# Proposed Transit Train Terminal

**(Energy Efficiency in Transit Train Terminal Design)**

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## Certification

This is to certify that Almustapha Muhammad BAWA, with matriculation number LG/PG/003977 carried out this research work titled 'Energy Efficiency in Transit Train Terminal Design in the Department of Architecture, Faculty of Environmental Design and Management, Lead City University, Ibadan, for the award of Master Degree (M.Sc) in Architecture and this has not been previously submitted.

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## Dedication

This thesis is dedicated to God Almighty, my father and uncle, Alhaji Bawa Garba and Mr. Ibrahim Abubakar Yaro, who laboured immensely over me.

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Thank you to Lead City University (LCU) for creating this incredible opportunity and enabling environment to conduct the research work and the library of the above-named institution used as part of my data collection. I sincerely appreciate both academics and administrative staff of Post Graduate (P.G.) School and most especially our P.G. Provost, Prof Folakemi Oredein for their huge input to my achievement in this M.Sc. program.

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# Abstract

This research explores sustainable design strategies and energy-efficient technologies in train terminals, aiming to minimize energy consumption while maintaining operational efficiency. A mixed-method approach is employed, combining an extensive literature review with case studies of existing train terminals. The study identifies key design elements and innovative technologies that contribute to energy savings, such as optimized building orientation, the integration of renewable energy systems like solar panels and wind turbines, and the use of energy-efficient lighting systems. By examining how these strategies can be applied, the research highlights the potential for significant reductions in energy use, offering insights for architects, engineers, and transport authorities. Additionally, the study emphasizes the importance of balancing energy efficiency with the overall functionality and comfort of the space to ensure a positive passenger experience. The findings are expected to serve as valuable guidelines for the future design and operation of sustainable train terminals, helping to reduce the environmental impact of transport infrastructure while supporting long-term energy goals and enhancing passenger satisfaction.



**Keywords:** Energy Consumption, Energy Efficiency, Operational Efficiency, Train Terminals, Sustainable Design


**Word Count:** 165

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# Chapter One

# Introduction

## 1.1 Background to the Study

Transit train terminals play a crucial role in the transportation network of a city, serving as a hub of connectivity for commuters and travellers. These terminals are not just a place where trains come and go, but they are also a focal point for various modes of transportation to converge, providing seamless connections for passengers to reach their destinations efficiently. In this analytical essay, we will explore the significance of transit train terminals in urban transportation systems and the impact they have on the overall mobility of a city.

One of the key functions of a transit train terminal is to facilitate the transfer of passengers between different modes of transportation. For example, a commuter arriving at a train terminal may need to transfer to a bus or a taxi to reach their final destination. The terminal serves as a central point where these transfers can take place smoothly, reducing the need for passengers to navigate through multiple stations or terminals. This seamless connectivity not only saves time for passengers but also enhances the overall efficiency of the transportation system.

Furthermore, transit train terminals play a vital role in promoting sustainable transportation options. By providing convenient connections between trains, buses, and other modes of transportation, these terminals encourage passengers to choose public transportation over private vehicles. This shift towards sustainable transportation not only reduces traffic congestion and air pollution but also contributes to the overall well-being of the city and its residents (Jones, A., & Brown, C. 2020).

In addition to facilitating transfers and promoting sustainable transportation, transit train terminals also serve as a focal point for economic development. These terminals are often located in strategic locations within a city, attracting businesses, retail establishments, and other amenities that cater to the needs of commuters and travellers. The presence of a transit train terminal can stimulate economic activity in the surrounding area, creating jobs and opportunities for local residents (Doe, M. 2018).

Overall, transit train terminals play a crucial role in the transportation network of a city, providing seamless connectivity, promoting sustainable transportation options, and stimulating economic development. As cities continue to grow and evolve, the importance of transit train terminals in facilitating mobility and connectivity will only increase. It is essential for urban planners and policymakers to recognize the significance of these terminals and invest in their development to ensure the efficient and sustainable movement of people within a city (Smith, J. 2019).

## 1.2 Statement of the Problem

The current energy consumption of Nigerian train stations consumes a significant amount of energy, and this consumption has a significant impact on the environment. According to data from the Nigerian Railway Corporation (NRC), train terminals consume an average of 10,000 kWh of electricity per day. This consumption is primarily from lighting, air conditioning, and other electrical appliances. The sources of energy consumption in train stations include grid electricity, diesel generators, and solar energy. The environmental impact of energy consumption in train terminals includes greenhouse gas emissions, air pollution, and noise pollution.

## 1.3 Aim and Objectives of the Study

This research aims to produce an environmentally friendly train terminal with the best rating of Energy Efficiency

While the specific objectives are to;

- To investigate the energy efficiency rating in the Train terminals (through a case study)
- To determine the suitable measures to be taken/used in solving the problem

- To propose a Transit Train terminal that tends to create a design with the best energy-efficient rating/characteristics.

### 1.4 Research Questions

-List the Research Questions

### 1.5 Significance of the Study

The Transit Train Terminal will provide job opportunities and improve people's quality of life, enhance the natural environment and help to reduce carbon footprint by promoting environmental sustainability. This is a vision that must be embraced for the sake of future generations. The station will present the image of quality and sophistication in Railway Architecture and to this end, the design facilities will support and encourage patronage and constant use. This development project would also contribute to GDP growth.

### 1.6 Scope of the Study

The research study will investigate the condition of energy efficiency in a train station/terminal and base its analysis on the tactics by which energy efficiency can be attained, through the creation of a more visually appealing and functional design.

### 1.7 Operational Definitions of Terms



## Chapter Two

## Literature Review

### 2.1 Conceptual Review

Train stations are essential hubs of transportation in many cities around the world. They serve as a central point for travellers to access various modes of transportation, including trains, buses, and taxis. Train stations are not only places where people catch their trains, but they also serve as meeting points, shopping centres, and cultural landmarks.

One of the key features of a train station is its accessibility (Mouratidis, 2021). Train stations are typically located in central areas of cities, making them easily accessible to both residents and visitors. This accessibility allows for seamless connections between different modes of transportation, making it convenient for travellers to reach their destinations.

In addition to their practical function, train stations also play a significant role in the cultural and social life of a city. Many train stations are architectural marvels, with grand facades and intricate designs that reflect the history and culture of the city. For example, Grand Central Terminal in New York City is not only a transportation hub but also a popular tourist attraction due to its Beaux-Arts architecture and iconic clock (Jones, A. 2020).

Furthermore, train stations often house a variety of amenities, such as shops, restaurants, and information centres. These amenities cater to the needs of travellers, providing them with a comfortable and convenient experience while waiting for their trains. Additionally, train stations often host events and exhibitions, further enriching the cultural experience for visitors.

#### 2.1.1 Types of Train Terminals

The Railway station can be classified by location on line, size and functions, then operations.

**Location on Line**

The first type of train terminal is the **Through Station**, which is designed for trains that pass through without stopping. Through stations are typically located on main lines and serve as important junctions for connecting different routes. Examples of through stations include Grand Central Terminal in New York City and King's Cross Station in London.

Another type of train terminal is the **Terminus Station**, which is designed as the final destination for trains on a particular route. Terminus stations are often located in city centers and serve as major transportation hubs. Examples of terminus stations include Union Station in Washington, D.C. and Gare du Nord in Paris.

A third type of train terminal is the **Junction Station,** which is designed to facilitate the transfer of passengers between different train lines. Junction stations are typically located at intersections of multiple rail lines and provide convenient connections for passengers. Examples of junction stations include Shinjuku Station in Tokyo and Frankfurt Central Station in Germany.

In addition to these types of train terminals, there are also **Specialized Terminals** such as **freight terminals**, which are designed for the handling and transfer of goods. Freight terminals are equipped with facilities for loading and unloading cargo, as well as storage and distribution services. Examples of freight terminals include the Port of Rotterdam in the Netherlands and the Port of Los Angeles in the United States.



**Size and Functions**

a. **Passing siding**: Passing siding enables trains crossing when running from opposite directions or trains overtaking when running in the same direction with different speed. It should have at least one subsidiary track. At traffic intensity over 12 train pairs per day at least 2 tracks and in case

the siding is built close to the junction station - 3 tracks should be designed. On a double track line for each direction, one additional track for overtaking should be provided and links enabling change the track on the opposite.

b. **Mall Station**: Serve passenger and freight traffic in towns smaller than 20,000 inhabitants between junction stations. It has one track group for passenger trains and one – for freight trains. Usually, there is 1 main track and 2 subsidiary tracks on single track line a) and 2 main tracks and 2 subsidiary tracks on double track line b). One or two side tracks and a dead-end track facilitating shunting are required. It is equipped with a buffer stop and its length should exceed ½ the length of a freight train.

c. **Medium stations:** Serve passenger and freight traffic on dedicated tracks in towns between 20,000 and 100,000 inhabitants. It can arise from a small station as a result of developing of the basic track layout. When at least 2 lines merge in the station it is a medium junction station. Characteristic property of the medium station is separation the subsidiary track for freight and for passenger trains and its specialization. The basic types of layout are transverse and longitudinal.

d. **Big stations:** Serve passenger and/or freight traffic on specialized track groups or on separate in big cities with over 100,000 habitants. It is a station serving one kind of traffic only and consists of a few specialized track groups or even separate stations creating a junction. The subsidiary freight track is split from the main line before the passenger station and on the passenger station, the tracks for regional and intercity traffic are split too. The station is intended for mutual reception and sending trains from various directions, for exchange of locomotives and crews, building and decomposing trains and for preparing the passenger trains for service.

### 2.1.2 Conceptual Review of Sub Topic

As society becomes more focused on sustainability and reducing carbon emissions, it is crucial for train terminals to prioritize energy efficiency. This not only helps them save money on operations but also helps protect the environment. The purpose of this document is to emphasize the importance of energy efficiency in train terminals and explore different methods to achieve this goal.

### 2.1.3 Importance of Energy Efficiency in Train Terminals

Train terminals are known to consume a significant amount of energy due to the operation of trains, lighting, heating, and cooling systems. By improving energy efficiency in train terminals, operators can reduce their carbon footprint and lower energy costs. According to a study by the International Energy Agency (2019), implementing energy-efficient measures in train terminals can lead to a reduction in energy consumption by up to 30%.

Furthermore, energy-efficient train terminals can enhance the overall passenger experience by providing a comfortable and sustainable environment. By investing in energy-efficient technologies, train terminals can attract more passengers and improve their reputation as environmentally responsible transportation hubs.

### 2.1.4 Strategies for Achieving Energy Efficiency in Train Terminals

Several strategies train terminals can adopt to improve energy efficiency. One of the most effective ways is to invest in energy-efficient lighting systems, such as LED lights, which consume less energy and have a longer lifespan compared to traditional lighting fixtures. Additionally, train terminals can optimize their heating and cooling systems by using programmable thermostats and energy-efficient HVAC units.

Another strategy is to implement energy management systems that monitor and control energy usage in real-time. These systems can help identify areas of energy wastage and optimize energy consumption to reduce costs. Additionally, train terminals can explore renewable energy sources, such as solar panels or wind turbines, to generate clean energy on-site.

## 2.2 Design Consideration/Guidelines

To put ourselves in a passenger's shoes, there is a need to consider all aspects of a rail journey: from planning ahead, arriving and spending time at a station, making the journey, and leaving a station at the other end. The industry is well aware of the need to constantly improve this 'end-to-end journey' experience. Many such improvements are informed by the extensive feedback from the National Rail Passenger Survey (NRPS) which has collected passenger opinions since 1999

The Rail Delivery Group is also developing 'Wavelength', an industry-wide monitoring tool, aiming to track performance against core passenger priorities. The following sections track the passenger journey through the station environment and highlight key design considerations specific to each area.

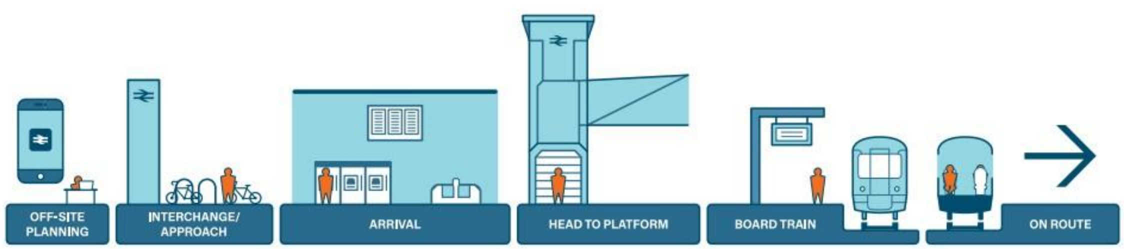



**Figure 2.1 The Stages of a Rail Journey**

Source- (Google Search, 2024)

### 2.2.1 Safety, Security and Cleanliness

For these spaces to be successful it's important that they feel welcoming at any time of day or night. This means keeping them clean and free of vandalism and other anti-social behaviour. All transport infrastructure to a degree and city centre stations in particular also present high-profile targets for terrorism. To a large extent the same measures should mitigate both: → Maximising passive surveillance, whereby all spaces are overlooked → Making sure all spaces are well lit → Avoiding blank facades, blind corners and dead ends → Maximising the hours in a day when the space is activated by planned activity, whether from the station, retail or other uses → Gathering space providing for crowds without disrupting flows and operations of the station → Bollards and other vehicle control measures to keep hostile vehicles at a safe distance from the station buildings → Using robust materials and a low maintenance design so that it is easy and affordable to keep the space clean.

### 2.2.2 Entering the Station

When entering the station there should be a clear line of sight to ticketing facilities, CIS and departures information, and the gateline. Retail grab and go provision should be located on the route between entrance to gateline without interrupting the visual legibility of the main routes through the station.

### 2.2.3 Concourse / Ticket Hall

In smaller stations the mediating space between the forecourt and the platforms is likely to be no more than a single room ticket hall, offering ticket facilities, information, shelter and seating. At larger stations this expands to become a concourse that acts as the heart of the station, where movement decisions are made and passengers meet, eat and shop. At either scale the function calls for a light, welcoming space with a generous ceiling height and a calm and uncluttered ambience. There should be space for passenger flows, queuing zones and quieter spaces for waiting and meeting. Clearly visible onward routes to the forecourt in one direction and the platforms in the other should help people to move freely and avoid congestion. Security and the perception of safety can be built in by avoiding blind corners and having clear lines of sight throughout the public areas. This supports passive surveillance, making it easier to spot both anti-social behaviour and those who may require assistance.

A visible staff presence reinforces the image of the railway as a supervised safe space for passengers. The high footfall and passenger dwell times in the concourse make it an ideal location for retail and advertising. Commercial opportunities need to be balanced with essential railway operations, in particular they should not obscure or confuse wayfinding signage or occupy space that is necessary for key passenger movements.

### 2.2.4 Gateline

The gateline is the primary access control point to the railway via the platforms and often the key means of revenue control. It is the boundary between the 'paid' and 'unpaid' areas of the station. The gateline requires run-off space either side to allow for safe queuing and decision making on exit. There is an aspiration to remove ticket gates and ticket offices and replace with digital or self-service technologies to increase capacity, reduce costs and improve customer experience, for example by freeing up station staff to circulate among or be more available to support passengers.

### 2.2.5 Concourse Volume

Guidance on the relationship between concourse area and height can be derived from operational and historic examples. As a rule of thumb, there should be a minimum floor to ceiling height of 5 metres for concourses up to 500m² and an additional height of 1 metre for every 500m² thereafter up to a maximum height of 15 metres. Beyond this, architectural judgement should be made as to the most appropriate height. For very small concourses e.g. below 100m² it may be permissible to reduce the height to 3.5 metres but in this instance consideration should be given to the availability of natural lighting from above, through side windows and from clerestory windows. It is permissible to vary the headroom within a concourse so long as those areas where this is below the minimum are transitional spaces or where there is no dwell time.

