e = level of precision or margin of error (commonly set at 0.05 for a 95% confidence level) The target population consists of residents living in low-rise housing estates within selected districts of Abuja, including Gwarinpa, Lokogoma, Lugbe, and Kubwa. Based on development records and estimated average household sizes, the combined residential population of these areas is estimated at approximately **2,000 housing units** occupied by eligible adult respondents.
Applying Yamane's formula with a margin of error of 5%:

$$n = \frac{2000}{1+2000(0.05)^2}$$

$$= \frac{2000}{1+2000(0.0025)}$$

$$= \frac{2000}{1+5}$$

$$= \frac{2000}{6}$$

$$\approx 333.33$$

Thus, a minimum sample size of 333 respondents was deemed sufficient to ensure the statistical reliability of the findings.

RESULTS AND DISCUSSION

Awareness and Knowledge of Passive Design

Table 1 The data gotten from respondents include: Awareness and knowledge of passive design, how they learnt about passive design, level of understanding of passive design concepts. These are presented in the tables below.

Category	Key Findings
Awareness of passive design principles	- 55.86% aware - 29.73% not aware - 14.41% not sure
Source of learning about passive design (Among 186 aware respondents)	- Internet: 50.54% - Formal education: 20.97% - Architect/Builder: 17.74% - Personal experience: 10.75%
Understanding of passive design concepts	- Highest familiarity: Natural ventilation (65.1%), Daylighting (59.2%) - Moderate familiarity: Building orientation & shading devices (~50%) - Lowest familiarity: Thermal insulation & landscape design (<50%)

The data shows that while there is a decent level of awareness about passive design, much of it comes from informal sources (mainly the internet). People understand the more visible and practical elements (ventilation, daylight) but lack knowledge of technical strategies like insulation and landscape integration.

Experience with Passive Design Elements

Table 2 The data gotten from respondents include: If their home incorporates any passive design feature, which passive design is present in their current home, how effective these passive design features in improving comfort, what are the major benefits of these passive design elements. These are presented in the tables below.

Category	Key Findings
Homes with passive design features	- Yes: 78.98% - No: 16.52% - Not sure: 4.50%

Common passive design features present	- Natural lighting: 82.6% - Large windows for ventilation: 73.6% - Cross ventilation: 59.5% - Window shading/overhangs: 49.5% - Courtyards/green spaces: 42% - Building orientation: 38.1% - Insulated walls/roofs: 33.6%
Effectiveness of features in improv comfort	- Very effective: 54.65% - Effective: 26.73% i - Neutral: 11.11% - Ineffective: 5.11% - Very ineffective: 2.40%
Major benefits noticed	- Reduced electricity bills: 81% - Improved indoor comfort: 66.6% - Better air quality: 52.5% - Aesthetic value: 17.4% - None: 2.4%

Most respondents already experience passive design in their homes, mainly through simple features like natural light and ventilation. These features are widely perceived as effective, delivering real benefits such as energy savings, comfort, and better air quality. However, advanced strategies (insulation, orientation, landscape integration) remain less common, indicating room for improvement in design practices to maximize performance.

Preference for Passive Design in Future Housing

Table 3 The data gotten from respondents include: How important are passive design elements when choosing or designing a home, which passive design is present in their current home, if they will be willing to pay more for a house that integrates passive design for better comfort and lower energy use, which passive design elements would they prioritize in a new home, Will they suggest the adoption of passive design elements to improve thermal comfort for houses in Abuja. These are presented in the tables below.

Category	**Key Findings**

Importance of factors when choosing/designing home	- Access to natural light: very important/important (79.3%) - Energy efficiency: very important/important (68.4% - Shading/protection: very important/important (68.7 - Thermal comfort: very important/important (59.4% - Outdoor/green spaces: very important/important (63%)
Willingness to pay more for passive design	- Yes: 54.9% - No: 29.7% - Maybe: 15.3%
Passive design elements prioritized in a new home	- Natural ventilation: 70% rate as important/very important - Shading systems: 68.7% important/very important - Thermal insulation: ~60% important/very important - Building orientation: ~60% important/very important - Daylighting: ~59% important/very important
Barriers to adoption	- Cost implications: 87% - Lack of awareness: 59.3% - Poor policy implementation: 38.4% - Lack of skilled professionals: 31.5% - Aesthetic/space concerns: 28.5%

Residents value natural light, ventilation, and shading most when choosing or designing a home, and more than half are willing to invest extra in passive design for comfort and energy savings. However, cost, limited awareness, and weak policy support remain major barriers.

Discussion of Results

Most residents in Abuja are aware of passive design but mainly through informal sources, with knowledge limited to basic features like ventilation and daylighting. While these features are common and effective in improving comfort and reducing energy costs, advanced strategies such as insulation and orientation are rarely applied. Broader adoption is hindered by cost, limited

awareness, weak policies, and skill gaps, highlighting the need for education, policy support, and affordable design solutions.

CONCLUSION

The study concludes that while passive design features such as natural ventilation, shading, and natural lighting are valued and partially adopted in Abuja's low-rise housing estates, their full potential remains untapped due to limited awareness, cost barriers, and lack of professional expertise. There is a strong willingness among residents to embrace these strategies, indicating a need for targeted education, policy support, and affordable implementation to promote sustainable, climate-responsive housing in Abuja.

RECOMMENDATIONS

a. **Increase Public Awareness**: Launch educational campaigns to inform residents about the benefits and practical applications of passive design, especially insulation and cooling landscaping.
b. **Policy Support**: Government and planning authorities should integrate passive design requirements into building codes and housing policies in Abuja.
c. **Professional Training**: Provide targeted training for architects, builders, and construction workers on passive design techniques and climate-responsive architecture.
d. **Promote Affordable Solutions**: Encourage the use of cost-effective, locally sourced materials and passive strategies suitable for Abuja's climate to make sustainable housing more accessible.
e. **Incentivize Adoption**: Offer tax reliefs, grants, or subsidies to developers and homeowners who implement passive design elements in residential projects.

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APPENDICES

PROJECT TITLE:
Design of a passive low-rise housing estate based on user preferences

CLIENT:
Federal housing authority or a private real estate developer

LOCATION:
Karsana district Abuja, Nigeria

by
IORNUMBE VICTOR
BHU/23/MSC/ARC/022

INTRODUCTION

The term "estate" generally implies a higher-end or prestigious property, possibly with luxury features, while "low-rise" refers to the height of the building.

Based on the Nigerian building code, a low-rise housing estate can be said to be a residential development consisting of houses whose vertical rises are within three suspended floors and below.

Such group of houses do not require a lift as a conveyor system for vertical circulation or movement.

NAME	IORNUMBE VICTOR
SCALE	1:100
COURSE	ARC 821
MATRIC NO	BHU/23/MSC/ARC/022

Evaluation of User Preference on Passive Design Elements for the Design of

PROPOSED LOW-RISE HOUSING ESTATE in Abuja.

Aim & objectives

AIM

To create a sustainable low-rise housing estate incorporating user-preferred passive design features to enhance comfort and reduce energy use.

OBJECTIVES

To deliver functional, energy-efficient homes based on user feedback, aligned with Nigerian Building Code and Abuja planning standards.

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DESIGN REQUIREMENT

Key Design Requirements:

a. Estate layout promoting natural ventilation and optimal solar orientation
b. Passive features: cross ventilation, shading devices, natural lighting, insulated roofs/walls and thermal mass
c. Housing types: 1-bedroom flat, 2-bedroom flat, 3-bedroom duplex, 4-bedroom duplex
d. Shared amenities: green spaces, walkways, community areas
e. Infrastructure: solar readiness, water/waste systems, accessibility for all users.

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Site Location
Map of Nigeria showing Abuja
Map showing proposed site
Map showing Gwarimpa - kubwa express road
Map of Abuja showing the six area councils
Map of Abuja municipal area council
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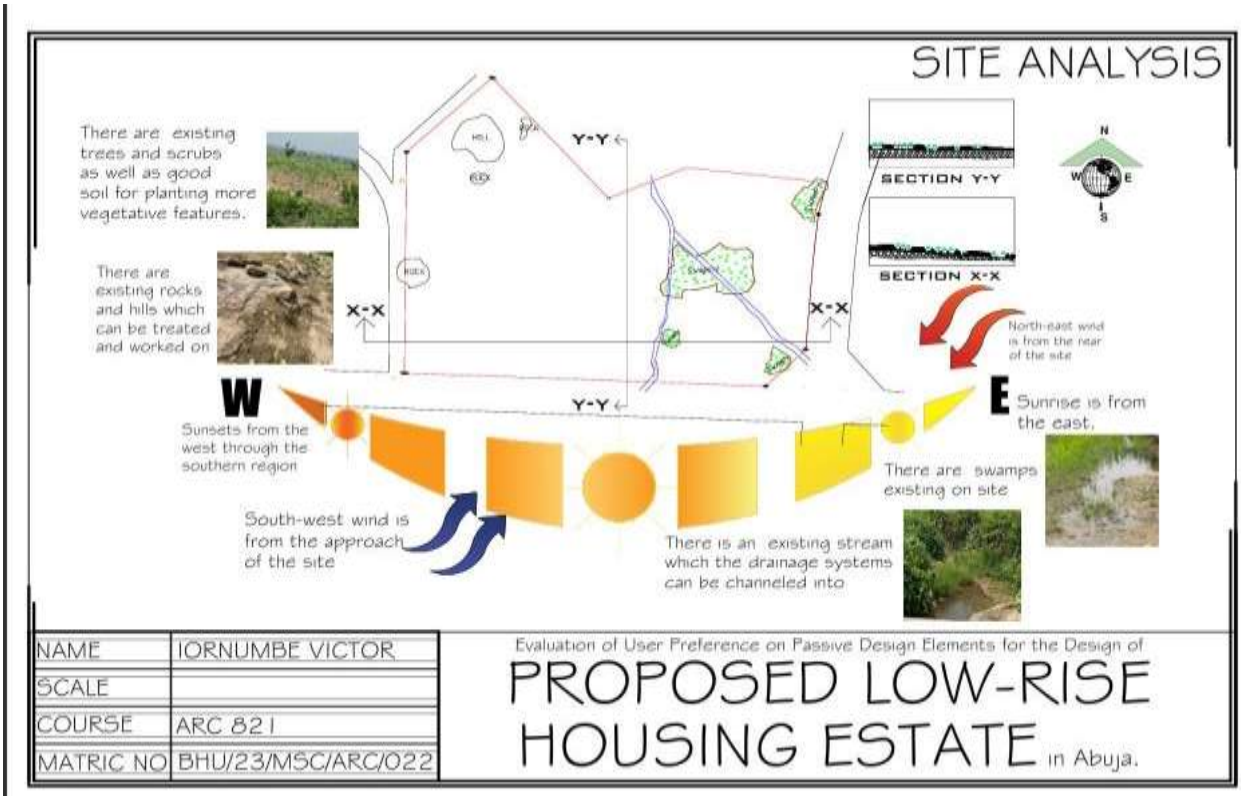
SITE ANALYSIS
There are existing trees and scrubs as well as good soil for planting more vegetative features.
There are existing rocks and hills which can be treated and worked on
X-X
Y-Y
SECTION Y-Y
SECTION X-X
N
W
E
S
North-east wind is from the rear of the site
W
Sunsets from the west through the southern region
E
Sunrise is from the east.
There are swamps existing on site
South-west wind is from the approach of the site
There is an existing stream which the drainage systems can be channeled into
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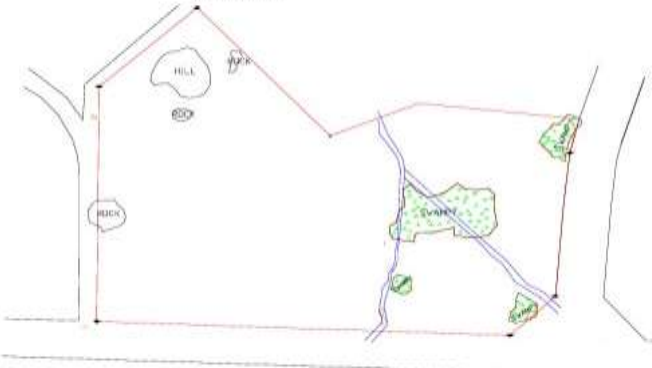
Site Analysis

NNPC Limited and NIPCO fillings station are located north of the proposed site, providing convenient access to fuel and other petroleum products.



