AN ARCHITECTURAL RESPONSE TO INTEGRATING USER FACILITIES IN THE PROPOSED REDEVELOPMENT OF JOS RAILWAY TERMINUS

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Declaration

I declare that the work in this Thesis entitled ‘’An Architectural Response to Integrating User Facilities in the Proposed Redevelopment of Jos Railway Terminus’’, has been performed by me in the Department of Architecture Faculty of Environmental Design Ahmadu Bello University, Zaria. The information derived from the literature has been duly acknowledged in the text and a list of references provided. No part of this dissertation was previously presented for another degree or diploma at this or any other Institution.

Ibrahim IBRAHIM _____ _____

Name of Student **Signature** **Date**

Certification

This Thesis report entitled "AN ARCHITECTURAL RESPONSE TO INTEGRATING USER FACILITIES IN THE PROPOSED REDEVELOPMENT OF JOS RAILWAY TERMINUS'', by Ibrahim IBRAHIM meets the regulation governing the award of the degree of Master of Science in Architecture and is approved for its contribution to knowledge and literary presentation.

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Dedication

This study is dedicated to my late grant parents Alhaji Ibrahim Talle and Hajiya Dela. May their gentle souls rest in perfect peace, amin!

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Praise be to Allah, the One and only, the creator and the originator of the universe for sparing my life up to this memorable period of penning down a research thesis in my area of research interest, Alhamdulillah.

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Abstract

Internationally, railway stations have changed in their functions from transit point for passengers and goods leading to the introduction of new facilities in their design. However, in Nigeria, station buildings which have the attribute of passenger station have been unable to function as civil buildings providing other facilities independent of the railway system during the period of declination. The study aimed at integrating contemporary user facilities that would enhance passenger's patronage with the objective of ascertaining the contemporary user facilities that can be incorporated in the design of Jos railway station to increase it is functionality capturing the modern trend of design. Contemporary user facilities were explored through extensive literature review to arrive at some set of variables which were then studied in three cases of passenger railway stations in Nigeria. The cases were purposefully selected and the study was conducted using multiple instruments of data collection. Survey research method was employed as the main research method in carrying out the research and questionnaires were administered. A total of 280 questionnaires were administered on passengers and staff, out of which 202 (72.1%) were returned/retrieved. Structured interview, and physical observation were used as well. The major findings are that: i) there is absence of integration of public transport modes to the station buildings; ii) Commercial facilities were not incorporated in two of the stations studied; iii) Good-quality waiting space and modern shopping or retail, pertinent to passengers' need is largely absent; iv) number of 4 foreigners representing (5.6%) patronising the three station is very low; v) Lack of temporary accommodation to accommodate late arrival passenger in two of the station; vi) about 53 respondents representing 77.8% chooses public mode of transport (taxi, keke napep and motor cycle) as their mode of transport to the station which

suggest that intermodal facilities should be integrated in the proposed remodelling; vii) 95% respondents prefer restaurant having the highest scores and viii) Results also show that respondent representing 0.782 R.I.I value agree more on improving local area integration, while respondents representing 0.748 R.I.I value agree more with improving the site planning and respondents, representing 0.745 R.I.I value agree more on enhances landscape and spatial integration. Finally, some of the recommendations made include; a research framework based on contemporary user requirements to guide the architects and researchers in proposing new design and redevelopment of old railway stations in urban centres in Nigeria with the goal of enabling such stations function more as civic buildings.

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LIST OF ABBREVIATIONS, DEFINITIONS, GLOSSARY AND SYMBOLS

PPP	Public Private Partnership
NR	Nigerian Railway
FG	Federal Government
BTS	Bangkok Mass Transit System
HST	High Speed Train
RII	Relative Importance Index
Railway	A railway is a way or road laid with rails (wood, iron or steel)on which carriages or wagons conveying passengers or goods are moved by a locomotive engine.
Terminal	End of a railway line.
Ballast	Gravel used to make a foundation bed for railway
Bay	Side line and platform in a railway station, used as a starting point and terminus for trains, separate from the main lines.
Bogie	Four wheeled under carriage fitted under a railway engine or wagon to enable it go round curves.
Branch Line	Line other than main lines (see main lines). Branch lines extend between main line and various places not served by main line such as farming community.
Carriage	Wheeled vehicle for passengers on a railway train.
Concourse	Large hall of railway station where goods gather. Serving as a vast mixing chamber and a self-adjusting traffic centre.
Freight	Carriage of goods from place to place.
Gauge	Distance between the rails of a track. The gauge is said to be

	standard when it is 1435mm and broad if greater than the standard and narrow if smaller.
Goods	Loads other than parcels and luggage's carried from goods shed.
Goods shed	Store for goods in a railway station.
Junction	A point where two or more lines from different directions meet. This could be an administration centre or station located beyond the converging point of the lines
Locomotive	The powered engine used for hauling railway carriages and wagon
Loop line	A railway line laid away from the main line, runs in a curve and made to join the main line again a distance away
Luggage	All such articles as a passengers may take with him for convenience and use during the journey. Such articles should not include the ones intended for business trade or profit (except in the case of commercial travelers).
Main line	The primary line of a railway main line routes linking major cities
Platform	Flat surface built at a higher level than the railway track in a station used by passengers for getting in and out of the train
Rail	Steel bar, or continuous line of such bars, laid on the ground as one side of a railway track.
Railway Terminus	The station at the end of a main line or branch line. There are terminus where the lines, instead of terminating in a buffer stop, continue to service points for other purposes such as goods yards, sidings for factories among others. It could continue past station

	to engine sheds as the case may be.
Rolling Stock	All railway stock that are on wheels for example, coaches and wagons
Shunting	The process of sending railway coaches and wagons from the track to another, especially to keep a track clear for important traffic.
Siding	A short railway track alongside a main or branch line to which one of two meeting trains is switched, until the other train passes.
Traction	Power used in hauling trains along the tracks.

1.0 INTRODUCTION

The introductory section gives a picture of the incitements for this thesis. In this section, a brief introduction is given, problem statement, aim and objectives of the study, research questions, justification of the study, scope of the study as well as the significance of this master thesis. The final section will present the structure of thesis.

1.1 Background to the Study

Railway stations are points of transport interchange where the departure and arrival activities take place (Edwans, 1997). It is also defined by a "point" (building structure) of interchange of passengers an d goods, where passengers can get on and off trains and/or goods maybe loaded or unloaded (Kido, 2013). In essence, the station is a space between a particular place and the trains Ademiluyi (2006).

"For a long time people erroneously believed that railway stations would become a point of attraction for the inhabitants of a city. On the contrary, today it has been ascertained that people prefer to keep at a distance from such noisy centres. Generally, the hotels closer to a station do not do good business".

These words, written by perdonnet in 1865, point out the poor relationship that existed in those years between cities and their railway station.

In the 19th century, railway station was not integrated to the city; this could be perceived by its location, outside the old walls in Germany, as sort of appendix. At the time, the station building itself was an anomaly: The railway station, half factory and half building, represented a novelty in the history of architecture (Bukar, 2010). Bukar (2010), further revealed that no other type of single construction joined two bodies so heterogeneous in their form, with a brickwork building destined to passengers and large glass and iron sheds for the parking of trains in Britain.

Bukar (2010), opined that the expansion and consolidation of railway innovation and social changes led to a gradual incorporation of station into urban framework, where they look on an important role as access gateway to the city. Nowadays many cities are witnessing a renewal of their railway transportation system, accompanied by substantial operations of urban transformation: not simple adaptations of the stations to the new technologies, but rather real changes in the functions of the entire neighbourhood in the vicinity of railway buildings.

The role of railway stations has significantly changed overtime amounting to a numerous new approaches to modern passenger railway stations design, making them more popular, than they were years ago (Edwards, 1997; Lami, 2007; Kido, 2010).

Noticeable a good relationship between stations and their communities encourages the commercial approaches and economic growth; these will bring together transportation facilities, commercial developments, local activities that allow the congregation of all classes of people (Kumar, 2015).

However, in Nigeria, station buildings which have the attribute of passenger station have displayed redundancy attributes – being unable to function as a civic building providing other services independent of the railway system during the period of decline (Olawale, 1999; Adesanya, 2010 in Kandee, 2010). This redundancy attribute is unexpected since these stations were designed to incorporate facilities that can function independent of the railway sector. This is a major issue facing passenger railway station in the Nigeria.

As so many researchers hghlighted some of the issue facing passenger railway stations the Nigeria was the fact that the railway station, was one of the first infrastructures put into place by the colonial government to facilitate in the exploitation of agriculture and

mineral resources (Greene, Reyes, & Castro, 2012). It was designed to meet the objectives of the colonial administration: the movement of freight from inland to costa land and the connection of colonial administrative centres (Adesanya, 2010).

It is therefore ironical to note that in Nigeria the railway industry has virtually collapsed and the programme for revitalising it seems like possible with the new government in position to restore the railway sector into function. As points out some commonly identified urban transport problems in Nigerian cities such as the Jos city are long waiting times for buses, traffic congestion, parking difficulties, air pollution, and traffic accidents (Asiyanbola, 2007; Aderamo, 2010; Ashiedu, 2011).

Greene, Reyes, and Castro, (2012) further asserts that the railway station is moving toward the development of providing high-speed convenient service for the passengers. It handles a Multi-transport system and various service functions in an integrated building. This type of railway station is a new urban space; it has become one of the important features of the contemporary city. Further, train stations are also shopping malls, meeting places and urban landmark.

1.2 Problem Statement

Internationally, railway stations have changed in their functions from transit point for passengers and goods leading to introduction of new facilities in their design (Kandee, 2010). Nowadays railway stations are undergoing redevelopments in order to become transportation hubs where different means of transport are located. They are very often situated in the city centres. Continuous pedestrian circulation and good access to the stations create a possibility and necessary to accommodate new spaces of consumption and leisure such as commercial facilities, shopping mall, inter-modal facilities (Kandee, 2010).

The railway station now handles multi-transport system and various service functions in an integrated building. This type of railway station is a new urban space; it has become one of the important features of the contemporary city. Further, train stations are also shopping malls, meeting places and urban landmark (Greene, Reyes, and Castro, 2012).

Good quality waiting space and modern shopping or retail related to passenger's needs is largely absent in most of the Nigerian Railway Station (Adesanya, 2010). Most of the Stations in Nigeria have not been built with any architectural or aesthetic consideration and as a result act as a poor introduction to the cities they serve. Thus, this research intends to introduce this contemporary user facilities into the proposed redevelopment of the Jos Terminus Station as well as ensuring good quality waiting spaces, intermodal facilities, temporary accommodation, modern shopping facilities related to passenger's need.

1.3 Aim of the study

This dissertation aims at integrating contemporary user facilities in the Redevelopment of Jos railway station.

1.4 Objectives of the study

i. To understand the concept of user facilities to see which facilities have change from literature.

ii. To develop a framework from literature and case studies on contemporary user facilities and functional features in Railway Station design.

iii. To understand which contemporary user facilities features can be incorporated in the design of similar Railway Station from case studies.

iv. To understand which Architectural features addresses these contemporary User facilities.

1.5 Research questions

i. Which User Facilities have changes from the literature?

ii. Which frame work can be develop from the literature and case studies on contemporary user facilities?

iii. Which contemporary User facilities can be incorporated in the design of Jos Railway Station to increase its functionality?

iv. Which Architectural features address contemporary User facilities in Railway Station design in the study area?

1.6 Justification

The rise in advancements in railway innovation, ongoing development of increasing road traffic, growing car ownership, individual mode choices, increased concern for the environment, and the need for a cheap and reliable source of mass transportation of people and goods, the railways have once again come alive as a transport mode of choice (Greene, Reyes, and Castro, 2012).

The federal government has graciously granted approval for the remodelling and redevelopment of major railway stations to incorporate modern commercial outlets under Public Private Partnership (PPP) arrangement.

The process for the engagement of the Private Sector Partners will soon commence. The railway stations to be remodelled and redeveloped are: Iddo Terminal Station, Lagos, Ebute Metta junction Station Lagos, Ilorin Station, Kaduna Junction Station, Kano Station, Port Harcourt Station, Enugu Station, Jos Station, and Gombe Station (Umar, 2013).

1.7 Scope

The research focuses on redevelopment of Jos existing train station from an Architectural point of view. The work also is concentrated on the redevelopment of the terminal building and other included supporting facilities. It is limited to the immediate station environment and does not include a redevelopment proposal for the areas around the Railway Station.

1.8 Significance of the study

The Terminus Station will provide jobs and improve people's quality of life, enhance the natural environment and help to reduce carbon footprint. This is a vision that must be embraced for the sake of future generations. 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.

1.9 Structure of the Study

The research work is structured into seven chapters as presented in Figure 1 below

Chapter one – The present chapter introduces the context of the study or the background of the study, statement of the problem, the research objectives, research questions, justification, scope and organization of the study.

Chapter two - Focuses on a review of relevant prior literature in the field of contemporary User facilities in Railway Terminus design.

Chapter three – Describes the research design, the population and sample of the study as well as the data collection techniques.

Chapter four – In this chapter the data collected was analysed and discussed.

Chapter five – This chapter was discussed under three headings, namely: summary of findings, conclusion and recommendations.

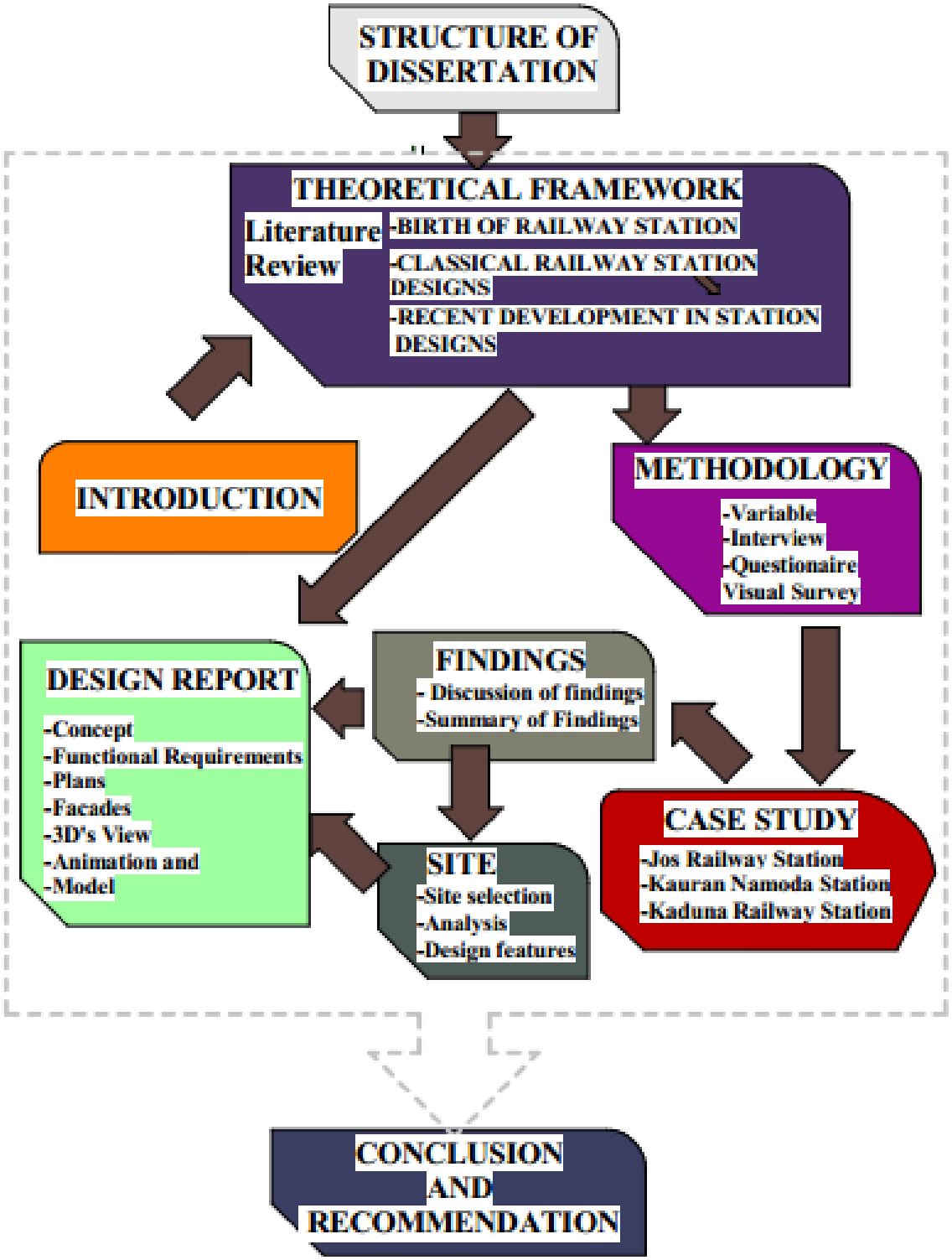


Figure 1.1: Dissertation Structure. Source: Author, Jan. 2016

2.0 LITERATURE REVIEW

This chapter contain literature review of relevant materials, categories under the following topics introduction, inception of the Nigeria railway, types of railway station, classification of railway station, classical design of railway station, recent development of railway station, contemporary user facilities, spatial structure of railway station, users of railway station facilities, railway station design principles, facilities in contemporary railway station, forms of development and the overall summary of the relevant literature.

2.1 Introduction

Maria (2013), opined that travel by railways is now more popular, than it was several years ago. Since 1980s, railways and rail architecture have been experiencing "station renaissance". Along with this trend, many new stations have been built and many historical stations have been refurbished, upgraded and redeveloped. Stations have become more user-friendly, satisfying many needs and various additional functions (Maria, 2013). A railway station can be defined as a place where trains load or unload passengers or goods. Historically railway stations dealt with goods just as much as passenger traffic but nowadays, they are almost solely used for passengers (Ewa, 2010). According to Ewa (2010), railway station usually consists of a combination of a platform and a station building or shelter, or only one of either.

2.1.1 The Birth of Railway Station

The first full scale railway steam locomotive was built in 1804 by Richard Trevithick, an English engineer born in Cornwall. He built a full-size steam road locomotive on a site near the present day Fore Street at Camborne (Galli, 2009). Dating back to the 1630s, railways were developed in Britain (Vecchio, 1998). Soon after, they became a major mode of public transportation in many places across the world and served

communities with a strong sense of technological accomplishment (Kandee, 2001). Passenger stations became a new building type and gateways to rail lines connecting cities where technology was expressed through daring structure of the stations. In their early age, large-span train sheds, magnificent head houses for entrance halls and huge interior concourses were recognized as challenging design solutions of the stations where architecture and engineering perfectly met. Play of materials, texture, light, and space were also another architectural expression that gave the buildings modern presence. The great age of railway station design was initiated in late 19th and early 20th centuries.

Significant influences appeared in the Beaux-Art style, which originated in France. Examples include Grand Central Terminal in New York City, Main Street Station in Richmond as shown in (See Plate I), Virginia, and Union Station in Washington, D.C. After World War II, the continuous development of railways slowed noticeably. Since rail passenger service in many places started to decline due to the use of automobiles, the growth of bus transport, and the convenience of air travel--railways were not competitive and many grand stations deteriorated and even closed (Kandee, 2010).