### 2.2.6 Circulation Routes

Circulation around the station should be arranged to give passengers confidence to make the journey through the station by themselves and reduce the walking distances between any point on a train to the station entrance or, if applicable, an interchange route. Routes should be logically arranged, direct, and vertical circulation should be clearly indicated. This is often not the case in stations that have developed piecemeal over time, where platforms are offset or misaligned, and routes between them can be circuitous. In these circumstances new infrastructure, for instance a new footbridge, can cut through this historic tangle to provide a much quicker, direct route. New circulation routes can also provide more flexibility for station operation, for instance allowing one-way routing to reduce cross-flows of passengers during peak periods. There can be a tendency for boarding passengers to gather at or close to the point at which they step onto the platform, locally overloading trains. New points of platform access can help make better use of platforms by dispersing passengers along their full length.

Routes should be safe and secure with good visibility and be free of obstructions, recesses and blind corners. At decision points passengers may slow down or pause before continuing their journey. Allowing additional space is useful to prevent people from obstructing one another. Footfall is high on circulation routes, making them ideal opportunities for 'grab-and-go' retail or advertising. However, the hierarchy of information should be maintained so these facilities do not compromise Wayfinding signage or the route itself.

### 2.2.7 Vertical Circulation

The different types of vertical circulation — stairs, escalators, lifts and ramps — vary in terms of their capacity (the number of people that can use them per minute), the maximum recommended rise and their spatial requirements. All require run-off zones at the top and bottom. Whilst widening a flight of stairs increases its capacity, and the capacity of a lift can be increased by increasing its size, the capacity of an escalator is effectively fixed.

To increase capacity another escalator is required. This means increasing the capacity of a bank of escalators results in a jump in width, rather than the incremental increase of a stair. This is a key consideration when assessing capacity requirements against the spatial constraints on a platform, where minimum clear widths need to be maintained to safely accommodate passenger numbers.

**2.2.8 Ramps**

Ramps are best used to overcome small changes in level. With large changes in level ramps require multiple intermediate landings and quickly become very long, taking up significant space within a station.

**2.2.9 Stairs**

The recommended maximum overall rise for a staircase is 5m. The height of a footbridge across tracks is often greater than this, especially where it needs to be clear of overhead electrification. This may force a choice of escalators instead, though an acceptable alternative is to have an escalator and a stair, with the escalator serving the Up direction. The stair can then become two-way if the escalator is out of action. Stairs are the most appropriate means of level change for subways, where this level change is usually less than 5m. This shorter distance makes subways a quicker means of interchange than footbridges, and they also have less visual impact, which can be critical in a heritage station environment. Building a new subway can however be a challenge to construct and disruptive where it runs below the track-bed of operational tracks.

### 2.2.10 Lifts

Lifts are the primary means of providing step-free access through stations. They should be located as close as possible to the main passenger routes whilst providing clear space in front to wait, so that they are highly visible, convenient to use, and to make sure that those using step-free routes benefit from the same experience of the station as those using stairs and escalators. Through-lifts are recommended to avoid users having to reverse out or turn around within the lift to leave, and lift doors should face along the platform rather than towards the platform edge. For resilience it is preferable for all platforms to be served by at least two lifts in case one is out of action. The overall width of two lifts side by side can make it difficult to fit these next to each other safely on a platform though, and arranging them back to back means they can't be through lifts. A large number of lifts can also place a high on-going operational and maintenance cost on a station. It is therefore important that lift numbers and locations are carefully assessed on the basis of the size and footfall of the station.



### 2.2.11 Escalators

As escalators can only serve one direction at a time a minimum of two, or an escalator and a stair, are required so that one can run in the Up direction and the other Down. This allows for the eventuality of an escalator breaking down and requiring maintenance or replacement during station operation hours. A bank of three or more escalators also provides this resilience and allows for the direction of escalators to be changed to suit AM or PM peak passenger flows that may run in opposite directions. Consideration needs to be given to the expense of installation and ongoing maintenance of escalators and the spatial and construction requirements of the machinery requirements at the top and bottom.

### 2.2.12 Platform

Platforms accommodate both passengers waiting to board and passengers alighting from trains. At the same time there are often passengers moving along the platform, whether this is to find space to stand, access platform facilities or as a route to other parts of the station or the exit. With the risk of falling onto the tracks or being hit by a train, platform edges are the most hazardous part of the station. It is critical therefore that they are a sufficient size to accommodate passenger numbers. Platform widths are based on calculations derived from the peak number of passengers boarding and alighting trains plus an allowance for circulation along the platform, the interface with the platform edge (yellow line zone) and an 'activity zone' for seating and passenger facilities. If fast non-stopping trains pass through a station it is important that people can wait further back from the platform edge. Platforms can be made safer by making it easier for passengers to circulate and find space. This can be done by managing and minimising obstructions on the platforms, providing clear lines of sight and by locating vertical circulation where it should encourage passengers to disperse over the full length of the platform. Guidance on Station

Elements state that "The Platform Platforms should be long enough to accommodate the full length of the trains that call at the station, with 5m added to allow for slight variation in the train stopping point". Curved platforms can result in large gaps between the platform edge and the train door so should be avoided where possible. The relative levels of train door and platform on the UK rail network are such that there is typically a step down, often large, from one to the other. This results in slower boarding and alighting and an increased risk of tripping and falling. It is also very difficult for wheelchair passengers to get on and off a train without assistance. Temporary ramps need to be stored on the platform and are put in place by a member of station staff. This operation takes up space on a platform, increasing congestion and acting as a hazard if the platform is busy. Serious consideration should be given to reducing the level difference between train and platform so that the transition can be managed by wheelchair users without assistance.

**Servicing Routes Servicing**

(deliveries, maintenance, material handling and waste management) is an important element in the successful functioning and operation of all stations. Lack of proper planning and design for operations should result in the potential for ongoing issues throughout the lifetime of the station, including poor functionality and resilience, safety issues and cost. Consideration should be given to the servicing strategy early on in the planning of a project. **Determining The Quantity of Service Space**

A key factor is the quantity of space that needs to be provided. This should be calculated and presented within an accommodation schedule that articulates the spatial requirements for a future station.

**Security Undertake** a TVRA (threat and vulnerability risk assessment) to determine the security requirements (e.g. service vehicle access control) and provide the operational flexibility/resilience required for the site.

**Servicing Routes**

Provide logistics routes that minimise travel distances and level changes. The key to this is to locate the loading bay area(s) as close as possible to the final points of goods delivery, ideally at the same level. Where possible there should be independent servicing for station and retail functions.

**Vehicular Routes**

A key hazard relating to servicing is the potential for conflict between servicing vehicles (including material handling equipment) and pedestrians (passengers, staff and visitors). To avoid this, separation of pedestrian and vehicular routes should be planned, with clear demarcation. Highways design should be undertaken for vehicle tracking and for connecting the vehicle access to neighbouring roads.

**Provision of Staff Parking**

Staff parking may be required for a percentage of the total number of staff. As a minimum, blue badge parking should be provided for 5% of the total number of staff. The staff that need blue badge parking may be less mobile, so this should be in close proximity to staff entrances, with a step free route. This needs to be considered early on in the project, particularly for larger stations or those in constrained locations where passenger parking would not be provided and space is at a premium.

**Electric Vehicle Charging**

As part of NR's decarbonisation initiatives consideration should be given to the provision of electric vehicle charging points.

**Segregating Service Access for Retail**

Where retail is provided, service access should be required. For small kiosks, access may be via the passenger environment. For larger retail units, access that is separate from both public and station staff areas is advised.

**Retail Management Suite**

In large stations, a retail management suite should be included alongside station management offices where retail is managed by the station operator or owner. **Building Services**, **Connection and Extraction**

Early on in the design of any project the Mechanical, Electrical and Public Health requirements should be considered.

→ Does the retail unit require toilet facilities?

→ Is cooking taking place? Will it require an extraction system to atmosphere?

→ Is the station power supply sufficient to support the proposed retail?

Designing and Planning Retail Service Area

A retail accommodation schedule can help to define the spatial requirements for a retail service area. Other key considerations include:

→ How is vehicle access provided, and has sufficient space been provided for the retail units to load and unload

→ What size of servicing vehicle has been allowed for?

→ Will servicing space for the retail units be shared, and should usage be staggered or required at the same time?

→ Is there a change of level between service area and retail area? Has adequate lift provision been allowed for?

→ Is the transfer distance between servicing and retail as short as it can be?

→ Where should waste be stored and how can recycling be maximised?

→ Is a compactor required, and has sufficient space and headroom been allowed for?

→ To what extent should waste management and servicing be combined or separated between station and retail?

**Staff Facilities**

The range of staff rooms and facilities may vary depending on the size of the station. The requirements for the largest of these rooms are introduced here.

**Ticket Office**

Ticket Offices are located adjacent to the station concourse, and should be visible from the concourse without having to visually compete with retail and other station elements. Space for ticket vending machines should be provided adjacent to the ticket office, and there should be space for passengers to queue without disrupting station flows. Staff facilities for ticket offices should be in a secure area adjacent to and accessed from the ticket office, with toilets, a mess room and lockers provided. These should be separate from other staff facilities at the station.

**Station Control Room (SCR)**

The function of the SCR is to provide safety and security to passengers, customers, staff and visitors to the station at all times, to provide information on train services to passengers and coordinate operational train and platform information in liaison with the TOCs. It is the point of contact with all the emergency services during incident management. The SCR may be located alongside the station management suite.

It should be located in close proximity to the Telecoms Equipment Room.

**Station Management Suite**

This provides accommodation for the station manager and duty manager teams, along with meeting, conference and training space.

**Staff Facilities and Mess Rooms**

Staff mess and toilet facilities are to be located wherever staff are based. They are to include segregated male and female locker areas. These facilities may be duplicated where access is made difficult by distance or change of level. They may also be duplicated in secure areas of the station such as the secure suite.

**Train Management Suite**

At terminus stations and larger stations, a Train Management suite may often be required. This includes management space and facilities for drivers and conductors. Space for drivers should include a mess room and toilet facilities for use between services. This may be shared with other staff, but it is important that it is located close to the trains. 4.9.7 Train Cleaning and Servicing Space is required at some stations for train servicing, this includes train cleaning and fitting. Cleaning of trains is managed by the TOCs and includes turnaround cleaning, berth cleaning, toilet tanking and providing a supply of fresh water to the train. Cleaning staff require a mess room, toilets and showers, locker facilities, a cleaner site manager desk and storage space. Work is usually undertaken by contract cleaners. Accommodation is best located on platforms, near to the trains, as the cleaning staff carry heavy containers and chemicals. Cleaners toilets may not be shared with other staff.

## 2.3 Empirical Review

Many helpful suggestions have been proposed by relevant departments, the public, and the urban transit industry. An analysis of the design conditions for large-scale integrated terminals was conducted based on detailed sociological investigations, demographics, tourism sources, concourse information, transfer stations, trip chains, and trip distribution tendencies of passengers. This analysis was facilitated by an agent-based simulation platform, which saved time and labor resources. However, the analysis results may not accurately reflect real-life situations due to the model's lack of complexity compared to the actual environment. On the other hand, the optimal layout of subway pedestrian transfer corridors has achieved a balanced state in terms of waiting time. Some researchers have focused on optimizing pedestrian transfer designs to address imbalances around subway premises. As a result, a new tool called the crowding-induced multi-class M/M/m/k boarding model has been developed based on simulations of passenger behavior characteristics at stations. In recent years, the rapid development of urban rail transit systems and the increasing number of passengers in transit terminals worldwide have transformed subway stations from traditional transitional spaces to crowded modern terminal service facilities.

The modern terminal system plays a crucial role in urban transit by serving as a central hub for various transportation functions. It allows for easy transfers between different transit routes and provides convenient shuttle terminals for passengers. In order to handle the large influx of passengers during peak hours, it is important to enhance the efficiency of subway interchange terminals. As China continues to construct multilevel comprehensive urban transit terminal buildings and streamline internal operations, the increasing passenger flow in these terminals has highlighted the need for standardized and scientifically planned terminal designs within the industry.

# Chapter Three

# Research Methodology

## 3.1 Research Design

Similar to the research approach, different textbooks place different meanings on research design. Some authors consider research design as the choice between qualitative and quantitative research methods.

Others argue that research design refers to the choice of specific methods of data collection and analysis. Research design is also placed as a master plan for conducting a research project and this appears to be the most authentic explanation of the term.

In your dissertation you can define research design as a general plan about what you will do to answer the research question. It is a framework for choosing specific methods of data collection and data analysis.

Research design can be divided into two groups: exploratory and conclusive. Exploratory research, according to its name merely aims to explore specific aspects of the research area. Exploratory research does not aim to provide final and conclusive answers to research questions. The researcher may even change the direction of the study to a certain extent, however not fundamentally, according to new evidences gained during the research process.

Conclusive research, on the contrary, generates findings that can be practically useful for decisionmaking. The following table illustrates the main differences between exploratory and conclusive research in relation to important components of a dissertation.

**Table 3.1: The Main Differences Between Exploratory and Conclusive Research**

| Research project components | Exploratory research | Conclusive research |
|---|---|---|
| *Research purpose* | General: to generate insights about a situation | Specific: to verify insights and aid in selecting a course of action |
| *Data needs* | Vague | Clear |
| *Data sources* | Ill defined | Well defined |
| *Data collection form* | Open-ended, rough | Usually structured |
| *Sample* | Relatively small; subjectively selected to maximize generalization of insights | Relatively large; objectively selected to permit generalization of findings |
| *Data collection* | Flexible; no set procedure | Rigid; well-laid-out procedure |
| *Data analysis* | Informal; typically non-quantitative | Formal; typically quantitative |
| *Inferences/ Recommendations* | More tentative than final | More final than tentative |

Source: (Research-Methodology.Net, 2024)



## 3.2 Case Study Method

A case study is a research method that involves an in-depth examination and analysis of a particular case, such as an individual, organization, community, event, or situation.

It is a qualitative research approach that aims to provide a detailed and comprehensive understanding of the case being studied. Case studies typically involve multiple sources of data, including interviews, observations, documents, and artifacts, which are analyzed using various techniques, such as content analysis, thematic analysis, and grounded theory. The findings of a case study are often used to develop theories, inform policy or practice, or generate new research questions.

### 3.2.1 Types of Case Study

Types and Methods of Case Study are as follows:

**Single-Case Study**

A single-case study is an in-depth analysis of a single case. This type of case study is useful when the researcher wants to understand a specific phenomenon in detail.

**Multiple-Case Study**

A multiple-case study involves the analysis of several cases that are similar in nature. This type of case study is useful when the researcher wants to identify similarities and differences between the cases.

**Exploratory Case Study**

An exploratory case study is used to explore a new or understudied phenomenon. This type of case study is useful when the researcher wants to generate hypotheses or theories about the phenomenon.

**Descriptive Case Study**

A descriptive case study is used to describe a particular phenomenon in detail. This type of case study is useful when the researcher wants to provide a comprehensive account of the phenomenon.

**Instrumental Case Study**

An instrumental case study is used to understand a particular phenomenon that is instrumental in achieving a particular goal. This type of case study is useful when the researcher wants to understand the role of the phenomenon in achieving the goal.