Kaniz estate is situated north-east of the proposed site, providing a nearby community for potential residents or visitors.

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CASE STUDY 1

CASE STUDY 'LOCAL' MSHEL GULF VILLA GUZAPE

- Location:Plot 498 BalaMohammed Way, Guzape, F.C.T, Abuja.
- Area:
- Number of apartments:7
- Number of floors: 3
- Construction started : September 2021
- Construction ended: December 2022
- Architect: The design team of Mshel homes Ltd

OVERVIEW

- The Recessed windows and glass create an interesting visual effect by adding depth to the facade. The shadow play generated by the recess makes the building look more dynamic and less flat.
- The Light colors on the exterior are appealing and they serve as a neutral base, making it easier to pair with accent colors.

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SCALE	1 : 100
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Evaluation of User Preference on Passive Design Elements for the Design of

PROPOSED LOW-RISE HOUSING ESTATE in Abuja.

CASE STUDY 1

APPRAISAL

MERITS

- The use of Features such as recessed windows and arcades to offer additional shading while enhancing the aesthetic appeal.
- The use of black-tinted glass to absorbs sunlight, reducing heat transfer into the interior spaces, which can lower cooling costs and reduce glare. This can significantly improve indoor thermal comfort without compromising daylight availability.

DEMERIT

- Inadequate green area.

DEDUCTIONS

- The use of tinted glass to absorbs sunlight.
- The use of recessed windows and arcades.
- The use of Light-colored exterior paints reflect more sunlight.

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SCALE	1:100
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CASE STUDY 1

GROUND FLOOR PLAN FIRST FLOOR PLAN SECOND FLOOR PLAN

NAME	IORNUMBE VICTOR
SCALE	1:100
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Evaluation of User Preference on Passive Design Elements for the Design of

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CASE STUDY 2

CASE STUDY 'LOCAL' MSHEL OPHELIA, MAITAMA

- Location: 12 Loire Crescent, Maitama, F.C.T, Abuja.
- Area:
- Number of apartments: 10
- Number of floors: 6
- Construction started : OCTOBER 2022
- Construction ended: MARCH 2024
- Architect: The design team of Mshel homes Ltd

OVERVIEW

- Ophelia is dynamic, formal, intimate, and exclusively sited in one of the best locations in the city with breathtaking views.
- The Light colors on the exterior are appealing and they serve as a neutral base, making it easier to pair with accent colors.

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SCALE	1:100
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Evaluation of User Preference on Passive Design Elements for the Design of

PROPOSED LOW-RISE HOUSING ESTATE in Abuja.

APPRAISAL

CASE STUDY 2

MERITS

- The use of black-tinted glass to absorbs sunlight, reducing heat transfer into the interior spaces, which can lower cooling costs and reduce glare. This can significantly improve indoor thermal comfort without compromising daylight availability.
- The use of Light-colored exterior paints reflect more sunlight, reducing heat absorption. This helps keep interiors cooler, particularly in hot climates, and lowers air conditioning costs.

DEMERIT

- Inadequate green area.

DEDUCTIONS

- The use of tinted glass to absorbs sunlight.
- The use of Light-colored exterior paints reflect more sunlight.

NAME	IORNUMBE VICTOR
SCALE	1:100
COURSE	ARC 821
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Evaluation of User Preference on Passive Design Elements for the Design of

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CASE STUDY 2

TYPICAL FLOOR PLAN

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SCALE	1:100
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CASE STUDY 3

CASE STUDY 'INTL' EUGENIA WOW CONDOS

- Location: av huayacán, cancún, q.r., mexico
- Area: 1046 m²
- Number of apartments: 32
- Number of floors: 8
- Year of completion: 2018
- Architects: Larraín architects

OVERVIEW

- The design prioritizes intimate proportions and an individual scale, creating spaces that feel private and comfortable.
- The use of locally inspired materials like stucco, concrete, and wood creates a balance between modernity and traditional Mexican architecture.

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Evaluation of User Preference on Passive Design Elements for the Design of

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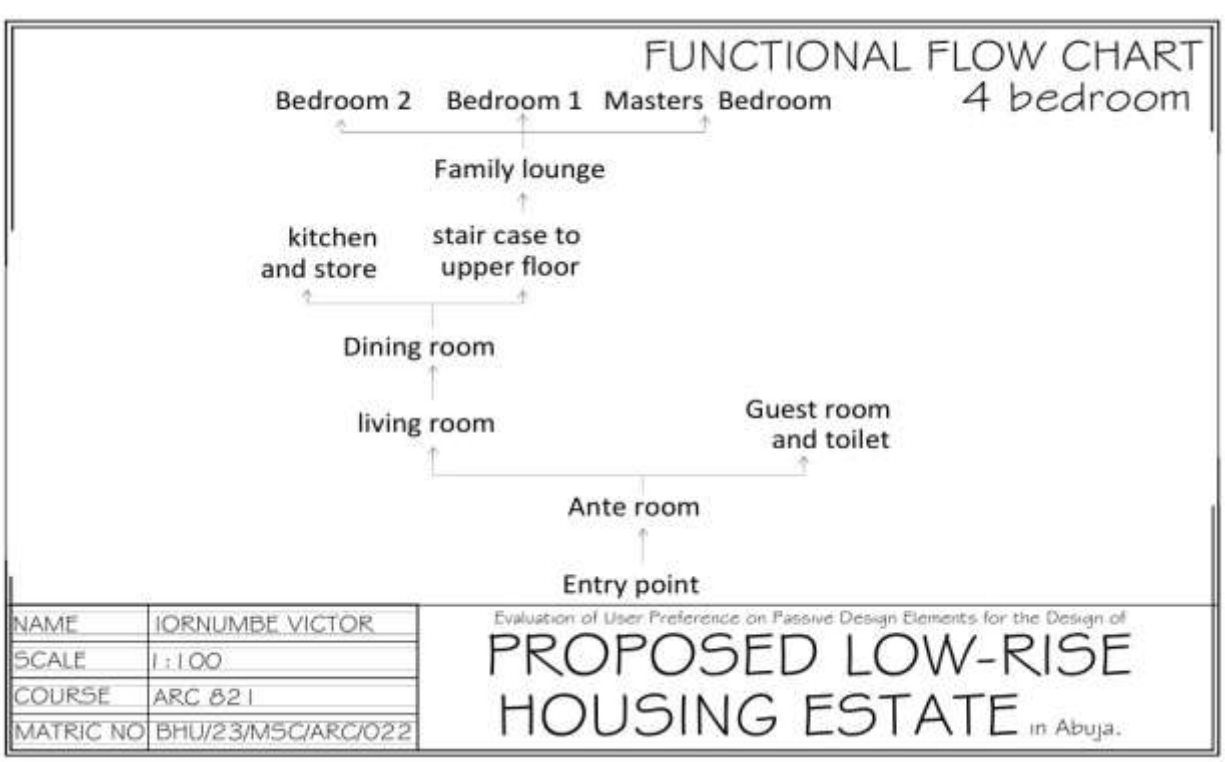
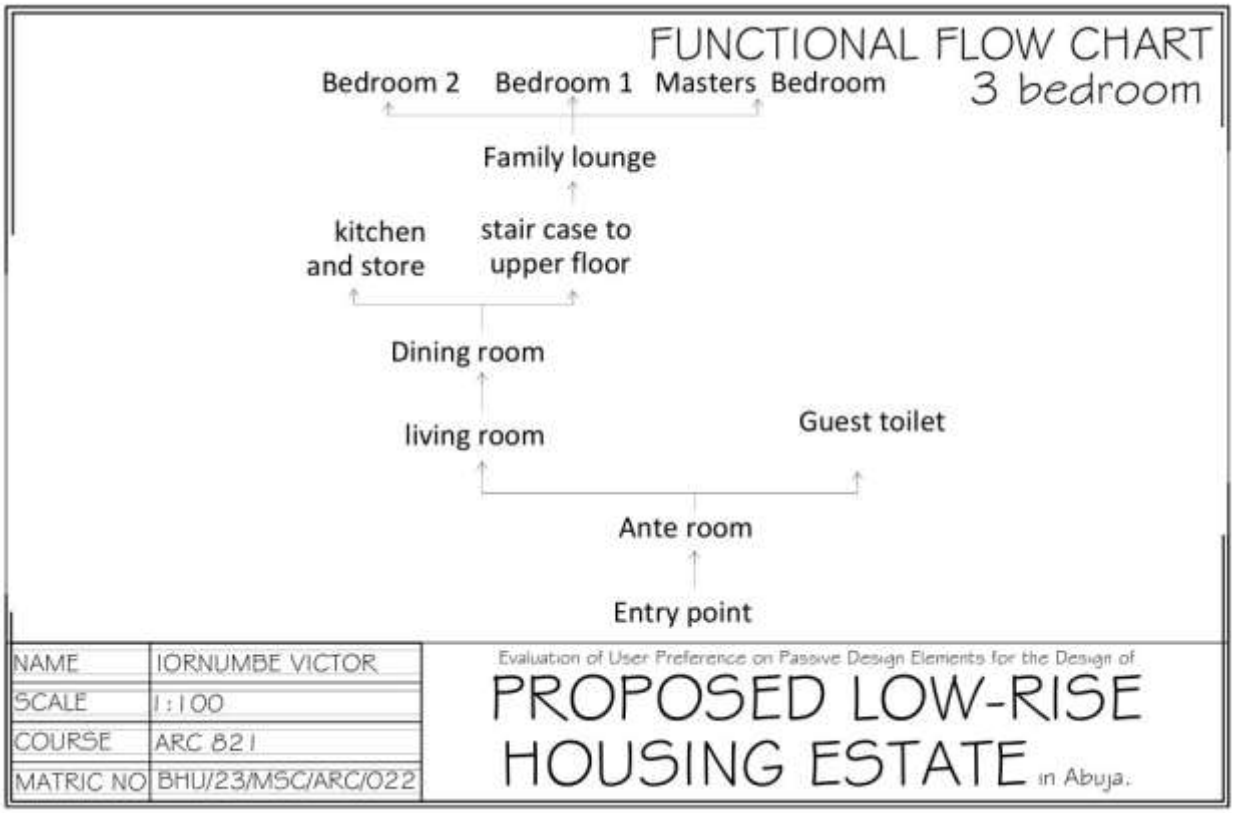
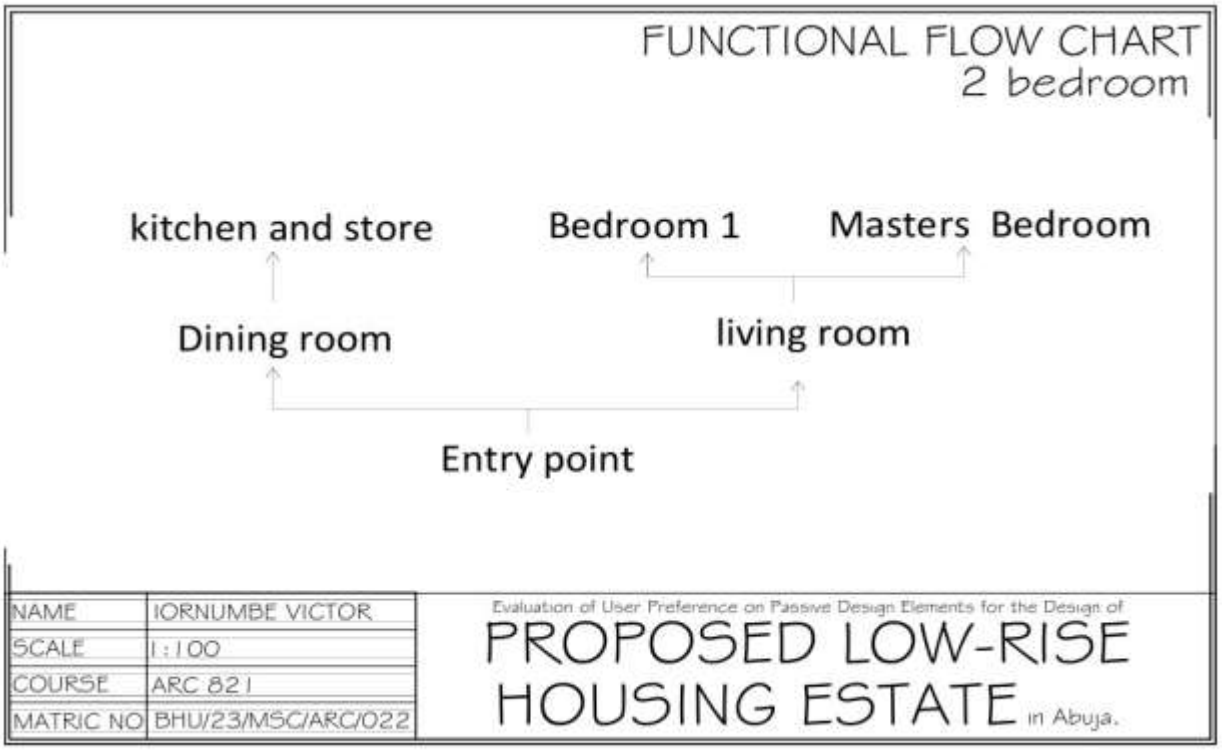