Plate I: Main Street Station, Richmond, Virginia One of Beaux-Art style stations built in early 20th century. Source: Kandee, 2010

Railway stations entered a new age again in the late 20th century after the introduction of high-speed trains (Binney, 1995). As evident mostly in Europe, many new stations were built, and the old ones were renovated to efficiently serve the system. The revival of the stations was intended to create a continued language in station architecture.

Borrowing from the 19th century architecture, the daring construction of very large spanned train sheds and the use of new materials, such as lightweight steel and glass, become a distinctive feature of 20th century railway architecture. Nicholas Grimshaw's Waterloo International Terminal in London (See Plate II a & b) is one of the great new stations, which represents this new beginning. With a 1,300 foot-long and a 53 foot-wide shed supported by bowstring-shaped steel trusses, it clearly expresses the challenging work of bringing architecture and engineering together (Kandee, 2010).



a) b)

Plate II(a&b): The Exterior view of the Train shed & the Interior view showing Bowstring shaped steel trusses, Waterloo International Airport in London.
Source: (Kandee, 2010)

2.2 The Inception of the Nigerian Railway

Background history of railway construction in Nigeria shows that between 1879 and 1892 various applications for concession to construct railways in Nigeria were made to the office by private colonial interest (Goggin, 2011). The Construction work commenced in 1889 at Iddo, it got to Ibadan in 1901 and then Jebba on the Niger in 1909 (Nkoju, 2001). Its original conception by the colonial authorities was to open up

the country to trade with England as well as an instrument of administrative control, regional growth and development, politics and military control (Robinson, 1961, Ademiluyi, 2006). The Lagos – Ibadan line was extended to Jebba in 1909, and this line later joined the Kano – Baro line in 1911 (See Table 2.1). In the East of Nigeria, the Port Harcourt line reached Enugu in 1916. Between 1916 and 1966, the railway line was connected to towns and cities like Jos, Kaduna, Zaria, Namoda, Nigwu, IFO, Maiduguri and Gombe. Alesa Eleme oil refinery to Eleheruwa in Port Harcourt was connected to Enugu line in 1966 (Ademiluyi & Dina, 2011).

Table 2.1: Railway Construction in Nigeria. Source: Nigerian Railway Corporation, 2007)

Lagos – Ibadan	1898 – 1901
Ibadan – Jebba	1901 – 1909
Kano – Baro	1911
Jebba – Minna	1961 – 1915
Port Harcourt – Enugu	1916
Enugu – Maiduguri	1916 – 1924
Kaduna – Kafanchan	1927
Kafanchan – Jos	1927
Kafanchan – Bauchi	1958 – 1961
Bauchi - Gombe	1961 – 1963
Ajaokuta – Itape (standard gauge)	1990
Port Harcourt - Onne	Under construction

The total abandonment of the railway system by successive governments had plunged the railway system in Nigeria into a state of comatose. In 1981 alone, the corporation recorded a loss of more than N83 million and since then the lost has been continuous (Ademiluyi and Dina, 2011). Studies had revealed that there has been a persistent downward trend in Nigeria Railway's fortunes (Solarin, 2000); (Abubakar, 2002); Ademiluyi (2006).

The rapid increase in the use of motorized transport has led to precipitous decline in railway patronage both in passengers and freights. This is presented in (See Figures 2.1) is a pictorial presentation of the trend of freight carried in metric tonnes by railway from

1990 – 2008. There was increase in freight carried from 1990 to 1991 and between 1992 and 1994 it decreased (Ademiluyi, 2006).

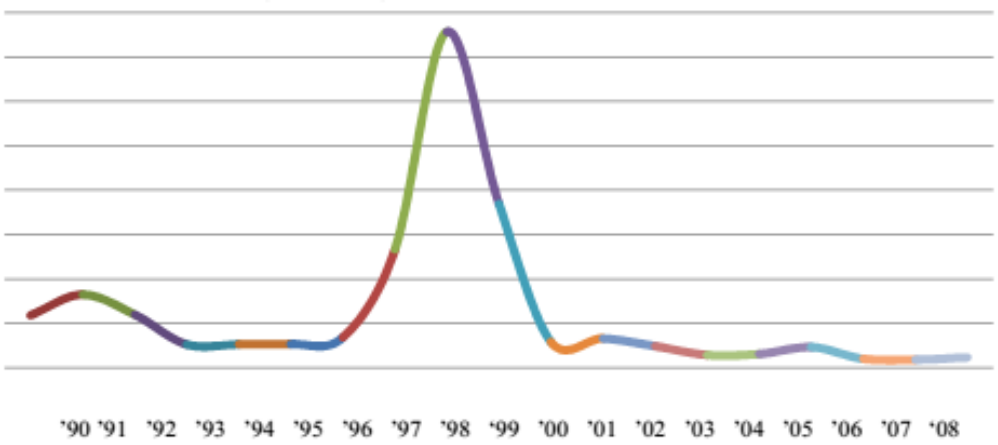


Figure 2.1: Freight carried (metric tons) (1990-2008),
Source: (Amba & Danladi, 2013)

In the same light, the number of passengers fluctuated in downward trajectory with sharp decline in 1998 as against the peak recorded in the freight carried under the same period. Ademiluyi and Dina, (2011) this implies therefore, that when the demand for railway services by passengers dropped, trains resulted in carrying more freight to compensate for the loss. In another development, the number of passengers rose sharply in 2000 as against the precipitous drop in the freight carried in 2000 (Ademiluyi and Dina, 2011).

According to Olasiji (2003), the purpose of railway construction in Nigeria was partially for the colonial administration to maintain a link between the central seats of government in Lagos and other parts of Nigeria. In addition, colonial railways were meant to facilitate the exploitation of agriculture and Mineral resources for export to Europe. Hence railways were established to serve the objectives and interest of the colonial state (Olasiji, 2003).

2.2.1 Railways as a means of Transport in Nigeria

The need for a better transportation in the Nigerian cities has become an important matter, particularly in order to improve the mobility of citizens. Main roads had to be enlarged and newly paved to meet the demands of the increased vehicle traffic. Yet, various efforts of public authorities, chaos and congestion in major cities did not seem to stop (Cavallo, 2012).

The new problems awaiting an architectural solution become visible when the new railway system with its iron bridges and viaducts, symbols of the modern technology but traditionally belonging to the world of engineers, is a threat for the existing city and its monuments. In this respect the mission of the architect is to harmonize the realistic and practical approach of the engineer with the more idealistic attitude of the artist (Cavallo, 2012) .

This can be achieved by carefully considering significance of architecture in the spatial arrangement of various units and places in the railway station.

Today the transformations of railway networks are such that it is legitimate to question the future of cities in relation to the train not only as means of transportation but also as catalysts for developments. The design research in the academic dissertation is needed in order to help in defining the right parameters of intervention in the integration of spaces in the railway station.

2.2.2 Development of Railway Station till Date

The Nigerian Railways (NR) is about 116years old, between 1898 and 1964 Nigeria had built a network of narrow gauge rail lines totalling about 3,505 kilometres. Out of this, the western line constitutes about 1,621km of track, 183 bridges, 1992 culverts, 12 quarries and 154 stations (Federal Republic of Nigeria Railway Project).

In 1986, the Federal Government (FG) commenced the construction of 326 standard gauge line phase 1 from Itakpe-Ajaokuta-Warri. However, for over two decades, the rail system became comatose up until 2009 when the government commenced implementation of a 25years strategic vision to revive the sector. FG in its determination to revive and modernize the railway system in line with the strategic vision adopted a systematic dual approach. The entails the rehabilitation of the entire existing narrow gauge lines simultaneously with the development of standard gauge lines (Federal Republic of Nigeria Railway Project).

Additionally, former President Good luck Jonathan granted approval for the remodelling and redevelopment of major railway stations to incorporate modern commercial outlets under Public Private Partnership (PPP) arrangement. The process for the engagement of the Private Sector Partners has commenced. The railway stations to be remodelled and redeveloped are: Iddo Terminal Station, Lagos, Ebute Metta junction Station Lagos, Ilorin Station, Kaduna Junction Station, Kano Station, Port Harcourt Station, Enugu Station, Jos Station, and Gombe Station (Umar, 2013).

2.3 Types of Railway Station

Railway stations varies according to function, spatial organisation, or facilities located in them. For the purpose of this study, the researcher will discuss based on spatial organisations:

2.3.1 The Intermodal Concept of Railway Station

Different transportation modes were unconnected during the heyday, but today the trend is towards an integrated system. Many railway stations form an interchange between modes of transportation that may include buses, air services, metros, taxi, private cars, and so forth (Kandee, 2010). Kandee (2010) further highlighted that the Intermodality denotes a passenger's ability to use more than one transportation mode for a single trip

in a convenient and seamless way. Inter-modal stations provide connections from the railway stations to other modes of public transportation including bus, light rail transit, people movers, and metro transit systems (Ministry of Railways Board Government OF India, 2009). Hopkinson and Parkinson, (1995) defined the intermodal transportation Centre as a structure combining various technologies of transportation such as regional trains, light rails, bus lines and taxes with centres accessible to airports. Moreover many transit planners believe that such centres serve more than just transportation. They include well-designed buildings providing various kinds of integrated services, such as restaurants, newsstands, small shops, and travel information systems. They further reveal that good public transport connectivity and high levels of Intermodality are key objectives in transportation planning because they allow passengers several options for travel and thus make travel more efficient, convenient, and attractive.

2.3.2 International Stations

This station type emerged in the past two decades after the introduction of high-speed trains connecting countries in Western Europe (Binney, 1995). The services of rail lines crossing countries' borders demanded particular facilities that differ from those of other stations. Many facilities have been borrowed from airports and adaptively applied to existing rail services. They include passport control, security checkpoints, and the different levels of departure and arrival pattern. The Waterloo International Terminal in London is an excellent example of this type of station (See Plate III). It utilizes many of the characteristics and functions of airports and provides different levels for departing and arriving passengers.

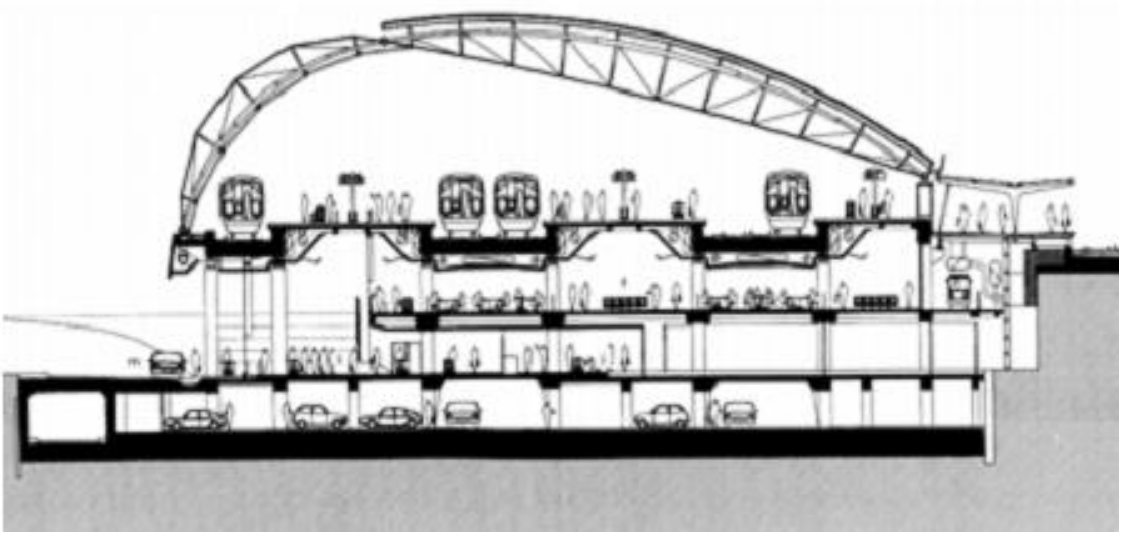


Plate III: Waterloo International Terminal, London Cross section showing departure and arrival. Source: Ross, 2000

2.3.3 Airport Stations

Kandee, (2010) reveal that connection requires that railway facilities are located at the airport. Therefore, such railway stations are constructed as additional parts of airport buildings and some facilities with selected design elements adapted from the airport terminals to these stations. Obviously, the space provided must be sufficient to meet the needs of air-travel passengers who need extra facilities for baggage and group tours (See Plate IV). Signs in a variety of languages are also provided when international travellers use the trains to airport connections (Moller, 2000).



Plate IV: The exterior view of the terminal 3 and the train station, Copenhagen Airport. Source: (Calatrava, 1994)

2.3.4 Metro or Light Rail Stations

Generally, light rail refers to a transit system, which combines the vehicle technology of trams and buses with the characteristics of steel rail engineering (See Plate V). It is well adapted to cities and suburban needs, and also has the advantages of flexibility and less expensive installation and maintenance than a regional rail system (Edwards, 1997). A good example is the Bangkok Mass Transit System (BTS). It is a street-based high-level light rail system that places most stations on a double cantilever supported by a line of single columns these attributes also make such stations very suitable for linking rail services to airport Often, a metro station and an airport station may serve simultaneously as the starting and destination points for the same rail service. This necessitates the sharing of certain facilities. For example, baggage check-in and security may be provided at the metro station rather than at the airport station.

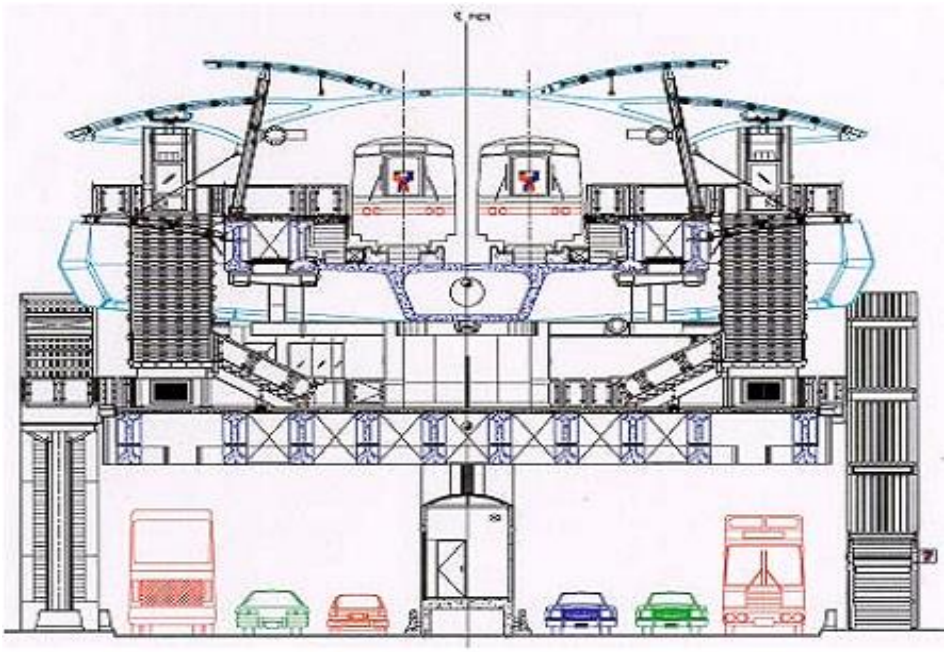


Plate V: Cross section of BTS station. Source: Kandee, 2010

2.4 Classification of Railway Station Design According to Their Spatial Configuration

Railway stations building through the years have varied in size and function, from small country halts to large main line stations. These stations were built to handle all forms of local, national and international traffic that passes through them. Stations are normally located along the line, at a junction or at the end of a main line.

2.4.1 Junction Station

Junctions are always along the line-where the workshops are located sometime, the station building itself could be sighted from the line (Icha, 1997). The junction stations usually function as a diversion point for trains as such trains may stay longer at this terminal and passenger may switch trains depending on their travel destination. The major spatial character of such stations is an island platform (See Figure 2.2) with a lot of activities located on the platform (Muses, 2014).

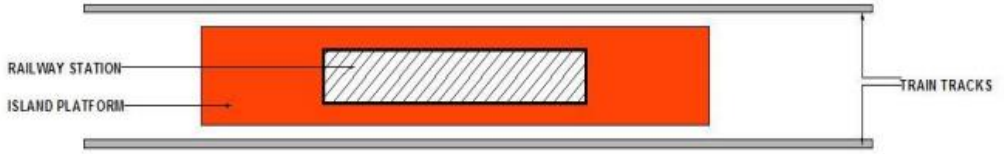


Figure 2.2: Basic plan layout of Junction stations. Source: Muses, 2014

2.4.2 Line Station

According to Ministry of Railway board Government of India (2009), line stations lie between the terminal ends of the tracks and do not connect (provide transfers) to any other stations. Line stations serve origin and destination passengers only (i.e., all customers enter the station from a station entrance or from a train). Line stations predominantly serve passengers destined to or bound from the station's immediate catchments area. Muses (2014), the Line stations are more common as they occur along the railway line. The major spatial feature of this category of station types is their occurrence along the rail track and serves as transition points where trains make intermittent drops and pickups for a particular train journey (See Plate 2.3). They have a common spatial character which is the fact that they lay parallel to the rail track and have platforms attached to the station building. Passenger flows at line stations tend to be bi-directional, depending on demand characteristics:

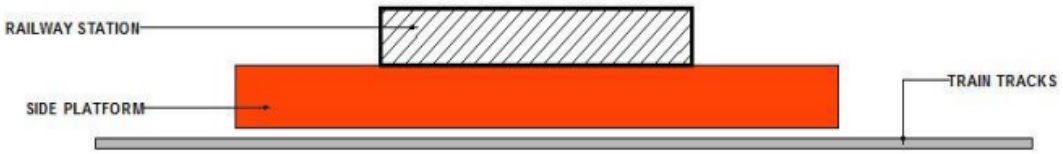


Figure 2.3: Basic plan layout of transitory stations. Source: Muses, 2014

2.4.3 Terminal Stations (Terminus)

Terminal stations are located at the end of the Railway line network and tend to have significant inter-modal transfers (India, 2009). They further explain that the Terminus stations tend to serve passengers from beyond the immediate station catchment area. Commuter Passenger flows at terminal stations tend to be uni-directional according to morning and evening peak passenger demands. In case of Long Distance trains at the Terminal Station, the Passenger flow is equally spread over the day (Ministry of Railways Board Government OF India, 2009). Terminus station are usually oriented perpendicular to the rail track (See Figure 2.4) and serve as final destination or starting point for a particular train journey (Muses, 2014).