## 3.3 Case Study Data Collection Methods

Here are some common data collection methods for case studies:

**Interviews**

Interviews involve asking questions to individuals who have knowledge or experience relevant to the case study. Interviews can be structured (where the same questions are asked to all participants) or unstructured (where the interviewer follows up on the responses with further questions). Interviews can be conducted in person, over the phone, or through video conferencing.

**Observations**

Observations involve watching and recording the behaviour and activities of individuals or groups relevant to the case study. Observations can be a participant (where the researcher actively participates in the activities) or non-participant (where the researcher observes from a distance). Observations can be recorded using notes, audio or video recordings, or photographs.

**Documents**

Documents can be used as a source of information for case studies. Documents can include , memos, emails, letters, and other written materials related to the case study. Documents can be collected from the case study participants or from public sources.

**Surveys**

Surveys involve asking a set of questions to a sample of individuals relevant to the case study. Surveys can be administered in person, over the phone, through mail or email, or online. Surveys can be used to gather information on attitudes, opinions, or behaviours related to the case study.

**Artifacts**

Artifacts are physical objects relevant to the case study. Artifacts can include tools, equipment, products, or other objects that provide insights into the case study phenomenon.

## 3.4 Case Study Selection Criteria

It was ensured that each study selected had a relationship directly or indirectly with the research area. The case studies were chosen using a purposive sampling technique.

The city is Among the highest number of Industrial Development in Nigeria therefore is the best locations of Industrial building.

## 3.5 Case Study Analysis

A case is a phenomenon specific to time and space Johansson (2010), Johnson also identified a case study as the dominant factor of architectural research, Veal (2006) noted that a case study may refer to both research method or unit of analysis, which involves the study of examples- a case-of being researched. Case studies is defined as a method for learning about a complex instance, based on a comprehensive understanding of that instance obtained by extensive description and analysis of that instance taken as a whole and in its context (GAOPEMD, 1995). Hence, for this research, it will therefore be conducted only with specific cases with related peculiarities to the topic in consideration, through the objective method of observation. The method of study of this research involves a qualitative analysis of case studies as well as a study of published and unpublished literature.

### 3.6 Case Study One - (Mobola Johnson Train Station Lagos, Nigeria)

The Mobolaji Johnson Train station, one of the modern train stations in Nigeria. It is at located at Alagomeji, near Yaba. It is the take-off station from Lagos to Ibadan. Trains leave here at 8am and 4pm every weekday, but there are three departure times on weekends. The Ebute Metta Station, known as the Mobolaji Johnson Station, is the largest railway station in West Africa with a holding capacity of 6000 passengers**.**

**Observations**

- The use of enough glazing for natural lighting.
- Ample parking area for vehicles.
- Conspicuous modern aesthetics.
- Good zoning system with relation of spaces.
- Spacious waiting areas with a high holding capacity.



**Plate 3.1: Station Façade of the Mobola Johnson Train Station Lagos**
(Source: Researcher's Field Work, 2024)

**Plate 3.2: Rail Track of the Mobola Johnson Train Station Lagos**
(Source: Researcher's Field Work, 2024)

**Plate 3.3: Waiting Area of the Mobola Johnson Train Station Lagos** (Source: Researcher's Field Work, 2024)

### 3.7 Case Study Two - (Taiyuan South Railway Station, China)

**Architects: Csadi │ Area: 183952 M² │ Year: 2014**

Taiyuan south railway station, consisting of 10 sets of trains and 22 railway lines and covering an area of structure of 183,952m2, is one of the principal junction stations along the Shijiazhuang-Taiyuan passenger dedicated railway line and the modernized and largescale transportation junction integrating the functions of railway, urban rail and traffic transfer, which could gather 4000 passengers at most.

**Observations**

- Expression of regional culture.
- Ecological strategy, Passive energy-saving measures and active ecological technology combined in the design effectively reduces energy consumption of the building.

- Shading system of the building-reasonable and excellent length of the main station building designed based on computer simulated data.
- Natural lighting.
- Natural ventilation.

**Figure 3.1: Station Façade of the Taiyuan South Railway Station, China**
(Source: Archdaily.com, 2024)

**Figure 3.2: Façade of the Taiyuan South Railway Station, China**
(Source: Archdaily.com, 2024)

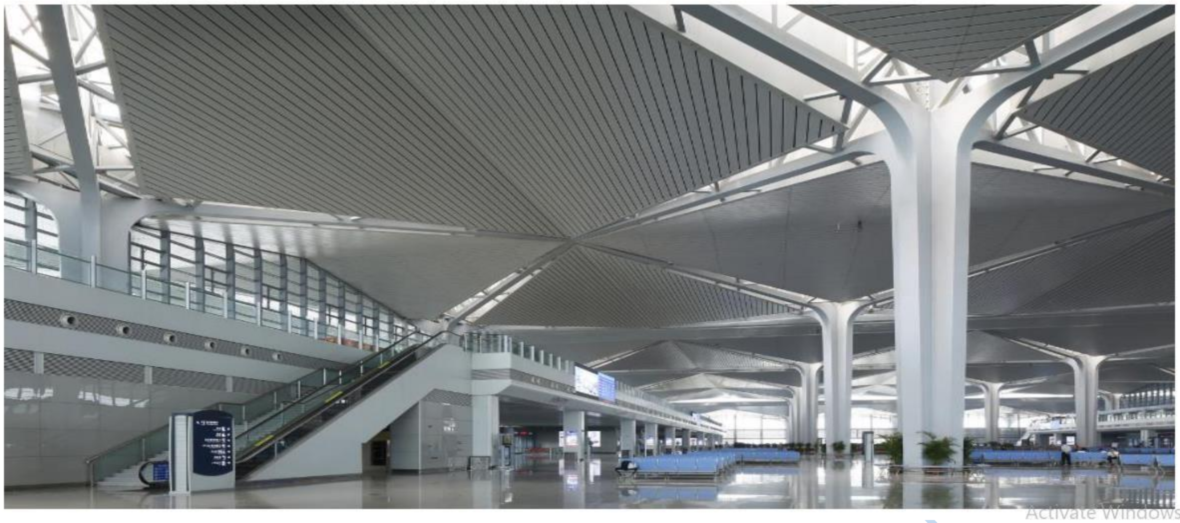


**Figure 3.3: Waiting Area of the Taiyuan South Railway Station, China**
(Source: Archdaily.com, 2024)

### 3.8 Case Study Three - (Train Station Casablanca, Morocco)

Architects: AREP, Groupe3 Architectes │ Landscape Architect: Atelier Bertrand Houin

Area: 2500 m² Manufacturers: Ductal® │ Structures: MAP3 -Emmanuel Livadiotti, Erick Cuervo Under its large roof, the transport hub houses waiting. areas, circulations, services as well as retail outlets and a two-tier underground car park facility. The concourse is the major element of the hub and opens up onto a large forecourt on the south-west and the platforms on the north-east. As if in anticipation of possible new transformations, the station has been devised in a way that allows its future connection with a potential regional express line station.

**Observations**

- Materials and lighting draw on the architectural MERITS modernity of Casablanca.
- The dimensions of the vast concourse and the walkways leading to the transverse platform are suited to deal with.

- The concourse hosts all travel-related services (ticket offices, information displays, reception, waiting areas etc.) as well as a prayer room away from the bustling crowd.

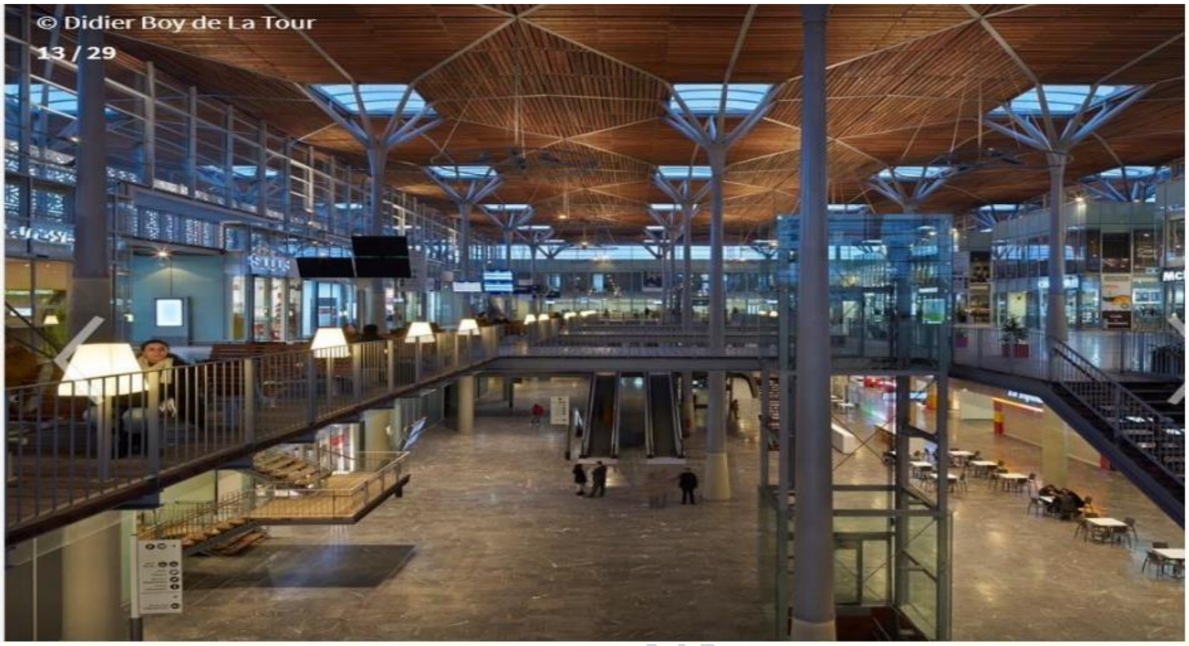



**Figure 3.4: Interior Image of the Train Station Casablanca, Morocco**
(Source: Archdaily.com, 2024)

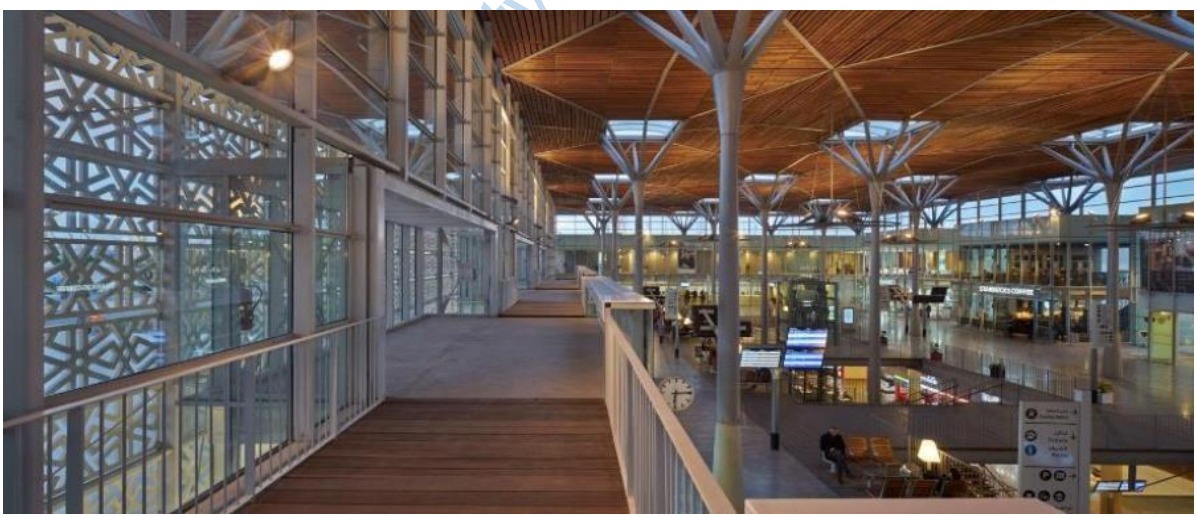


**Figure 3.5: Entrance Porch of the Train Station Casablanca, Morocco**
(Source: Archdaily.com, 2024

## Chapter Four

## Site Analysis and Design Synthesis

### 4.1 Study Area

#### 4.1.1 Site Location

The site for the proposed Train terminal is located at Nassarawa local government of Kano state. Hence, the site has been critically studied with the research work in mind.

**Figure 4.1: Google Earth of Railway Station Kano**

Source: (Google Earth 2024) **4.1.2**

**Site Characteristics**

i. **Water supply**

There is provision of water on the site due the presence of government water supply pipe very close to the proposed site.

ii. **Electricity**

Kano Electrical Distribution Company (KEDCO) are the main suppliers and distributors of electric power in all over of Kano state. There is adequate supply and distribution of electricity in domestic, commercial and industrial areas.

There is over one thousand KVA over ahead high tension line passing along the main road of the city. Although the electric power supply is erected. Therefore, the standby generators are emphasized because of the erective nature of power supply from public power supply.

**iii. Telephone/internet services**

The site is being service by various G.S.M service providers. Internet services are also available on the site.

**iv. Sewage disposal**

The disposal of rain water is by gravity. The site drainage will follow the natural site slope to the drainage while the solid waste disposal has been taken care during the design of the market, by providing all necessary treatment and disposal required.

**v. Transportation**

The major means of transportation to and from the site is by road. The site is linked to (Matan fada road) whereby good road network is available.

## 4.2 Site Inventory

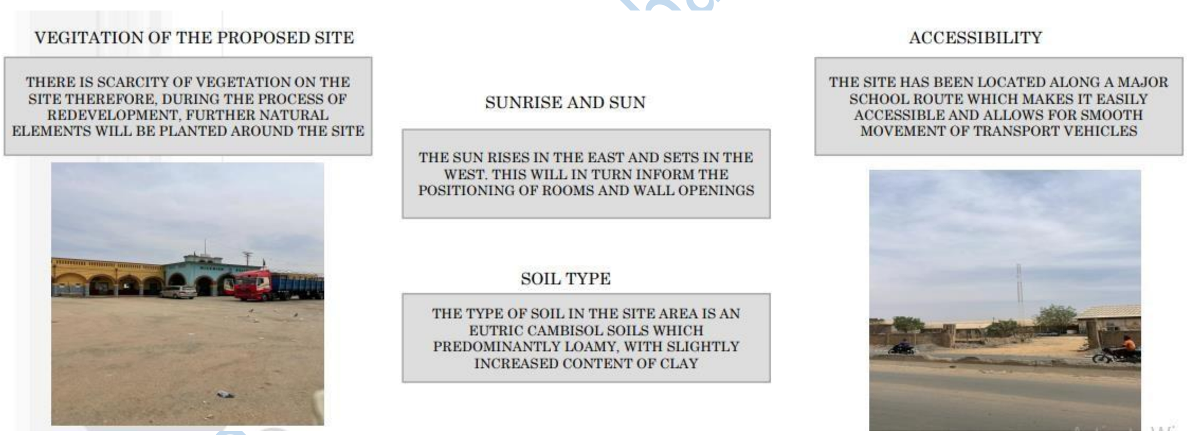


**Plate 4.1: Site Inventory**
(Source: Researcher's Field Work, 2024)

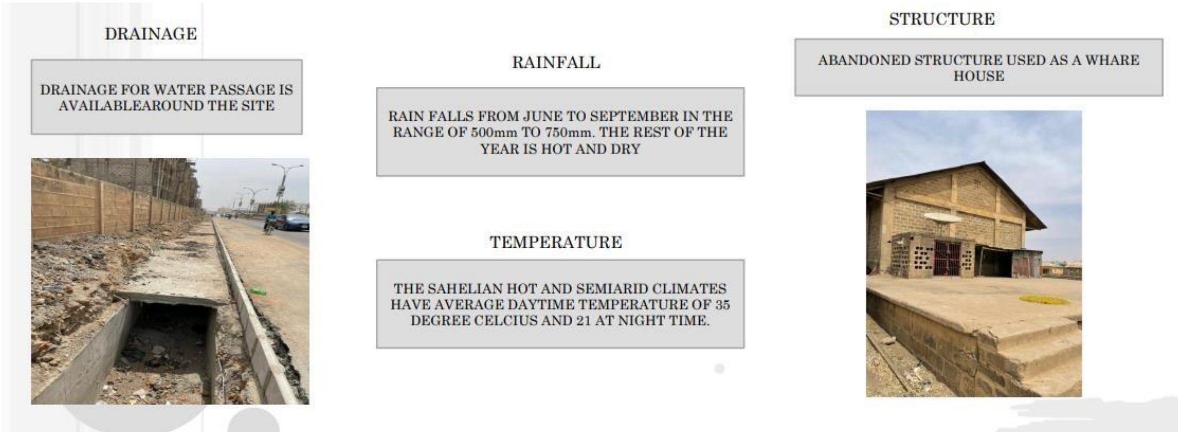



**Plate 4.2: Site Inventory**
(Source: Researcher's Field Work, 2024)

### 4.3 Site Selection Criteria

Every site has its ideals use and for every use there is an ideal site. The selection of the site for the proposed Transit Train Terminal, are based on the following criteria.

i. **Accessibility to road network: -** The site should be easily accessible; this is to ensures easy access for all users with little or no difficult.

ii. **Ease of ownership: -** this has to do with the process of owning the site where by if a suitable site is found then some part of the site is own by private individuals, the compensation to be paid will not be much if the individuals have not erected a structure within their lands. But in this case, the site is own by Nigerian Railway cooperation. Which make it perfect for the proposed design.

iii. **Site potential: -** The site possibility of developing to becoming a permanent residence for the nomadic Fulani.

iv. **Water: -** this is one of the factor to be considered when situating a transit train terminal in a humid area. Because water is highly essential in keeping the green landscape alive.

v. **Size of the site: -** the site needs to cover large area of land, so as to accommodate the design requirement (spaces).

vi. **Topography:** - The site topographical features should be in such a relatively flat area for the proposed Transit Train Terminal so as to avoid soil erosion.