- The use of natural light and ventilation, reducing dependency on




FUNCTIONAL FLOW CHART
2 bedroom
kitchen and store
Bedroom 1
Masters Bedroom
Dining room
living room
Entry point
NAME
IORNUMBE VICTOR
SCALE
1:100
COURSE
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FUNCTIONAL FLOW CHART
1 bedroom
Bedroom
living room
kitchenette
and store
Entry point
NAME
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SCALE
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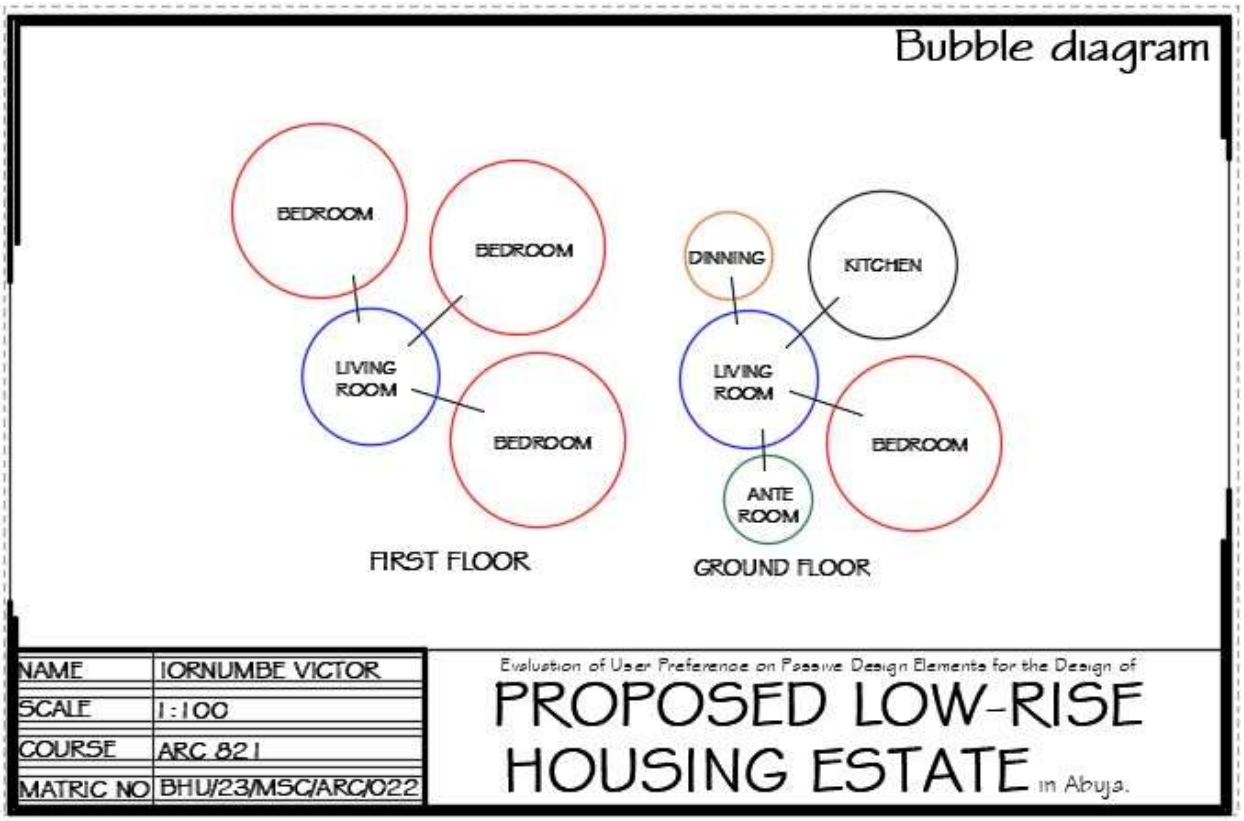
Bubble diagram
BEDROOM
BEDROOM
LIVING ROOM
BEDROOM
FIRST FLOOR
DINNING
KITCHEN
LIVING ROOM
BEDROOM
ANTE ROOM
GROUND FLOOR
NAME
IORNUMBE VICTOR
SCALE
1:100
COURSE
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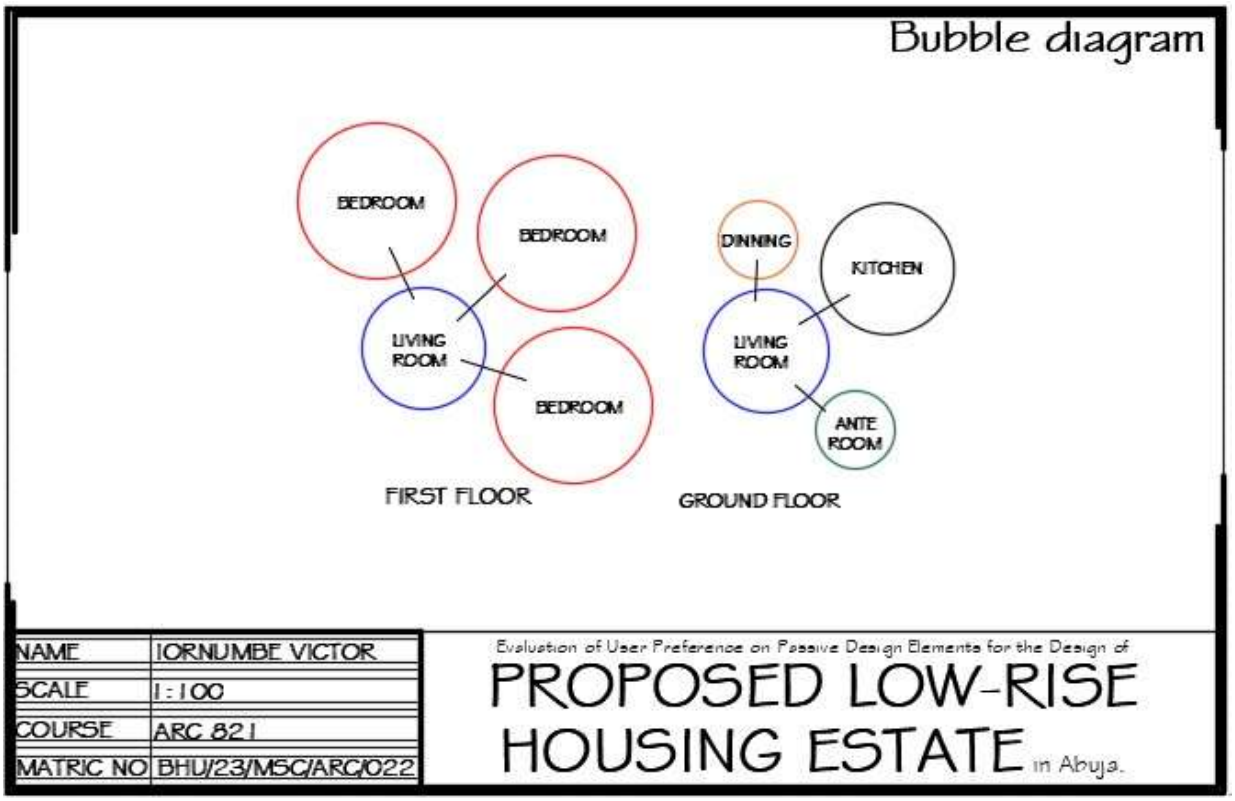
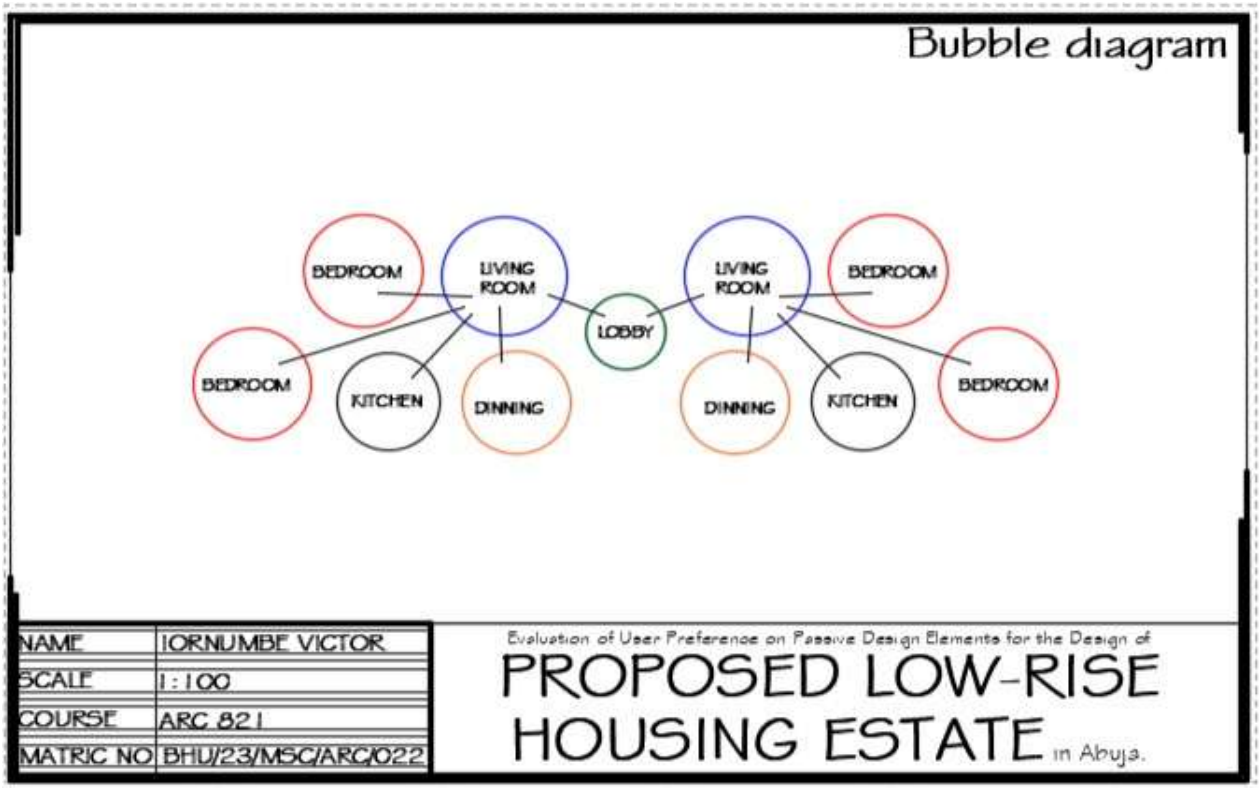
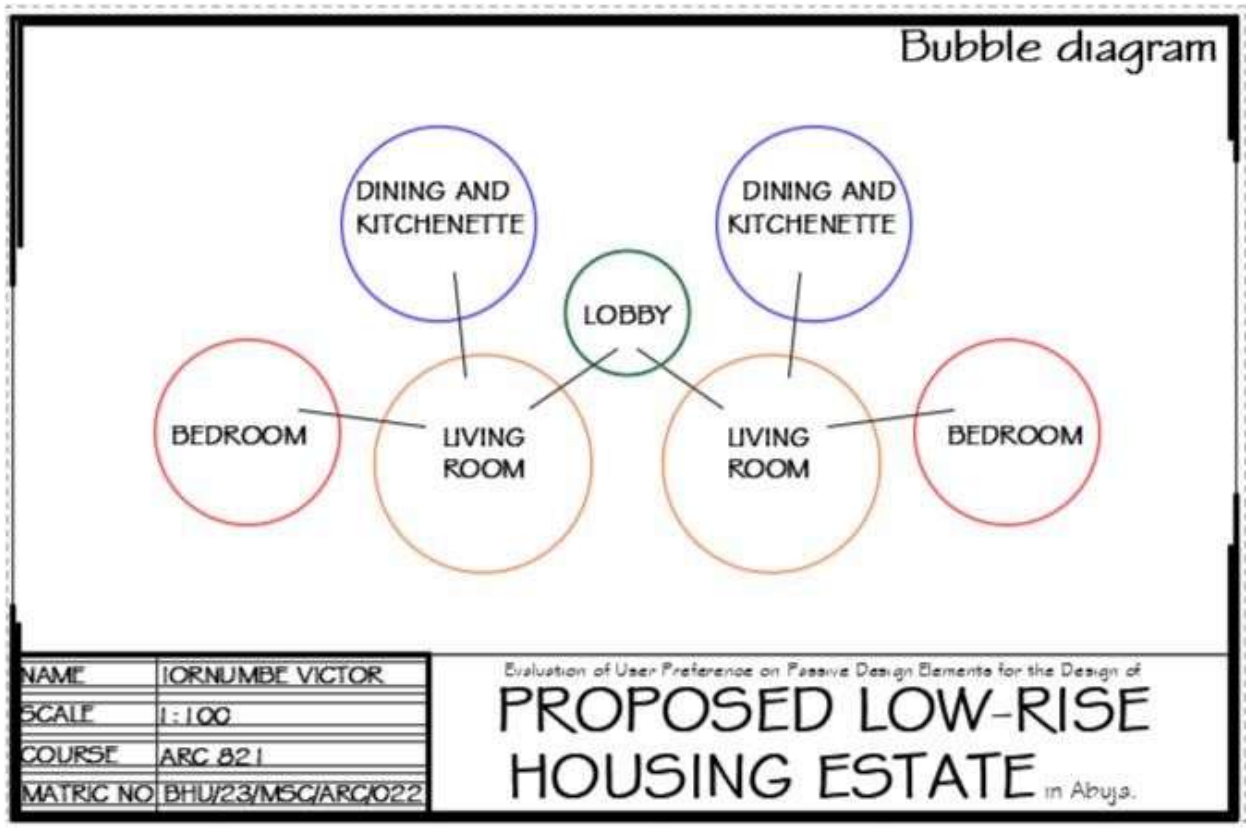

Bubble diagram
BEDROOM
BEDROOM
LIVING ROOM
BEDROOM
FIRST FLOOR
DINNING
KITCHEN
LIVING ROOM
ANTE ROOM
GROUND FLOOR
NAME
IORNUMBE VICTOR
SCALE
1:100
COURSE
ARC 821
MATRIC NO
BHU/23/MSC/ARC/022
Evaluation of User Preference on Passive Design Elements for the Design of
PROPOSED LOW-RISE HOUSING ESTATE in Abuja.


Bubble diagram
BEDROOM
LIVING ROOM
LOBBY
LIVING ROOM
BEDROOM
BEDROOM
KITCHEN
DINNING
DINNING
KITCHEN
BEDROOM
NAME
IORNUMBE VICTOR
SCALE
1:100
COURSE
ARC 821
MATRIC NO
BHU/23/MSC/ARC/022
Evaluation of User Preference on Passive Design Elements for the Design of