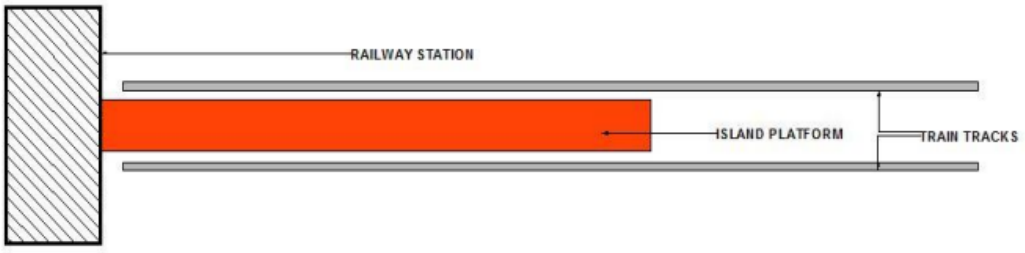


Figure 2.4: Basic plan layout of terminus stations. Source: Muses, 2014

2.5 Classical Designs of Railway Station

Hashizume, (2014) explains that, numerous stations that were built during the pioneering heyday used the Western method of design which employed brick. These were typical of the so-called "era of civilization and enlightenment". Early stations were simple in that they were designed around a central hall and had ticket gates and waiting rooms spread about. The design aspect of traditional stations provide only normal sequences--ticket halls, waiting areas, platforms, and trains (Kandee, 2010).

Example of Pembroke Railway Station: The Pembroke railway station was built 30th July, 1863 and originally consisted of small temporary wooden buildings (Hogg, 2001).

The building was of dressed limestone with three ornamental chimneys and a slate roof; very much in the style of Pembroke Dock (See Plate VI). At the eastern end of the main building there was a small addition built of the same materials and this housed the Gentleman's lavatories. As there was a fireplace in this room, it is unlikely that it was originally intended to be a lavatory and may have been a waiting room or staff room.



Plate VI: View of Pembroke Station. Source: Hogg, 2001

Hogg, (2001) documents that the constructed station did not have a platform canopy or front entrance canopy. The main building consisted of five rooms and a store. From the western end they were the Station Master's Office, the parcels office, the booking office, the entrance hall and general waiting room, the ladies waiting room and toilets and adjoining store room (See Figure 2.5). The general waiting room, booking office and ladies waiting room all had fireplaces but the Station Master had to make do with a coal fired stove with a ‘tin’ flue (later supplemented by a bottled gas heater).

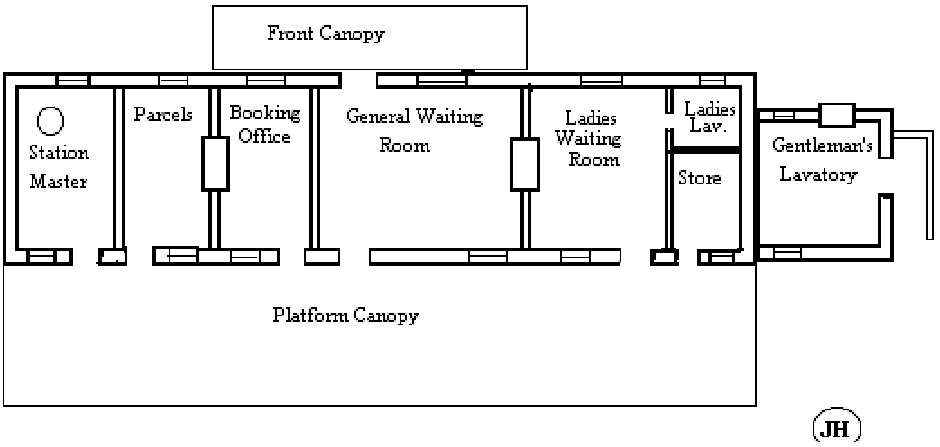


Figure 2.5: Floor Plan of Pembroke Station. Source: Hogg, 2001

Example of Enugu Railway Station; Olawale, (1999) asserts that the Enugu railway station consist of station buildings and other facilities necessary for operational conveniences such as engineering yard, sidings workshop, carriage and wagon shed and running shed. The station houses a wide range of facilities, such as toilets, buffet, waiting room for second class, ticket booth and parcels office, all under one roof (See Figure 2.6). Beside the main station building is a post office (Olawale, 1999).

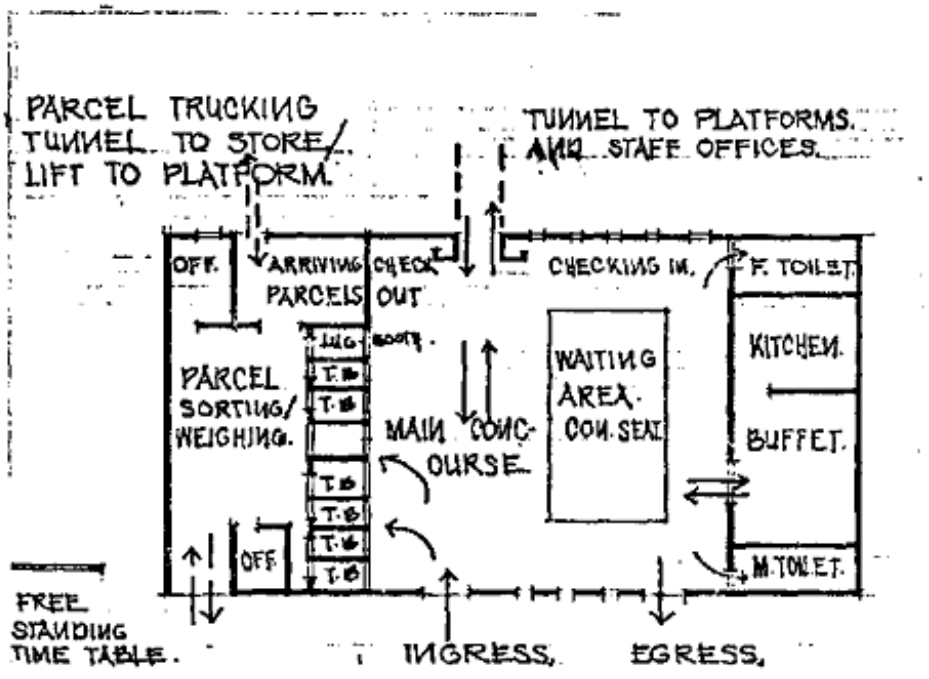


Figure 2.6 Floor Plan of Enugu Railway Station. Source: Olawale, 1999

Example of Dandong Railway Station; Dandong is a thriving and vibrant Chinese frontier city of 2.4 million people on the northeast border of China and North Korea (Tang, 2012).It was built by the Japanese in 1909 to connect the Korean peninsula to northeast China for transporting natural resources during Japanese occupation in the early twentieth century. The station had a passenger hall, an administrative building attached to the hall, and the train platform behind the hall for boarding trains. Crucially, the railway was built on raised tracks deliberately constructed to avoid periodic flooding on the riverbank (Tang, 2012).

2.6 Recent Development in Railway Station

The architecture of the stations has gone beyond the design of main functions, which include core, transition, peripheral, and administrative (Kandee, 2010). Depending on the needs of the station, the design of these spaces has to also include supplementary functions; for instance, integration of light and structure, access for disabled people, and commercial development. It is possible to also see them as an expression of modern technology reflected in their daring structure and use of new materials. The railway station currently is a major transport hub with a lot of traffic interchange. Greene, Reyes, and Castro, (2012) further assert that the railway station is moving toward the development of providing high-speed convenient service for the passengers. It handles a Multi-transport system and various service functions in an integrated building. This type of railway station is a new urban space; it has become one of the important features of the contemporary city. Further, train stations are also shopping malls, meeting places and urban landmarks. Tang, (2012) opined that railway stations frequently also provide additional commercial facilities built and integrated into the building. Functionally, these commercial facilities provide amenity, retail and advertising opportunities aim at

passengers, and they give passengers a way to fritter away time while waiting in queue or on boarding platforms. This can be seen in several station as follows:

Example of Newport Station / Grimshaw; Newport is bisected by the railway tracks (See Plate VII). As a result, each half of the city has developed its own character. Grimshaw's design embraces this divide, creating two major new concourses. The North Concourse will be on the civic side of the city and focus on the needs of commuters. The South Concourse, on the commercial side houses restaurant, café, retail stores etc. will be for connecting travellers, daytrippers and tourists. Each terminal's ticket facilities and platform access are split equally between the two terminals. All the main facilities at both terminals are housed in continuous ETFE and aluminium clad spirals.



a)



b.)

Plate VII (a&b): Perspective views of Newport Station England. Source: Taboola, 2015

The spiral form of the station mirrors the journey taken within and helps to ease traffic flow by guiding the passenger from ground level up to the connecting bridge and back down onto the platforms.



Figure 2.7: Ground Floor Plan, Source: Taboola, 2015

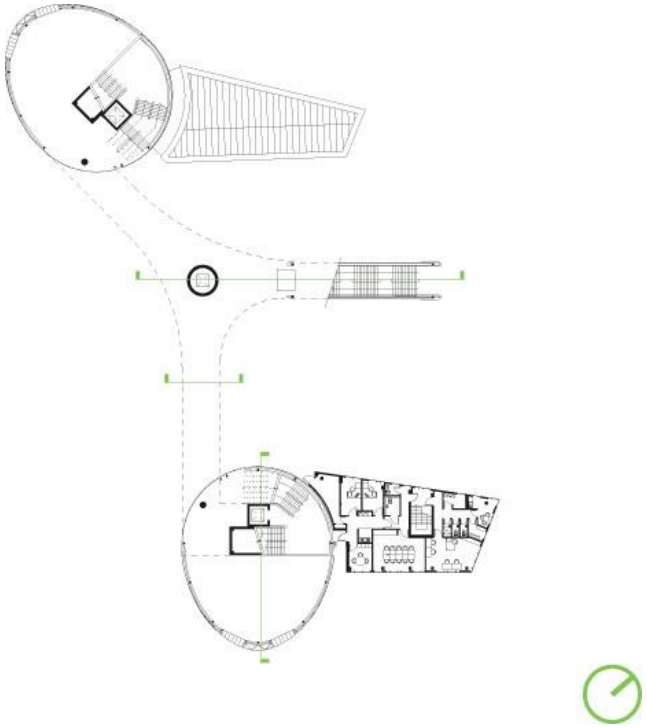


Figure 2.8: First Floor Plan. Source: Taboola, 2015

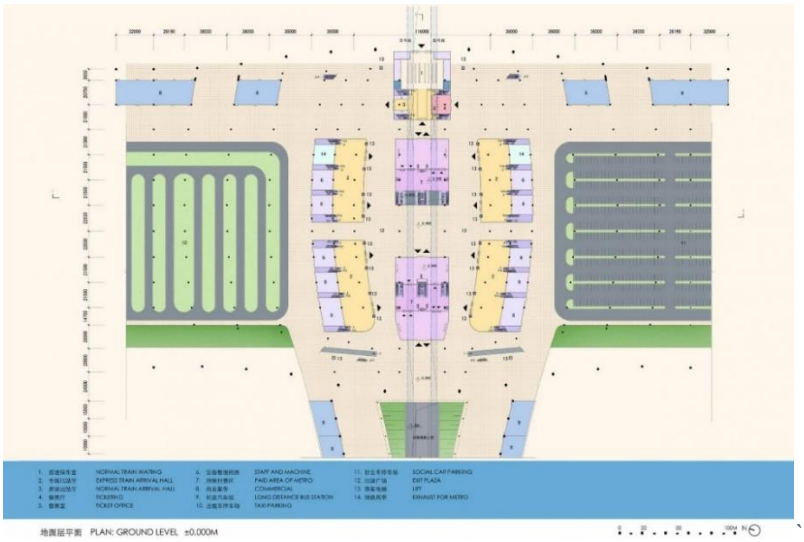
Example of Wuhan Train Station China; the new train station for Wuhan, the capital for central China, is both refreshingly contemporary and at the same time, reverential to tradition and past times. The building is an icon. The roof is certainly the most notable feature of the building- its sweeping form of nine overlapping wings is steeped in symbolism and lore; it acts as a landmark to the area while sheltering the platforms and various amenities below (See Plate VIII). It offers commercial space and different stores, including a number of movie theatres (See Figure 2.9). This roof presents a specific problem which can be found plaguing contemporary buildings the world over. How does one gracefully enclose a structure with such a curvilinear element? The problem can be seen solved at the Munich Olympic compound. There it was glass, meeting the flexible curvilinear roof at a buffer zone of inflated PVC or some analogous material. In the Wuhan station, the difficulties of differential expansion/contraction rates are not present, but the aesthetic dilemma is just as real.



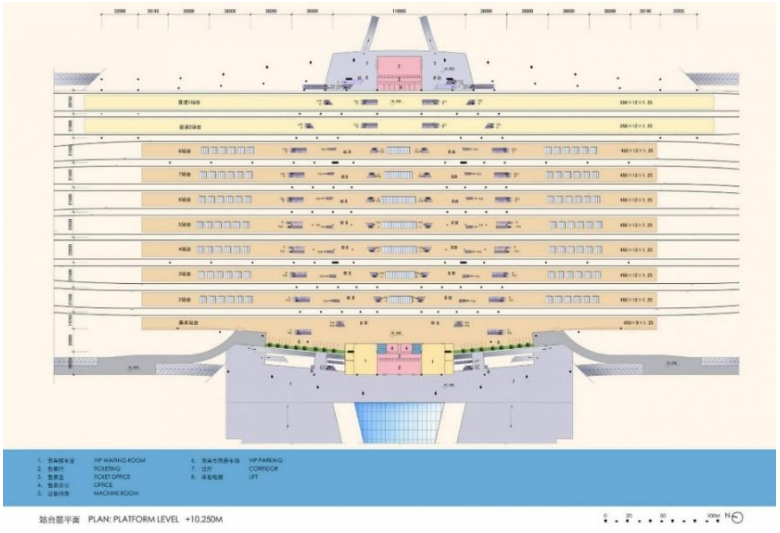
Plate VIII: Wuhan Train Station. Source: www.arch20.com, 2015

The roof extends out far beyond the enclosing glass, giving the roof a clear visual hierarchy. A sort of semi-transparent mesh is used on the roof's underbelly, enabling the roof and glass to meet under similar circumstances. The semi-transparency gives the roof depth; the glass meets something similar, not a stark solid field. Inside, once

through the enclosing wall, natural light abounds. The wings of the roof overlap, allowing sunlight to stream in over the multiple levels of restaurants, departure halls, waiting rooms and platforms. The roof is also, itself translucent, which of course helps with the lighting.



a.)



b.)

Figure 2.9(a&b): Ground Level & Upper Level of Wuhan Train Station.
Source: www.arch20.com, 2015

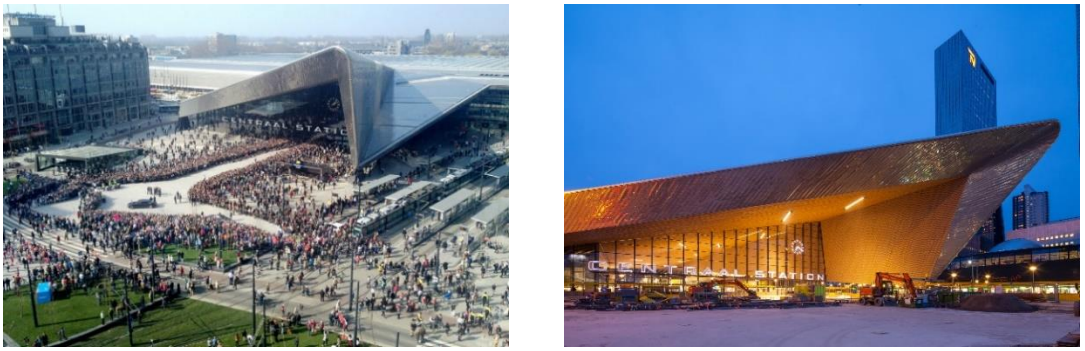
The station is bright and airy, which also includes a number of services for passengers—ticket windows, information desks, automatic check-in kiosks, travel and tourist information centre, storage lockers, car-rental services, VIP lounge, and many eateries and retail stores (See Plate IX).



Plate IX: site plan of Wuhan Train Station. Source: www.arch20.com, 2015

Aside from acting as a monument for the surrounding city, the station is a link between lakes to the north and south. Gardens surround the structure, tying these two bodies as well as creating an intermediary between the city and the station.

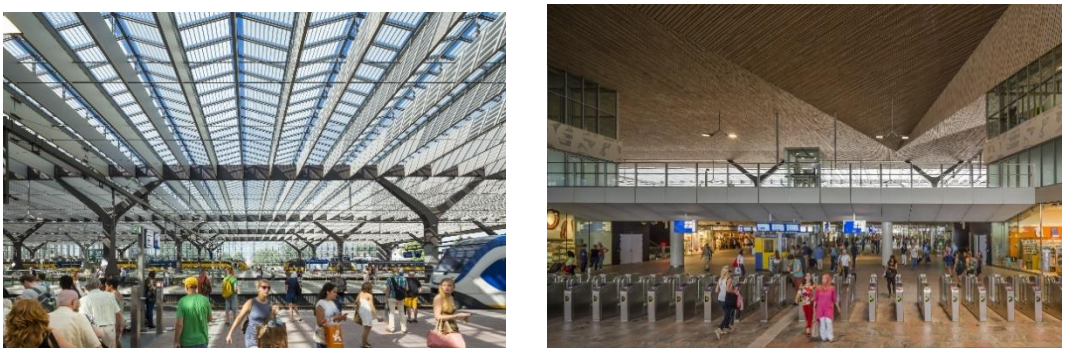
Example of Rotterdam Central Station Netherlands; Rotterdam Central Station is one of the most important transport hubs in The Netherlands. With 110,000 passengers a day the public transport terminal has as many travellers as Amsterdam Airport Schiphol. In addition to the European network of the High Speed Train (HST), Rotterdam Central is also connected to the light rail system, with the advent of both the HST the number of daily travelers at Rotterdam Central is expected to increase to approximately 323,000 by 2025 (See Plate X).



a.) b.)

Plate X (a&b): Façade of Rotterdam Central Station. Source: archdaily, 2017

The city of Rotterdam is drawn to the new station via the compaction of the small-scale urban texture surrounding the public transport terminal. The entire railway zone becomes one with the city. This finer urban texture with new sightlines and a mixture of living and working will dramatically improve the quality of life and the environment of the station area (See Plate XI).



a.) b.)

Plate XI (a&b): Perspective View of Rotterdam Central Station.
Source: archdaily, 2017

Incorporation of natural light as shown in Plate XI (a), the warmth of the sun's rays and a modern look are important elements in the design. The platform roof on the Proveniersside is transparent. When the train drives into the station, there is an almost tangible feeling of being enshrouded in the station building. Plate XI (b) illustrate the wood finish on the inside of the hall, combined with the structural wooden beams of the platform roof creates a warm and welcoming ambience, inviting visitors to linger.

