A PROPOSED BUS STATION FOR ELESEKAN IBEJU LEKKI , LAGOS STATE.

BY

ABINOKHAUNO AMOBOTSE NICHOLAS

MAT. NO.: ENV/2292070107

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BEING A PROJECT WORK SUBMITTED TO THE DEPARTMENT OF ARCHITECTURAL TECHNOLOGY, AUCHI POLYTECHNIC AUCHI EDO STATE.

IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF HIGHER NATIONAL DIPLOMA (HND) IN ARCHITECTURAL TECHNOLOGY.

DECEMBER, 2022

CERTIFICATION

This is to certify that this project is an original work undertaken by **ABINOKHAUNO AMOBOTSE NICHOLAS** with mat. No.: **ENV/2292070107** and has been prepared in accordance with the regulation governing the preparation and presentation of project in the Federal Polytechnic, Auchi.

_____ _____

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(Project Supervisor)

_____ _____

ARC. MRS AKHARIA O. **Date**

(Head of Department)

_____ _____

External Supervisor **Date**

DEDICATION

This project is dedicated to God Almighty for his divine inspiration, infinite mercies, protection and guidance upon my life and academic pursuit.

ACKNOWLEDGEMENT

The success of my work does not exist in a vacuum. It depends strongly on a number of both material and human factors that must have positive impacts on its accomplishment, which therefore needs to be acknowledged.

I wish to express my profound gratitude to God Almighty for seeing me through my academic life and for his divine works and mercies.

I also want to appreciate the management and staff of the department of architectural technology, Auchi polytechnic Auchi, for their support and impact of knowledge.

My gratitude to my lecturer/supervisor Arc. Timothy Aigboje. His sage advice, insightful criticisms and patient encouragement aided the writing of this work in immeasurable ways.

My gratitude also goes to my parents Mr and Mrs Abinokhauno for their support financially, spiritually, morally and in other aspects. To my siblings, I say thank you all.

ABSTRACT

This research shall be based on provision of a central bus transit station which is a proposed bus terminal for Elesekan ibeju lekki, Lagos. This research design will make provision for sufficient offices to carryout administrative activities and also provision and considerations will be taken into account with regards to the passengers making use of the terminal. The proposed development in terms of structural design shall be in harmony with surrounding environment of that area. The study of existing related types in different parts of the world with good adherence to establish standard guides towards better appraised as this enables a complete analytic profile to be drawn in the evolution of the proposed facility. A complete study of the region in which the intended facility is situated guides toward a better understanding of the effect of the proposed bus terminal building on its immediate environment and vice-versa. It is with the aforementioned that a functional bus terminal building will become established in its intended official setting.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 BACKGROUND STUDY

Transportation is an integral part of the functioning of the society. The transport system improves the social, economic, industrial, commercial progress and transfers the society into an organized one. It is one of the most essential services, vital force for determining the direction of development.

Bus terminals are predominantly used for inter-city and intra-city movement because of the higher accessibility of bus terminals. These are the places with very high pedestrians which might be looking for another transport mode to continue their journey and reach their destination.

Terminals serve as a point of:

- Concentration
- Dispersion
- Loading /unloading of the passengers
- Interchange of mode
- Storage of passengers and vehicles
- Documentation of movement
- Information system
- Integration of various systems of transportation.

Lagos is an overpopulated city, with scarcity of land and disorganized transport planning. So cohesive planning of land use, transport and road network is very necessary for the proper development of the city.

Bus transportation is very important mode of transportation of a city. A bus terminal is defined as an area way from the general flow of road vehicle, which gives buses and coaches the freedom of movement to set down and pick up passengers in safety and comfort. Intercity, inter-district and sometimes international buses use this structure for the pickup and drop off of passengers. The terminal may be intended as a terminal station for a number of routes, or as a transfer station where routes continue. The number of bays for arrival and departure, number of bus parking all depends on the number of buses that terminal is serving and the per hour departure and arrival rate. Bus terminal platforms may be assigned to fixed bus lines, or variables in combination with a dynamic passenger information system. Sometimes this structure comes along with other commercial facilities which serve as a revenue generating source.

An increased emphasis on bus transportation linking suburbs and downtown via regular thoroughfares seems to offer a reasonable solution to the problem of mass-movement in many medium-sized metropolitan areas. This approach has, of course, considerable advantages of flexibility and lower cost of facilities and equipment. Bus transportation has had a steady but

back door type development; it has missed completely the heraldry that surrounded the railroads during their great period of expansion in the last century. Small bus companies, many lacking adequate capital, sprang up rapidly and haphazardly during World War I and in the several years thereafter; they developed business largely in communities lacking convenient access to the railroads.

Public Transport Stations, that is bus station, is the product of urban development, the corresponding design proposals are drawn up based on the status of the city frequently, and unified with urban planning. Although the bus stations can satisfy the basic function of the urban environment at the present stage, but it lacks the cultural connotation and individual character of the city as a whole. The appearance of bus station looks all in the same key, which not only do not play the role of beautifying the city, but also leave passengers cannot feel the feeling of freshness. Solving the general decorative structural problems by space modeling and color matching simply leads no breakthrough innovation, which ignores discussion of cultural heritage and integrity. As a whole, the spiritual connotation of the bus station is not given, and the cultural and artistic characteristics of the bus station cannot be taken into account. In addition, urban residents have weak awareness of the public transport station, and their participation in design opinions is low, resulting in the bus station is still unable to fully meet the wishes of people, the damages of stations are serious, design strategy for fast lane that leads to the frequency of safety accidents increases. At this stage, although the bus station can ensure the realization of basic functions, but new technologies and concepts are still lacking in development .

1.2 STATEMENTS OF RESEARCH PROBLEMS

Most bus stations in developing countries are often design without taking sufficient consideration of climatic factors. At this stage, the bus station meet their basic functions at the same time without considering the parking area. When the bus pulled into the station, passengers are crowded with each other in order to get on the bus as soon as possible, sometimes passengers could be pushed down the station, and this could lead to injuries. There is no obvious boundaries between bus station and pavement, and the bus station is easily to get destroyed.

Bus station not only need to consider the general passenger situation, but also should consider special group situation, such as children who are not tall enough, old people who are not easy to move and parents who are carrying their children, which are not fully considered in current bus station design status. There are some shortages like lighting intensity of the stop sign is not high, no English version in the stop sign, no access for physically handicapped, which could not meet the needs of special groups. **T**he bus station failed to satisfy the humanization design completely, such as text is too small in the stop sign to recognize, no public seat and ceiling are designed as rest and shade parts for passengers, large advertising area resulting in the bus route map occupied and the size of the bus station is not considered according to the flow of people.