### 4.4 Project Analysis and Design Synthesis

Project analysis and design synthesis are essential stages in architecture research, involving the examination and interpretation of existing projects and the generation of new design solutions. Project analysis and design synthesis are research stages that focus on examining and improving the design of the proposed transit train terminal. Here's a breakdown of these stages in train transit:

- Assessing the functionality, capacity, and user experience of existing train stations or terminals.
- Developing new design concepts that enhance passenger experience, improve wayfinding, and increase efficiency.

**a) Brief Development**

The proposed railway transit station is expected to have the following essential facilities:

1. Core Area
2. Transition Area
3. Administrative Area
4. Peripheral Area

**b) Brief Analysis**

This section shows the breakdown of the facilities provided;

**i. Core Area**

Access Queuing and Circulation

Signage and Information

Ticketing facilities

Seating and Waiting area

Security **ii.**

**Transition Area**

Retail

Toilets

Eating area **iii.**

**Administrative Area**

General office

Parcel office

First Aid

Left luggage

Communications room

Offices

Toilets **iv.**

**Peripheral Area**

Train track

Maintenance

Platform

Toilets

## 4.5 Design Criteria

Certainly! When designing train terminus stations, several key criteria come into play. Let's explore some of the essential considerations:

**Safety And Security**: Ensuring passenger safety is paramount. Stations should be designed to prevent overcrowding, provide unobstructed lines of sight, and maintain well-lit spaces throughout.

**Station Layout**: The layout should facilitate easy access for all passengers. Consider factors like platform spacing, pedestrian access, and intermodal connectivity.

**Queuing and Circulation**: Designing efficient queuing areas and circulation paths helps manage passenger flow.

**Platform Design**: Platforms should accommodate passengers comfortably. Consider platform size, clearances, edge detection, emergency third rails, and slope.

**Vertical Circulation**: Stairs, escalators, and elevators play a crucial role in moving passengers between levels. Compliance with code requirements ensures safety and accessibility.

By considering these design criteria, train terminals can become functional, sustainable, and welcoming hubs that enhance the overall passenger experience.

### 4.5.1 Conceptual Development

In the design and planning of railway transit terminal, the principle of form follows function is usually adopted and this has unassailable advantages which make it well suited for this project. Thus, the concept behind this design is along the order of form follows function. Various functional spaces were harmonised together in a complimentary manner. This led to the initial bevelled symmetrical form of the design. The final design concept is arrived at having satisfied the basic design requirements for typical railway station designs, the resulting form was then modified in such a way as to make the plan view more aesthetically pleasing as well as to suit the site characteristics particularly the north orientation.

The concept is formed based on Function and Form.

***Function:*** The design is considered for functionality which should be the major priority of a good design.

Functionality seeks for good ventilation, good lighting, and adequate circulation within the activity areas. The functional spaces should be so linked together as to give the users the sense of being in a building with good flow.

***Form:*** This is the resulting geometrical shape which envelopes the various functional spaces. It should be directly derived from the above (Function).

The concept is formed based on Function and Form. Function: The design is considered for functionality which should be the major priority of a good design. Functionality seeks for good ventilation, good lighting, and adequate circulation within the activity areas. The functional spaces should be so linked together as to give the users the sense of being in a building with good flow. Form: This is the resulting geometrical shape which envelopes the various functional spaces. It should be directly derived from the above (Function).

The design concept was achieved by taking into consideration some fundamental and physical features. which are: Orientation of the building, Circulation, Zoning and Psychology.

**Orientation:** The building is oriented in such a way that as much as possible, direct sunlight is prevented from entering the building.

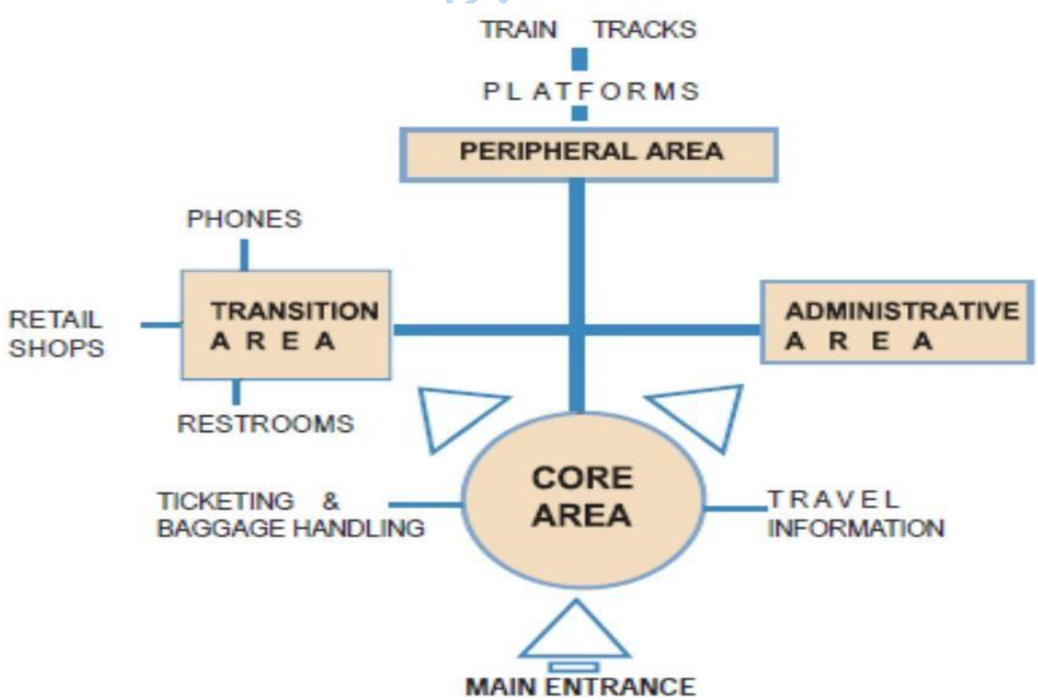
**Circulation:** Easy accessibility of pedestrian users into the building was also taken into consideration.

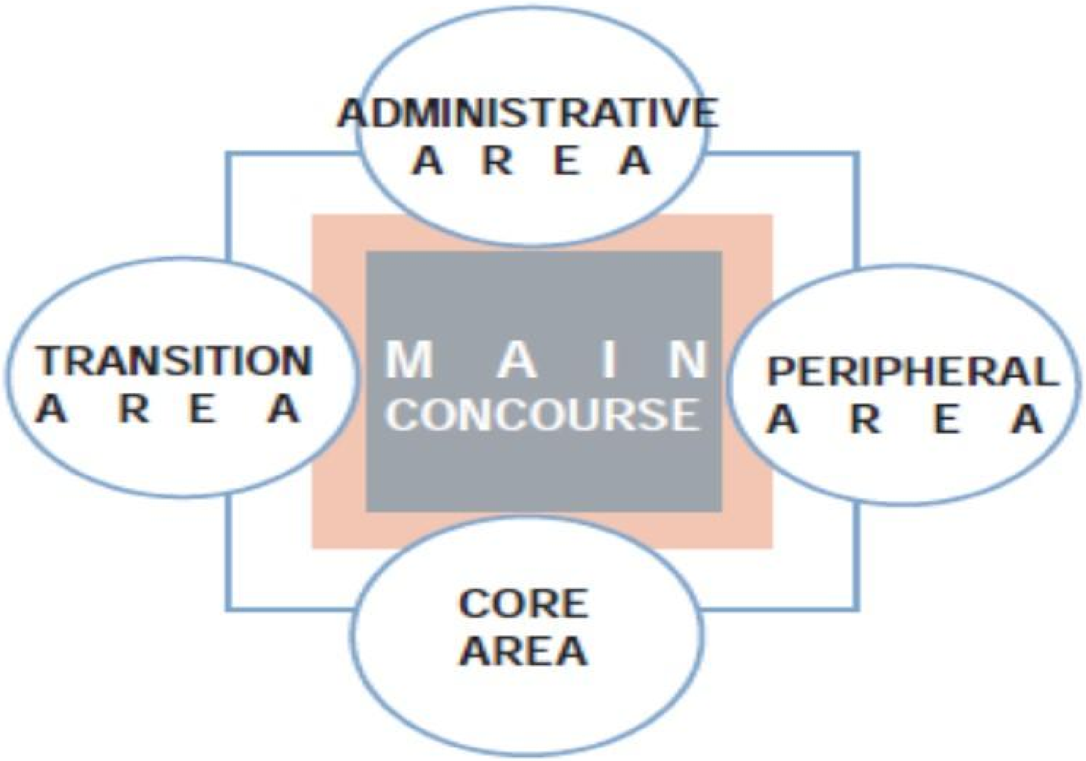
**Zoning:** Zoning of required functional spaces is done with respect to their various uses.

**Psychology:** The entire space in the building is planned and harmonized to depict an eye.



### 4.5.2 Functional Relationship




ADMINISTRATIVE
A R E A
TRANSITION
A R E A
M A I N
CONCOURSE
PERIPHERAL
A R E A
CORE
AREA

### 4.5.3 Space Allocation/Schedule of Accommodation

| ACCOMODATION | FUNCTION | NO | AREA | TOTAL AREA |
|---|---|---|---|---|
| MAIN CONCOURSE | MAIN RECEPTION AND CIRCULATION | 1 | 1333.41 SQM | 1333.41 SQM |
| TICKET OFFICE | ISSUING TICKETS | 6 | 2.28 SQM | 13.68 SQM |
| SECURITY POST | SECURITY | 5 | 12.13 SQM | 60.64 SQM |
| RETAIL | SHOPS | 8 | 9.70 SQM | 77.62 SQM |
| | SUPERMARKET | 1 | 106.72 SQM | 106.72 SQM |
| | STORE | 1 | 259.29 SQM | 259.29 SQM |
| | GAMES ARCADE | 1 | 106.72 SQM | 106.72 SQM |
| | FOOD COURT | 1 | 259.29 SQM | 259.29 SQM |
| TOILETS | MALE | 3 | 1.21 SQM | 3.63 SQM |
| | FEMALE | 6 | 1.21 SQM | 7.26 SQM |
| ADMINISTRATIVE OFFICES | PARCEL OFFICE | 1 | 27.36 SQM | 27.36 SQM |
| | FIRST AID | 1 | 25.80 SQM | 25.80 SQM |
| | LEFT LUGGAGE | 1 | 40.60 SQM | 40.60 SQM |
| | GENERAL OFFICE | 1 | 27.84 SQM | 27.84 SQM |
| | COMMUNICATIONS ROOM | 1 | 29.58 SQM | 29.58 SQM |
| | OFFICES | 2 | 19.72 SQM | 39.44 SQM |
| | TOILETS | 5 | 1.21 SQM | 6.05 SQM |
| PLATFORM | ACCESS TO TRAIN | 3 | 1190.0 SQM | 3570 SQM |
| | TOILETS | 21 | 1.35 SQM | 28.35 SQM |
| | MAINTENANCE | 2 | 22.26 SQM | 44.52 SQM |
| | TRAIN TRACK | 2 | 469.0 SQM | 938.0 SQM |

### 4.5.4 Construction Method and Materials

**The Building Requirement Structure**

a. **Foundation**

Foundation is the building sub structural member that transmit load to the ground on which it rests the combined dead, imposed and wind load in a safely manner without causing any damage to the structure. The foundation type and depth of the project are to be determined by the structural engineer for the efficiency of the project.

**Walls**

A wall is a continuous, usually vertical structure, that is in proportion to its length and height, built to provide shelter as an exterior wall. The main function of an external wall is to provide shelter against rain, wind and daily seasonal variation of outside temperature normal to its location. In this proposed project. The walls of the structures are to be constructed using a solid clay brick of (230×113×75) mm while the walls of the dwellings are to be constructed using a 13⁄radius solid clay brick.

**Beams and Columns**

Beams and columns are to be constructed using a reinforced concrete and steel iron **Roof**

The roof is an important element of a building which provide protection against weather and has a significant role in reduction of heat gain to the building. (Stephen Emmitt 2005) The rafters of the transit terminal are to be constructed using steel. While the roof sheet is to be of

**BIVP Panels (glazing)**



**Special Design Requirement a.**

**Lighting and Ventilation**

Natural lighting and ventilation are use for decorating and achieving a functional purpose, during the cold season the sunlight that passes through the window also helps in maintaining the indoor temperature at a favorable condition. While the ventilation helps during hot season. **b. Orientation**

In planning, this refers to the positioning in such a way that the building is put into consideration of the movement of the sun and the direction of the prevailing wind. The building should be positioned in such a way that the openings are oriented away from direct sun and from the prevailing wind.

**c. Landscape**

Efficient landscaping of the layout has been used in the design to attain functional flow within the surrounding, a welcoming environment and as a means of reducing noise in the surrounding of the site. The entire building is landscaped with trees and also walls along the perimeters of the building as a means of minimizing the level of noise into the building. **d. Planning**

Site planning plays an important role in achieving thermal comfort. The first is to place the longest side of the building as facing north or south direction. 37

**e. Screening**

Screening is the most commonly used in controlling traffic noise, as in case of vehicle way passing near a housing estate or any set of buildings. The screening can be made from walls, hedges or any other barriers. Landscaping plays an important role in the choice of the screens. The most effective position for a screen is to be near to the source of noise.