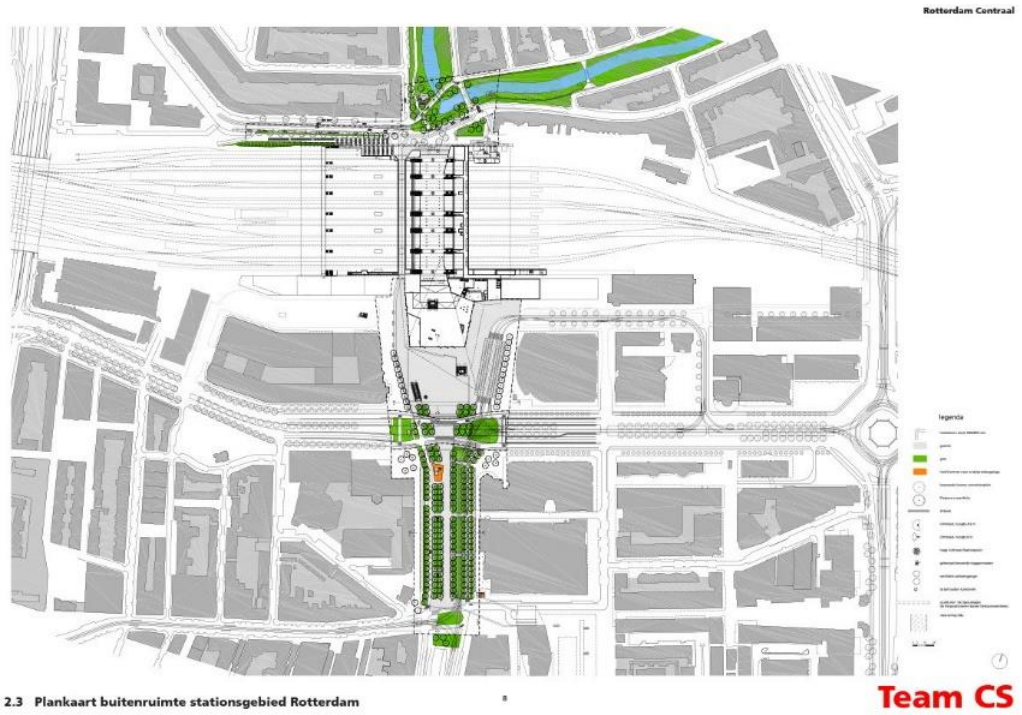


Figure 2.10: Ground Level of Rotterdam Central Station. Source: archdaily, 2017

Rotterdam Central Station houses commercial spaces, a lounge, restaurants, offices, parking for cars and bicycles (See Figure 2.10). In the spacious concourse the passenger service functions are conveniently arranged. There is travel information, an information point, the Dutch Railways (NS) travelers shop, ticket vending machines and commercial functions. The grand café and the NS-lounge offer spectacular views across the hall and the adjacent tracks. Waiting areas in the hall and the passage are linked to the passenger flows, with areas both for browsing and quick shopping.

Example of Hangzhou East Railway Station China; Hangzhou East railway station is a massive three-dimensional transportation hub. It has provided multiple transportation service such as railway, underground, over ground, bus, coach, taxi (See Plate XII), etc.



Plate XII: Main Concourse with other incorporating functions.
Source: archdaily, 2014

Station architecture forms has cleverly reflected on the meaning of Hangzhou "the Qiantang bore" by using modern, fluency, full of tension steel structure work (See Plate XII). The design of the station has represented the spirit of the city which is delicate and grand open (See Figure 2.11 & 2.12).

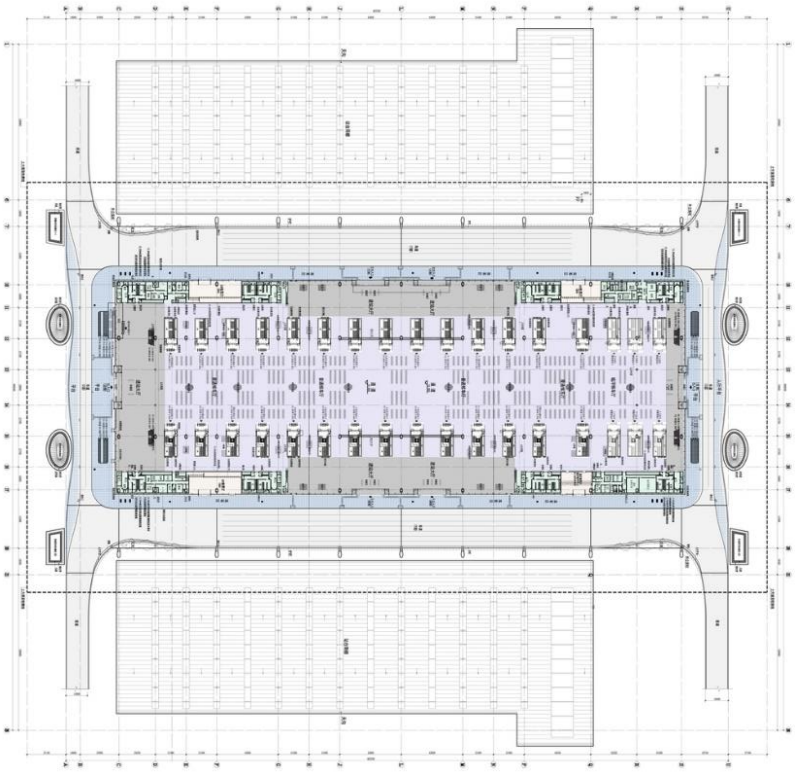


Figure 2.11: Perspective View of Hangzhou East Railway Station China. Source: archdaily, 2014

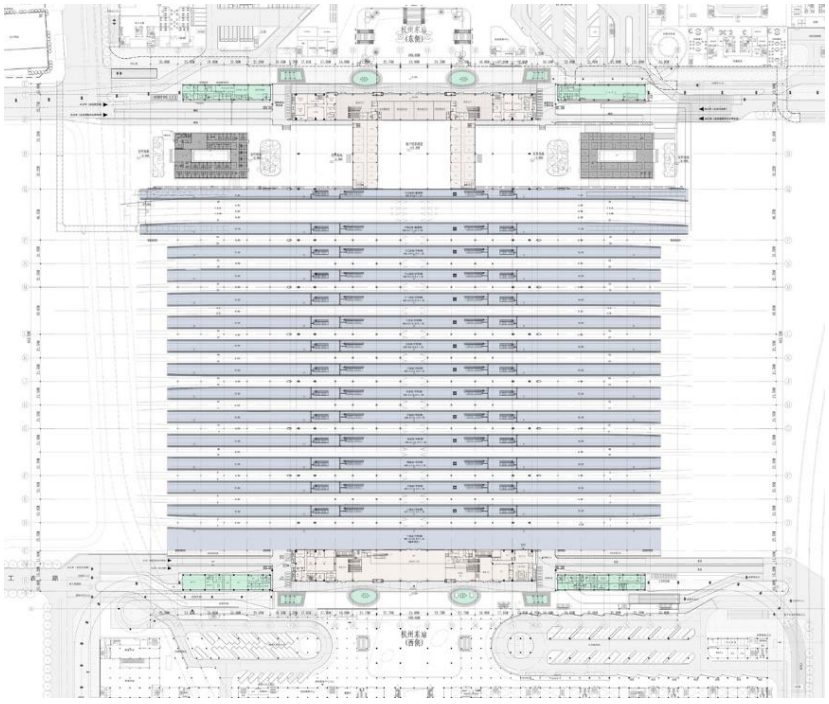


Figure 2.12: Lleida-Pirineus Station Layout, Source: archdaily. 2014

The design has been using construction volume self-shading, movable external sunshade, natural ventilation by thermal pressure for passive energy conservation measure, and also using ground-source heat pump system, rooftop solar photovoltaic battery for active ecological technology (See Plate XIII). The roof with solar and photovoltaic cells lies with 79 thousands m2 of polycrystalline silicon solar photovoltaic modules. The generating capacity is about 10.04 MWP. The concept of sustainable green station will bring huge energy saving demonstration effect to the community.



Plate XIII: Glass skin, which clads the building. Source: Cilento, 2015

The main hall accommodates ticket offices, retail shops, Bureaux, cinema, commerce's, restaurant, night club, cafes and ticket offices.

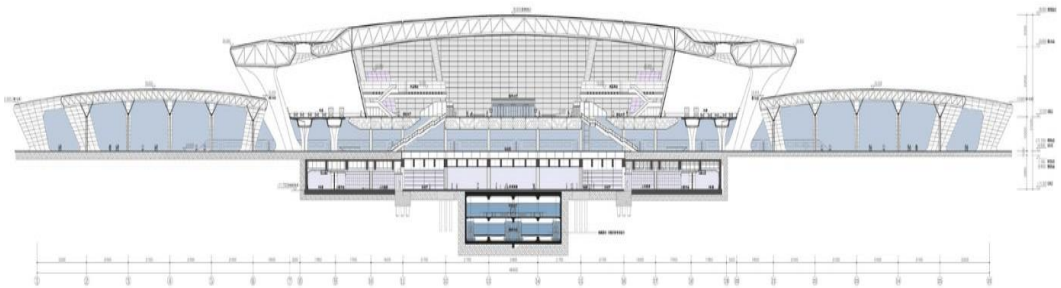


Figure 2.13: Functions within the station. Source: Cilento, 2015

The perfect combination of architecture forms, space and structural style has showed authenticity and rationality of structural. The roof of main station room spans 280 meters from south to north and the maximum outreach is 81 meters by using giant space truss work system (See Plate XIV). It has created the beauty and lightness of structural mechanics with sense of dynamic and futuristic.



Plate XIV: View of 6 Cristal Riviera in Zac Eurorennes. Source: Cilento, 2015

2.7 Contemporary User's Facilities in Modern Train Station

It has been commonly observed that railway architecture have experienced a "Renaissance" since the 1980s, and as a result station architecture has very much improved (Kido, 2013).

Today railway planners see railway stations as part of a broad urban infrastructure and transportation network and are now connected with airports, rails, and bus stations, underground and light rail. Train services are now part of new urban and commercial centres which accommodate businesses, hotels and shopping centres. In the past station design was designed more for trains than for passengers. Today, according to the concept of "seamless journey" designers try to make travel experience more efficient by planning sophisticated stations, which include features arranged for ticketing, waiting,

transfer, shopping, recreation and administration- making their services have a big influence on transportation, urbanscape and the people. But sometimes, depending on locations and user needs these requirements may have differences in priorities. The contemporary facilities needed for railway stations are discussed below:

2.7.1 Station's Relation to Its Urban Content

Shaw, (2013) suggested that any major intervention in a station and certainly any new station construction must take into account the aspirations of the people using it or being affected by it. Typically being the first impression of arriving in a locality, the station and its urban integration with the surrounding environment are of prime importance and often act as catalysts for future development (Shaw, 2013). Context sensitive station design can deliberately shape and animate surrounding public spaces, and in turn, creates building that are active and integrate fixtures within their local communities. Network Rail, (2011) suggests three guidelines to inform this principle: design station facilities to integrate with surrounding public realm; develop an integrated network of streets, footpaths, bike routes, and public spaces; provision of active and animated public spaces in surrounding areas. Railway stations and rail lines often form a barrier that results in severance in local communities.

Station as urban centre expresses a great agenda for facilities and services to cyclists and pedestrian to be prioritised over a car users (Maher & Skinner, 2011). As a result, station facilities should be designed to integrate seamlessly with the public realm, including adjacent office buildings and shopping facilities, and to facilitate cross as well as through movement.

Goggins, (2011), suggested that creating a strong relationship between the station and its surrounding context delivers a richer and more fulfilled environment, enhancing

local character and providing a sense of place for its users. For street network design, indicators include street lighting, and clear sight lines, integrated local way finding systems, spaces with human scale. On the aspect of creating active and animated public spaces in surrounding areas, Goggins further proposed that sensitive integration enhances the local character and encourages natural surveillance and animation around stations. However, an important consideration during the design process is the social, physical and functional needs of the local community. The discussion under this principle infers a focus on street level architecture that relates to the human scale. Stations and the urban environment within which they sit mean many different things to many different users. It is important that good design harnesses these perceptions to maintain and ultimately enhance the area to in still a positive sense of place for all (Goggins, 2011; Sayers, 2011).

An important master planning identified the potential of station design to connect communities otherwise divided by the rail corridor. In particular there was a common theme of a generous public concourse or parkland public spanning the tracks. The continuity of landscaped open space across and along the tracks was recurrent. The design guidelines for sense of place are presented in three sections: locating and designing stations to promote a positive image and identity; considering landmark design where demand or status provides justification; adding value through landscaping and public art (See Figure 2.14). An integrated station connects with its surroundings and reflects the character and identity of the community.

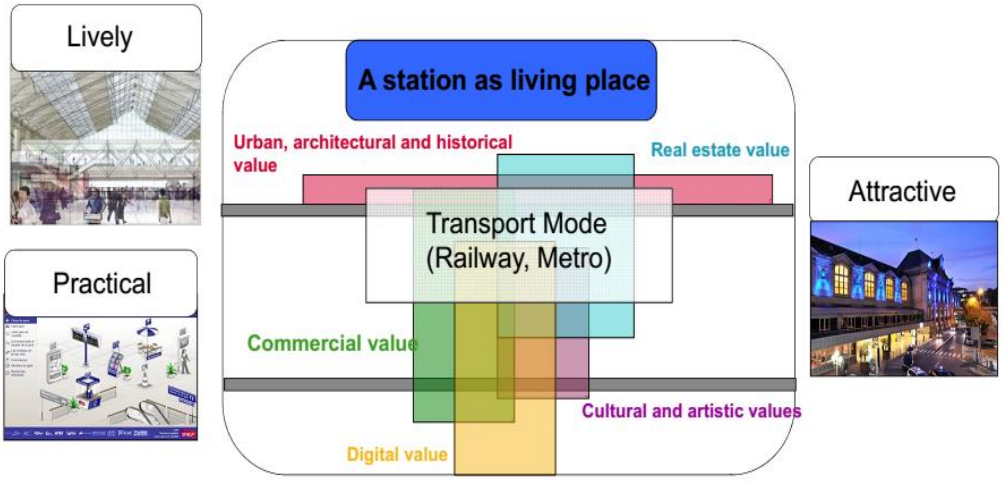


Figure 2.14: Multi-modal/-service station. Source; Kaplan, 2013

Spatial Components of Local Area Integration principle:

1. Design station facilities to integrate with surrounding public realm
2. Develop an integrated network of streets, footpaths, bike routes, and public spaces;
3. Provide active and animated public spaces in surrounding areas.
4. Clear sight lines
5. Spaces with human scale
6. Landscape design and public art

2.7.2 Shops and Amenities

Shops and amenities are considered important factors for making the interchanges more agreeable as the users are entertained while waiting for their transport. Travellers and operators ask for the opening of retail shops inside the terminal (Desiderio, 2010). He further asserts that the presence of open shops increases the feeling of security and therefore reduces fear of crime. Moreover people returning from work can do their shopping. Busy interchanges are safe places and can be as important as social meeting places and sources of information on the local area. In fact, although users demand

shops and facilities inside interchanges with short waiting times, it is often harder to attract shops and business because traders feel people will not be shopping while they are waiting, or only be there for a short period (Desiderio, 2010).

In addition, station functions beyond the food, retail (See Plate XV) and accommodation can be integrating in station with a civic function such as a library, gallery, museum or even a zoo. In less urban settings community markets, playgrounds, parkland and child care centres were considered. Workspaces with Wi-Fi connection were advocated for both station and carriages (Maher & Skinner, 2011)



Plate XV: Kiosks encourage activity. Source: Maher & Skinner, 2011

In addition to the cycling facilities some works included a selection of domestic and offices services within stations to add convenience and value to the rail journey. In recognition of the fitness culture associated with end of cycle trip facilities, gyms, pools and associated health facilities were also popular.

2.7.3 Ease of navigation/ Way finding

The designer is expected to ensure that journeys are as seamless as possible. The station design has to take into account that passengers do not start and end their journey in a

station (Shaw, 2013). Ease of navigation refers to the ability of station users to locate facilities and connect between transport modes (See Figure 2.15) as well as external routes (Sayers, 2011; Rodrigue, 2013).

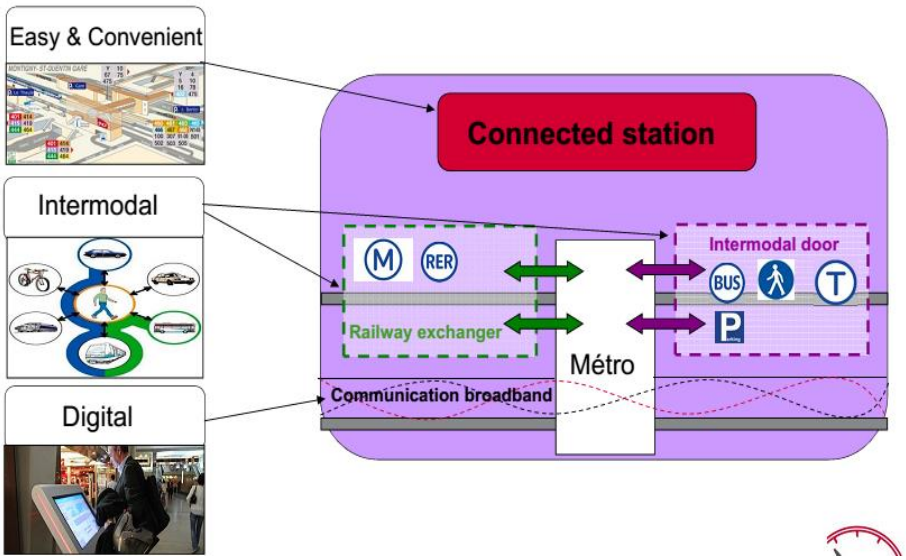
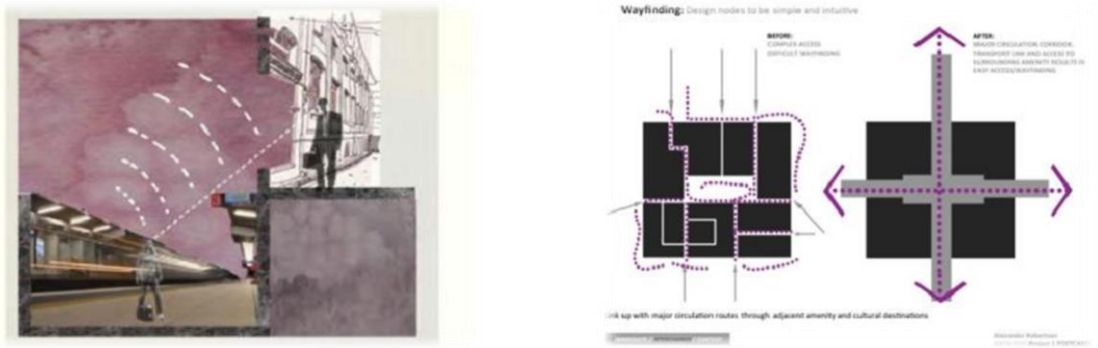


Figure 2.15: level of service, and connected facilities. Source: (Kaplan, 2013)

Signages promote wayfinding through intelligible form, openness, visual hierarchy, a removal of visual clutter and the use of key orienting landmark structures (Maher & Skinner, 2011). By contrast other works suggest strong colour coding and path markers. The larger issues of orientation to the station from the city was also considered an important idea (See Plate XVI).