In recent years, traffic accident occurred frequently around the bus station, which mainly due to few consideration for the parking area in bus station design, The passengers see the bus approaching in the distance, in order to get on the bus as soon as possible, has crowded to the

road, sometimes passengers could be pushed down the station, if bus has no time to brake personal injuries could be caused. Safety is also an important principle to avoid the occurrence of safety accidents.

The above reasons make it essential to come up with a design of a bus station for Elesekan Ibeju Lekki Lagos, which will embark upon the action of providing enough spaces for in and out movements which will be able to accommodate more than one buses per hour and also provide an interface between transport modes enabling passengers and cargo to transit.

1.3 JUSTIFICATION FOR THE STUDY

The purpose of the bus station is to create and maintain adequate communication channels. The bus station design is an integrated complex, therefore, the local design should be unified with the whole. Not only the local style should be unified with the whole city, but also capacity design requires the area vehicle flow rate and visitors flow rate as the baseline, so as to effectively promote the relationship between people and people, structure and function.

Architecturally. This research is undertaken to solve the problem of providing adequate spaceing for one or more vehicles coming in per hour, and also to establish a smooth circulation to reduce traffic congestion.

1.4 RESEARCH QUESTIONS

In the cause of this research the following question are raised to assist in research process.

A. Is there really the need for more parking spaces?
B. How many number of vehicles will be coming in per hour?
C. What means can be adopted for controlling traffic and congestion of vehicles?
D. How can these means be applied?

1.5 AIM AND OBJECTIVES

1.5.1 The Aims of This Are;-

To design a bus station for Elesekan Ibeju Lekki Lagos, which will embark upon the action of providing enough spaces for in and out movements which will be able to handle more buses per hour and also provide an interface between Transport modes enabling passengers and cargo to transit.

1.5.2 The Objectives of This Are;-

• To establish a transport system which will have smooth circulation and reduce traffic congestion occurs due to the buses of the terminal.
• To design a terminal with facilities for increased number of proposed buses and passenger (both inter-district & international)
• To create a structure that serves as an iconic landmark for both the city and the country.

• To design a commercial building along with terminal with BRTC offices and other commercial facility.

1.6 SCOPE OF THE STUDY

Designing a bus station entails a comprehensive description of both constructive and structural infrastructure.
The scope of this design guideline is to provide a proposed bus station for Elesekan Ibeju lekki, Lagos. A detailed case study was carried out on existing bus stations so as to identify some elements that are lacking in the existing buildings so as to be able to come up with a good and sustainable design. The bus station shall meet the basic necessary requirement by its users such as comfort.

1.7 SIGNIFICANCE OF THE STUDY

Typical features of a senate bus terminal includes the list of applicable design objectives elements as outlined below for a complete list and definitions of the design within the context of the whole building design.

1.7.1 Cost Effective

To achieve the optimum performance in the facility, a means for accessing the performance versus the cost of each design element and building component should be provided. in the design phase building development, a consultant (quantity surveyor) should be involved, so as to consider alternate design solution to optimize the expected cost/ratio of the project at completion.

1.7.2 Flexibility

The bus terminal (administrative building) should be easily and economically accommodate frequent renovation and alteration, sometimes referred to as chum, those modification may be due to management reorganization, personal shifts, changes in models or advent technological innovation, but the administrative building infrastructure, interior systems must be up to the challenge.

Incorporate features such as plug and play floor boxes for power, data, voice and fibre, modular harnessed wiring buses, and conferencing hubs to allow for daily flexibility at work as well as future reorganization of the office workstations.

1.8 LIMITATION TO STUDY

- In the course of this research, some limitations and hindrances occurred, such as;
- Access to relevant architectural drawings were denied due to security reasons.
- Snapshots were not allowed in some areas of the investigated buildings.
- Using the internet, one has to check through several pages to get vital information, and there were some difficulties due to poor network or server.

- Travelling to some of the investigated areas cost a lot of resources.

CHAPTER TWO

2.0 LITERATURE REVIEW

Bus station is defined as an area away from the general flow of road vehicles, which gives buses and coaches the freedom of movement to set down and pick up
passengers in safety and comfort. Locations are either near shopping centers or other transport terminals, thereby affording the best interchange. (Transport terminal & Modal Interchanges, 2009) It is larger than a bus stop. Bus stop is something which is usually simply a place on the sidewalk, where buses can stop. But a terminal is something which may have broader issues, regarding departing & arrival of passengers.

2.1 Types of Bus Terminal

2.1.1 Intercity Bus Terminal

The intercity terminal is usually found in the downtown core and is accessible directly by local transit, taxi, and auto . It differs from other terminal types in that it includes long haul service in excess of several hundred miles and provides for a much greater number of bus movements. Land costs normally dictate vertical expansion capability in the denser city areas. More elaborate "package express" facilities are provided in the intercity terminal and a greater amount of concession and rental space is provided to defray higher terminal construction.

2.1.2 Suburban Interstate Terminal

The suburban interstate terminal is a peripheral type designed to avoid the traffic
congestion and heavy investment associated with central city and/or airport terminal facilities. The terminal is usually located adjacent to interstate highway connections with major cities or regional airports and in many instances serves the increasing outlying "urban sprawl" areas. In an increasing number of cases terminals of this type serve a commuter-type function where the daily journey to work in the central city may take as long as 2 hours . Sometimes referred to as "park and ride" terminals, because access is primarily by auto, these facilities are provided with open, paved parking spaces. Investment in waiting-room and bus-berthing facilities is minimal. The terminal is usually a one-story building of simple construction.

2.2 Factors affecting size of bus terminal

Stations will vary in size governed by the following basic points, apart from the obvious physical constraints of the site:

■ **The number of bays to be incorporated** (the term ‘bay’ is used in connection with stations instead of the term ‘bus stop’), determined by the number of bus and coach services to be operated from the station, and by how practical HOQUE | 29
it is, related to the local timetable, to use an individual bay for a variety of service routes.

■ **the vehicle manoeuvre selected to approach the bays** - Three basic types of
manoeuvre are used, namely ‘shunting’, ‘drive-through’ and ‘saw tooth’.

2.2.1 Vehicle maneuvers used in approaching parking bays.

(a) Shunting is used where a vehicle only sets down passengers on to their concourse before moving away to park or to a bay position for collecting passengers. This maneuver avoids waiting to occupy a predetermined bay and effectively reduces journey time.

(b) Drive-through bays are fixed bay positions for setting down and/or collecting passengers. They are in a line, so a vehicle often has to approach the bay between two stationary vehicles. In practice, it is often necessary to have isolated islands for additional bays with the additional conflict of passenger and vehicle circulation.