PROPOSED LOW-RISE HOUSING ESTATE in Abuja.


Bubble diagram
DINING AND KITCHENETTE
DINING AND KITCHENETTE
LOBBY
BEDROOM
LIVING ROOM
LIVING ROOM
BEDROOM
NAME
IORNUMBE VICTOR
SCALE
1:100
COURSE
ARC 821
MATRIC NO
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CONCEPT

CONCEPT TITLE: HARMONY IN SUSTAINABILITY

The estate is envisioned as a passive, walkable community where residential comfort, ecological sustainability, and urban connectivity coexist. Its layout facilitates natural ventilation, solar control, and social interaction through strategic zoning, building orientation, and integration of public spaces. Each zone is interwoven with green infrastructure to enhance environmental performance and livability.

NAME	IORNUMBE VICTOR
SCALE	1:200
COURSE	ARC 821
MATRIC NO	BHU/23/MSC/ARC/022

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SITE PLAN

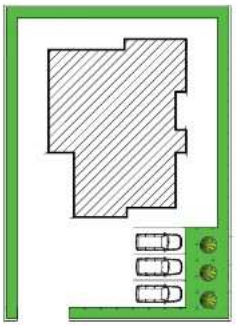
NAME	IORNUMBE VICTOR
SCALE	1:100
COURSE	ARC 821
MATRIC NO	BHU/23/MSC/ARC/022

Evaluation of User Preference on Passive Design Elements for the Design of

PROPOSED LOW-RISE HOUSING ESTATE in Abuja.

SITE PLAN

4-BEDROOM



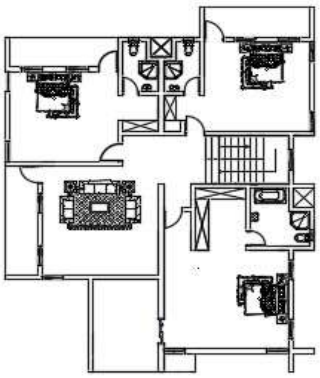
NAME	IORNUMBE VICTOR
SCALE	1:200
COURSE	ARC 821
MATRIC NO	BHU/23/MSC/ARC/022

Evaluation of User Preference on Passive Design Elements for the Design of

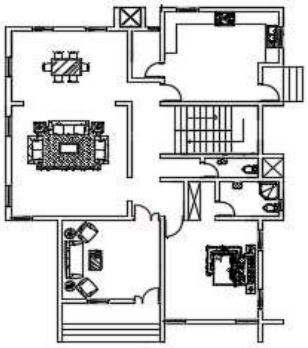
PROPOSED LOW-RISE HOUSING ESTATE in Abuja.