(a) (b)

Plate XVI (a&b): Connection to Street and Direct Path & Wayfinding.
Source: Maher & Skinner, 2011

Rodrigue, (2013) further suggested that legible design for passenger information and way finding from the outset will result in places that are easy to use, require minimal signage and are well integrated with their surroundings. Sayers, (2011) also suggests that station navigation must be intuitive for first-time users while According to network Rail (2011), it is important to provide a suitable balance between front- and back-of-house requirements so that passenger, operational and management needs can be met while not interfering with each other unduly. This statement points to the need for station navigation that does not interfere with the back of house operation. Sayers further identified the concentration of facilities and indirect access as indicators of poor station layout design. He further suggested that information display regarding way finding should include reference to surrounding local area and services. Another indicator of station navigation is the nature of access to platform from several station access points. Multiple access and exit points to platform are also another indicator of station navigation (Sayers, 2011; Goggins, 2011).Spatial Components of Ease of Navigation/Way Finding principle:

1. Intuitive spaces
2. Optimize signage placement
3. Clear separation between front of house and back of house operations
4. Furniture placement
5. The nature of access to platform from several station access points

2.7.4 Accessibility

According to Sayers, (2011) equitable access, seamless connections and convenient station location are key identifiers to the degree of accessibility to railway stations. However, his definition of convenient station location as closeness to key activities and destinations seem to be similar to the concept of relative location

identified by (Slack et. al., 2013). Network Rail (2011), also identifies three key variables of station accessibility: equitability of access to all users, seamless connections between modes; and convenient station location (Network Rail,, 2011). The third variable is already fixed for existing stations and may only be a variable for new station development. Also Rodrigues (2013), suggests that accessible station design is about making places easy to use for all passenger and station users. He further expands the user group to include people with visual and cognitive impairment, those in wheel chairs, older people, people with bulky baggage, young children and their carriers and those with bicycles (Rodrigue, 2013). Conclusively, the accessibility principle tends to focus on the application of universal design principles in the design of circulation paths for users of station facilities. The principle also focuses on circulation not just within the station but also around the station precinct by seeking to connect stations with other transport modes through convenient access. As such station design must demonstrate a reasonable effort in reducing, or removing altogether barriers to access or use, both to and within stations, in respect to buildings and provision of physical elements.

Spatial Components of Accessibility principle:

1. Seamless connection between modes and with external routes and Destinations.
2. Links to surrounding destinations.
3. Alternative access for both vertical and horizontal circulation elements.

2.7.5 Information

According to Network Rail, (2011) information is a fundamental requirements for a positive passenger experience. Information can serve multiple purposes including: rail services, station and facility opening hours, maps of local area and information for interchange modes. Information should be delivered across the full

range of media including audio, visual and tactile to meet with the needs of all interchange facility users (See Plate XVII). It also identifies three essential elements of the information principle: timely service information; accessible and comprehensive station information; customer service.



(a) (b)

Plate XVII (a&b): Real-time info from pocket devices & Multimedia Entertainment.
Source: Maher & Skinner, 2011

philosophy. Among these elements, the second element is the one that relates to design; however, it will suffice to note that the information principle is both a design as well as a management challenge. As a result, what is displayed may be an operator's input while how and where such information is displayed is essentially a design input. Consequently, Sayers (2011) identified some indicators of design of information display systems which include: signage placement, alternative information display systems, clarity of display, and height of signage post. For an integrated design approach, (Network Rail, 2011) suggests use of multiple formats including pictorial, symbols, audio announcements, tactile indicators and video.Travel information are factors that have to be encouraged both to increase the usage of the public transport, and to create a real integrated system of mobility (Desiderio, 2010). The purpose of information is to assist the users in deciding on the appropriate transport modes and to confirm their findings. The needs of the travellers are focused not only on the easy and economical way to move but also on all of this information connected with

the type of the journey. It means that where the user needs information on the transport system, it should be possible for him to obtain details in places (streets, squares, monuments, etc.) and for services such as: renting a car or bike, changing money, finding left-luggage, and so on shown in fig below (See Figure 2.16).

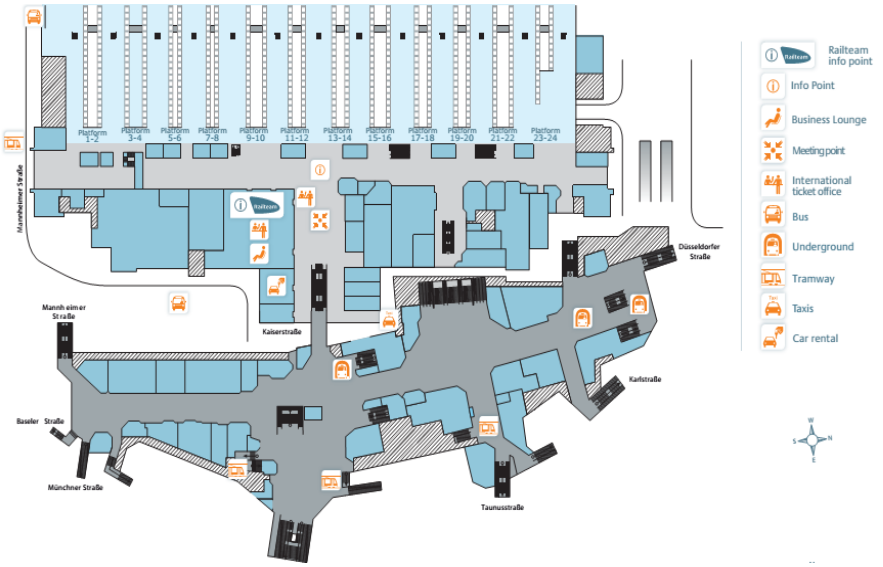


Figure 2.16: Frankfurt / Main HBF (Frankfurt, Germany).
Source: (www.realteam.eu, 2013)

Station architecture should guide travellers and passers-by through the station in all situations, at night and in the day, when deserted and through bustling crowds. (Australian Station Design Guidelines, 2013). Some of the most important information needed to navigate a station is given by written, numeric or iconographic signs.The name of the station, the time of the service, the number of the platform, the cost of the fare, the graphic depiction of a particular metro line and the important indicators to exits and warnings of hazards are given through visible signage and auditory announcements.

2.7.6 Security

The station area and site which comprises the ingress and egress to the station need to be defined as a separate distinct area within the overall station complex. Safety and security provisions shall be included in design to address all sections of the separation

of station operating area and the remainder of the station complex (Ministry of Railways Board Government OF India, 2009). Concerns for personal safety and security on the interchange site and in its immediate local environments are a major priority to all users and operators. The feeling of insecurity, when using the public transport system depends on both real security and psychological factors (Desiderio, 2010). Such feeling shows itself in each category of users, including the transport staff inside the interchanges and the drivers of public vehicles. Desiderio, (2010) further suggests that the sense of insecurity can appear during the transfer from one means of transport to another, during one section of a journey instead of another one, or simply during a short stop in a non-busy period of the daytime(See Plate XVIII).



(a) ***(b)***

Plate XVIII (a&b): Activate Under-utilised Space & Rely on activity over CCTV.
Source: Maher & Skinner, 2011

But (Maher and Skinner, 2011) oppose to surveillance and security patrols include a selection of domestic and offices service within station precinct that would populate the spaces around the space to create a means of passive surveillance (See Plate XVIII).

2.8 Spatial Structure of Stations

The design of stations has developed over the years as the use of railways has first expanded and latterly declined. A new form of station design has also evolved with the introduction of metros and high capacity urban railways.

2.8.1 Conventional station structure

The basic spatial configuration of large scale stations comprises of core areas, transition areas, peripheral and administrative spaces (Kandee, 2010). The relationship between these spaces (See Figure 2.17) is dependent on several factors such as scale of station, which may determine the inclusion or exclusion of the administrative space; the type of station, whether a junction terminal or a terminus station which may influence station orientation; and the railway track system, whether single or double track system (John-Paul & Slack, 2010).

- Core areas are spaces created for processing passengers.

Kandee (2010), explains this core area as spaces that are located in central area in railway terminal and contain spaces for ticketing, information, baggage handling, reclaiming and waiting, while according to (Goggins, 2011), the facilities in this zone should follow a logical grouping based on the needs of passengers and should be visible or clearly signed from access points. This suggestion indicates the need to understand how passengers interact with station facilities in order to identify the patterns of usage that exist among various user groups. This can be achieved by observation and interaction with the users of those facilities (See Table 2.2).

- *Transit areas connect transit facilities in the core areas to transport modes.* They often include secondary, but often essential facilities such as rest rooms, telephones and commercial spaces, while according to (Kandee, 2010), depending on the need of stations, other supplementary functions may be incorporated in these transition spaces. He further points the fact that good relationship between stations and their communities encourages commercial approaches in development of these transition spaces. Goggins, (2011), called this zone "access and interchange" and he defines it as a gateway between station and its surrounding environment. He suggested that the zone

should have a strong interaction with surrounding development around the station (See Table 2.2).

- *Peripheral areas support circulation outside the main buildings and often include platforms, tracks and vehicle service spaces*. This is also referred to as the platform zone (Network Rail, 2011). Access between core facilities and transition spaces is often restricted to the peripheral areas by manual inspection or automatic ticket gates (See Table 2.2).
- *Administrative areas control both traffic and station management*. This section is found only in some station types that provide complex arrangement for handling large number of passengers. These areas can be isolated from other facilities or inserted in them. (Goggins, 2011) identifies safety as a major design challenge for this zone. Another zoning of station facilities is given by Network Rail, it includes: access zone, facility zone and platform zone. This categorization is similar to the one given by Kandee, 2010, with the exclusion of the administrative zone (See Table 2.2) and (See Figure .

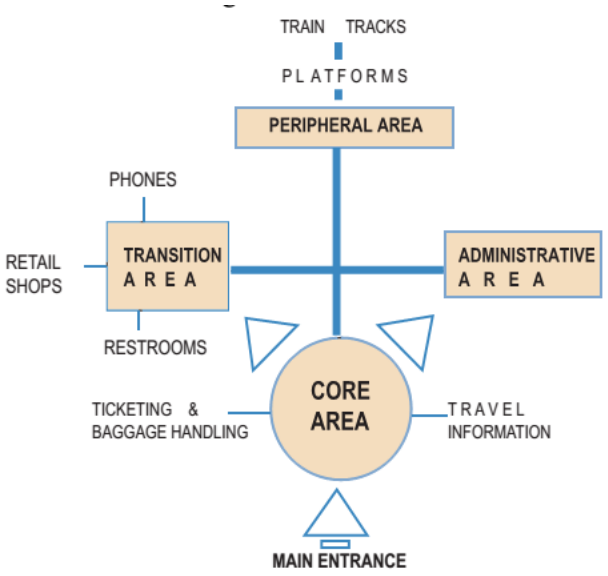


Figure 2.17: Flow Diagram of Functional Elements. Source: Kandee, 2010

The four areas described in Table 2.2 represent the major physical and functional elements considered necessary in establishing an intermodal station and, consequently, must be included in its design. Other significant features inside the station building need also to reflect functional hierarchies.

Table 2.2: Functional Standard of Four Main Areas in Railway Stations.
Source: Kandee, 2010

	Activities	**Area requirements**	**Users**	**Comments**
Core Area	**Departing** - Checking train Schedule. - Ticketing. - Baggage handling - Fare collection. - Gate check-in. - Waiting. **Arriving** - Meeting & Greeting. - Reclaiming, Baggage	**Main Hall** - Information. - Ticket office. - Ticket machine. - Ticket counters with baggage check -in. **Departure hall**-Automated fare collectors or staff. - Seating **Arriving Hall** - Meeting point or seating. - Baggage reclaim.	Passengers & guests. - Staff. -Passengers - Greeters. - Staff.	- Ticket sales in several forms depending on type and size of stations. - All functions may take Place in one open space, i.e., main lobby, ticket hall, etc. or separate areas, but connecting. - An arrival hall is normally The same area as a departure hall.
Transition Area	**Departing, Arriving, Working & Visiting** -Using public facilities. -Walking to vehicles or waiting around before boarding - Shopping or Eating.	**Connecting Area or Main Circulation** - Public service facilities, i.e., restroom, public & Lockers. - Amenities, i.e., Shops, restaurants and snack bars.	- All users: passengers and their guest, staff, and visitors.	- Public facilities are necessary for any type of station. - The variety of amenities depends on the type, size, and concept of stations.
Peripheral Area	**Departing, Arriving, Working** - Boarding. - Loading and Unloading. -Maintenance.	Platforms. - Tracks. - Workshops or Vehicle service areas. - Traffic signal.	-Passengers. - Staff.	Numbers of platforms and train tracks derive from numbers of passengers a Terminal can handle. - Maintenance services are provided only at large Terminals.
Admin. Area	**Working & controlling Traffic System** - Working. - Controlling traffic systems and functions in the Stations.	- **Management Office.** - Traffic Controlling office.	-Staff. - Visitors.	- Locations of Administrative office maybe isolated from others or Inserted among facilities in every area, but they have to be able to control all systems.

As Edwards, (1997) points out, "the clutter of shops, stalls, information displays, ticket booths, and so forth, could increase confusion. Thus, the internal circulation reinforcing the functional priorities needs to be used in conjunction with narrower routes to help distinguish major and minor spaces (See Figure 2.18)

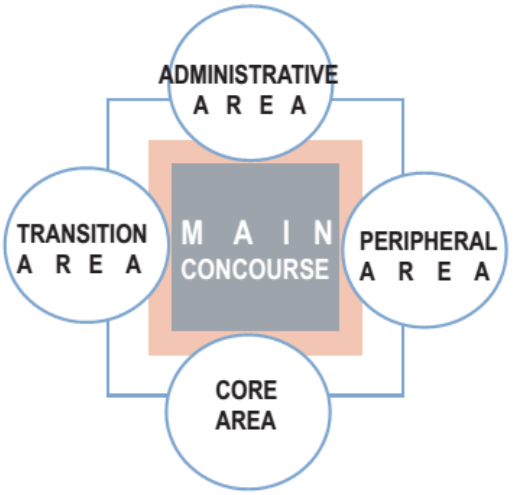


Figure 2.18: The Interrelationships between the four Functional Areas Constituting an Intermodal Station, Source: Kandee, 2010

2.9 Users of Railway Station Facilities

It is important to understand the users of railway stations in order to understand how best to integrate contemporary facilities in the design of stations. Station users can be categorized into commuters, business travellers, leisure users, tourists and station visitors (Goggin, 2011). Goggin, (2011) further discusses that, such user groups may have needs that vary either in extent of degree of need of a particular service or extent of quality and such variations can significantly influence user satisfaction. This assertion suggests that the design of station elements at various zones of stations can be done with great degree of sensitivity to the larger user group (class) expected to use the service.The commuter group consists of frequent users of stations with

low dwelling time. Goggin, (2011) suggests that the overriding objective for this user group is the minimization of journey time. This he suggests will require the provision of reliable services supported by real time information on delays and service disruption. Other needs of this user group as identified by (Network Rail, 2011), to include: efficient transfer, direct access to and from station threshold including access to parking and taxi pick up and drop off points, fast and efficient ticket collection, convenient retail facilities and real time information display for onward travel.Business travellers on the other hand, refer to a category of travellers used to a first-class facilities and high levels of comfort (Goggins, 2011). Periods of time spent on stations will vary as such this user group will require high-quality and comfortable waiting areas (Goggins, 2011). Also, Kandee (2010), suggests that this user group have developed due to the transformation in the role which rail travel plays in the overall modal share.Leisure users and tourists are usually less time constrained and generally less familiar with train stations than the commuter group (Network Rail, 2011). Luggage constraints, baggage and cultural differences may drive the needs of this user group. This user group is usually of great concern for station types such as international stations and airport train terminals as such the type of station will determine to a large degree the user group to be considered in a given station design.

Station visitors' is that group of users who may wish to use the station for non-travel purposes. This group is likely to include people that arrive to meet and greet family and friends, use the station to shop or eat. Their needs are met by diversity of station functions and amenities. Such approach to station design aimed at meeting the needs of these user group is defines as intermodal approach to station design often defined as intermodal concept which is an integration of transport and

commercial facilities in station development (Goggins, 2011, Kandee 2010). Muses (2014), identified four main dimensions of experience based on passengers' aim of movement or sojourn. These include safety, reliability, travel time, comfort, convenience and experience. According to Muses (2014), all zones of station spaces are important, but not in all spaces in station area. Comfort and experience are considered more important during sojourn (waiting) while in transit spaces, safety and speed are considered paramount. Include fear of crowded conditions, perceived unhelpfulness of staff, and unreliable provision of toilets Facilities.

2.9.1 Usability principle and spatial components

In the field of architecture the usability concept is known and often translated as functionality. Nevertheless some researchers prefer to make a distinction between functionality and usability. Where functionality in the building industry is objectively measurable, while usability introduces the subjective views of the users (See Table 2.3).

Table 2.3: Usability principle and spatial components Source: (Muses, 2014)

Usability Principles	**Spatial Indicators**	**Use Patterns**
-Accessibility -Ease of Navigation/Way finding -Local Area Integration -Information -Safety and Security	-Location and design of both vertical and horizontal circulation elements -Spatial Layout, -Information display -Pedestrian and vehicular circulation routes -Location of Information display -Location of Physical barriers, -Location of both active and passive surveillance	-Arrival and Departure Waiting -Commercial Activities -Vehicular circulation -Pedestrian circulation Waiting

2.10 Railway Stations Design Principles

The railway station has some architectural design principles that when carefully considered and achieved would have a good end result. In a time when passenger expectations are rapidly increasing, the provision of safe, accessible and inclusive station environments are to be provided as a minimum. Allied to these are a sustainable whole life-whole system approach to asset design, construction, operation, maintenance and decommissioning, all of which are required for effective asset management (Wilson & Yariv, 2015).

The following are postulated by the Queens Land Heritage Act, (1992) as design approach and hierarchy for designing and redeveloping a modern railway station:

- Primary order (Design Priority)
- Architectural heritage & presentation
- Circulation & space planning
- Urban integration
- Efficient movements of passengers
- Transfers & interchange with the other modes of transportation
- Accessibility
- Visibility

Figure 2.19 illustrates the inputs and outcome of a good railway station design.