(c) 'Saw tooth' layouts have fixed bay positions for setting down and/or collecting passengers with the profile of the concourse made into a saw tooth (sometimes referred to as echelon) pattern. In theory, the angle of pitch between the vehicle front and the axis of the concourse can be anything from 1 to 90 degrees. In practice, however, it usually falls between 20 and 50 degrees. The vehicle arrives coming forward and departs going backwards, thus reducing the conflict between passenger and vehicle, but demanding extra care to be taken when reversing out of the bays The choice of manoeuvre will be influenced by the size and proportions of the site available, the bus operators' present and anticipated needs, and in particular the preference of their staff. Some will accept the saw tooth arrangement while others prefer the drive-through. The area of the site is further added to by the requirement of 'layover'. This is where vehicles were having set down their passengers, but which are not required to collect passengers, are parked on the station until needed again. The layout for this should be based on the requirement for parking, but preferably in such a manner that no vehicle is boxed in by another, and of course positioned so as not to interfere with other bus movements. In some cases economy of space can be achieved, again dependent upon local timetables, by using spare bays for layover purposes.

■ **The facilities to be provided for passengers** - Provision for passengers will depend entirely upon anticipated intensity of use and the multi-modal nature of the interchange. If, for example, there are already public toilets, a bus and coach information centre and cafes nearby, then these may not be required on the station concourse. However, waiting room facilities will probably be required, with someone on hand to give information and supervision. In more comprehensive schemes, in addition to a waiting room, a buffet and public toilets, one may plan for kiosks and enquiry, booking, left luggage and lost property offices.

■ **The facilities to be provided for staff** -There will invariably be an inspector or inspectors in a station who, as well as assisting passengers, are primarily concerned with supervising the comings and goings of vehicles, their drivers and conductors. If there is a depot near to the station then most staff facilities will be provided there. However, if the depot is some distance away, it will be necessary to provide canteen and toilets for them on the station site, so that during breaks and between working shifts they do not need to get back to the depot until they return their vehicle for long-term parking. Should the depot be even more remote, it will be necessary to provide all facilities at the station site and only basic amenities at the depot. In this case, as well as the canteen and toilets, a recreation area, locker rooms and 'pay-in'

facilities should be provided. The latter is an office area where drivers/conductors check, then hand over monies taken as fares, which in turn are checked and accounted for by clerical staff.

■ **Facilities for bus maintenance** - It will be appreciated that the proper inspection, repair and servicing of buses and coaches is an integral part of a bus operator's responsibility. Normally, such work would be carried out at a local depot, with a repair workshop together with fuelling, washing and garaging facilities. The provision of some or all of these facilities within a station complex is unusual, but by no means unique.

2.3 **Standard dimensions for petrol pump**

Planning- The size of facilities is determined by location, ease of access, typical traffic flows and competitors. Entrance and exits must allow easy steering onto the site and space is needed for cars to queue while waiting for a vacant pump; it should also be easy to steer away from the pump, with no obstruction of exits and good visibility when pulling out onto the road. Provide good entry/exit sight-lines. Access may be by one way flow onto the site or combined in-and-out routes, depending on the location (e.g approaching a roundabout).

2.4 Problems existing in the design of bus station

Lack of security considerations. At this stage, the bus station meet their basic functions at the same time without considering the parking area. When the bus pulled into the station, passengers are crowded with each other in order to get on the bus as soon as possible, sometimes passengers could be pushed down the station, if bus has no time to brake personal injuries could be caused. There is no obvious boundaries between bus station and pavement, and the bus station is easily to get destroyed.

Ignore special group. Bus station not only need to consider the general passenger situation, but also should consider special group situation, such as children who are not tall enough, old people who are not easy to move and parents who are carrying their children, which are not fully considered in current bus station design status[8]. There are some shortages like lighting intensity of the stop sign is not high, no English version in the stop sign, no access for physically handicapped, which could not meet the needs of special groups.

Lack of humanity. The bus station failed to satisfy the humanization design completely, such as text is too small in the stop sign to recognize, no public seat and ceiling are designed as rest and shade parts for passengers, large advertising area resulting in the bus route map occupied and the size of the bus station is not considered according to the flow of people.

Lack of sustainable development policy. The ecological environment is facing great challenges, in recent years, Chinese government promotes vigorously the idea of building modern ecological civilized society based on the concept of sustainable development and ecological urban. The use of new energy sources, such as solar energy, wind energy and biomass energy, has not yet been fully popularized in bus station design. Single function, high manufacturing cost, unreasonable use of materials and low recycling rate lead to the failure to achieve sustainable development in a comprehensive way. With the progress and development of

society, people's demand for the bus station constantly changing, the design requirements of the bus station are also rising. Under the environment of sustainable development, the design concept can only follow the principle of sustainable development. On this basis of innovation and development, so that the bus station can better meet the needs of modern people. Large touch screen games are designed into bus stations in San Francisco, which reduce the boredom of waiting for bus by incorporating interesting and intelligent design. The bus station near the Vitoria insect paradise simulated the insect's visual system, which allow passengers to intuitively see their image in the insect's eyes. This kind of bus station is loved by people, so we can see that the combination of form and function to meet people's needs is the trend of the future bus station design.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 INTRODUCTION

The research methodology and methods of data collection in conducting this thesis is qualitative analysis of case studies and review of some relevant literature from documented past work of published and unpublished literature.

3.1.1 SAMPLING TECHNIQUE

Purposive sampling technique is to be adopted in this research work. However, variants of this sampling technique would be applied at different levels of the study. Sample survey of related and relevant Bus stations will be carried out. Case studies have always been important means to bring a sense of reality to a design process. It is helpful to be able to study example of buildings that are known to perform well and to be see how and why they do so. It is also helpful to be able to see where certain strategies will produce limitations to the design in other ways.

3.1.2 SOURCES OF DATA

A. PRIMARY SOURCES

The primary sources of data to be use in this research are:
1. Architectural drawings and specifications
2. Direct observation
4. Photographs

B. SECONDARY SOURCES

The secondary sources of data to be use in this research are:
1. Books
2. Journals
3. Web documents

3.2 METHOD OF DATA ANALYSIS

Analyses of data during this research include the following

3.2.1 ANALYTICAL STRATEGY

The point is to develop a descriptive framework for organizing the study.

3.2.2 MODE OF ANALYSIS

The mode of analysis adopted in this research is the pattern matching which involves comparison of the expected results with the obtained results to know the extent of the problem in order to come up with the better solution of that particular problem.