**4.5.5 Building Services**

**a.** Electrical:

The site is to be connected to the National grid. Due to the fact that power supply is available around the site, electricity can be connected from the line 33 after the approval of the authority. With this in mind natural ventilation was adopted in the design with mechanical means of ventilation as supplement.

**b. Mechanical:**

Water supply is available around the site and can be connected from the nearby source Water Resource and Engineering Construction Agency (WRECA) pipe after the approval from the authority. Rain water collected from the gutter drains through the drainage within column to the storage tanks can be treated for washing and flushing. Waste from the toilet drain to the inspection chamber to the manhole then to the septic tank and then the water waste is drain to the soak away.

i. Plumbing ii.

Drainage

**c. Fire Safety:**

Fire hazards are considered by minimising the use of combustible material in the design of the entire structure, which will reduce the effect of fire transfer from one unit to another. Since the building is a public building, the building is designed in such a way that each unit is independent of itself, minimizing the effect of fire transfer from one place to another and ensuring that there is an existing door on each unit of the building. Another method of reducing the effect of fire outbreaks includes the following;

i. Well-designed buildings ii.

Use of fire resistance door

In the case of a fire outbreak, the use of protective devices is also employed and these devices include

i. Smoke detector ii. Fire

extinguisher

Escape doors and also the provision of an escape staircase **Chapter Five**

## Conclusion and Recommendation

### 5.1 Project Appraisal

The report focuses on how transit train terminals can be optimized to operate as sustainable buildings and how the findings can be implemented into the proposed eco-friendly design that tends to reduce energy consumption and minimize environmental impact. The energy consumption of train terminals/stations as discussed in Chapter Two caused a great impact on the natural environment. Strategies and means of controlling these impacts on the natural environment were discussed. Case studies were carried out and based on the results from the findings, a transit train terminal is proposed with both passive and sustainable elements for controlling the degrading energy efficiency in the train terminal.

### 5.2 Conclusion

Train Transit Terminal is an interesting place that need to be designed to give it users an appealing/welcoming state of mind. These transit terminals must be planned to be naturally ventilated, use natural lighting during the day and, in the event of an emergency or fire, allow for fast and safe evacuation from the building by all its occupants. In the design of the practical issues, energy efficiency is one of the most important and complex considerations. Architects play a very vital role in ensuring that energy efficient measures are achieved in the design of Train terminals. Based on the findings, none of the Train stations adapt/employ the use of renewable energy (solar energy). This research has helped in outline the impact of energy consumption and how to tackle the problems with a successful design. Most architects lay more emphasis on special arrangements and aesthetics, and neglecting the energy consumption of a building.

### 5.3 Recommendation.

This thesis report can be used as a startup in providing a design with sustainable design approach, most especially for transit train terminal. Now that federal government is working towards reviving the railway transport sector. It is recommended that further research can be carried out in landscape, so as to give it a holistic approach.

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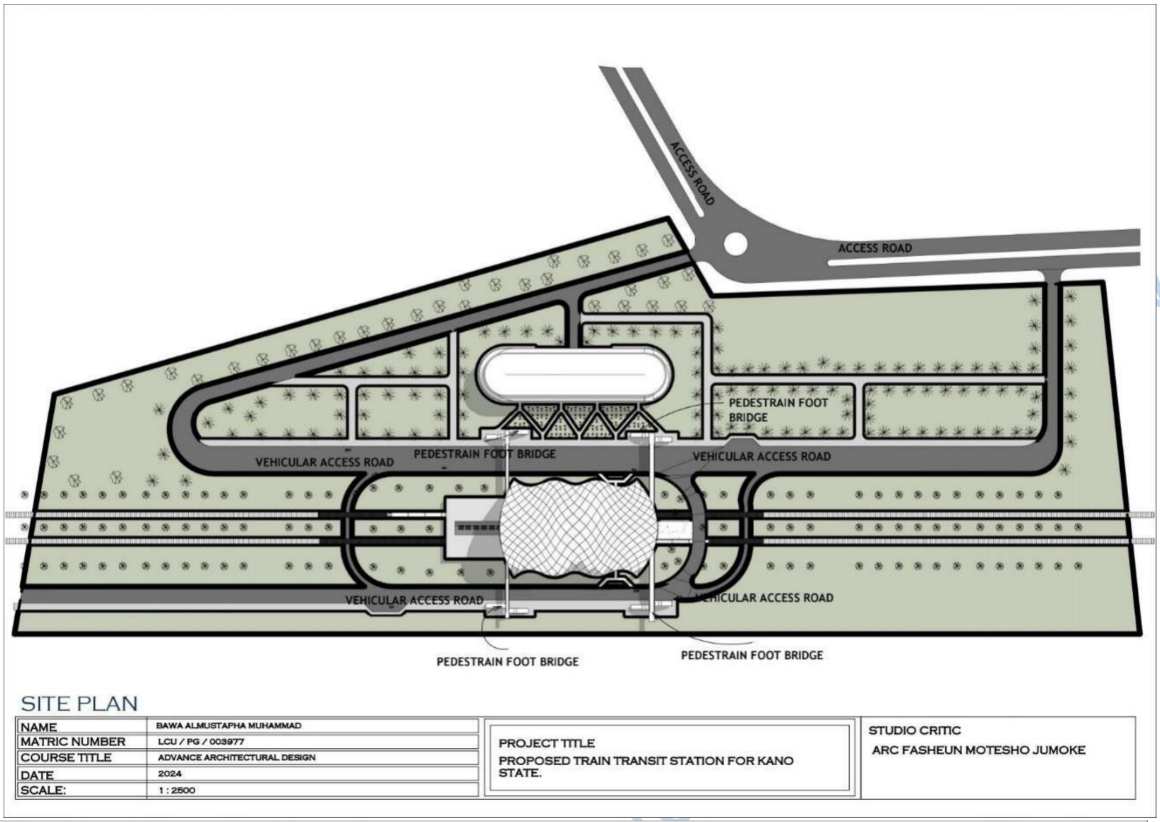
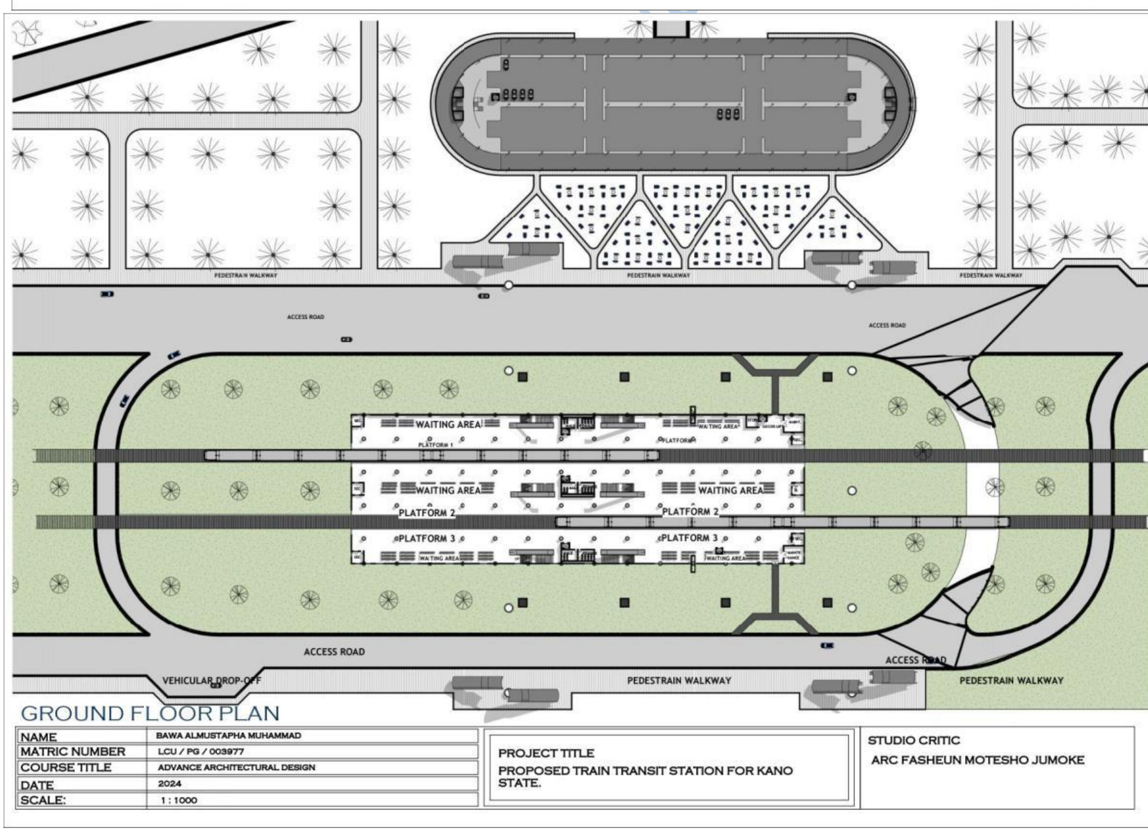
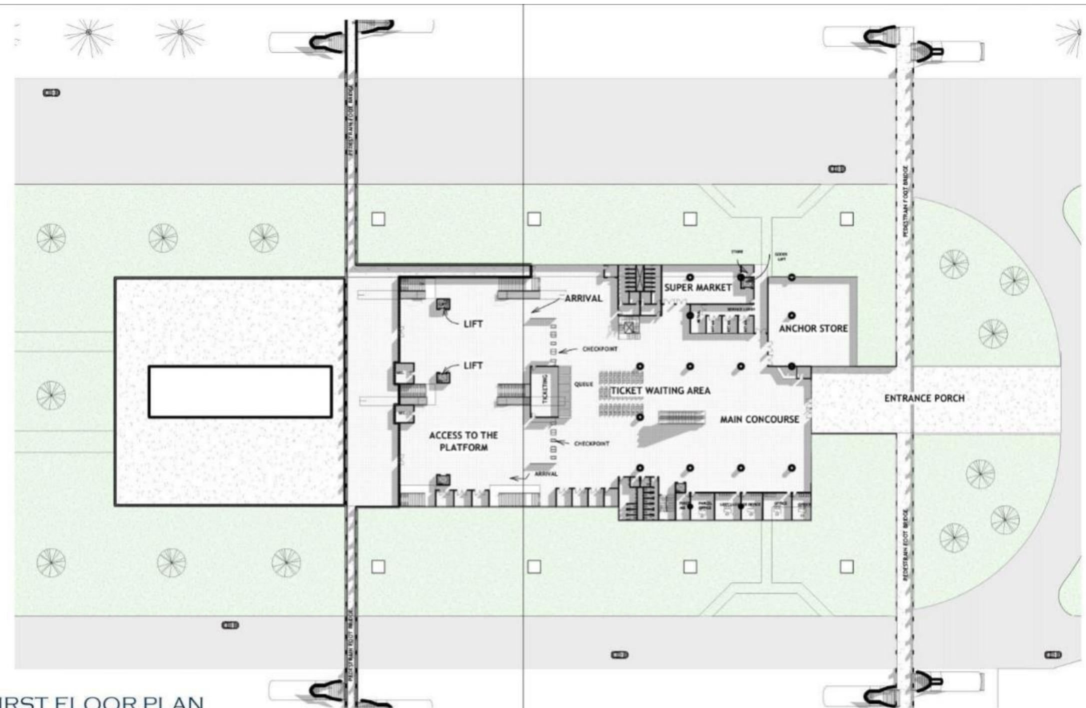
## Appendices - Appendix 1 – Presentation Drawings






FIRST FLOOR PLAN

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| MATRIC NUMBER | LCU / PG / 003977 |
| COURSE TITLE | ADVANCE ARCHITECTURAL DESIGN |
| DATE | 2024 |
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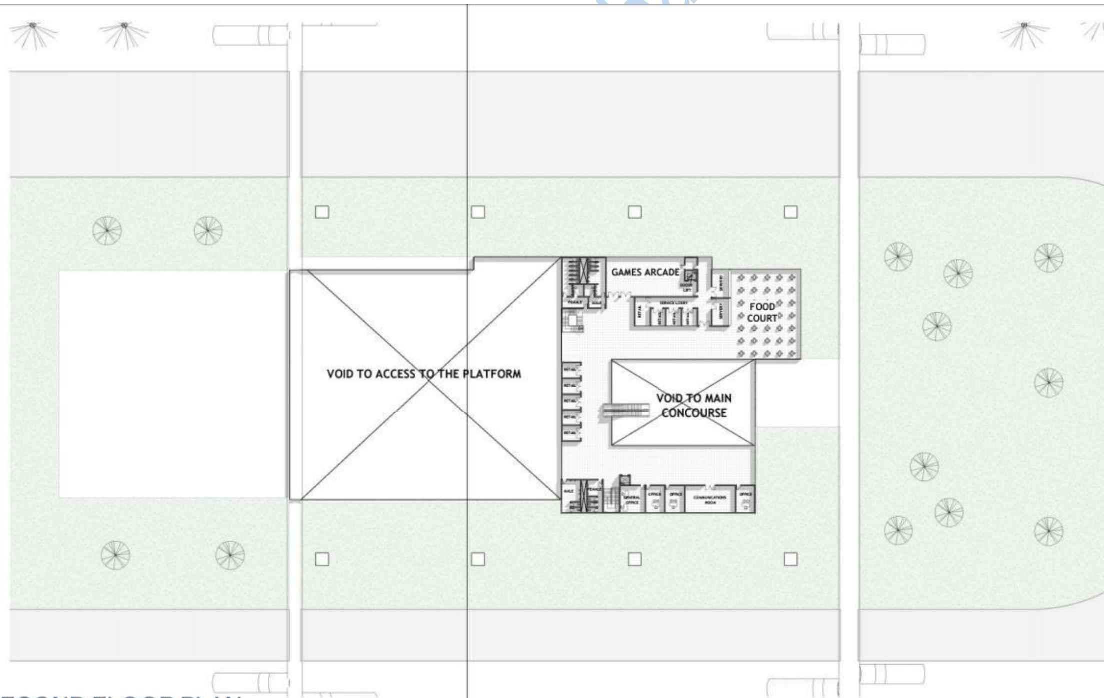
PROJECT TITLE
PROPOSED TRAIN TRANSIT STATION FOR KANO STATE.