FLOOR PLAN

4 BEDROOM



FIRST FLOOR



GROUND FLOOR

NAME	IORNUMBE VICTOR
SCALE	1:100
COURSE	ARC 821
MATRIC NO	BHU/23/MSC/ARC/022

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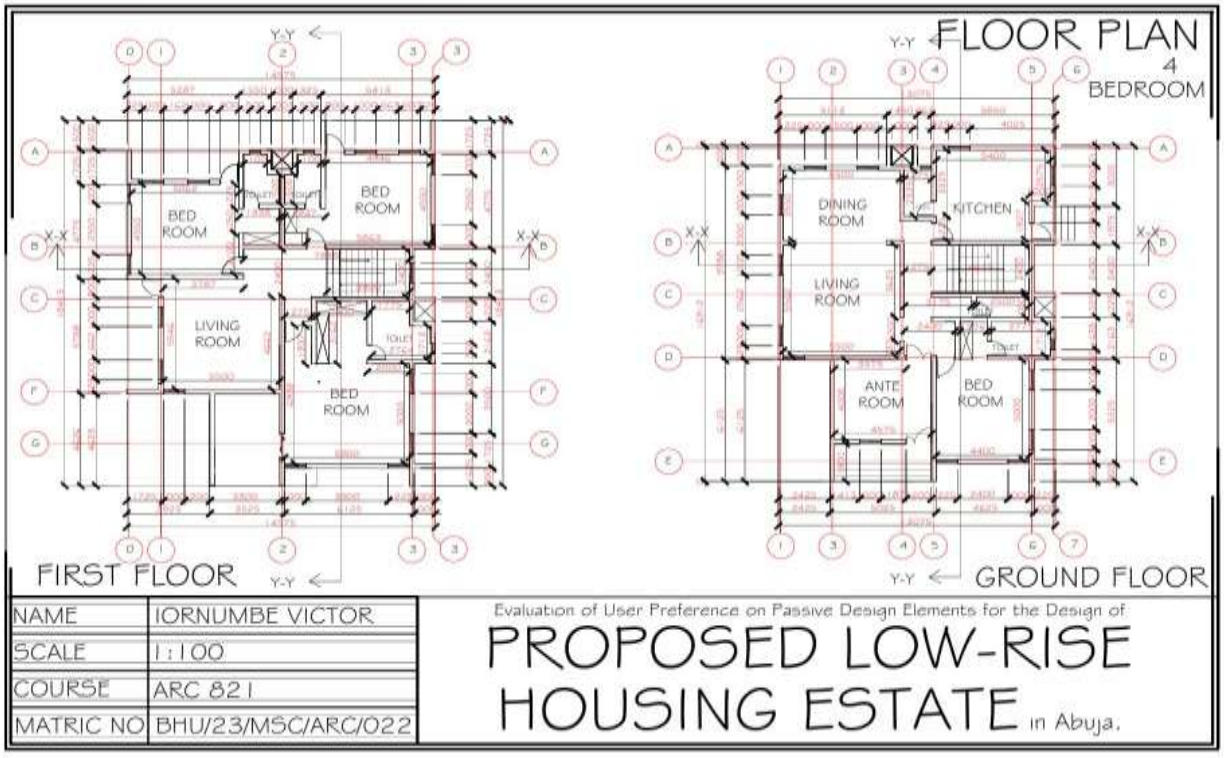
PROPOSED LOW-RISE HOUSING ESTATE in Abuja.


FLOOR PLAN
4
BEDROOM
BED ROOM
BED ROOM
LIVING ROOM
BED ROOM
DINING ROOM
KITCHEN
LIVING ROOM
ANTE ROOM
BED ROOM
FIRST FLOOR
GROUND FLOOR
NAME
IORNUMBE VICTOR
SCALE
1:100
COURSE
ARC 821
MATRIC NO
BHU/23/MSC/ARC/022
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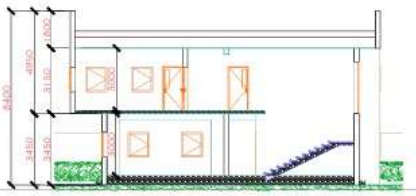
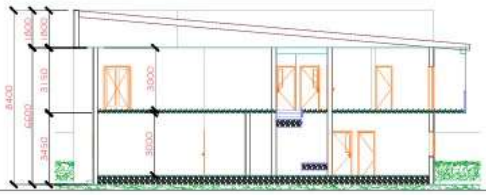
ROOF PLAN
4 BEDROOM
NAME
IORNUMBE VICTOR
SCALE
1:100
COURSE
ARC 821
MATRIC NO
BHU/23/MSC/ARC/022
Evaluation of User Preference on Passive Design Elements for the Design of
PROPOSED LOW-RISE HOUSING ESTATE in Abuja.

SECTION
4 BEDROOM



SECTION X-X



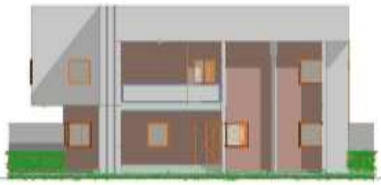
SECTION Y-Y

NAME	IORNUMBE VICTOR
SCALE	1:100
COURSE	ARC 821
MATRIC NO	BHU/23/MSC/ARC/022

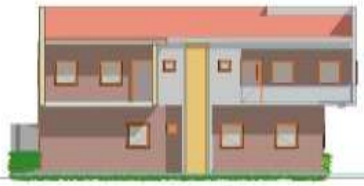
Evaluation of User Preference on Passive Design Elements for the Design of

PROPOSED LOW-RISE HOUSING ESTATE in Abuja.

ELEVATIONS
4 BEDROOM



FRONT ELEVATION



BACK ELEVATION

NAME	IORNUMBE VICTOR
SCALE	1:100
COURSE	ARC 821
MATRIC NO	BHU/23/MSC/ARC/022

Evaluation of User Preference on Passive Design Elements for the Design of

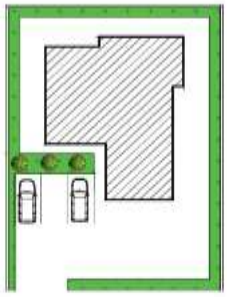
PROPOSED LOW-RISE HOUSING ESTATE in Abuja.


ELEVATIONS
4 BEDROOM
LEFT ELEVATION
RIGHT ELEVATION
NAME
IORNUMBE VICTOR
SCALE
1:100
COURSE
ARC 821
MATRIC NO
BHU/23/MSC/ARC/022
Evaluation of User Preference on Passive Design Elements for the Design of
PROPOSED LOW-RISE HOUSING ESTATE in Abuja.


3D
4 BEDROOM
NAME
IORNUMBE VICTOR
SCALE
COURSE
ARC 821
MATRIC NO
BHU/23/MSC/ARC/022
Evaluation of User Preference on Passive Design Elements for the Design of
PROPOSED LOW-RISE HOUSING ESTATE in Abuja.

SITE PLAN

3-BEDROOM



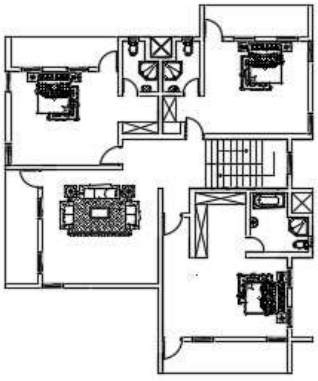
NAME	IORNUMBE VICTOR
SCALE	1:200
COURSE	ARC 821
MATRIC NO	BHU/23/MSC/ARC/022

Evaluation of User Preference on Passive Design Elements for the Design of

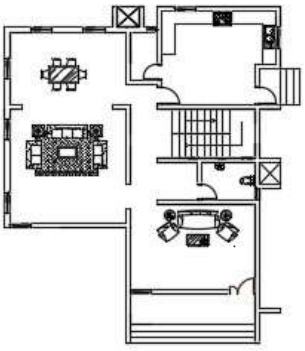
PROPOSED LOW-RISE HOUSING ESTATE in Abuja.

FLOOR PLAN

3 BEDROOM



FIRST FLOOR

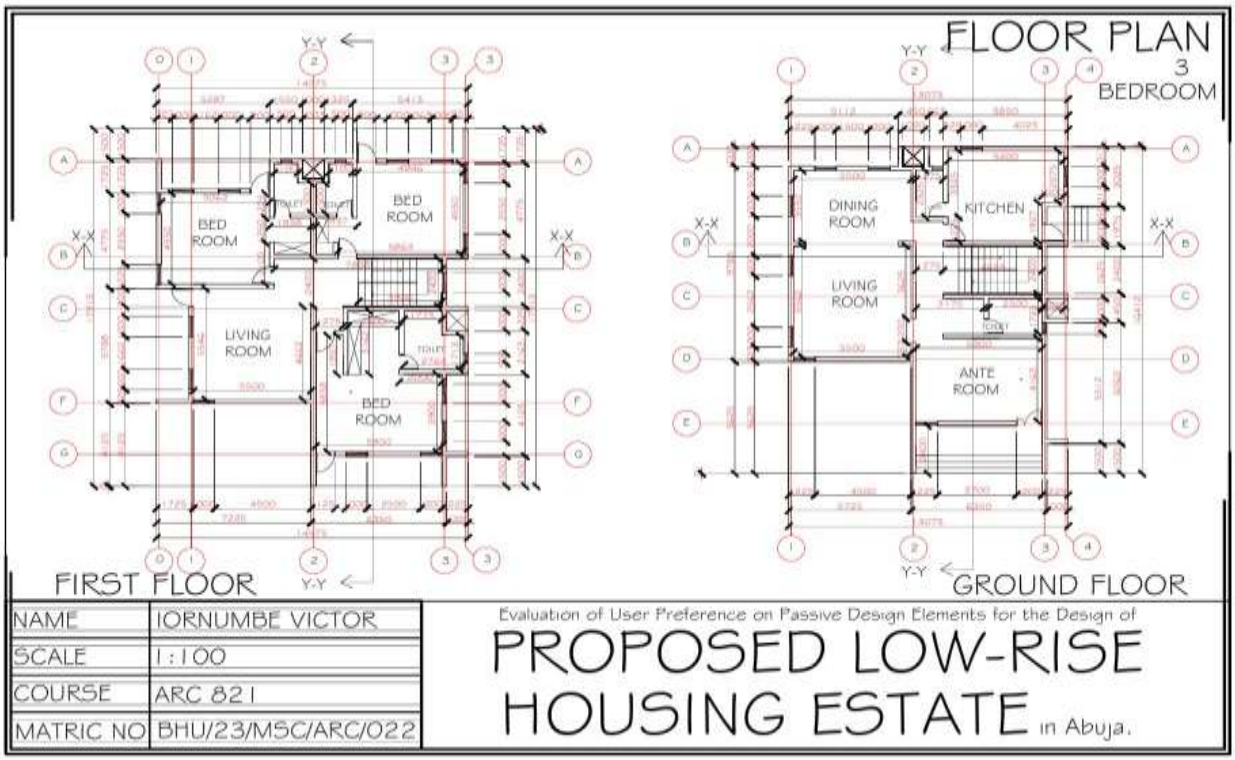


GROUND FLOOR

NAME	IORNUMBE VICTOR
SCALE	1:100
COURSE	ARC 821
MATRIC NO	BHU/23/MSC/ARC/022

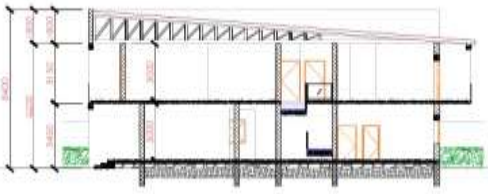
Evaluation of User Preference on Passive Design Elements for the Design of

PROPOSED LOW-RISE HOUSING ESTATE in Abuja.