3.3 INSTRUMENTS OF DATA COLLECTION.

The instruments of data collection are the tools that assist in carrying out the research, for assessment of the variables used in the research. The instruments of data collection applied in this research are listed below:

3.3.1 PHOTOGRAPHS

Photographs of relevant case studies are to be taken to observe the existing senate building and to carefully observe areas that needs amendments so as to come up with a better design.

3.3.2 SKETCHES

Sketches were made of some parts of the selected

3.3.3 NOTES

These notes where in form of field forms outlining the variables of passive cooling techniques as they relates to senate buildings and some other public building types.

3.4 PROCEDURES FOR DATA COLLECTION

These involved visits to two local case studies and taking a visual analysis based on application of passive cooling techniques in then* design. These buildings were then evaluated on the created field forms.
However, the foreign case studies were gotten through the internet and their analysis based on the application of passive cooling techniques are evaluated on the field forms as well.

3.4.1 CASE STUDIES

Case study research in Architecture goes beyond the documentation and description of the physical characteristics of the built environment (Oluigbo, 2010).
In architectural research a case study is the most prepared mode of assessing a particular phenomenon or group of phenomena which enables the research to see the situation of a particular sample of the similar phenomenon thereby assessing and analyzing it. The case studies selected for this research work were sampled purposively.

3.5 CASE STUDY SELECTION CRITERIA

The case studies were purposely selected on two bases which include:
For being bus station.

3.5.1 CASE STUDY ONE

NAME

THE OSHODI BUS INTERCHANGE TERMINAL, LAGOS NIGERIA.

LOCATION

The Oshodi Transport interchange station is located between the Lagos - Apapa Expressway and the Agege Motor Road.

BRIEF HISTORY:

The Oshodi bus station started operation in May 2019 as announced by the contractor handling the project. Terminal one is for interstate transportation, and it was designed for destinations spanning the southwest, FCT, and Northern states. Terminal two is for intercity routes.

DESIGN APPRAISAL

a) EXTERIOR IMAGE AND ARCHITECTURAL EXPRESSION:

The external wall has non-structural shading devices. The building is rectangular in form.There are no hindrances of light into interior spaces. The building is the most dominant structure within the area.

b) INTERACTIVITY:
Stairways and elevator which a located at strategic places are to ensure ease in traffic flow and enhance interactivity between spaces.

c) PHYSICAL ORGANIZATION AND DESIGN:

The structure is a typical office building. It has a rectangular plan and is the tallest building, signifying its importance. Adequate conveniences have been provided and also car parking space

d) CLIMATE RESPONSIVENESS:

The building was planned in such a way that it conformed to the environment. Orientation of existing BUS T is adequate, which provide optimum ventilation and minimizes wind effects. Noise has been reduced by placing some of the offices at lower floors.

Source (Student field work)

3.5.2 CASE STUDY TWO

THE IKEJA BUS TERMINAL IKEJA, LAGOS STATE.

LOCATION

THE IKEJA TERMINAL IS LOCATED IN IKEJA, THE CAPITAL CITY OF LAGOS STATE.

BRIEF HISRORY:

The bus terminal was commissioned by President Muhammed Buhari GCFR on the 29th of march 2018. The facility was designed and constructed by planet projects, an indigenous construction firm.

a) EXTERIOR IMAGE AND ARCHITECTURAL EXPRESSION:

The bus terminal is the most dominant structure within its location of the city. The external walls have non-structural shading devices. The design adopted a courtyard system and the Corridors are single banked which enhances ventilation flow, presence of fountain in the courtyard provided evaporative cooling so as to make the building cooler.

b) PHYSICAL ORGANISATION AND DESIGN:

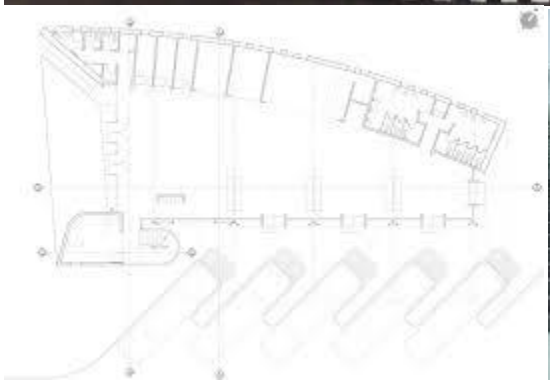
 The building is a very massive one. The building houses offices, administrative units and reception hall.
 The structure is a typical office building with spider form concept.
 The reception lobby is spacious enough to accommodate student crowd
 Adequate conveniences have been provided at strategic points
 The parking spaces provide is well defined.
 The building has a total of two staircases. It also has a courtyard that is located near to the entrance. Offices within the building were zoned according to the functions they perform.

INTERACTIVITY:

Due to the lengthy nature of the building, staircases were introduced at strategic intervals to enhance ease of traffic flow between the floors.

e) CLIMATE RESPONSIVENESS/PASSIVE COOLING VARIABLES:
 Building technique and materials that are suitable for the environment were adopted. Reinforced concrete gutters were introduced to effectively eliminate water from the roof also to minimize effect of roof blown away.
 The shape of the building is considered as appropriate design approach to reduce direct penetration of solar radiation. Smaller windows were used which are more desirable in hot dry climate in order to minimize the direct penetration of solar radiation into the interior.
 Orientation of the existing terminal is adequate, which provide optimum cross ventilation and minimize wind effects.

 Trees and shrubs were planted around the building and within the courtyard to absorb the solar radiation thereby reducing the amount of heat generated around and within the building.



Source (Student field work)

3.5.3 CASE STUDY THREE

THE MOHAKHALI, DHAKA BUS TERMINAL

LOCATION

MOHAKHALI, DHAKA, BANGLADESH.

BRIEF HISRORY:

Mohakhali Bus terminal is situated at the prime location of Dhaka, adjacent to the Mohakhali Rail crossing and flyover. It is a well maintained bus terminal among the terminals situated in Dhaka. It has proper circulation pattern and well guided management for which the terminal works very well among the other terminals. It has other facilities like shops, mosque etc which a terminal requires.

3.5.1 PLANNING

- The circulation planning of Mohakhali bus terminal is properly designed
- There are separate ticket counter & departure shed divided according to districts.
- There are separate entry & exit points for the terminal buses
- There is separate drop for the passenger vehicle, coming via car, rickshaw or autorikshaw.

-the long distance buses have facility for overnight parking

-the waiting lounge & public toilet is not maintained properly, but is in better state than other terminals of the city.