STUDIO CRITIC
ARC FASHEUN MOTESHO JUMOKE

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PROJECT TITLE
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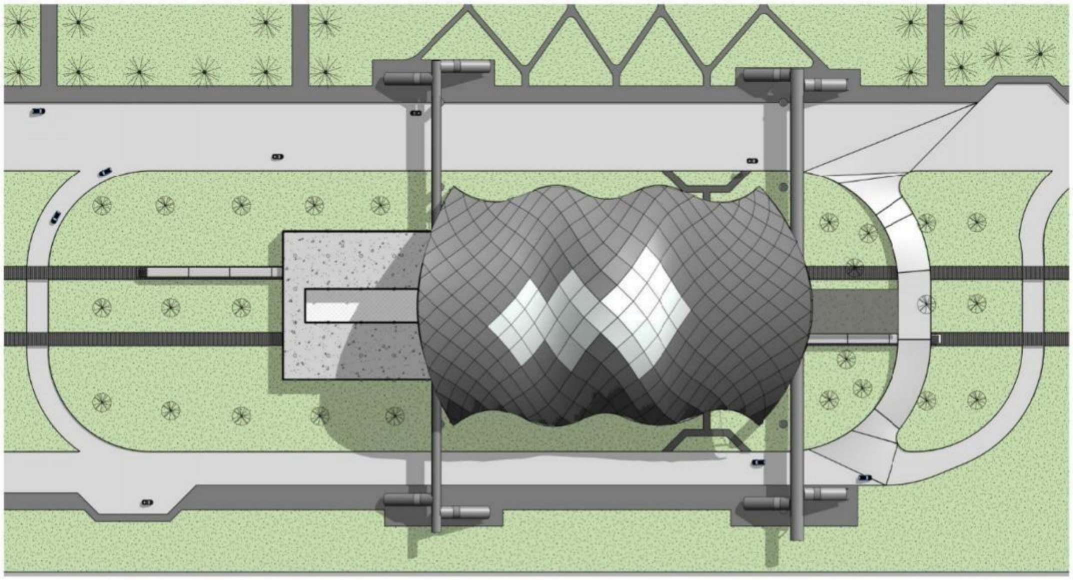
STUDIO CRITIC
ARC FASHEUN MOTESHO JUMOKE



ROOF PLAN

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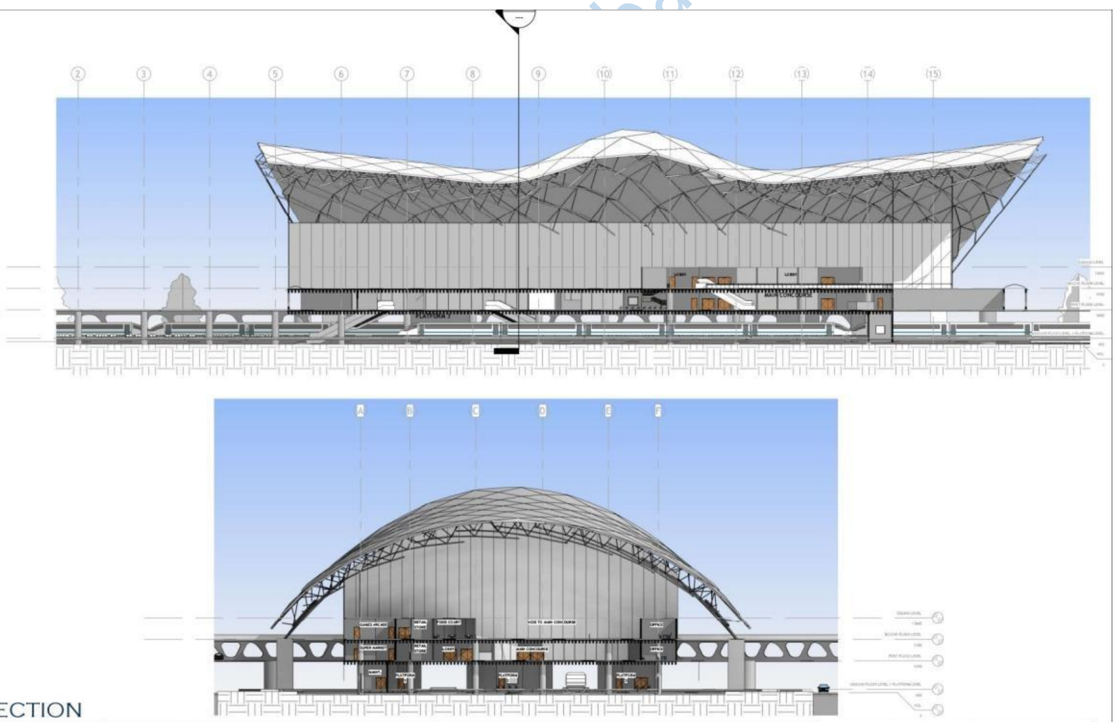
PROJECT TITLE
PROPOSED TRAIN TRANSIT STATION FOR KANO STATE.

STUDIO CRITIC
ARC FASHEUN MOTESHO JUMOKE



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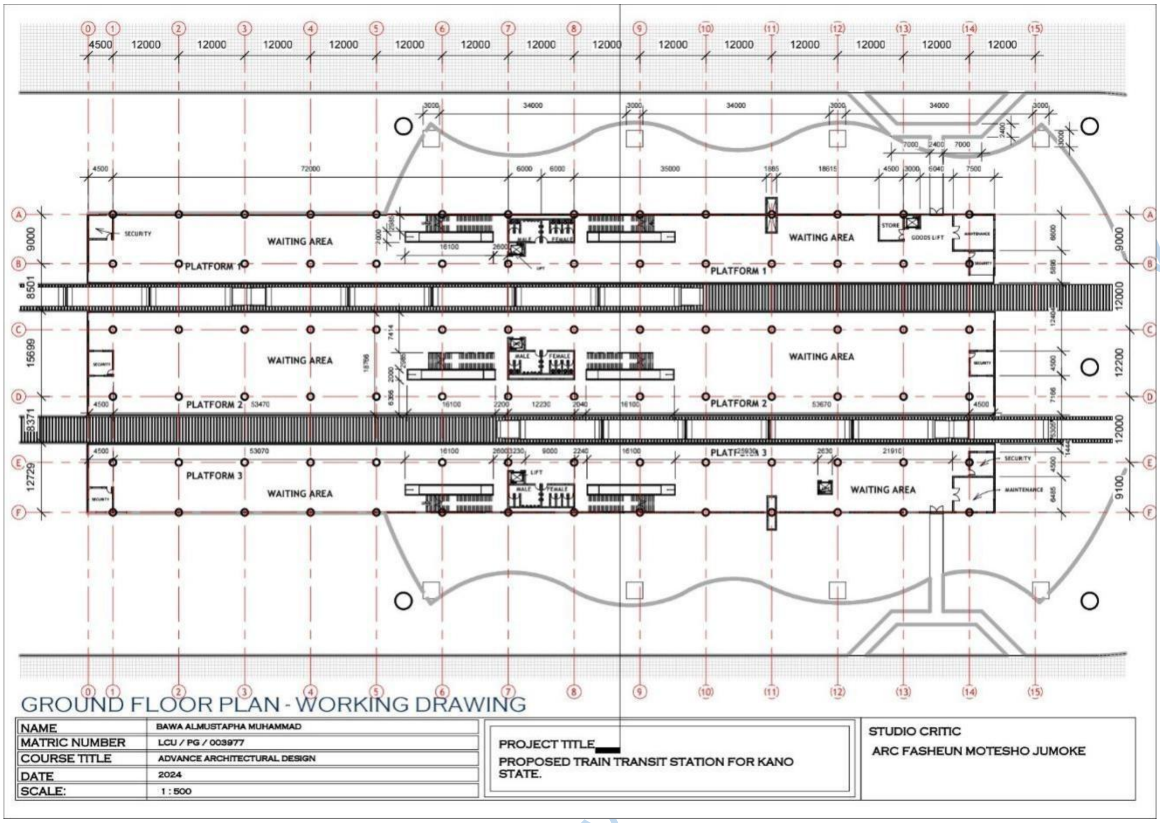
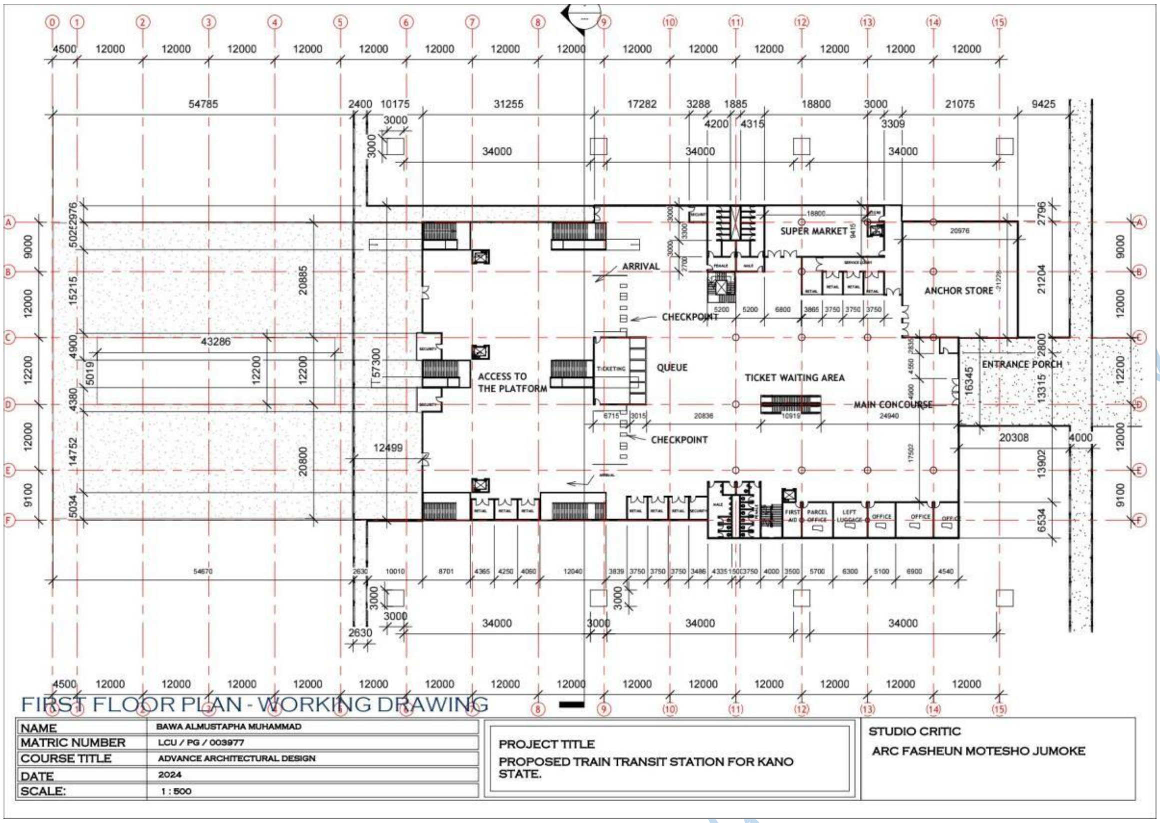
| SCALE: | 1 : 500 | |

PROJECT TITLE
PROPOSED TRAIN TRANSIT STATION FOR KANO STATE.