FLOOR PLAN
3 BEDROOM
BED ROOM
BED ROOM
LIVING ROOM
BED ROOM
TOILET
DINING ROOM
KITCHEN
LIVING ROOM
ANTE ROOM
TOILET
X-X
Y-Y
FIRST FLOOR
GROUND FLOOR
NAME
IORNUMBE VICTOR
SCALE
1:100
COURSE
ARC 821
MATRIC NO
BHU/23/MSC/ARC/022
Evaluation of User Preference on Passive Design Elements for the Design of
PROPOSED LOW-RISE HOUSING ESTATE in Abuja.


ROOF PLAN
3 BEDROOM
NAME
IORNUMBE VICTOR
SCALE
1:100
COURSE
ARC 821
MATRIC NO
BHU/23/MSC/ARC/022
Evaluation of User Preference on Passive Design Elements for the Design of
PROPOSED LOW-RISE HOUSING ESTATE in Abuja.

SECTION
3 BEDROOM



SECTION Y-Y

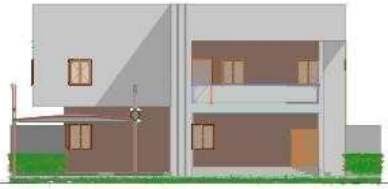
SECTION X-X

NAME	IORNUMBE VICTOR
SCALE	1:100
COURSE	ARC 821
MATRIC NO	BHU/23/MSC/ARC/022

Evaluation of User Preference on Passive Design Elements for the Design of

PROPOSED LOW-RISE HOUSING ESTATE in Abuja.

ELEVATIONS
3 BEDROOM



FRONT ELEVATION

BACK ELEVATION

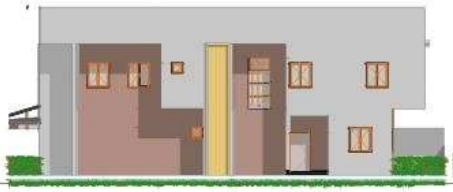
NAME	IORNUMBE VICTOR
SCALE	1:100
COURSE	ARC 821
MATRIC NO	BHU/23/MSC/ARC/022

Evaluation of User Preference on Passive Design Elements for the Design of

PROPOSED LOW-RISE HOUSING ESTATE in Abuja.

ELEVATIONS
3 BEDROOM

LEFT ELEVATION



RIGHT ELEVATION

NAME	IORNUMBE VICTOR
SCALE	1:100
COURSE	ARC 821
MATRIC NO	BHU/23/MSC/ARC/022

Evaluation of User Preference on Passive Design Elements for the Design of

PROPOSED LOW-RISE HOUSING ESTATE in Abuja.

3D
3 BEDROOM

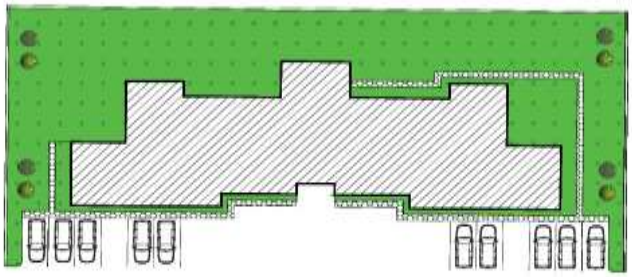
NAME	IORNUMBE VICTOR
SCALE	
COURSE	ARC 821
MATRIC NO	BHU/23/MSC/ARC/022

Evaluation of User Preference on Passive Design Elements for the Design of

PROPOSED LOW-RISE HOUSING ESTATE in Abuja.

SITE PLAN

2-BEDROOM



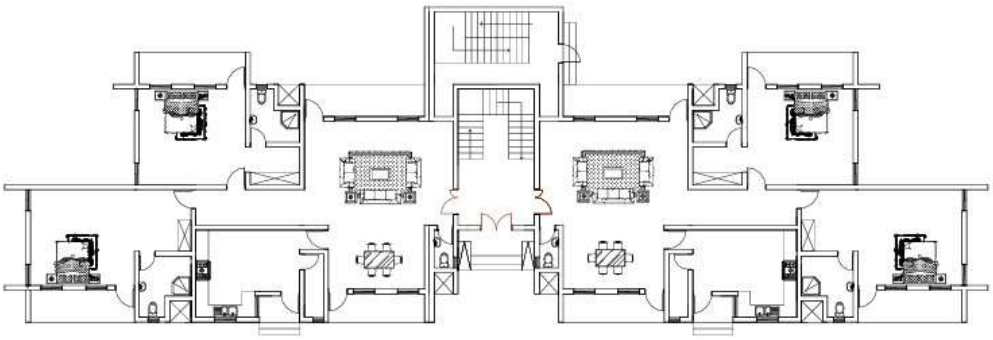
NAME	IORNUMBE VICTOR
SCALE	1:200
COURSE	ARC 821
MATRIC NO	BHU/23/MSC/ARC/022

Evaluation of User Preference on Passive Design Elements for the Design of

PROPOSED LOW-RISE HOUSING ESTATE in Abuja.

FLOOR PLAN

2 BEDROOM



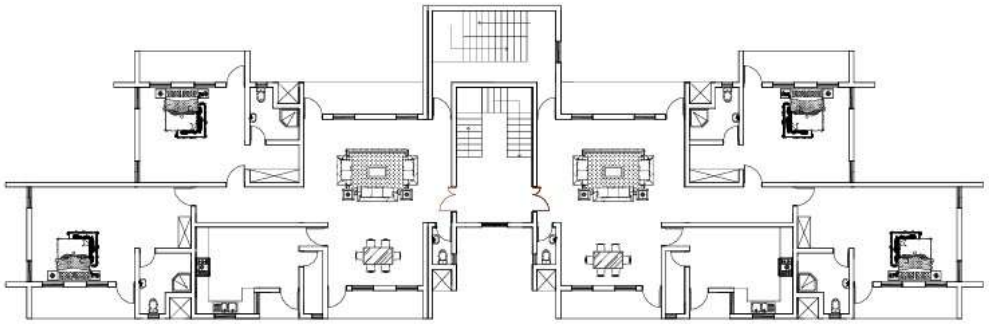
GROUND FLOOR

NAME	IORNUMBE VICTOR
SCALE	1:100
COURSE	ARC 821
MATRIC NO	BHU/23/MSC/ARC/022

Evaluation of User Preference on Passive Design Elements for the Design of

PROPOSED LOW-RISE HOUSING ESTATE in Abuja.

FLOOR PLAN
2 BEDROOM



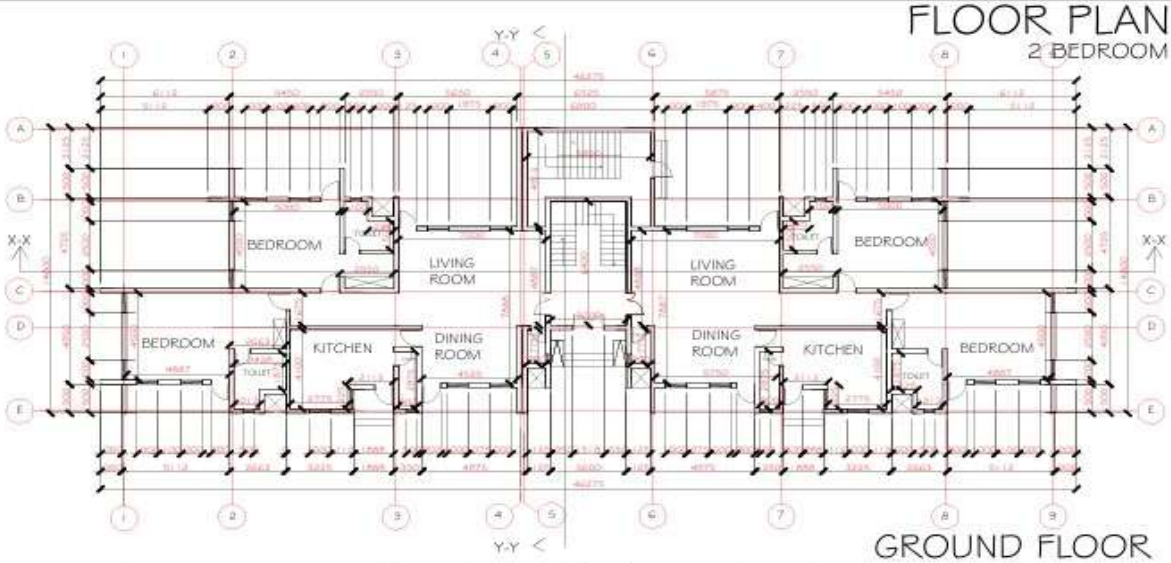
1 & 2 FLOOR

NAME	IORNUMBE VICTOR
SCALE	1:100
COURSE	ARC 821
MATRIC NO	BHU/23/MSC/ARC/022

Evaluation of User Preference on Passive Design Elements for the Design of

PROPOSED LOW-RISE HOUSING ESTATE in Abuja.