-there is a auto-rikshaw terminal which helps passenger to find connecting vehicle after getting down from the bus easily

3.5.2 STRUCTURE & MATERIAL

STRUCTURAL SYSTEM : Concrete column & beams

CANOPY MATERIAL: Vaults are made of concrete but vertically covered by ceramic bricks Mohakhali bus terminal has vaulted sheds for the departing and arriving buses and passengers. This acts as the canopy for shed.

3.5.3 FINDINGS

The observations made from the study of the projects are

- Every bus terminal has a simple functional flow in systematic way
- The bus terminal has divided layovers for departing & arriving buses
- To create ventilation 7 openness maximum numbers of bus terminals are shaded by the use of vaulted structure canopy.
- The ticket counters are adjacent to the lounge and bus departure space.
- The circulation pattern for buses entry and exit follows one-way rule
- There are facilities for overnight parking is present.
- There are waiting & resting facilities to ensure the passenger comfort.

• The public vehicle facility like auto stand is present in the terminal.
• The public toilet is not maintained properly
• Shops & ancillary commercial facilities are needed with the terminal.

3.5.4 DESIGN APPRAISAL

a) EXTERIOR IMAGE AND ARCHITECTURAL EXPRESSION:

The external walls have non-structural shading devices. The building is square in form with a central core tower. Its corridors are single banked which enhances ventilation flow. The bus terminal is the most dominant structure within the city.

b) PHYSICAL ORGANISATION AND DESIGN:

 The structure is a typical office building. It has a square plan and recesses were use to introduce shade.
 The reception lobby is double volume concept with staircase at both side and three (3) numbers lifts for vertical transportations.
 Adequate conveniences have been provided
 Scattered parking spaces provided.

INTERIOR IMAGE

The terminal has four staircases from the ground floor to the mezzanine and two separate ones from the ground floor up to the last floors. It also has one elevator centrally placed in the waiting area for the ease of traffic flow.

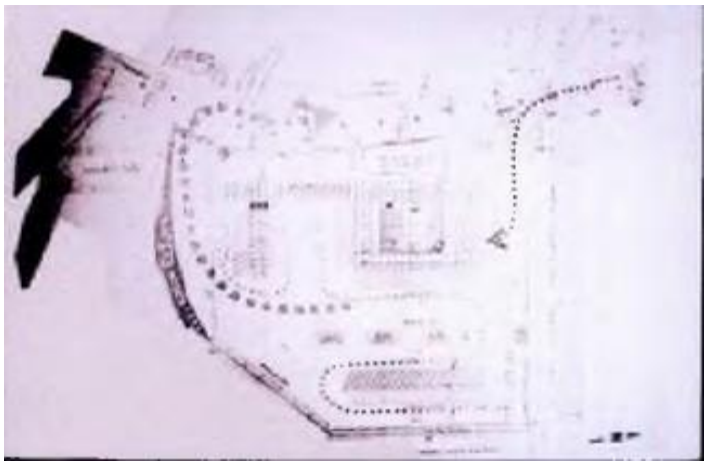
INTERACTIVITY:

Stairways and elevators which were located at strategic places are to ensure ease in traffic flow and enhance interactivity between spaces.

e) CLIMATE RESPONSIVENESS/PASSIVE COOLING VARIABLES:

 Recesses were used to prevent direct heating up of the external walls by solar radiation allowing the interior to remain cool even at the hot periods of the year. Also fenestrations were deliberately made to be large so as to allow adequate in-flow of air unto the building. Square shape was adopted considered as appropriate design approach to overcome solar radiation.
 External vertical and horizontal shading devices were observed on the tower. Also veranda was in cooperated round the entire podium, observed to be adequate.
 Wall-wall windows adopted on the podium and normal windows size on the tower, which are all adequate air floor especially for this region.
 Reinforced concrete roofing style was adopted for this structure, which minimizes effect of roof blown away.
 Orientation of the existing bus terminal is adequate, which provide optimum cross ventilation and minimize wind effects.

 Trees were adequately planted around the building which also protect the wind effect especially in the lower floors.
 The problem of noise has been considered by placing public office at the lower floors.
 The building was planned and designed in such a way that it is in conformity with surrounding environment. To further enhance the eco-system, trees and shrubs were planted around the building; this also absorbs the solar radiation thereby reducing the amount of heat generated around and within the building.




3.6 CASE STUDY FOUR

LOCATION

THE MOHAKHALI, DHAKA BUS TERMINAL

ARCHITECT

Pelli Clarke Pelli Architects

AREA: 5.4 acre
Budg$170 et: **million** given by the Transportation Infrastructure Finance and Innovation

ACT COMPLETION DATE: 2014

BRIEF HISRORY:

The Transbay terminal con c e pt design is forward -looking and generous, responding to emerging modes of living and working while allowing room for growth and change that cannot be fully anticipated. It envisions a terminal that will serve the whole Bay region, and the growing network of public transportation services, with a building that expresses the importance of the public's arrival in one of the world's great cosmopolitan cites.
The terminal will include wind turbines, geothermal heating methods and a gray water recycling system. The hub will be a strong message that green technology can successfully be combined with modern transportation

3.6.1 PLANNING

By 2010, the Transbay Terminal will have become a marketplace of public transportation, the place to get anywhere, anytime. New high-rise, mixed-income housing in the surrounding neighborhood, the possibility of new office space, a major new hotel and downtown conference and educational facilities will draw an 18-hour population into the terminal to use its services, enjoy its retail and restaurants, and carry on the commerce of a great city.
envisioning a one - b i o ck-wide by three - b I o ck - long terminal near the heart of San Francisco's Financial District , the " Great Expectation s "concept design effectively integrates the existing modes of regional public transportation and accommodates future system expansions .Two bus levels served by ramps directly connected to the Bay Bridge provide an efficient design for transit operators , while strategic bus storage locations and connected ramps avoid conflict on city streets .An underground rail facility welcomes the extension of Caltrain to down town and provides space for future East Bay com muter rail and California's high-speed intercity rail

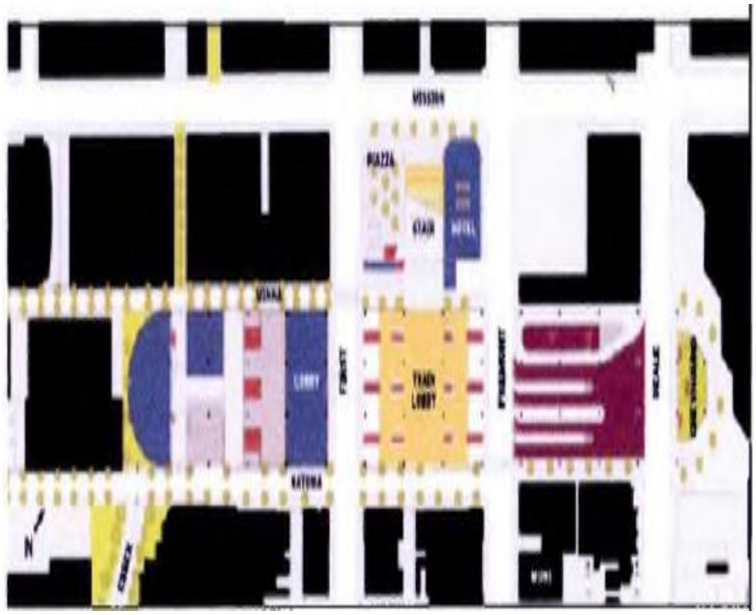
3.6.2 STRUCTURES : Steel, reinforced concrete

Environmental section : Daylight, natural ventilation, geothermal energy, green roof and water reuse are integrated into the building.