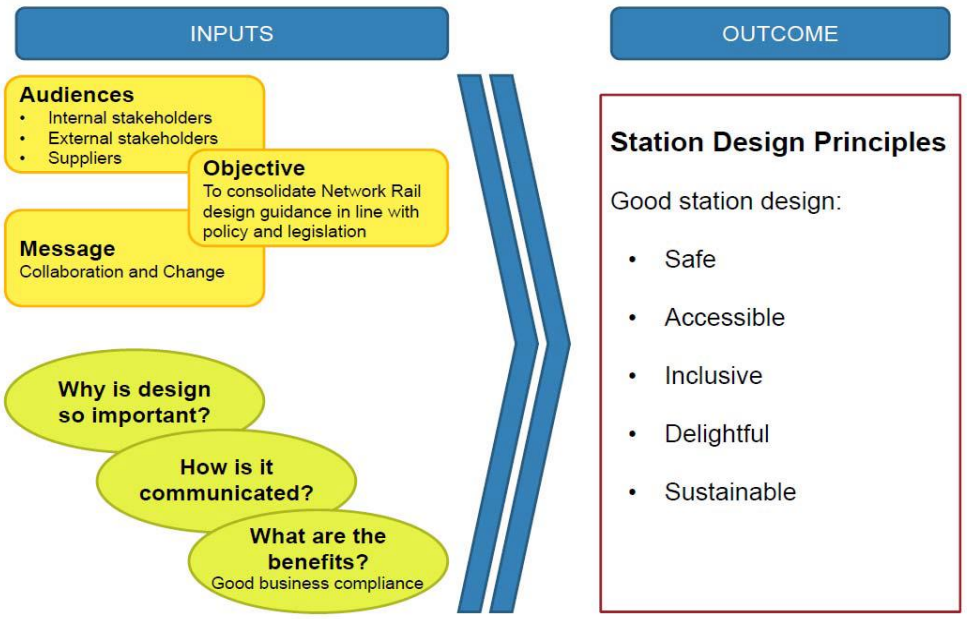


Figure 2.19: Railway Station design principles, Source: (Wilson & Yariv, 2015)

Users' satisfaction is very important in the design of a railway station for comfort and convenience of the customers. Figure 2.20 below highlights the factors that determine customer satisfaction and dissatisfaction.

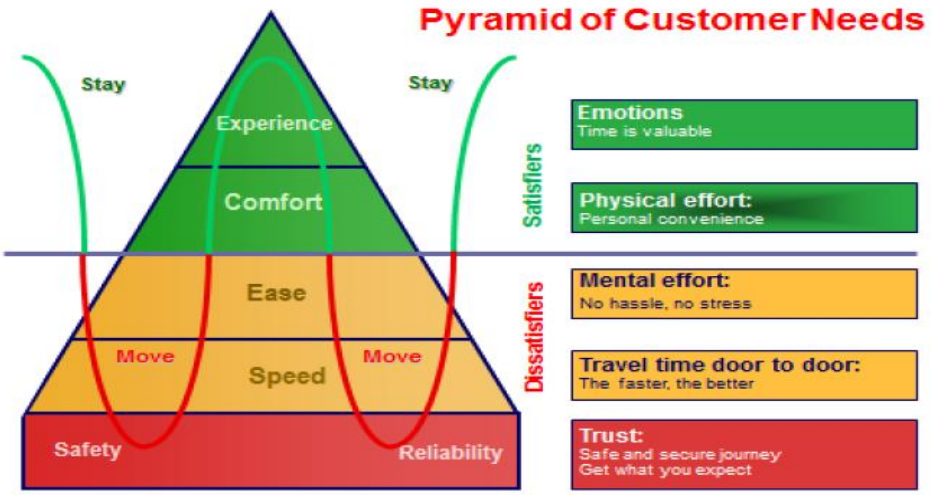


Figure 2.20: Customer needs in a railway station, Source: (Wilson & Yariv, 2015)

Furthermore; some architectural design consideration for the railway station are outlined as follows as regards the spatial integration in relation to its architectural significance:

- Safety and security by design
- Performance and reliability target
- Passenger experience and delight

2.11 Facilities Required in a Contemporary Railway Station

These include all facilities which make the railway experience less stressful and enhance comfort and easy circulation within the train station. They include,

a**. Security**: The security office should be located close to the shopping area for effective services.

b. Tiny Taxis: Free tiny taxis are facilities made available to customers purchasing large amount of good, hence walk ways should be wide to prevent its interference with pedestrian movement within the station.

c. Lifts And Escalators Public lifts should be conveniently located at the central atrium or side to assist movement between all floor levels .These lifts should preferably be of panoramic type to enhance the effect of vision while in use.

d. Meeting/Waiting Areas: should be provided at the reception near the main entrance, to ease the location of lost children and inquiry.

Categories of shops

i. **Department Stores:** These are shops which come in different sizes and offer

Various services to the public, to ensure financial stability of a railway. Departmental stores should be located in a way that they complement themselves and thus imposing minimal stress on the users.

ii. **Health stores:** Personalized health, vitamins & supplements, diet and nutrition, sports nutrition, healthy and pharmacy should be provided.

iii. **Beauty & Personal Care stores**: Women's skin care and makeup accessories, men's skin Care and hairdressing.

iv. **Jewellery & Fragrances stores**: Jewellery accessories, bracelets and watches, earrings, necklaces and chokers, rings, fashion accessories.

v. **Home care store:** Laundry and apparel care, wipes and cleaners, house wares, bedding and bath, air and water, home furnishings and f fabrics.

vi. **Apparel store**: Men's, women's, children's, shoes. Bridal wear, menswear, maternity wear, children wear, ladies wear.

vii. **Audio/Visual/Photographic**: Passport, photographs, recording studio, video clubs, music rooms.

viii. **Specialist Shops and Services**: Travel agents, opticians, fixed wireless service providers, cards and gifts shop.

ix. **Entertainment, Toys and Games shops:** Game arcade, children play room, aquarium among others.

x. **Financial stores:** Bureau de change and atm.

xi. **News/Stationery and Books:** Bookshops, newspaper stands and book clubs.

xii. **Food and Beverages stores**: Bars, beverages, breakfast foods, condiments, fast meals restaurants, cafés and fast food shops and stores.

xiii. **Anchor Stores:** These are typical examples of larger departmental shops which helps to draw as much traffic as possible, thus resulting in the patronage of other stores around them. These larger departmental stores could also be referred to as draw tenant. In physical configuration, anchor stores are normally located as far from each other as possible to maximize the amount of traffic from one anchor to another.

2.12 Forms of Development

2.12.1 Modification of the Existing Building

This involves carrying out improvement work on the existing building and conversion of existing building if it estimated that the capitalized value of the additional return will exceed the cost of alterations in the case of office refurbishment, the layout of shops adapted to self-service and house being converted into flat or offices (Showunmi, 2010).

2.12.2 Redevelopment

Redevelopment involves demolishing an existing structure on land and rebuilding of structure to greater density. This take place when the present value of the expected flow of future net returns form the existing use of a property is less than the capital value of the cleared site (Showunmi, 2010).

2.12.3 New Development

This involves the clearing of virgin land to erect a new building for certain uses, new development usually take place in the urban fringe and takes the form of out ward urban expansion (Showunmi, 2010).

2.12.4 Urban Transport Strategies for the Redevelopment of Railway Stations

Isabella (2007), stated that the renovation of the railway stations carried out during the last years in the cities has been primarily motivated by two factors:

a) Transport needs;

b) A new role of the Railways Companies.

Besides these two needs (adaptation of the railways station and railways infrastructures; real estate operation in order to enhance the sites), there is a third element that influences the renewal works of a railways area: stations have an undeniable function of physical and psychological centrality in the urban environment (Isabella, 2007). Only

the worsening of the quality of the railway service in common use has deprived the stations of economic resources and profitable activities, relegating them to the role of mere ticket offices. Therefore, a project of railway stations renovation becomes an outstanding opportunity for the transformation of a city, not just as a “patching up” of existing parts, but rather the exploration of new urban life styles (Isabella, 2007).

2.13 Summary of Literature Review

Railway station are facilities at which the level of interaction between architecture and structure is of paramount importance. Station usually consists of the combination of a station building with platform to allow the passengers to get on and off the train, or shelter, or only one of either. In the Past, large station buildings with spacious train sheds built for train terminals in major European cities were top achievements among engineering structures that flourished in 19th century. They also displayed outstanding architectural features. Today, along with ‘’station renaissance’’, some of these splendid stations have been modernized and adapted for high speed trains (HST).

Current multi-modal station, often resembling air terminals, must respond to different facilities than before. They provide access for airport, other rails, bus, and other intermodal services as part of new urban and commercial centres, they accommodate businesses, temporary accommodation, and shopping centres. Station buildings must include all the facilities arranged for ticketing, waiting, transfer, and those non-transportation facilities for shopping, recreation and administration (See Figure 2.21).

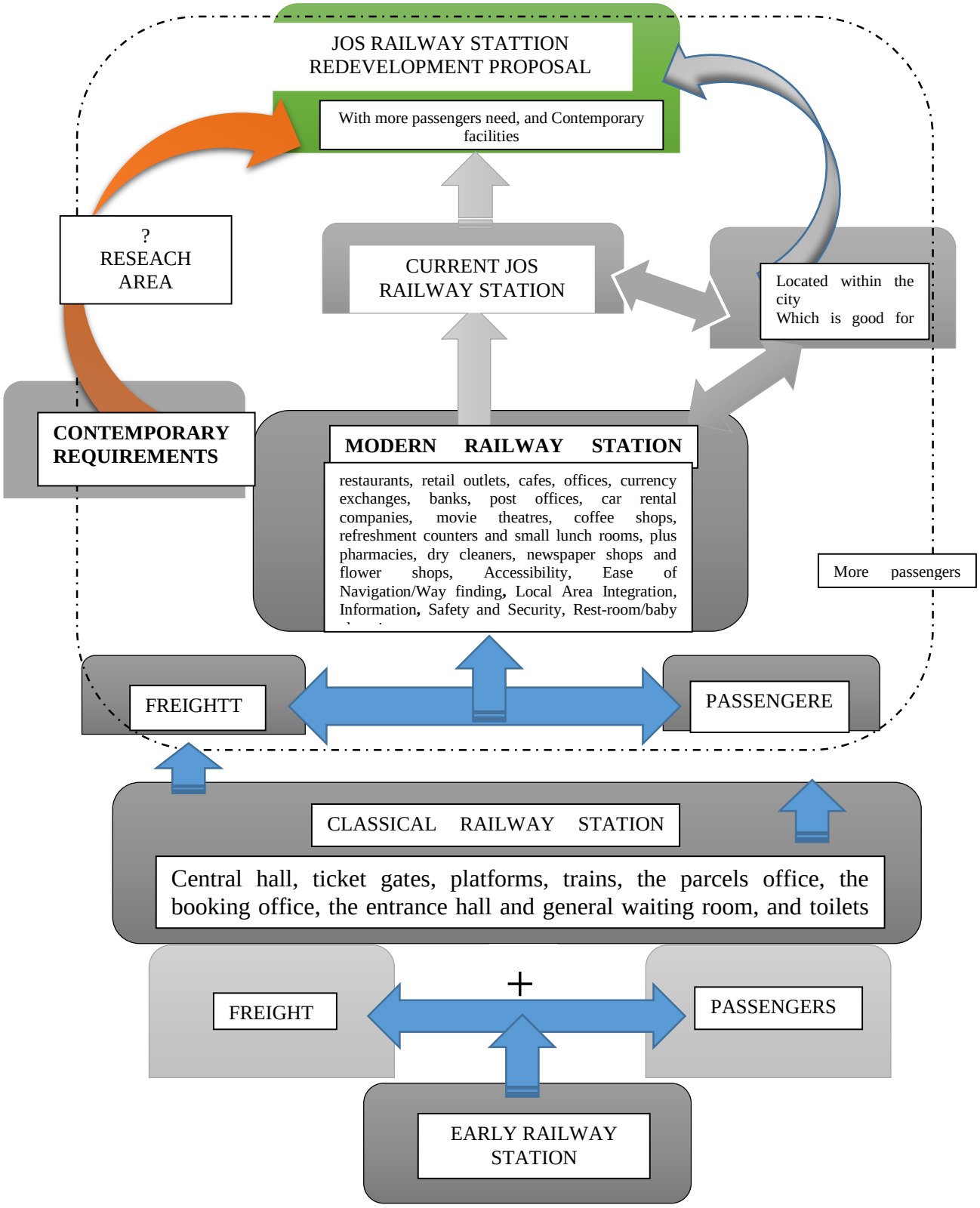


Figure 2.21: Conceptual Frame Work, Source: Author, 2016

3.0 RESEARCH METHODOLOGY

3.1 Introduction

Research methodology serves as the blue print of the research (Abdullahi, 2011). It is the plan, structure and strategy conceived so as to obtain answers to the research questions posed. He further emphasized that the plan is the overall scheme of programme of the research and, decisions made at this stage are very crucial to the success of any research project as they determine the quality of the research outcome. This chapter therefore discusses the strategy/research method selected and used in conducting the study and is arranged under the following headings: Introduction; Theoretical/conceptual framework Research method; Population of the study; Sampling procedure; Research instrument; Procedure for Data collection; Procedure Data analysis; The pilot study (pre-testing); and Conclusion.

3.2 Theoretical and conceptual framework

One of the reasons for undertaking a literature review, apart from establishing the gap in knowledge, is to retrieve and assess suitable methodologies relevant to the study at hand (Maina,2013).

Hashizume, (2014) asserts that early railway stations were simple in that they were designed around a central hall and had ticket gates and waiting rooms spread about. Kandee, (2010) described that the design aspect of traditional stations includes ticket halls, waiting areas, platforms, and trains. However, (Tang, 2012) opined that railway stations provide additional commercial facilities built and integrated into the building. Kandee, (2010) explains further that the design include supplementary functions; for instance, integration of light and structure, access for disabled people, improving way-finding and commercial development (See Figure 3.1).

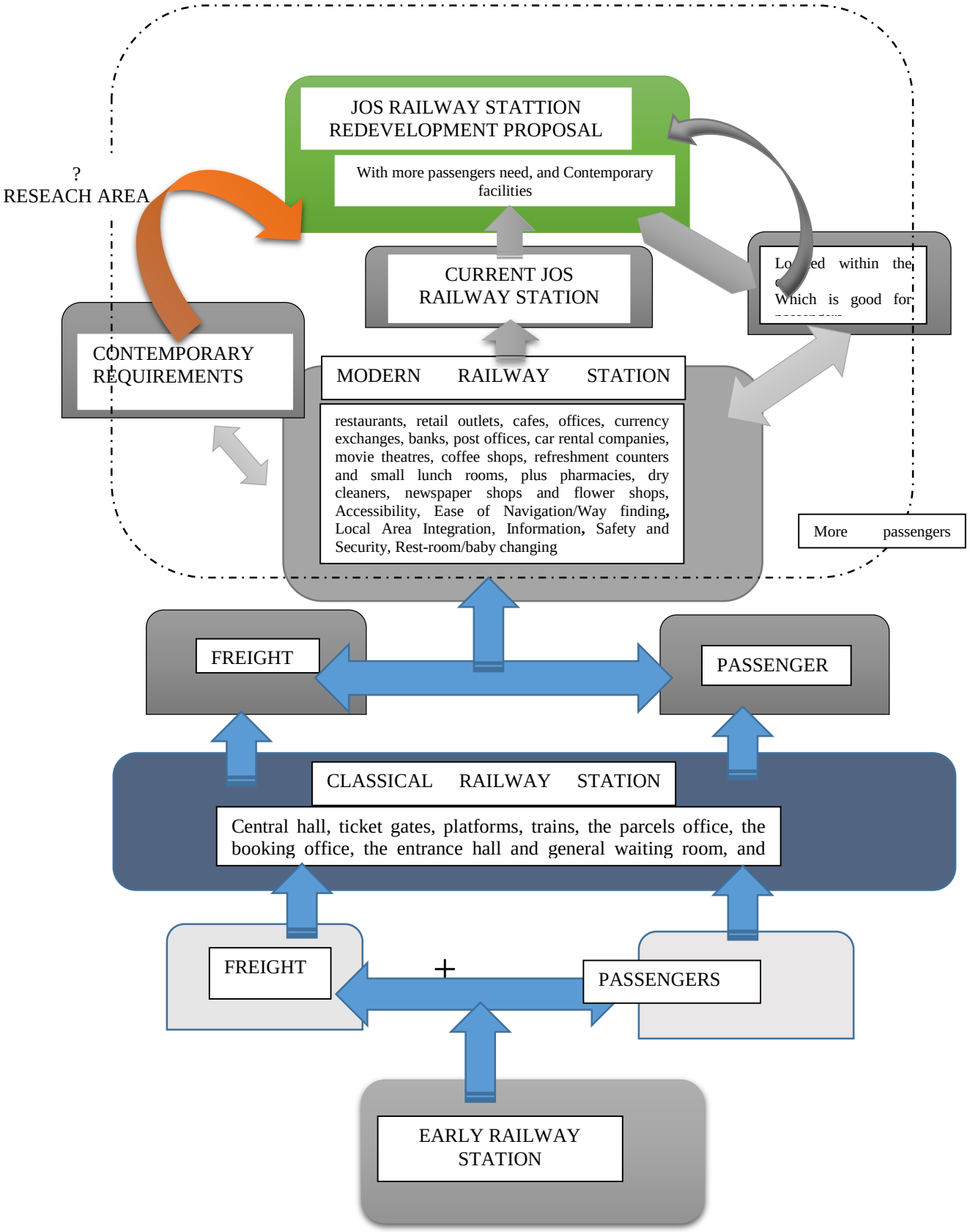


Figure 3.1: Conceptual Frame Work, Source: Researcher, 2016

3.3 Research Design

Usability pattern and contemporary user facilities in railway stations were identified from literature. The usability pattern and contemporary user facilities can be analysed and study through qualitative and quantitative approach carried out through the study of drawings, diagrams, sketches, photograph and other instruments that involved: visual survey, observation, questionnaire, case study and interview with the station official in order to discover whether these variable can fit in the redevelopment of Jos railway station.

3.4 Population of Study

In line with the scope of the study, the population of this study comprised of all terminus stations located in Nigeria. The selection of this population of study is appropriate best because it captures the wide range of data required for the study and secondly it facilitates the replicability of the study. These points are elaborated in the following paragraphs.

To facilitate replicability of this study in the future, cases to be studied must meet this requirements of closeness with urban centres. Secondly, significant variation exists in the spatial configuration between terminus and other type of railway stations. Additionally, this study aim to uncover the dynamics behind a passenger's railway station design.

However, it should be noted that most stations in the country have a level of passenger and freight service delivery coexisting together at different proportions. Thus the case studies were not selected because they offer passenger services only but rather they are chosen because they offer significantly larger passenger service and meet the basic requirements of location which is peculiar to passenger train stations (Muses, 2014). There is a total of forty-one (41) major railway stations in the country

(Olawale, 1999). The west line includes: Apapa, Iddo, Agbado, Ijoko, Abeokuta, Agege, Ibadan, Oshogbo, Ilorin, Zungeru, Minna, Kaduna, Zaria, Kano, Nguru, Funtua, Gusau, Kaura Namoda, Bajoga, Idogo, Minna, Ikeja; the East line includes: Port Harcourt, Aba, Enugu, Otukpo, Igumale, Makurdi, Kafanchan, Kuru, Bauchi, Gombe, Maiduguri, Lafia, Oshogbo, Umangha, Uyo, Umuahia, Chamo, Yenagoa, Agbadi as shown in (See Figure 3.2)



Figure 3.2: Major Rail Routes and Stations in Nigeria
Source:www.mapsofworld.com/nigeria/nigeriarail-map

3.5 Sample and Sampling Techniques

According to Burgess et al (2003) Sampling is a means of selecting a subset of units from a population for the purpose of collecting information for those units to draw inferences about the population as a whole. In sampling stations for the study, major stations located within city centres in the country were first identified and were categorized based on the major roles they play in train travel which is either as transitory stations, junction stations and terminal stations. The importance of this categorization for the fact that key platform layout designs are basically fixed for station design projects and serve as the starting point for station design. (See Table 3.1) classifies the major rail stations in Nigeria.