STUDIO CRITIC
ARC FASHEUN MOTESHO JUMOKE

**Appendices - Appendix 2 – Working Drawings**

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CHECKPOINT
ANCHOR STORE
QUEUE
TICKETING
ACCESS TO THE PLATFORM
TICKET WAITING AREA
ENTRANCE PORCH
MAIN CONCOURSE
CHECKPOINT
FIRST AID
PARCEL OFFICE
LEFT LUGGAGE
OFFICE
OFFICE
NAME
BAWA ALMUSTAPHA MUHAMMAD
MATRIC NUMBER
LCU / PG / 003977
COURSE TITLE
ADVANCE ARCHITECTURAL DESIGN
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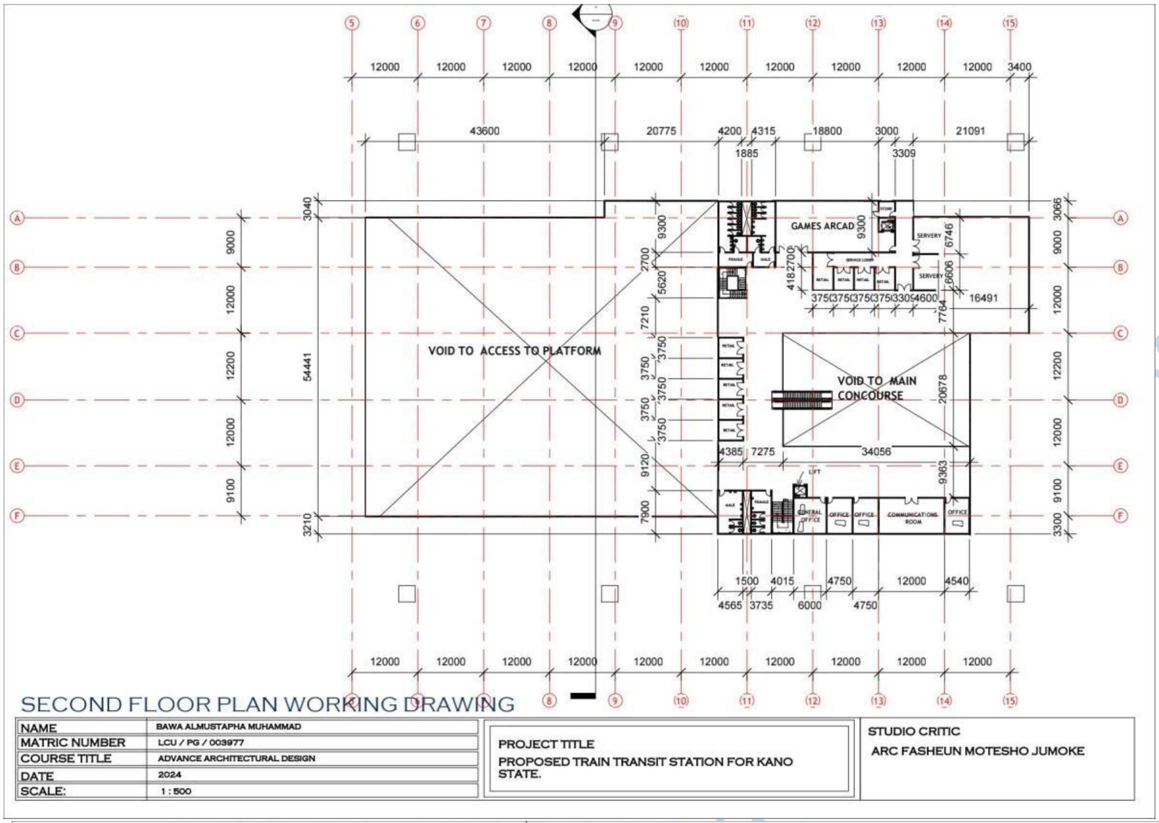
ARC FASHEUN MOTESHO JUMOKE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VOID TO ACCESS TO PLATFORM
GAMES ARCAD
VOID TO MAIN CONCOURSE
NAME
BAWA ALMUSTAPHA MUHAMMAD
MATRIC NUMBER
LCU / PG / 003977
COURSE TITLE
ADVANCE ARCHITECTURAL DESIGN
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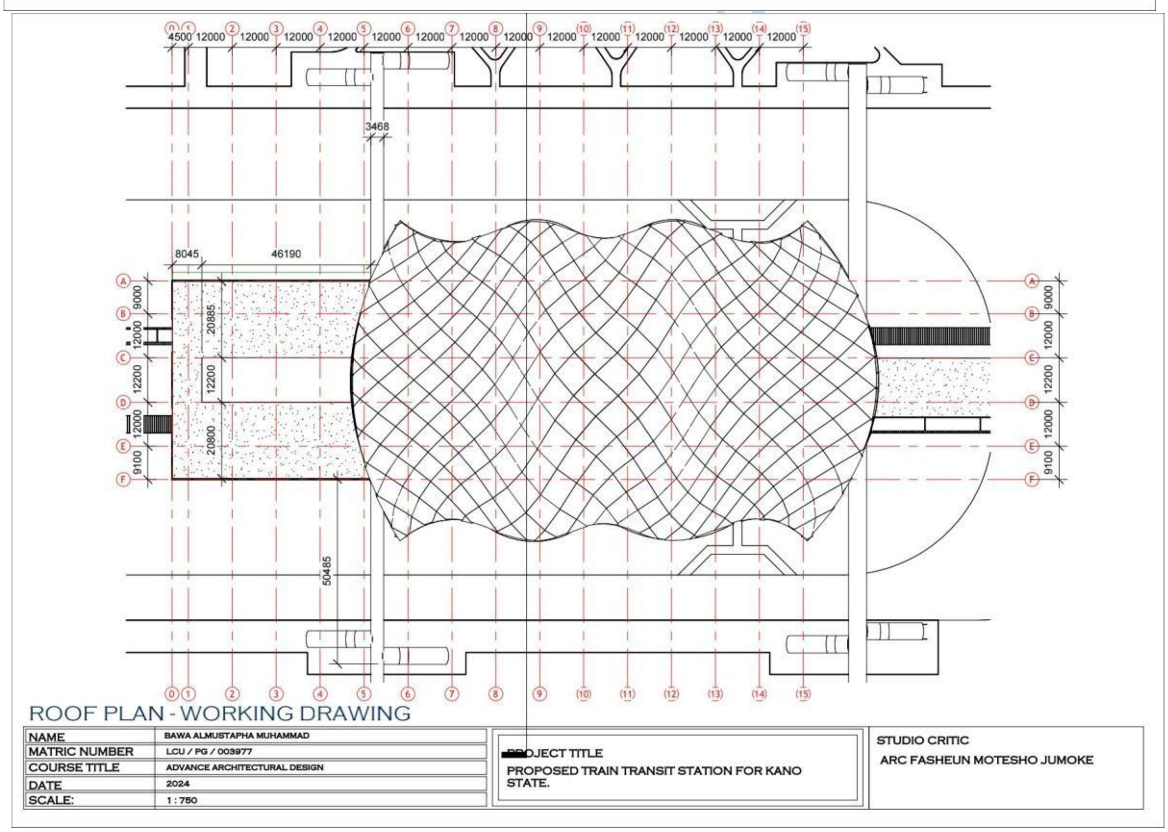
ARC FASHEUN MOTESHO JUMOKE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LCU / PG / 003977
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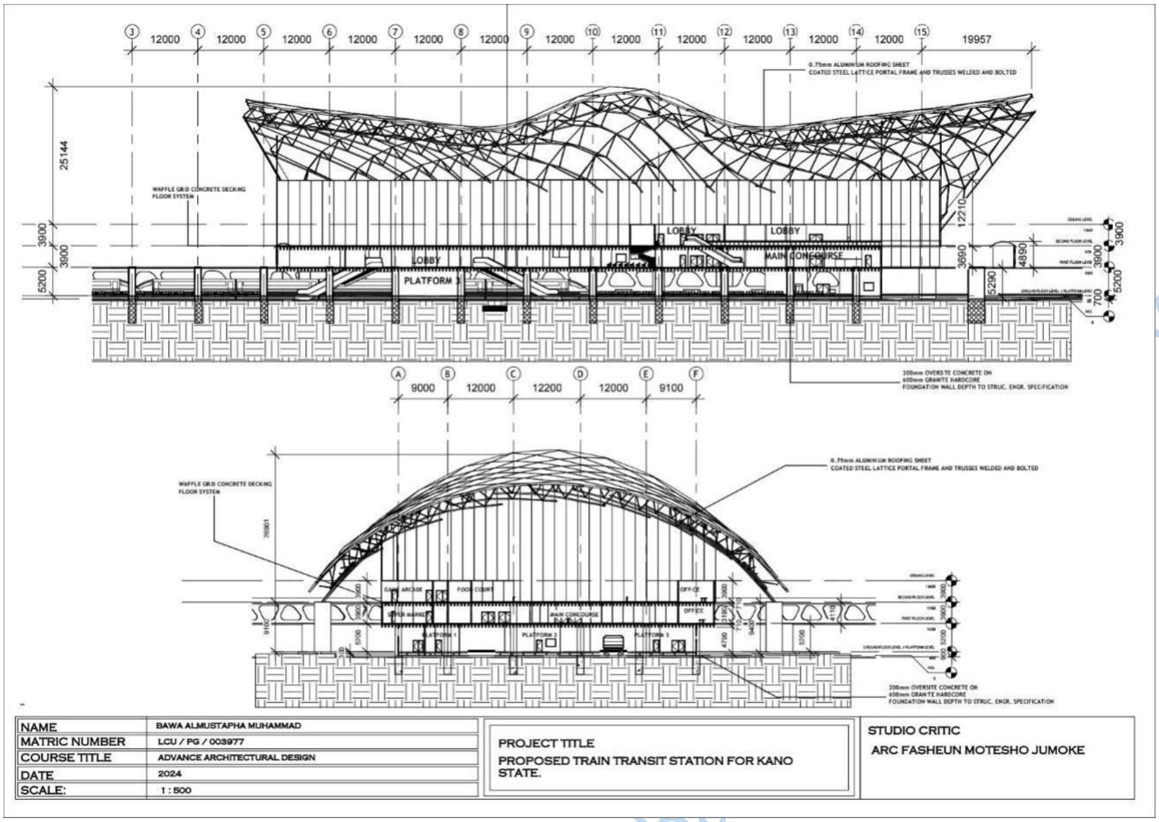
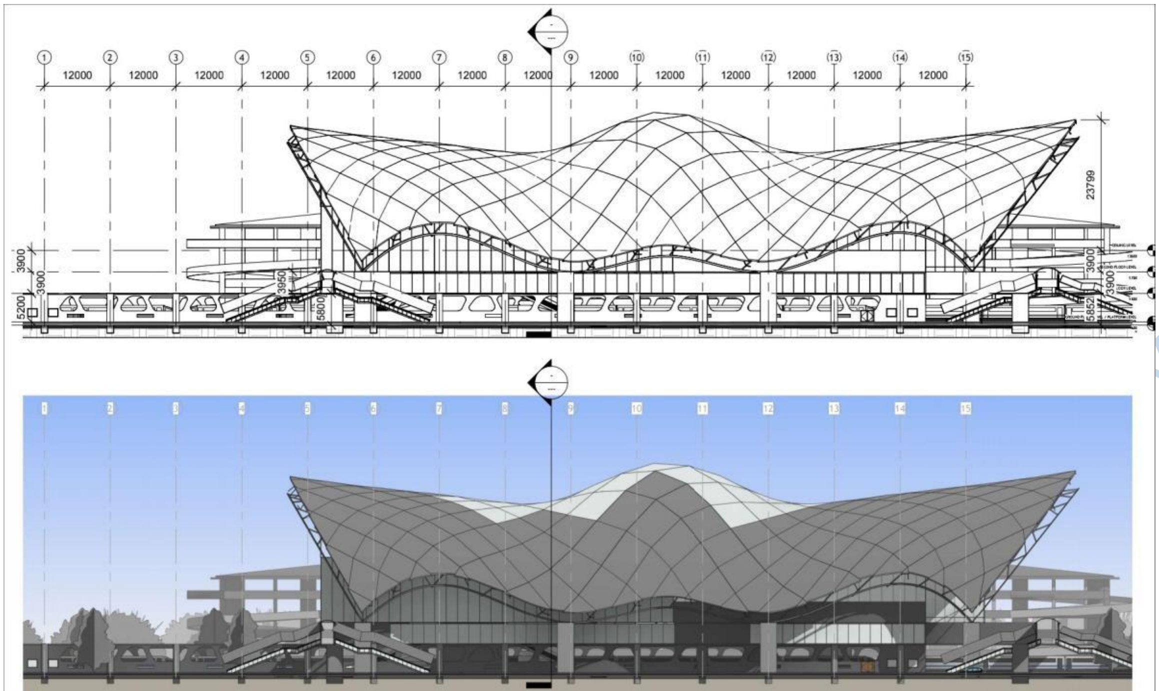
STUDIO CRITIC
ARC FASHEUN MOTESHO JUMOKE


LOBBY
PLATFORM 3
MAIN CONCOURSE
NAME
BAWA ALMUSTAPHA MUHAMMAD
MATRIC NUMBER
LCU / PG / 003977
COURSE TITLE
ADVANCE ARCHITECTURAL DESIGN
DATE
2024
SCALE:
1 : 500
PROJECT TITLE
PROPOSED TRAIN TRANSIT STATION FOR KANO STATE.
STUDIO CRITIC
ARC FASHEUN MOTESHO JUMOKE




SOUTH ELEVATION

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| NAME | BAWA ALMUSTAPHA MUHAMMAD | PROJECT TITLE<br>PROPOSED TRAIN TRANSIT STATION FOR KANO STATE. | STUDIO CRITIC<br>ARC FASHEUN MOTESHO JUMOKE |
| MATRIC NUMBER | LCU / PG / 003977 | | |
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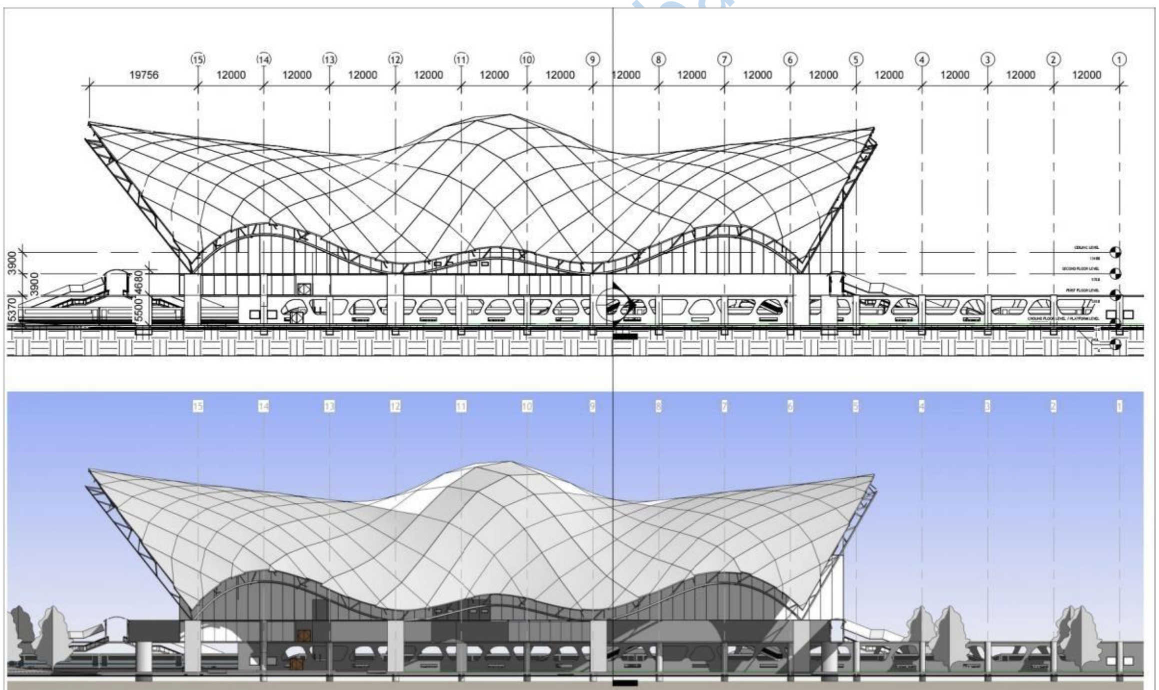


NORTH ELEVATION

| | | | |
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| NAME | BAWA ALMUSTAPHA MUHAMMAD | PROJECT TITLE<br>PROPOSED TRAIN TRANSIT STATION FOR KANO STATE. | STUDIO CRITIC<br>ARC FASHEUN MOTESHO JUMOKE |
| MATRIC NUMBER | LCU / PG / 003977 | | |
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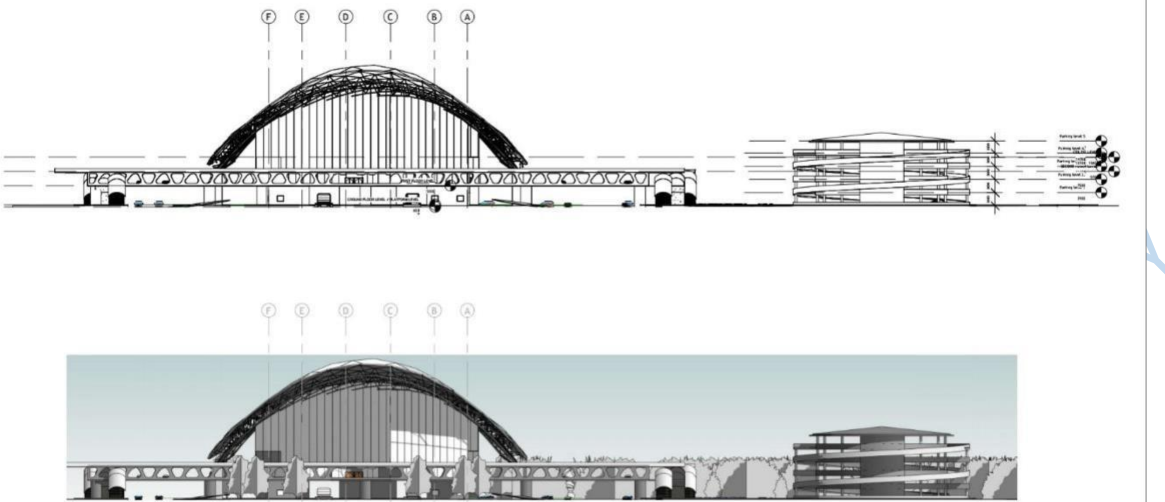


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| DATE | 2024 |
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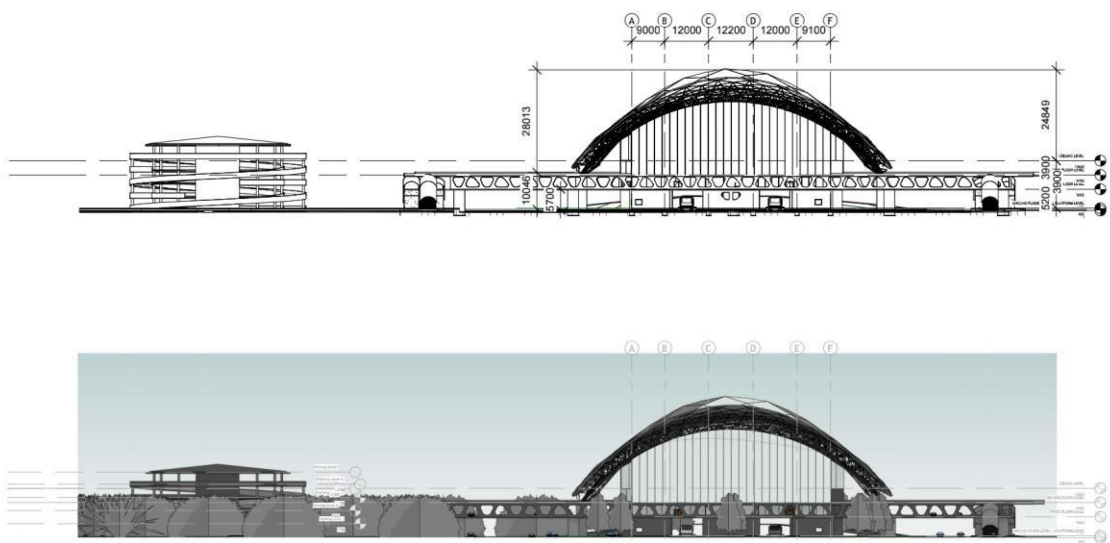
PROJECT TITLE

PROPOSED TRAIN TRANSIT STATION FOR KANO STATE.