Water reuse strategies The proposed strategy achieves a 54% reduction in domestic, mechanical, and irrigation water use. The roof park is designed to biologically filter greywater, storm water is captured and reused for toilet flushing.

3.6.3 FINDINGS

• It is integrated transport system containing subway and bus terminal
• The building has public function like shops & other commercial facilities.
• The bus terminal has separate layovers for departing & arriving buses
• The terminal building is highly energy efficient as it has Daylight, natural ventilation; geothermal energy, green roof and water reuse are integrated into the building.
• The entire terminal is landscaped on the roof, which provides public space for the entire community.
• The Terminal uses as partition to achieve clarity between the spaces.
• The circulation pattern for buses entry and exit follows one-way rule
• There is no provision for overnight parking.
• There is waiting & resting facilities to ensure the passenger comfort.
• The public vehicle facilities like taxi, auto-stand, and private car are is present to facilitate the passengers in terminal.


PIAZZA
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CHAPTER FOUR

ANALYAIS, FINDINGS AND DISCUSSION OF RESULTS

4.1 DESIGN CONSIDERATION

The design consideration of this proposed development includes the list of applicable design objectives element as outlined below.

a. FUNCTION/ OPERATION

The building design must consider the integrated requirements of the intended users. This includes their desired image degree of public access, operating hours, growth demand security issues, special health hazard and economic objectives.

b. FLEXIBILITY

This office building is economically accommodative for frequent renovation and alteration. These modifications maybe due to management re-organization or advent of technological innovation, but the infrastructure of the office, interior systems and furnishings must be up to challenge.

c. URBAN PLANNING

The concentration of a larger number of workers within one building can have a significant impact on neigbhourhoods. Office can vitalize neighborhood consideration of transportation issues is given when developing this office structures. Office building are often impacted by urban planning and municipal zoning, which attempt to promote compatible land use. Consideration is given when selecting location for office location because staff and users of the building would not like to walk a long distance in order to access the building.

d. SECURITY/ SAFETY

Protection of the occupant and their assets was also considered by providing adequate security in the office environment against violent attack through comprehensive threat assessment, security requirements for each floor are identified and appropriate reasonable design responses are identified for integration into the office building.

4.2 SITE SELECTION AND ANALYSIS

Criteria's for selecting a suitable site to locate the building was not a simple task. Countless factors-natural, social, man-made and ecology was examined. This is so because the proposed development and activities will have an impact on the local and global environments, ongoing cost (utility bills, maintenance) and physical wellbeing.

SITE LOCATION: The location to site the proposed development is at Elesekan Ibeju, Lekki (Lagos State), which can be easily accessed from the distribution road to other parts in the city. Putting this proposed development in this location, the proposed site shall be used strictly for administrative purposes. It will enhance
quick accessibility and recognizability. Adjacent to the proposed site are other structures which will not be a hindrance to the proposed development.

SITE ANALYSIS: Since a bus terminal is the center of a business district and also serves as a business district, then it must be located where it can easily be accessible by all, both workers and visitors. In view of this, a site that will befit the proposed development must complement the environment in which it is located.

The site for this kind of building is determined through this factor.

I. **Accessibility:** The site for this proposed development is located directly off the main road leading into the Epe, and it can be accessed by everyone..

II. **Proximity to power:** On the proposed site, there are electric poles that supply power to the site, it is needed to power (mechanical and electrical devices), and also to enhance comfort.

III. The site gives room to serve functional relationship with other facilities within the surrounding.

IV. The proposed site is adequate to accommodate the project and allow for future expansion.

4.3 SITE TOPOGRAPHY

The site is almost flat and as same level as the road. There is an imbalance of green and grey area and there is almost no plantation in the site. The site has low and flat topography as the city. The site does not have proper drainage system<so water log happens in times of heavy rainfall.
The topography of the site is relatively flat surface while other neighborhood has a gentle slope ground, the will be proper drainage system to make the site function well.

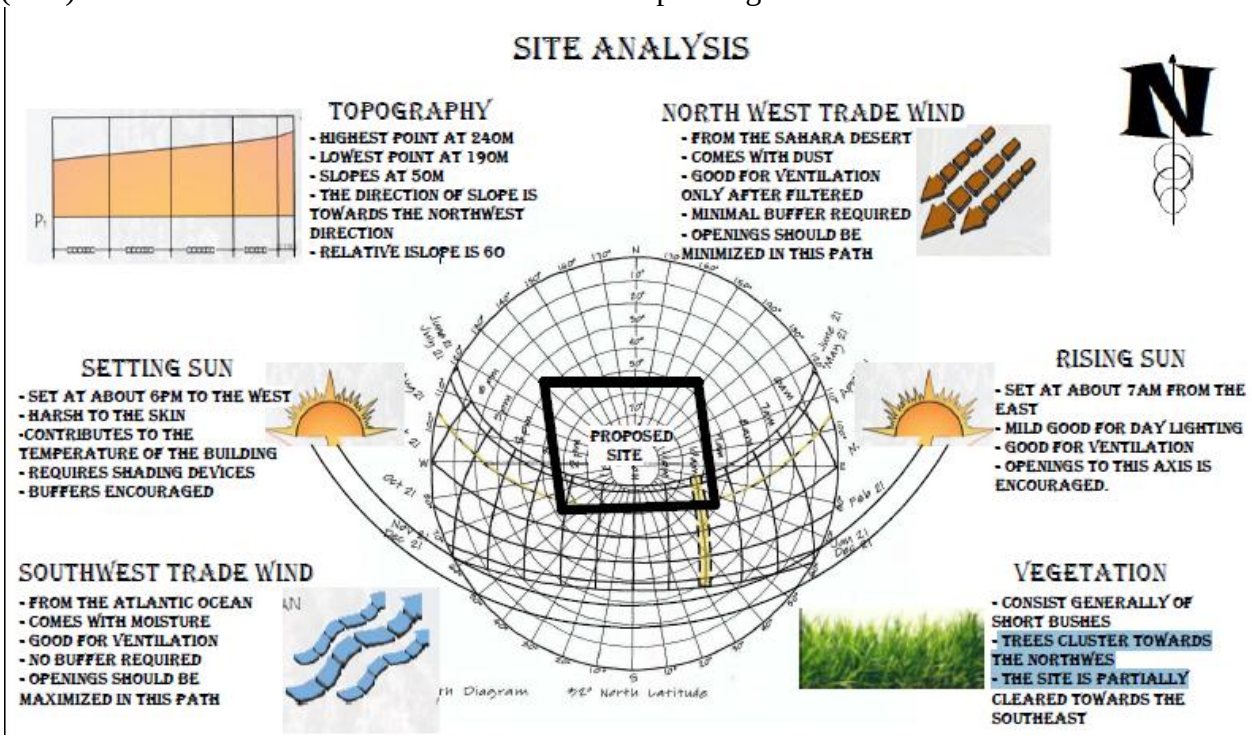
i. Vegetation: The type of soil on the site has a sandy clay type of soil almost transforming to loamy soil and this will support good vegetation as landscaping element and this will enable the site to have good micro element such as wind, humidity, radiation, temperature and grasses present on the site and shrubs.