Table 3.1: Classification of major railway stations in Northern part of Nigeria Source: (Moses, 2014).

Transit railway station	**Junction Station**	**Railway Terminus**
Lagos, , Agbado, Aba, Ijoko, Ibadan, Otukpo, Abeokuta, Zungeru, Igumale, Oshogbo, Gusau, Makurdi, Ilorin, , Umuahia, Bauchi, Kano, Chamo, Gombe, Funtua, Yenegoa, Lafia, Bajoga, Agbadi. Oshogbo, Enugu, Port Umagha, Ikeja, Harcourt**,** Uyo,	Agege, Minna, Kaduna, Zaria, Abuja, Kafanchan, and Kuru	Apapa, Iddo, Nguru, Kaura Namoda, Odogo, Baro, Maiduguri, and Jos.

3.5.1 Case Study Selection Criteria

Some strategies were considered in selecting the different cases to be studied for the purpose of this research, include;

i. Spatial configuration/ layout of the stations

ii. Nigerian railway corporation (NRC) operations and transport

iii. Scale of urban location of the stations to be studied

3.5.2 Selected Cases to be study

The cases selected include (See Figure 3.3):

1. Kaura Namoda railway station
2. Iddo railway station
3. Jos railway station (All of them being Terminus/ Interchange Station type).

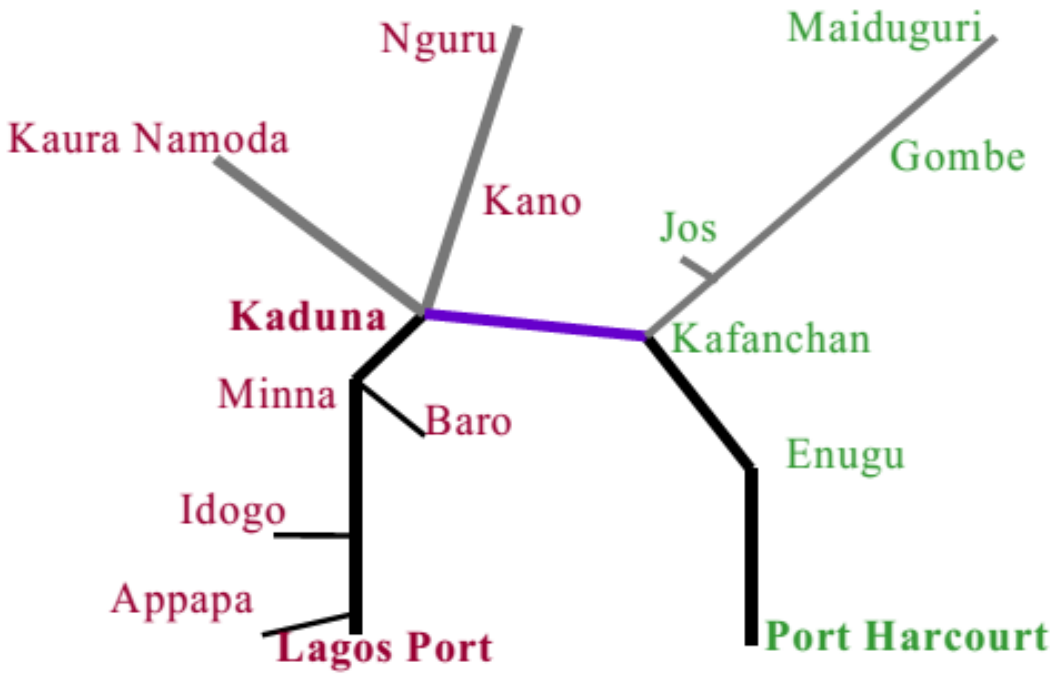


Figure 3.3: Western & Eastern Concessions. Source :(Umar, 2013)

3.5.3 Research Variables

In regards to this study, integrating contemporary user facilities in redevelopment of Jos railway station, the research variable to study were:

i. Contemporary User Facilities

Contemporary user facilities are additional and functional facilities integrated in the modern railway stations, they include retail outlets, cafes, Financial stores**,** car rental companies, Department Stores, Health stores, Beauty & Personal Care stores**,** Jewellery & Fragrances stores, Food and Beverages stores, pharmacies, dry cleaners,

News/Stationery and Books, flower shops, restrooms, Specialist Shops, Services Toys and Games shops, park and ride, and kiss and ride, Security, Lifts And Escalators and so on.

ii. Usability pattern

Through extensive review of literature, the following usability patterns were identified and observed include

1. Accessibility
2. Ease of Navigation/Way finding
3. Local Area Integration
4. Information
5. Safety and Security.
6. Spatial Organisation

3.6 Research Instruments

Three research instruments were used in conducting this study. These were the interview schedule, questionnaire and observation checklist. Interview was used as it allows for an in-depth information on the railway station, which made it possible to assess the state of railway usability pattern and contemporary user facilities. Physical observation was employed in assessing the state of facilities in the railway station and the questionnaire be used to get people opinions of contemporary user facilities. The three instruments used were designed in line with the objectives of the study.

3.6.1 Research instruments for measuring usability pattern

The measuring tape was adopted as the measuring instrument for this research and the unit of measurement was the metre. Since the aim of this instrument of data collection was to obtain a sketch of the station layout, measurements of certain spaces were taken and a sketch of the station was made on paper. For successful translation

of this data, architectural drawings from the station drawing office were obtained and itemize, photos were taken, also goggle maps of the stations were taken from which the sketch was either verified or modified and then the sketches are then import to CAD to draw them to scale.

3.6.2 Research instruments for Measuring Contemporary User Facilities

i. Visual Observation

Visual survey is the assessment of physical static objects, such as facilities, structures and building elements through a check list which serves as a visual lens to focus the study on set objectives. The check list is obtained from in-depth study of literature. For the study in question, visual survey was used to record positions of information display in the cases being studied, location of concession, conveniences, and vehicular and pedestrian accessibility. A check list was designed to help identify availability or absence of certain design requirements in stations. The same checklist is used across all the cases that are being studied. The checklist was developed based on the contemporary functional requirements identified and explored during the literature review.

ii. Observation Check List

The instrument use for observation in carrying out effective study for the contemporary user facilities are the use of observation checklist. For this study, the instrument was used to assess contemporary user facilities that are not incorporated, identified through literature. Some of these issues include access to train from platforms, access for disable people, access to conveniences, luggage handling, ticketing, and commercial activities like restaurants, retail outlets, cafes, offices, currency exchanges, banks, post offices, car rental companies, movie theatres, coffee shops, refreshment counters and small lunch rooms, plus pharmacies, dry cleaners,

newspaper shops and flower shops. The data obtained via the use of this instrument is meant to reflect contemporary user facilities in Railway Station.

3.7 Research Procedure

Design variables were identified based on contemporary user facilities: These are Usability pattern and contemporary user facilities. Case studies were then selected based on predetermined selection criteria. Data on the identified variables are then collected in each of the cases using multiple instruments of data collection: measuring instruments, observation, semi-structured interviews, and observations. The data collected is then subject to descriptive analysis within case and across case analysis.

3.7.1 Procedure for Data Collection

The procedure for data collection involved three steps:

1. Conducting a semi-structured interview with station managers Superintendent Officer

2. Identification of functional spaces in station area.

3. Application of research instruments to collect primary data in the functional spaces.

3.7.2 Measurements

The process for the measurement of station layout was conducted in the following steps:

Step 1: Manual sketch of station building and surrounding precinct with concentration on spaces accessible to passengers. These spaces include all the facilities and amenities that are in the station building.

Step 2: Obtain dimensions of spaces that are accessible to passenger.

Step 3: Obtain an aerial view of the station site from Google map and tracing this map in order to obtain proper orientation and location of station building on site.

3.7.3 Data Presentation

For data presentation, simple descriptive statistics in form of percentage, mean, median and mode were used in combination with simple description which were used to present the data collected from the field work. Figures and plates were also used to aid the description.

4.0 DATA PRESENTATION AND ANALYSIS

4.1 Preamble

Case studies are carried out to provide the researcher with information on the existing buildings under context, with a view to ascertaining their degree of architectural fulfillment and knowing their existing problems.

The Case study conducted in this research involved a critical study of some railway user facilities existing in Nigeria, with a view of appraising them and to find out how well these facilities satisfies user requirements. This is in an effort to solve the problems of station planning and building.

4.2 CASE STUDY I (Iddo Railway Terminus)

LOCATION: Iddo, area of Lagos State, Nigeria

OWNERSHIP: Federal Government of Nigeria

CONSTRUCTION DATE: 1953

4.2.1 Brief History

Iddo terminus is the point where the train terminates within Lagos. It covers a total area of 263.8sqm.It was commissioned in 1953 by Alhaji Tafawa Balewa a few years later when he was the minister in charge of the railway transport affairs. The Plate XIX below shows the main entrance at Otto road. The plan of the station is rectilinear in form with the ticket offices slightly curved in nature near the main entrance. Most of the elements are housed within the form, it has a barrel roof and it strikes one as a massive structure with a triple volume space highly ventilated.



Plate XIX: Approach at New Apapa road. Source: Field Study, 2016

4.2.2 Facilities in Iddo Terminus station

The following were observed as the existing functional spaces and facilities in the main station area of the Iddo Terminus station: these are, The main concourse, Ticket and booking office, South and North cabin, Signal cabin, Luggage and parcel unit, first and second class waiting rooms, Public conveniences, Long range station platform, Station building office block (Train's office), Security post, Information and signal office (See Table 4.1).

Table 4.1: Characteristics of Spaces studied in Iddo Railway Station.

Spaces	Description	Location characteristics
Parking area	For both public and staff parking	Stationed in front of the house by the main access
Ticketing facility	Purchase of tickets by passengers	Located in the main station Building.
Concourse	General hall for passenger circulation and use	Immediately you enter the main station building
First class waiting area	Enclosed area with entertainment for passengers booked on first class	Located in an adjacent room facing the main concourse space.
Second class waiting area	Enclosed space for passengers booked on second class	Located within the main concourse space.
Platforms	"U' Shaped elevated concrete area for access to trains and short-time waiting	Long range elevated area containing the train office, adjacent the platforms.
Information Centre	Communication to the passengers	Located in the main station Building.
Restaurant and cafes	Refreshments & dinning	Located in annex to main station building
Accommodation	Temporary lodgment of passengers	Located on first floor above second class waiting hall
Luggage and Parcel	Processing of passenger luggage & parcels	Between the "U" shapes platform Between and the main concourse
Security unit	Security coverage & Insurance for safety	The security unit is located in the main concourse.
Conveniences	For passenger use	Conveniences are also located in the station main concourse.
Lettable spaces	For commercial purpose	Located in main concourse

Figure 4.1 highlights of spaces in relation to spatial layout of the station.

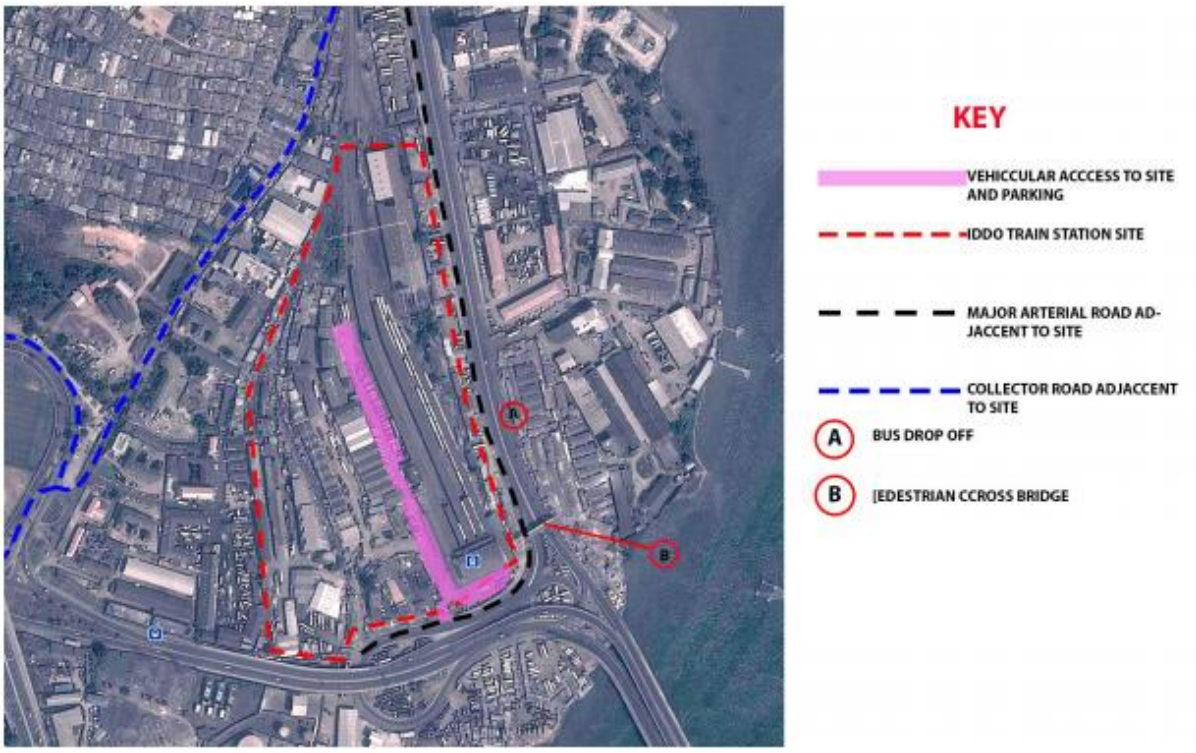
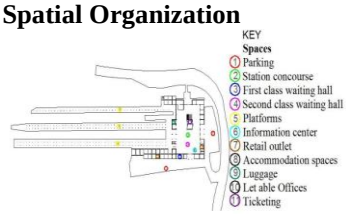


Figure 4.1: Iddo terminus station map showing access roads to the precinct.
Source: Moses, 2014

4.2.3 Usability Pattern related Data (General Visual Observation)

This section presents data collected to enable the researcher answer the research questions (See Table 4.2 & 4.3).

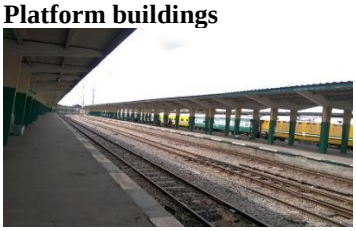
Table 4.2: Usability Pattern Related Data (General Visual Observation).

Accessibility  Plate XX: Major road to Iddo terminus. Source: Field Study, 2016	-The Station was sited within the central business district of Lagos. -Absence of equitable access to all users. -Poor Connection with other mode of transport except BRT bus drop-off adjacent to the major road (Plate XX)
Spatial Organization  Figure 4.2: CAD Sketch of Lagos Railway Station Layout. Source: Moses, 2014	An open concept layout (See Figure 4.2) is used for the main station building. These houses the ticketing hall, waiting area; information centre, offices, luggage spaces, Security unit and Conveniences.
Ease of Navigation  Plate XXI: Access that link to the station platform. Source: Field Study, 2016	-Poor access and exit points to platform, as only one access was provided (Plate XXI). -Absence of landmark, colours coding and path makers in the station which will ease passengers' navigation. -Journey is not as seamless as it is expected. -signage placement were not Optimize
Local Area Integration  Plate XXII: Services outside the Station. Source: Field Study, 2016	-The station building is integrated with surrounding public territory (Plate XXII). -Poor provision of an integral network of streets, footpaths, bike routes and public spaces. -Landscape design and public art are very scanty in the station.
Information  Plate XXIII: Information Display in Lagos Terminal. Source: Field Study, 2016	-Signages were highly integrated in Iddo terminus station which eases passenger's navigation. -Insufficient use of multiple format for information display, including pictures, symbols, audio announcement, tactile indicators and videos. -Clarity of display and height of Signages are appropriate in Iddo terminus (Plate XXIII).
Safety and Security  Plate XXIV: Checkpoint between the station concourse and the station platform. Source: Field Study, 2016	-Presence of security check-point (Plate XXIV) that leads to the station platform. -Presence of Island bridge that connect to the station building. These saves commuter from crossing the main road. -Absence of multiple access and exit platform which add to the safety of the commuters.

4.2.4 Contemporary Facilities related data

This section presents data collected to enable the researcher answer the first research question.

Table 4.3: Table showing Contemporary Facilities related Data

Ticketing office  Plate XXV: Ticketing Office in Lagos Terminal. Source: Field Study, 2016	The ticketing is manual system and is centrally located in the main concourse which makes it very accessible, (See Plate XXV). However the height of the counter is relatively accessible by persons with physical disabilities which improve its usability.
Second class Waiting Hall  Plate XXVI: Second Class Waiting Hall in Lagos Terminus. Source: Field Study, 2016	The waiting area consist of movable metal seats arranged in rows of two facing each other, located in the central open space in the main concourse. (Plate XXVI) below shows the second class waiting hall.
First class Waiting Hall	The first class waiting area is located in an adjacent room facing the main concourse space but is completely enclosed. The furniture is covered movable couch arranged round centre tables.
Platform buildings  Plate XXVII: Platform at Lagos Station Source: Field Study, 2016	Lagos terminal had three platforms parallel to the rail track but perpendicular to the station building and directly connected to it, as such, no overhead crossing is required to connect the station building to the platforms. The platforms are accessed through a gateway that serves as luggage check point and leads to the luggage department, the restrooms and some administrative offices are also located adjacent to the platform (Plate XXVII).
Commercial Developments around Station  Plate XXVIII: Bank in Iddo terminus Station. Source: Field Study, 2016	A lot of formal as well as informal commercial activities occur within the station building. Additionally, there is a bank attached to the main station building (Plate XXVIII).
Parking Areas  Plate XXIX: Parking A rear in Lagos Terminus Source: Field Study, 2016	The parking space is accessible from the major road and close to the station building. Plate XXIX shows the private parking area at Lagos station adjacent to the station building.