FLOOR PLAN
2 BEDROOM

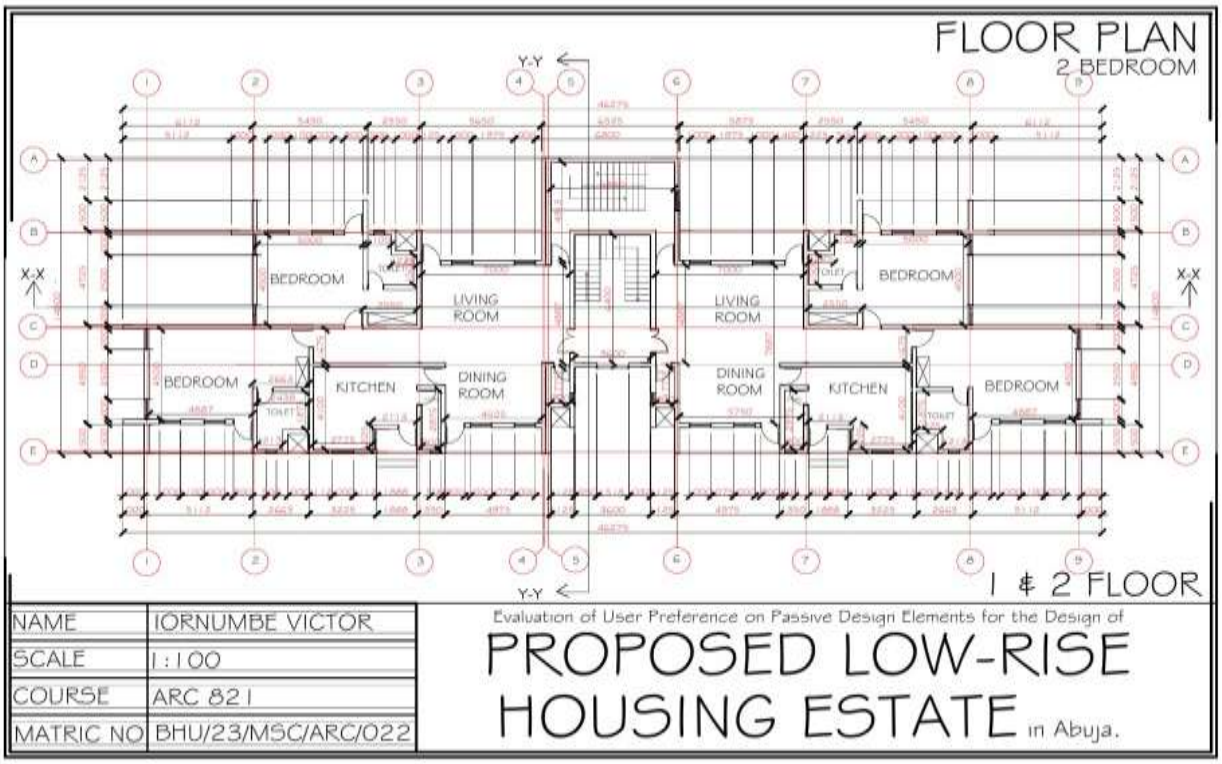


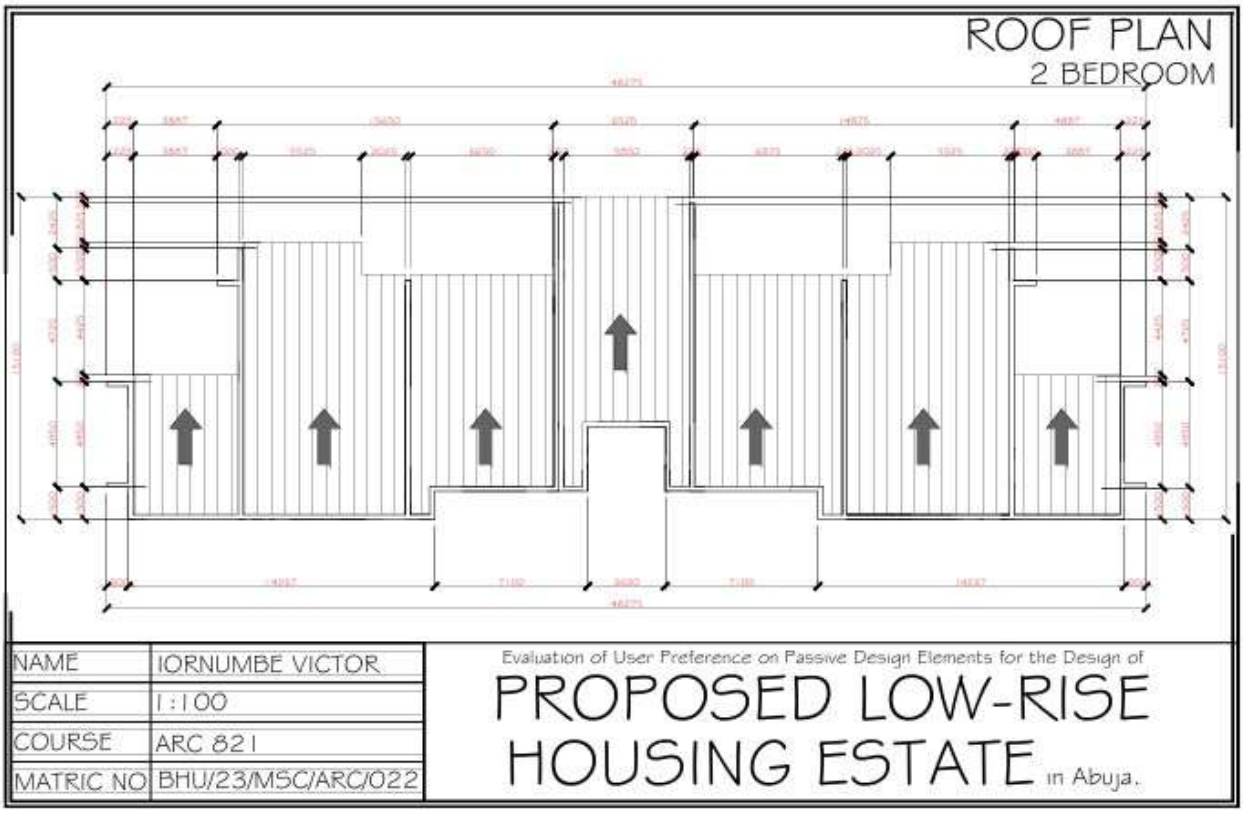
GROUND FLOOR

NAME	IORNUMBE VICTOR
SCALE	1:100
COURSE	ARC 821
MATRIC NO	BHU/23/MSC/ARC/022

Evaluation of User Preference on Passive Design Elements for the Design of

PROPOSED LOW-RISE HOUSING ESTATE in Abuja.


FLOOR PLAN
2 BEDROOM
Y-Y
X-X
BEDROOM
LIVING ROOM
KITCHEN
DINING ROOM
TOILET
1 & 2 FLOOR
NAME
IORNUMBE VICTOR
SCALE
1:100
COURSE
ARC 821
MATRIC NO
BHU/23/MSC/ARC/022
Evaluation of User Preference on Passive Design Elements for the Design of
PROPOSED LOW-RISE HOUSING ESTATE in Abuja.


ROOF PLAN
2 BEDROOM
NAME
IORNUMBE VICTOR
SCALE
1:100
COURSE
ARC 821
MATRIC NO
BHU/23/MSC/ARC/022
Evaluation of User Preference on Passive Design Elements for the Design of
PROPOSED LOW-RISE HOUSING ESTATE in Abuja.


SECTION
2 BEDROOM
SECTION X-X
SECTION Y-Y
NAME
IORNUMBE VICTOR
SCALE
1:100
COURSE
ARC 821
MATRIC NO
BHU/23/MSC/ARC/022
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PROPOSED LOW-RISE HOUSING ESTATE in Abuja.


ELEVATIONS
2 BEDROOM
FRONT ELEVATION
BACK ELEVATION
NAME
IORNUMBE VICTOR
SCALE
1:200
COURSE
ARC 821
MATRIC NO
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Evaluation of User Preference on Passive Design Elements for the Design of
PROPOSED LOW-RISE HOUSING ESTATE in Abuja.


ELEVATIONS
2 BEDROOM
LEFT ELEVATION
RIGHT ELEVATION
NAME
IORNUMBE VICTOR
SCALE
1:100
COURSE
ARC 821
MATRIC NO
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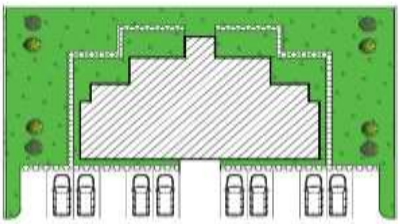
Evaluation of User Preference on Passive Design Elements for the Design of
PROPOSED LOW-RISE HOUSING ESTATE in Abuja.


3D
2 BEDROOM
NAME
IORNUMBE VICTOR
SCALE
1:200
COURSE
ARC 821
MATRIC NO
BHU/23/MSC/ARC/022
Evaluation of User Preference on Passive Design Elements for the Design of
PROPOSED LOW-RISE HOUSING ESTATE in Abuja.

SITE PLAN

1-BEDROOM



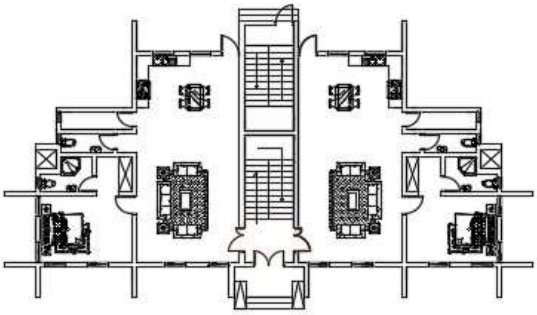
NAME	IORNUMBE VICTOR
SCALE	1:200
COURSE	ARC 821
MATRIC NO	BHU/23/MSC/ARC/022

Evaluation of User Preference on Passive Design Elements for the Design of

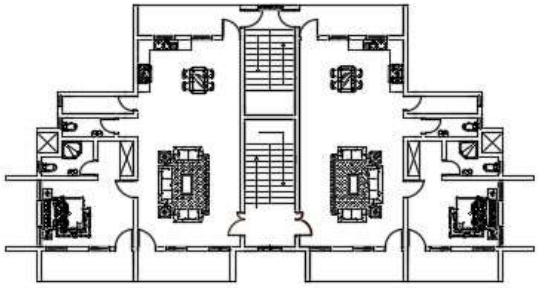
PROPOSED LOW-RISE HOUSING ESTATE in Abuja.