ii. Soil: The soil found on the site is well compacted to support the building foundation and the top soil can be used for planting vegetation or to landscaping the site.

iii. Drainage: Due to the relative flatness of the site, the pattern of the drainage system on the site encourages erosion. The erosion creates a high drain through the water passed through, so proper drainage system will be constructed.

4.4 CLIMATE ANALYSIS OF THE SITE

The chosen development site can greatly affect the comfort and energy efficiency of the home built upon it. Since Ajah is in Lagos State, the micro climate of Ibeju Lekki can be expressed or describe as the same climate of Lagos State at large or as a whole. There lies between the sub humid tropical regions. Simply because of its location. Ibeju Lekki has a temperature of 29oc and an annual rainfall of over 2000mm. it has two seasons, the wet and dry season. The wet season often begins from March to October while the dry season last from November to late February. These seasons are controlled with the inter-tropical discontinuities
(14D) whose movement is reflected with the corresponding shifts with rain belt.



4.5 SERVICES

For security and safety, and also to enhance a good working condition, there is need for the provision of some essential services to create a conducive environment and atmosphere for users. Among these facilities to be provided are:

1. A good water supply
2. Well-constructed drainage system
3. Both natural and artificial lightning
4. Power supply
5. Fire protection services.

4.6 SPACE IDENTIFICATION/ FUNCTIONAL RELATIONSHIP

To enhance the accessibility to basic amenities, circulation, services, functional

relationships and expected interaction among the users of the facilities, the senate building is to be located in such a way that it plays a central role to other facilities.
Below is the summary of the functional requirements

A. ADMINISTRATIVE UNIT:

 The managers office with support facilities including waiting room, office for secretary, personal assistant, typing/computer room.
 Boardroom for board of trustees meeting which should be an extension of the Assistant managers office with provision for changing room and toilet.
 Ticket / baggage checker [physically or with a computer]
 Accountants office.
 Storage

B. CONVIENENCE CENTERS

 Public Restaurant
 Restaurant for staff
 Kitchen
 Waiting / seating area
 cloaking room [staff]

SCHEDULES OF ACCOMODATION

The allocation of right size spaces to every activities and functions greatly determines the efficiency of the design.

GROUND FLOOR

SPACE	NO REQ	SPACE DIMENSION	TOTAL AREA OF SPACE IN M2
Entrance	1	3000 x 4200	1200 m2
Arrival course	1	7500 x 14200	10650 m2
Toilets	12	1200 x 1800	2160 m2
		1800 x 1200	2160 m2
Exit	2	2100 x 1200	2520m2
Storage	1	4800 x 5700	27360 m2

Arrival course	1	7500 x 14200	2520m2
Minor Offices	21	4800 x 3000	14400 m2
Storage Room	2	4800 x 3000	14400 m2
Admission Unit	1	4800 x 3000	14400 m2
Eatery	1	5400 x 9000	48600 m2
Kitchen	1	2400 x 2400	5670 m2
Stair Case	2	9700 x 3000	29100 m2
		1800 x 2400	1800 m2
Custom And Passage	1	4800 x 9900	47520 m2
Staff Office			
Accountant Staff Office	1	4800 x 9300	44640 m2

FIRST FLOOR

SPACES	NO REQ	SPACE DIMENSION	TOTAL AREA OF SPACE IN M2
General	1	6300 x 11700	73710 m2
Office			
Toilets	8	1200 x 1800	2160 m2
Major Office	4	4800 x 5700	27960 m2
Minor Offices	5	4800 x 3000	14400 m2

Secretary Office	4	4800 x 3000	14400 m2

CHAPTER FIVE

5.1 DESIGN BRIEF

The design brief is aimed at proposing a bus terminal for Elesekan Ibeju lekki, Lagos. This proposed development is to be used by members of the society for inter-state and intra-state movement . All architectural features will be put into consideration for the proper functioning of the building.

5.2 DESIGN CONCEPT

The idea behind the concept was to propose a simple modern form of development in harmony to the surrounding architecture or the terminal environment. The proposed bus terminal building for its intended use should have a clearly laid out strictly functional specification of the type of object, and yet so as to establish a modern facility, frequently staffed, in accordance with modern trend.

5.3 MATERIALS AND METHOD FOR BUILDING CONSTRUCTION

The bus terminal can be constructed and serve the task of cooling itself passively and ventilating itself through the adoption of the following materials and construction method and also the inter-city and intra-city movement.

A) FOUNDATION

The type of foundation footing is subject to structural engineer who in conjunction with geotechnician will recommend the appropriate foundation footing to be used based on the nature of soil of the proposed site.

B) WALLS

The wall is what encloses a space to make it serve as shelter for the human being. It is also the building component which interacts with the environment, therefore, the walls should be responsible for the control of the interior climate. The external wall should be constructed using ventilated exterior wall system which has a vacuum between the wall core and the finishing cladding. The internal partition is made up of block work with a plaster on top. The walls are finished with a decorative brick tiles at the ground floor, exterior wall of the senate council and parapet wall and light coloured paint which will aid in keeping the interior cool.

C) WINDOWS

The type of windows to be used in this proposed project is purpose made decorative swinging casement windows. The reason for swinging casement window is that, it is the type of window

that gives almost 100% of ventilation. The sizes vary with the location and position of the window.