STUDIO CRITIC

ARC FASHEUN MOTESHO JUMOKE




## WEST ELEVATION

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| DATE | 2024 |
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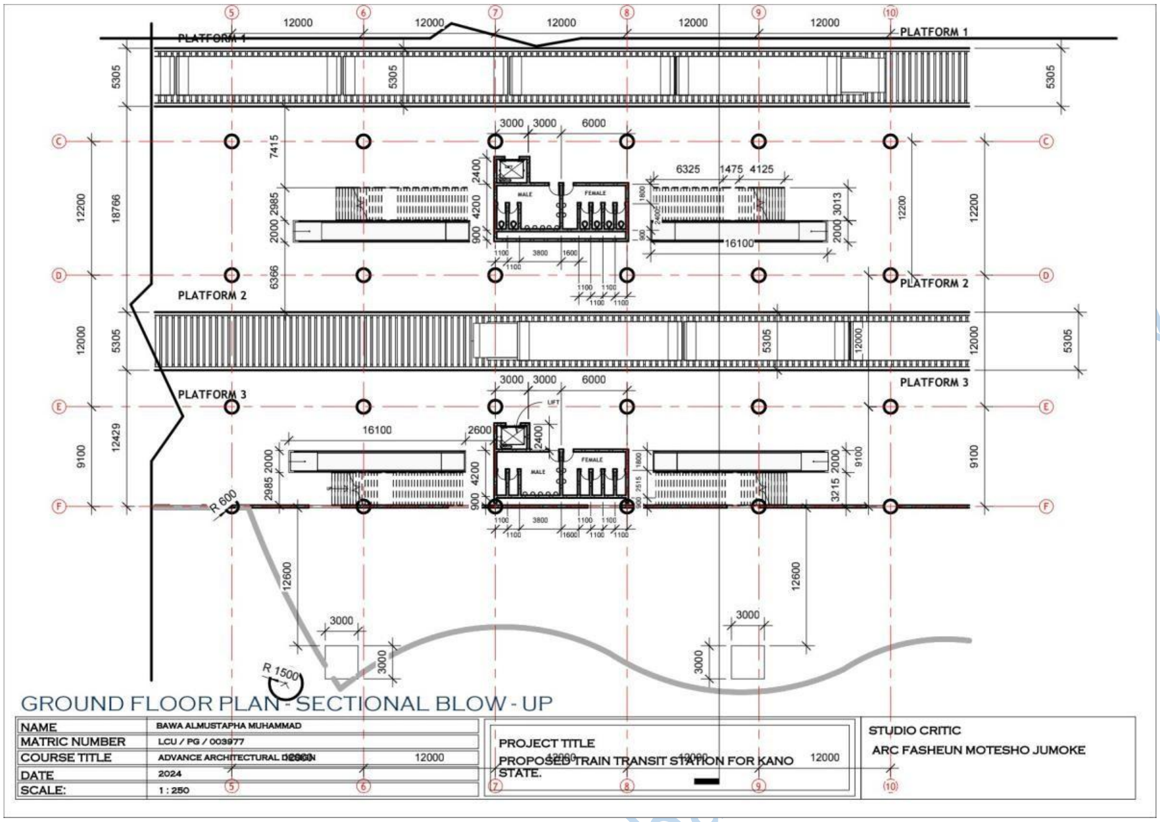
PROJECT TITLE

PROPOSED TRAIN TRANSIT STATION FOR KANO STATE.

STUDIO CRITIC

ARC FASHEUN MOTESHO JUMOKE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PLATFORM 2
PLATFORM 3
MALE
FEMALE
LIFT
GROUND FLOOR PLAN - SECTIONAL BLOW - UP
NAME
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MATRIC NUMBER
LCU / PG / 003977
COURSE TITLE
ADVANCE ARCHITECTURAL DESIGN
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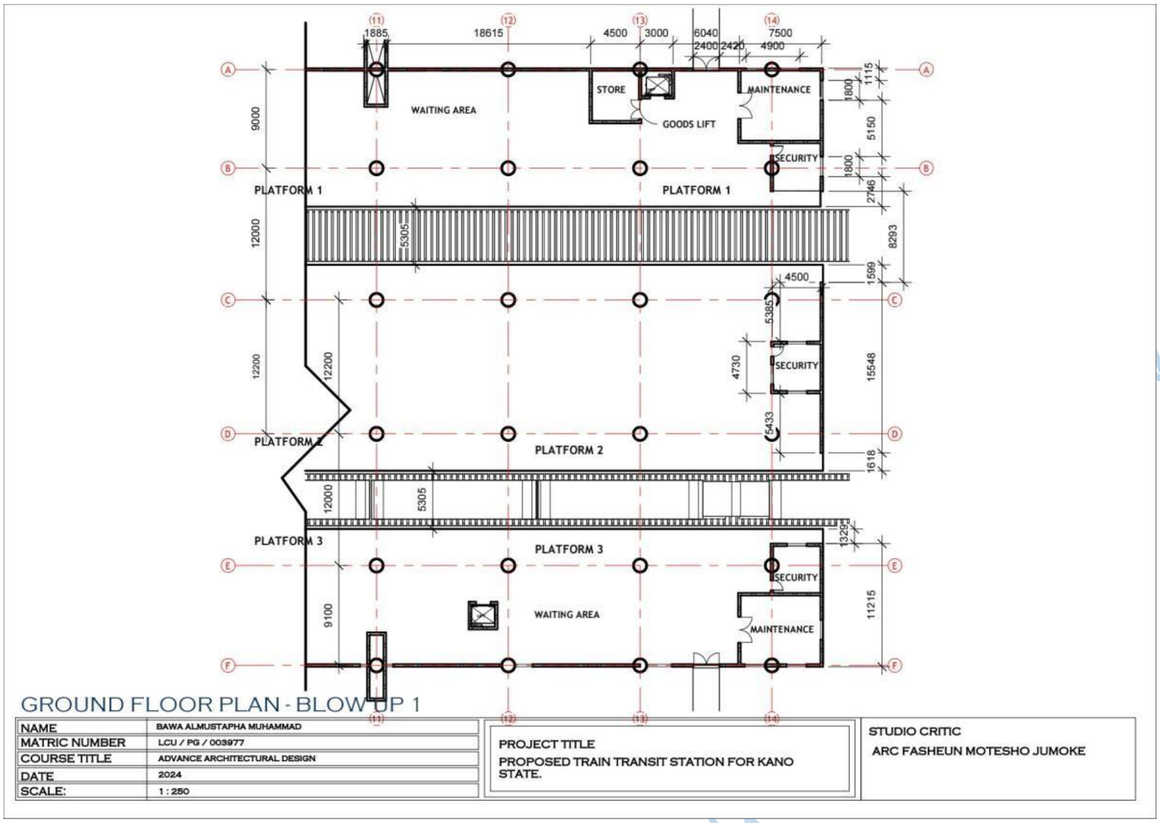
STUDIO CRITIC
ARC FASHEUN MOTESHO JUMOKE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STORE
GOODS LIFT
MAINTENANCE
SECURITY
PLATFORM 1
PLATFORM 1
PLATFORM 2
PLATFORM 2
PLATFORM 3
PLATFORM 3
SECURITY
SECURITY
WAITING AREA
MAINTENANCE
GROUND FLOOR PLAN - BLOW UP 1
NAME
BAWA ALMUSTAPHA MUHAMMAD
MATRIC NUMBER
LCU / PG / 003977
COURSE TITLE
ADVANCE ARCHITECTURAL DESIGN
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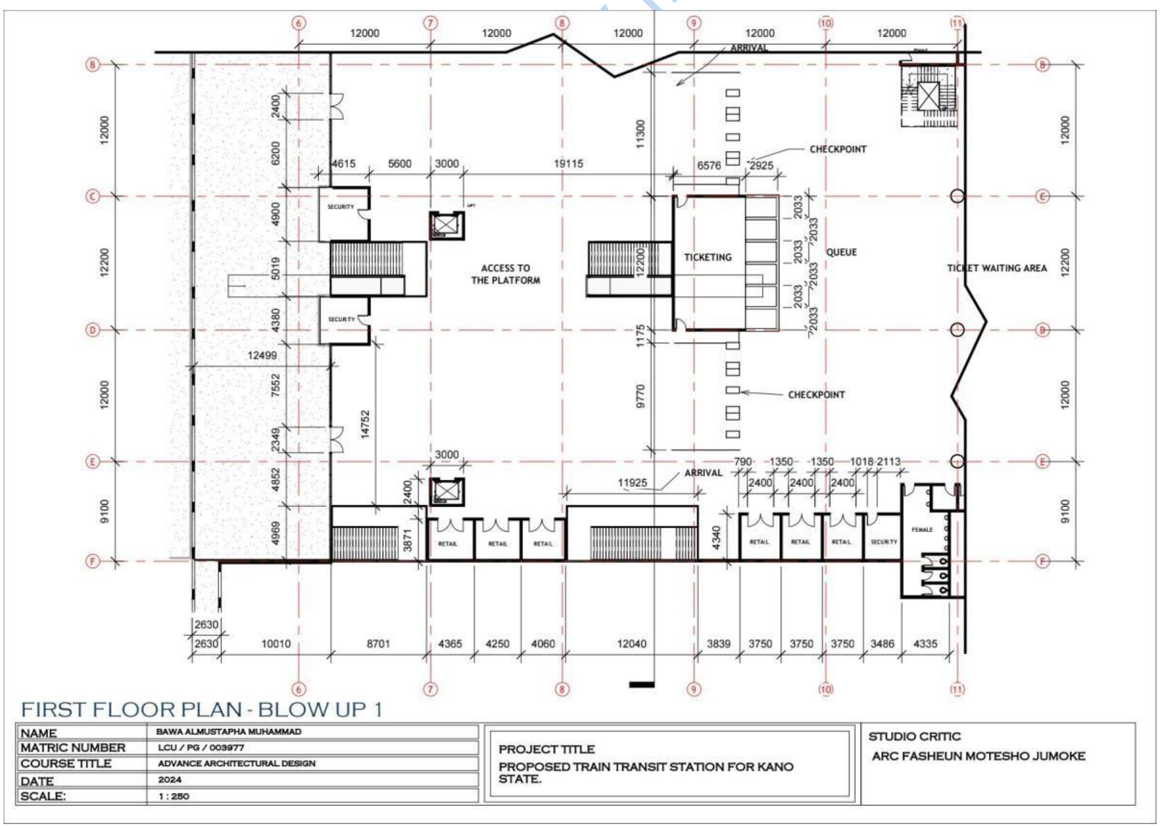
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RETAIL
RETAIL
RETAIL
RETAIL
RETAIL
SECURITY
FEMALE
FIRST FLOOR PLAN - BLOW UP 1
NAME
BAWA ALMUSTAPHA MUHAMMAD
MATRIC NUMBER
LCU / PG / 003977
COURSE TITLE
ADVANCE ARCHITECTURAL DESIGN
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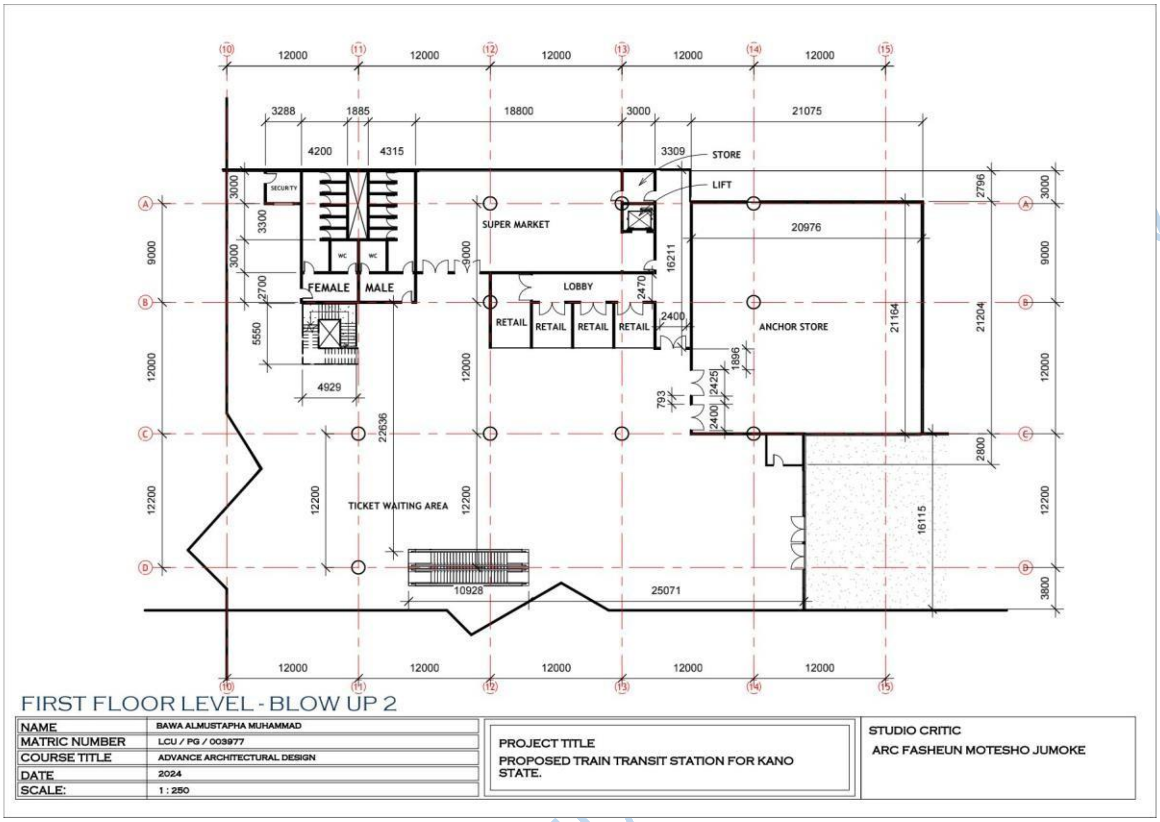
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WC
FEMALE
MALE
SUPER MARKET
STORE
LIFT
LOBBY
RETAIL
RETAIL
RETAIL
RETAIL
ANCHOR STORE
TICKET WAITING AREA
FIRST FLOOR LEVEL - BLOW UP 2
NAME
BAWA ALMUSTAPHA MUHAMMAD
MATRIC NUMBER
LCU / PG / 003977
COURSE TITLE
ADVANCE ARCHITECTURAL DESIGN
DATE
2024
SCALE:
1 : 250
PROJECT TITLE
PROPOSED TRAIN TRANSIT STATION FOR KANO STATE.
STUDIO CRITIC
ARC FASHEUN MOTESHO JUMOKE

## Bio-data

### A. Personal Data

1. Full Name: **BAWA Almustapha Muhammad,**

2. Address: Hausawa, bawo road, opp MIA international school

3. Email Adress: almustaphabawa@gmail.com

4. Phone Number: 08086449113

5. Date of Birth: 29/07/2000

6. Place of Birth: Tarauni, Kano

7. Nationality: Nigerian

8. Marital Status: Single

9. Name and Address of Next of Kin: Kaltume Bawa, Tarauni Kano, Bawo Road

### B. Educational Background

1. Educational Institutions Attended with Dates and Qualification:

| Qualifications | Institution | Date |
|---|---|---|
| MSc Architecture | Lead City University, Ibadan, Oyo State. | 2022 - Date (Ongoing) |
| BSc. Architecture | Lead City University, Ibadan, Oyo State. | 2018-2022 |
| Secondary School Certificate | . | |

| | |
|---|---|
| Primary School leaving Certificate | |

**E. Publications –**

Understanding Categories, Credits and Prerequisite in Green Building Rating System (In Press)



…………………………………                                                …………………………………

Signature                                                Date

**The University Compliance Certification**

This is to certify that the Thesis by Almustapha Muhammad BAWA, with the matriculation number

LG/PG/003977 in the Department of Architecture, Faculty of Environmental Design and Management Lead City University, Ibadan, is in full compliance with the University format and style of Thesis.

………………………………… …………………………………

Signature Date

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