FLOOR PLAN

1 BEDROOM



GROUND FLOOR

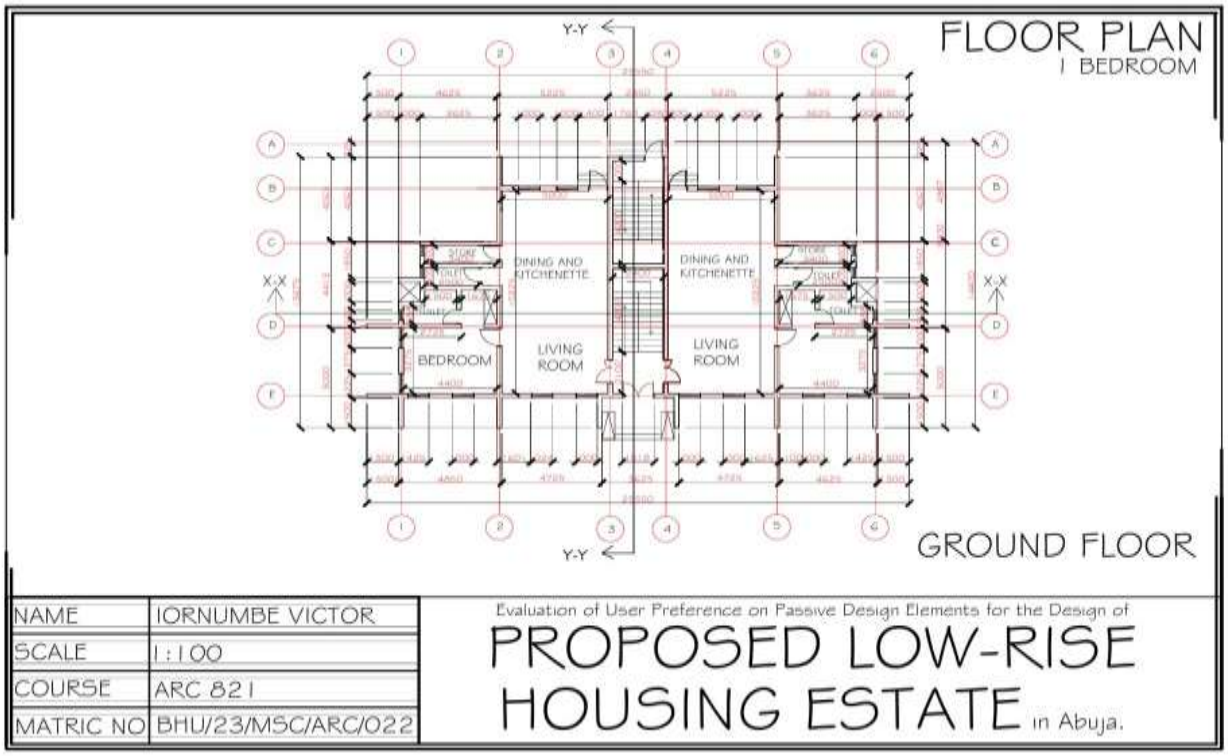


1 - 2 FLOOR

NAME	IORNUMBE VICTOR
SCALE	1:100
COURSE	ARC 821
MATRIC NO	BHU/23/MSC/ARC/022

Evaluation of User Preference on Passive Design Elements for the Design of

PROPOSED LOW-RISE HOUSING ESTATE in Abuja.


FLOOR PLAN
1 BEDROOM
Y-Y
X-X
DINING AND KITCHENETTE
LIVING ROOM
BEDROOM
GROUND FLOOR
NAME
IORNUMBE VICTOR
SCALE
1:100
COURSE
ARC 821
MATRIC NO
BHU/23/MSC/ARC/022
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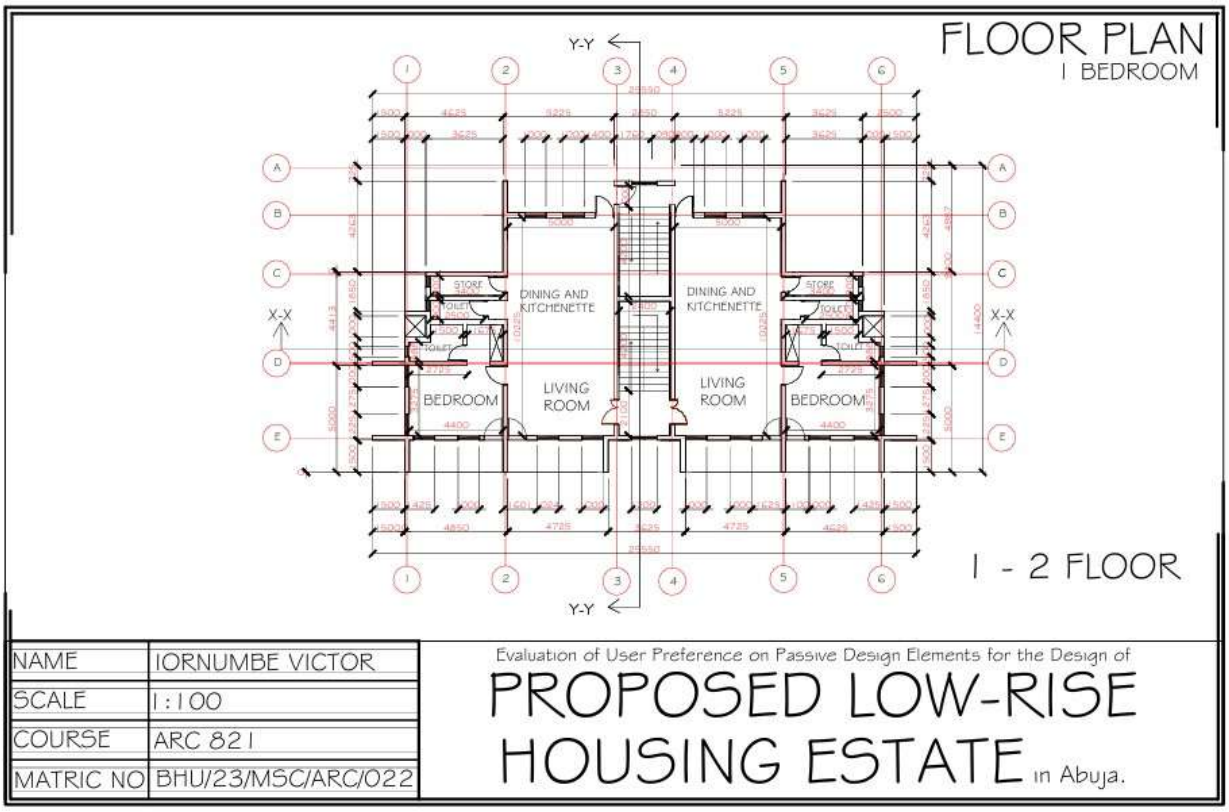
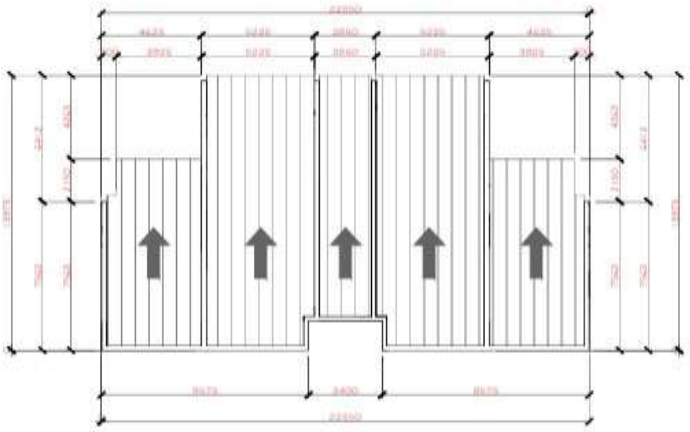
PROPOSED LOW-RISE HOUSING ESTATE in Abuja.


FLOOR PLAN
1 BEDROOM
Y-Y
X-X
DINING AND KITCHENETTE
LIVING ROOM
BEDROOM
1 - 2 FLOOR
NAME
IORNUMBE VICTOR
SCALE
1:100
COURSE
ARC 821
MATRIC NO
BHU/23/MSC/ARC/022
Evaluation of User Preference on Passive Design Elements for the Design of
PROPOSED LOW-RISE HOUSING ESTATE in Abuja.

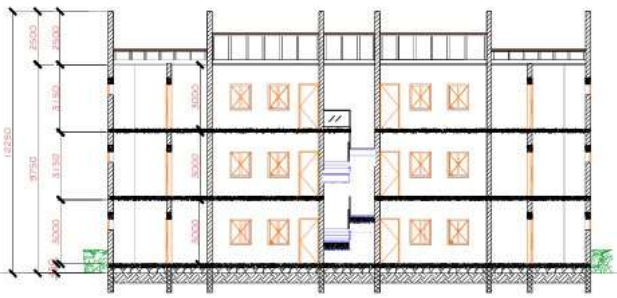
ROOF PLAN
1 BEDROOM



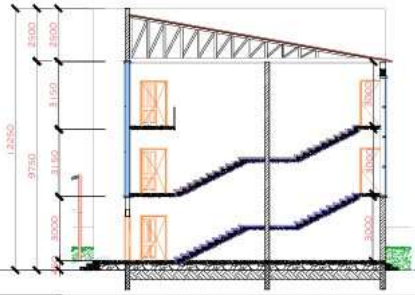
NAME	IORNUMBE VICTOR
SCALE	1:100
COURSE	ARC 821
MATRIC NO	BHU/23/MSC/ARC/022

Evaluation of User Preference on Passive Design Elements for the Design of
PROPOSED LOW-RISE HOUSING ESTATE in Abuja.

SECTION
1 BEDROOM



SECTION X-X



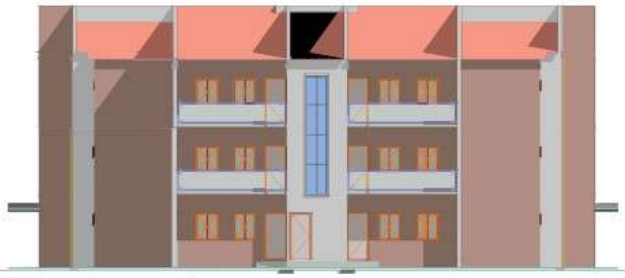
SECTION Y-Y

NAME	IORNUMBE VICTOR
SCALE	1:100
COURSE	ARC 821
MATRIC NO	BHU/23/MSC/ARC/022

Evaluation of User Preference on Passive Design Elements for the Design of
PROPOSED LOW-RISE HOUSING ESTATE in Abuja.

ELEVATIONS
1 BEDROOM

FRONT ELEVATION



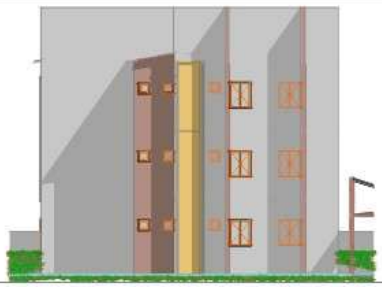
BACK ELEVATION

NAME	IORNUMBE VICTOR
SCALE	1:100
COURSE	ARC 821
MATRIC NO	BHU/23/MSC/ARC/022

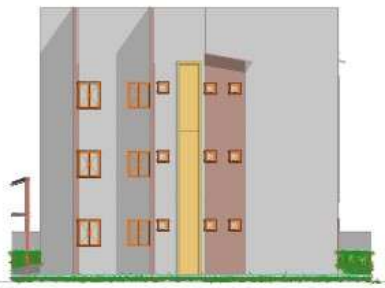
Evaluation of User Preference on Passive Design Elements for the Design of

PROPOSED LOW-RISE HOUSING ESTATE in Abuja.

ELEVATIONS
1 BEDROOM



LEFT ELEVATION



RIGHT ELEVATION

NAME	IORNUMBE VICTOR
SCALE	1:100
COURSE	ARC 821
MATRIC NO	BHU/23/MSC/ARC/022

Evaluation of User Preference on Passive Design Elements for the Design of

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3D
1 BEDROOM
NAME
IORNUMBE VICTOR
SCALE
1:200
COURSE
ARC 821
MATRIC NO
BHU/23/MSC/ARC/022
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PROPOSED LOW-RISE HOUSING ESTATE in Abuja.