D) **DOORS**

The door type recommended for this proposed design is purpose made doors with high thermal resistance to prevent heat gain through the doors.

E) **ROOF**

The roof is the building component that covers the highest level of the building preventing the interior of the building from the weather. In this design proposal there are two types of roofs adopted based on the roofing materials, namely roofing with roofing sheet with parapet wall and the roof with concrete slab. The type of roof with roofing sheet and parapet wall has steel trusses to support the roofing sheet with a void serving as vacuum to contain the radiant heat and the parapet wall to allow the free drain of water. The concrete roof is located at the ends of each lobby, which adds beauty to the structure and intensity to minimize the solar heat gain from the roof.

F) **CEILING**

The ceiling type suitable for this project is suspended ceiling for it having a void which will serve two purposes, the service duct and vacuum for radiant heat from the roof.

G) **LANDSCAPING**

The proposed bus terminal is surrounded by landscaping ranging from the planted trees to shrubs. This landscape is also serving two purposes in this design. The first purpose is that, it serves as solar radiation rays absorber where the rays are absorbed thereby reducing the radiant heat gain to the immediate surroundings. The second purpose is that, it serves as garden for leisure as well as aesthetic value

H) **FLOOR FINISH**

Floors in office complex or bus terminal building requires special considerations in order to achieve the desired design. It should be able to absorb sound, as well as being easily maintained. Though the soil type will determine floor type to be used for the ground floor (solid floor with finishes of hard weaving surface e.g terrazzo or cement sand finish) while from the first floor to the last floor reinforced concrete slab with terrazzo floor finishes only.
In choosing floor materials so as to disallow distractions arising from activities of the various offices, durability is important.

I) **SERVICES**

The services provided in this senate building can be grouped into two i.e. Mechanical and Electrical Engineering Services. The mechanical services provided in this building are:

(i) **WATER SUPPLY**

This office complex is linked with the mains of water supply within the campus for supply of water for such needs as, domestic fire-fighting, coo1ing and softening plant. Bore hole will also be drilled to serve as an alternative source of water supply.

(ii) **WATER STORAGE, DISTRIBUTION AND PRESSURE**

Sufficient water equal to at least 100% of the daily requirement is stored in tanks located in the basement to ensure continuity of supply and a suitable constant pressure .All pumping equipment is duplicated with provision for isolation, drainage and repairs.

The following pipe networks are provided for in this design;
- Supplies to water closet flushing values
- Hot and cold water distribution to toilets
- Supplies to sprinklers located in gardens hedges and lawns and the fountain.

5.4 BUILDING CONSTRUCTION

5.4.1 Site preparation: As earlier discussed, the site of this project is relatively flat latent surface which the soil is red laterite in nature, all necessary work required is to organize the site grade some part of the site and vegetation that are essential to the advantage of the design will be untouched, others can be cleared and left alone provided it is no causing any hindrance to the proposed development.

5.4.2 Foundation: The type of foundation footing is subject to structural engineer who in conjunction with geo-technician will recommend the appropriate foundation footing to be used based on the nature of soil of the proposed site. The foundation width should not be less than 675mm and a foundation are required for proper load bearing of the reinforced concrete.

5.4.3 Floors: A 150mm thick mass concrete slab cast over 750mm layer of stone rubble hardcore bed with sand and ash blinding shall be used in virtually all the building to give the base for the final floor finishes, the surface should not be toweled smooth to avoid moisture penetration, two layer of bituminous damp proof membrane (D.P.M) will be cast beneath the floor slab and raised by the side of the external wall to a minimum of 150mm above ground level.

5.4.4 Landscaping: This is the process whereby trees and vegetation like green covering plant shrub are planted to reduce the effect of heat that may likely penetrate the interior of the proposed design. Trees are planted along the path of the sun and also the plants are also used to temper the effect of solar energy and also create natural barrier in the building. Terrestrial heating are reduced by planting of green lawns (green covering) which is majorly to reduce solar radiation

CHAPTER SIX

6.1 SUMMARY

Public Transport Stations, that is bus station, is the product of urban development, the corresponding design proposals are drawn up based on the status of the city frequently, and unified with urban planning. The proposal of the project is to design a bus terminal with proper passenger facility, a bus terminal facility, which is able to handle more buses per hour and can accommodate more bus parking, along with a commercial building. Presently the bus depot only has inter-district buses travelling to 5 destination and international buses travelling to three destinations. Due to shortage of space and buses the depot could not host buses travelling to more place. More over there is no proper passenger facility, or proper arrival and departure bays. Buses pickup and drop off passenger on main road. After which buses are going to travel to different states and also within the district routes. So the aim of this project is to design a bus terminal structure which caters to both inter-district and district movements.

6.2 CONCLUSION

Through the design demonstration, it is found that the bus station changes the traditional single design concept, and the design details are integrated into people's lifestyle, which is popular for most people. In addition, making full use of energy conversion can not only protect the ecological environment, but also provide references for the design of bus station. Following conclusion are drawn by analyzing the present status quo and solution of the bus station design. Nowadays, the bus station design cannot fully meet the sustainable development, few breakthrough and innovation are provided. Through analysis and prediction, it is found that the bus station and the public facilities are classified and integrated to achieve more rational resource optimization and utilization based on different needs of different cities in the design of the future bus station. The empirical study shows that the bus station can reduce the waste of resources and meet the humanization design with integration of social networking tools, information consulting and other daily facilities besides existing functionality. It is found that the integration of green accessory products and strengthen the details for specific groups in the design of bus station are popular in its application examples at abroad. Therefore, the innovation and breakthrough of the bus station can not only be built on the city overall planning design concept and comprehensive system of government, but also need more people to strengthen the sense of ownership and protection and participate in the collection of opinions of the bus station design. The future bus station would adapt to international forms, and gradually form its own art products with geographical and cultural characteristics in the modernization, humanity, science and technology and information.

6.3 RECOMMENDATION

Well-designed energy efficient buildings maintain the best environment for human habitation while minimizing the cost of energy. The objectives of energy efficient buildings are to improve the comfort levels of the occupants and reduce energy for heating, cooling and

lighting.

The public, along with designers and clients, now realize the tremendous impact our buildings have on the natural and built environment. However, architects have to continually work towards providing friendly environment for the occupants of these buildings, let‘s encourage the use of architectural solutions based on the observation of natural principles that can reliably supplant artificial or mechanical means of cooling and ventilating the buildings. It is also recommended that, further research should be carried out to explore the sufficiency of the passive means of cooling and ventilating bus terminal buildings.