4.2.5 Checklist for Assessment of Contemporary User Facilities in Iddo Railway Station.

Contemporary User Facilities can be assessing using the following variable in the table below (See Table 4.4)

Table 4.4: Checklist for Assessment of Contemporary User Requirement in Iddo Railway

5-Execellent; 4-Very good; 3-Good; 2-Poor; 1-Very Poor)

S/N	Variables	Checklist	Level of Application					Remark
			1	2	3	4	5	
1	Information	Signage placement				■		Signage, and audio announcement were averagely use, which make it easier to locate facilities. However, symbols, tactile indicators and videos were absent, making it difficult for the physically challenged to locate the facilities.
		Alternative information display systems		■				
		Clarity of display and height of signage post		■				
		Use of pictorials, symbols, audio announcement, tactile indicators and video		■				
2	Local area integration	Connection of station to surrounding buildings			■			Integration of station to its surroundings & other facilities is averagely good.
		Connection of station building to other supporting facilities			■			
		Pedestrian connection to station building			■			
3	Contemporary Requirements	V.I.P lounge, dry cleaners, coffee shops, newspaper shops, car rental outlet, post office, restrooms, shops			■			Presence of some needful commercial activities.
		restaurant, cafes, bank, toilet, Nursing mothers' lounge, Offices, store, currency exchange unit, saloon, temporary accommodation etc.				■		
4	Site planning and landscaping	Use of soft landscape elements		■				Absence of landscape elements.
		Use of hard landscape surfaces			■			
		Consideration for future redevelopment/expansion			■			
5	Spatial organization	Pedestrian means of circulation		■				Undefined pedestrian routes with poor zoning.
		Utilization of spaces and proper zoning of activities		■				
6	Accessibility	Vehicular access to public spaces			■			Vehicular access road is tarred and accessibility to the interior and exterior is averagely good.
		Pedestrian access				■		
		Vertical access & universal design			■			
		Visual access			■			
		Access to manual ticketing						
		Separation between front & back of house				■		
7	Ease of Navigation/ Way finding	Integration of Interior & exterior transit routes				■		There is ease of navigation for passengers within the railway station.
		Connection of station to Drop off/ pick up points			■			
		Use of colours to define space/function	■		■			
		Floor finish texture		■				
8	Security & Safety Principles	Station security post				■		Crossing of tracks to access station building unsafe. Station building not protected from harsh weather conditions.
		Staff present in the station precinct			■			
		Lockable barriers such as bollard and barricade		■				

The above Table 4.3 shows the checklist for the assessment of the various variables relating to the contemporary user requirement in Iddo terminus station. Each variable and the various attached attributes were well studied before being given the actual ranking.

The maximum score for any item per respondent is 5 (on a 5 point Likert scale with 1 for Very poor to 5 as Excellent).

4.2.6 Discussion and Analysis of Results for Iddo Terminus Station.

The table below (Table 4.5) shows the overall average score of the assessed contemporary user requirement variables, using the frequency score from the checklist that was utilised for the assessment. From the calculation as seen above, the total percentage of the assessed variables is 42.29%.

Table 4.5: Average scores for variables checked in Iddo Terminus Railway Station.

S/N	VARIABLES	CHECKLISTS FREQUENCY OF SCORES/VARIABLE					AVERAGE SCORE/ VARIABLE (S/n)	PERCENTAGE (%)
		1	2	3	4	5		
1	Information	0	3	0	1	0	2.5	5.00
2	Local area integration	0	0	3	0	0	3.00	6.00
3	Contemporary requirements	0	0	1	1	0	3.5	7.00
4	Site planning and landscaping	0	2	1	0	0	2.30	4.70
5	Spatial organization	0	2	0	0	0	2.00	4.00
6	Accessibility	0	0	4	2	0	4.00	8.00
7	Ease of navigation/ Way finding	1	1	2	0	0	2.25	2.25
8	Security & Safety	0	1	1	1	0	3.00	6.00
	TOTAL	**13**	**13**	**7**	**0**	**0**	**18.85**	**42.95**

* (**S**- score value, **n**- number of sub-variables)

This percentage is not up to average of the required percentage but is fairly good which indicates that the Iddo terminus station facilities will influence the propose redevelopment to provide the needed requirement to an optimum percentage more than average.

The result illustrated in Figure 4.3 shows the percentage of each of the assessed variables in the Iddo terminus station. The Figure 4.3 demonstrates that accessibility has the highest score, followed by local area integration of security and safety, then next is the site planning and landscaping, then spatial organization followed by information and contemporary requirements, and lastly the ease of navigation/way finding as the least.

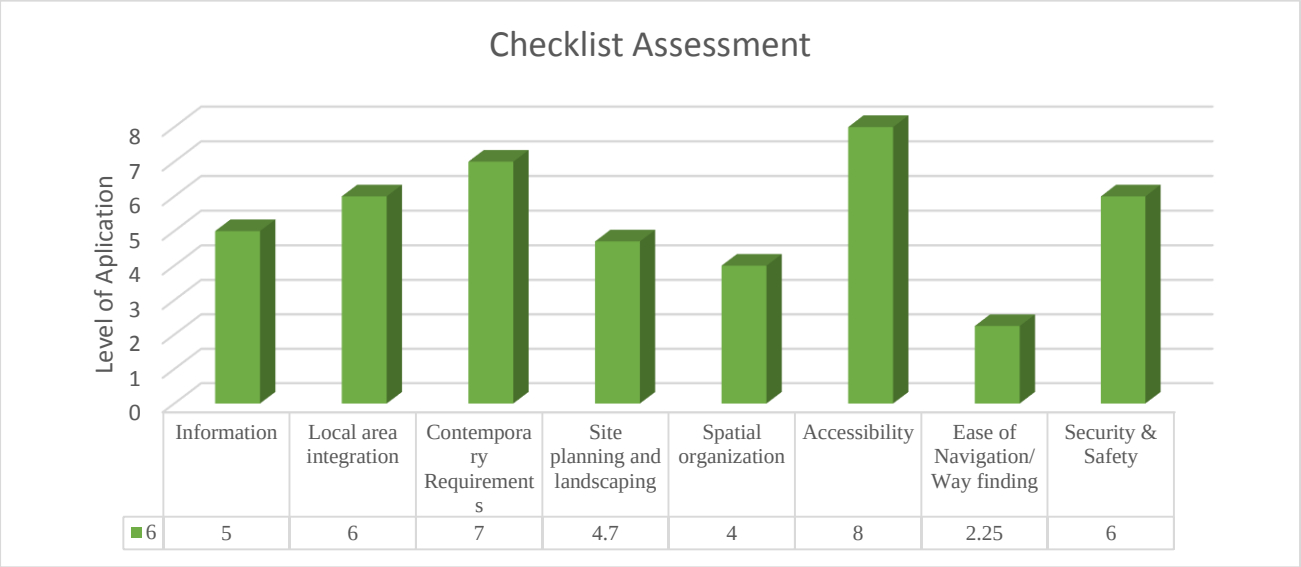


Figure 4.3: Frequency of scores of the observation assessment of Iddo Terminus station. Source: Field Study, 2016

From the above Figure 4.3, it can be deduced that the level of accessibility in Iddo terminus is good being the one with the highest score. There is high application of contemporary user requirements in the station such as restaurant, temporary accommodation, bank and so on.

The information variable display some adequacy, the Signage, and audio announcement were averagely use in the station, which would make it easier for passengers' to easy connect with facilities. However, suffers some inadequacies because symbol, tactile indicator and video are absence, making it difficult for those with physically challenge to locate facilities.

4.2.7 Questionnaire Related data

Aside the employment of observation survey using checklist for the assessment of the variables in the case study area, questionnaires were also administered to both the staff and the passengers that patronize the railway station. Numerical data obtained from questionnaire on integrating contemporary user requirements were analysed using simple frequencies, percentages and mean scores to identify and establish which of them are needful for contemporary railway stations. Using open-ended questions and 5 scale Likert responses, 120 questionnaires were distributed in Iddo terminus, Lagos state for the study, 93 were returned. Additionally, the following statistical procedure was employed to answer the research questions.

For research question one, (which addresses contemporary requirements which can be incorporated in the design of Jos railway station to increase its functionality), the staff and passengers were requested to indicate the functions they feel should be available in a railway station by ticking in the appropriate boxes provided in the questionnaires. Result obtained would be presented as simple counts and percentages. For this study, spaces/facilities are only considered satisfactory if their $scores\ are \geq 50\%$.

To address research question 2 concerning usability patterns of station users, two set of analysis were carried out. The first was to obtained Relative Important Index of every factor computed as a ratio of the sum of the actual total attainable Importance scores ($\sum$AIat) and the maximum possible attainable Importance score ($\sum$PAImax) on a 5 point Likert scale for each of the pattern used for the research, for each of this ($\sum$PAImax) is a multiplication of the highest attainable score of 5 (Very good) and the number of questionnaires analysed (Maina & Umar, 2015), in this case. ($i.e, 5 \times 93 = 465$)

Mathematically, this is expressed as:

$$RII=\Sigma AIat/\Sigma PAImax$$

A space is considered satisfactory if RII≥0.5 in this study. Furthermore, mean of responses across the railway station were computed in SPSS.

4.2.7.1 Passenger Characteristic data for Iddo Terminus station studied

Table 4.6 presents the analyses of the first part of the questionnaires asking demographic data (gender, age, nationality, journey purposed, occupation, and literacy level) in Iddo terminus station.

Table 4.6: Passenger Demographic data for Iddo terminus Station

Passenger Demographics		% of Iddo Railway Station Users	Comments
Age group	16-20	8.60	Station design should cater for all age groups.
	21-25	19.40	
	26-30	41.90	
	31-35	16.10	
	Above 36	14.00	
	Total	100.00	
Nationality	Indigenes	90.35	The amount of foreigners' patronage is insignificant to include foreign languages in the design of information systems.
	Foreigners	9.65	
	Total	100.00	
Journey Purpose	Business	49.10	This affects the comfort level of each category due to the purposes for the journey.
	Academic	20.20	
	Pleasure	15.40	
	Others	17.60	
	Total	100.00	
Occupation	Civil Servants	11.80	Identifying groups of users and their specific needs enhances usability.
	Small scale business	15.10	
	Students	38.70	
	Professional	19.40	
	Large scale business	15.10	
	Total	100.00	
Educational Qualification	WAEC	20.50	The level of literacy here enhances the information system.
	Diploma	11.80	
	OND	16.10	
	NCE	2.20	
	HND	9.70	
	Bachelor's Degree	29.00	
	Master's Degree	8.60	
	PhD	2.20	
	Total	100.00	

Figure 4.4 illustrates gender of users surveyed in Iddo terminus. It can be observed that majority of the users were male (65.6%) compared to their female counterpart (34.4%), the result indicated that male patronise the station more than their female counterpart.

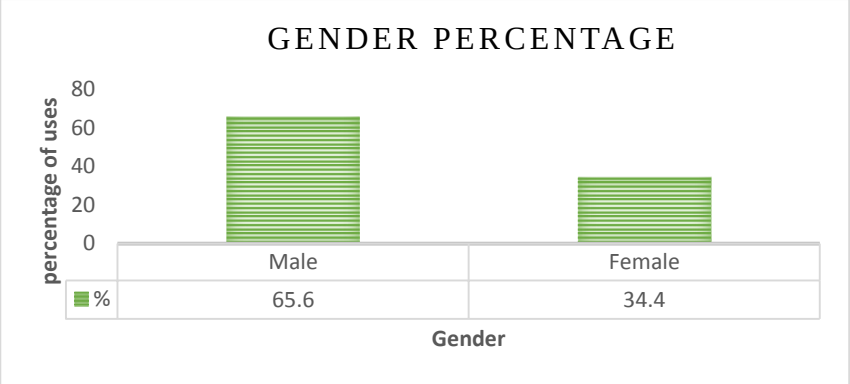


Figure 4.4: Gender of Railway Users in Iddo terminus Lagos. Source: Field Study, 2016

Fig. 4.5 below, shows that station design should cater for all age group since the variation amongst the age groups is not much as illustrated above. The only exception is that of (26-30) which score 41.9%, this shows high level of patronage which will be given due consideration in terms of the user facilities that will be made available in the proposed railway station design.

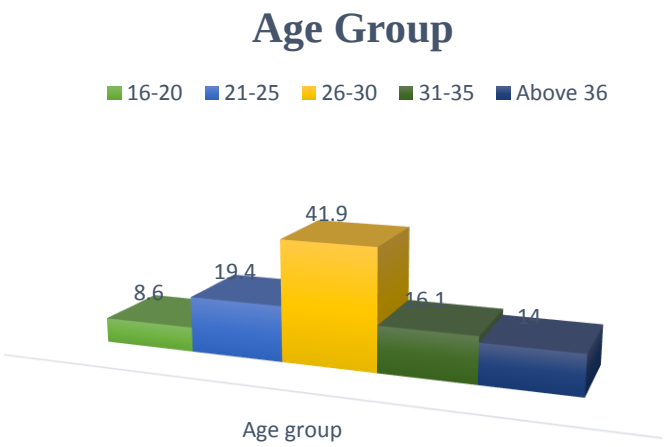


Figure 4.5: Gender of Railway Users in Iddo terminus Lagos. Source: Field Study, 2016

The results illustrated in Figure 4.6 below shows that 90% of users are Nigerian (Indigenes) that patronise the station and 10% users are foreigners. This implies that the number of foreigners is very low and therefore it is insignificant to incorporate foreign language in the information system of the station design.

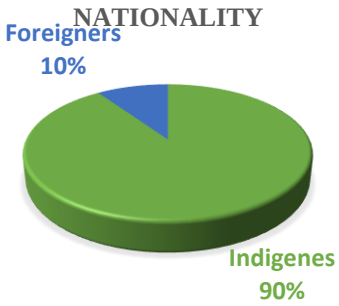


Figure 4.6: Nationality of Staff and Passengers. Source: Field Study, 2016

It also shows that (See Figure 4.7) the literacy level of users is average which indicated 29.9% degree holders, 19.4% secondary school graduates, 16.1% OND holders, 11.8% diploma holders, 9.7% HND holders, 8.6% M.Sc. holders, then 2.2% NCE and PhD holders. Therefore, this will influence and aid the information system in the design of the proposed station. The data will also help in determining how various user groups would use the station facilities that will be provided and made available, most especially, the signage placement and other information display mediums.

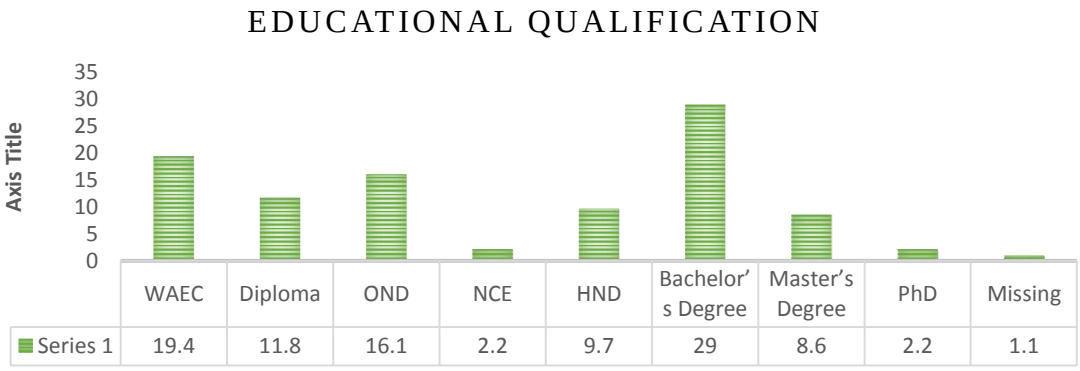


Figure 4.7: Educational Qualification. Source: Researcher (April, 2016)

The result illustrated (See Figure 4.8) below shows that 39.8% used public cars (bus) to arrive at the station, 20.4% used motor cycle, 19.4% used Keke Napep, 14.0% used private cars, this implies that there is a need to combined various technologies of transportation such as regional trains, light rails, buses, metros, taxis and so on in the design of the proposed station. Efficient parking spaces will be provided to avoid too much traffic congestion.

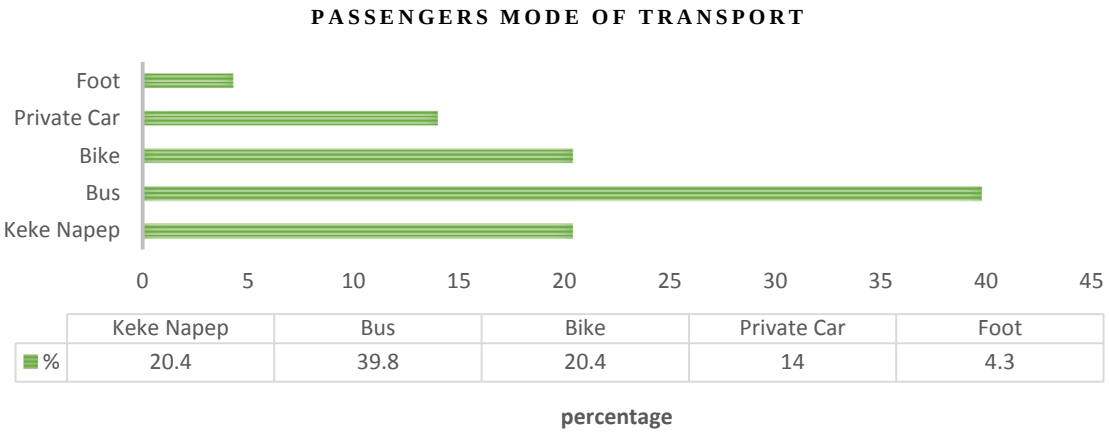


Figure 4.8: Passengers mode of transport to the station. Source: Field Study, 2016

4.2.8 Contemporary Requirements of Questionnaire Related Data

Table 4.7 below presented the list of Contemporary user Facilities used for the research, in order to find out which of them are satisfactory for the users?

Table 4.7: Contemporary User Requirements. Source: Field Study, 2016

S/N	Contemporary Facilities	Percentages %
1	Restaurant	94.6
2	ATM gallery	93.5
3	Kiosks	83.9
4	Restroom	82.8
5	V.I.P Lounge	79.6
6	Coffee Shops	78.5
7	Waiting rooms	77.4
8	Cafes	76.3
9	Temporary Accommodation	76.3
10	Staff offices	75.3
11	Newspaper shops	75.3
12	Pharmacy	74.2
13	Shops	73.1
14	Central Hall	72.0
15	Car rental office	67.7
16	Post office	67.7
17	Nursing mother lounge	67.7
18	Ticket gates	65.6
19	Currency exchange (Bank)	64.5
20	Dry cleaner Space	64.5
21	Retail outlet	62.4
22	Home care store	58.1
23	Security post	57.0
24	Store	57.0
25	Train office	36.6

Results from the questionnaires have helped to answer the first research question (which Contemporary User Facilities would be incorporated in the design of Jos railway station to increase its functionality?).

To answer this, any spaces/functions that $scores \geq 50\%$ are considered satisfactory in this study, the spaces that pass would be qualified for the proposed remodelling of Jos railway station. From the table above it was found out that the spaces/functions with the highest score are restaurant, ATM gallery, kiosks, and restroom with the following scores 94.6%, 93.5%, 83.9% and 82.8% respectively.

It shows that most of the respondents agree more with the provision of eatery facilities, coffee shops, and places where they can do their window shopping and conveniences.

From Figure 4.9 below shows the functions that are up to ≥50% were clearly illustrated and they can be employed as the design requirement in the redevelopment of Jos railway station. These spaces include; kiosks, offices, store, temporary accommodation, V.I.P lounge, central hall, ticket gate, waiting hall, newspaper shops, restaurant, car rental office, post office, dry cleaners, home care store, retail outlet, restroom, coffee shops, currency exchange(bank), nursing mother station, cafes, shops, pharmacy, ATM gallery, and public security post. Additionally, from the open-ended questions respondents mostly list the following spaces/functions that they feel should be available in railway station such as saloon, first aid unit, and hotel.

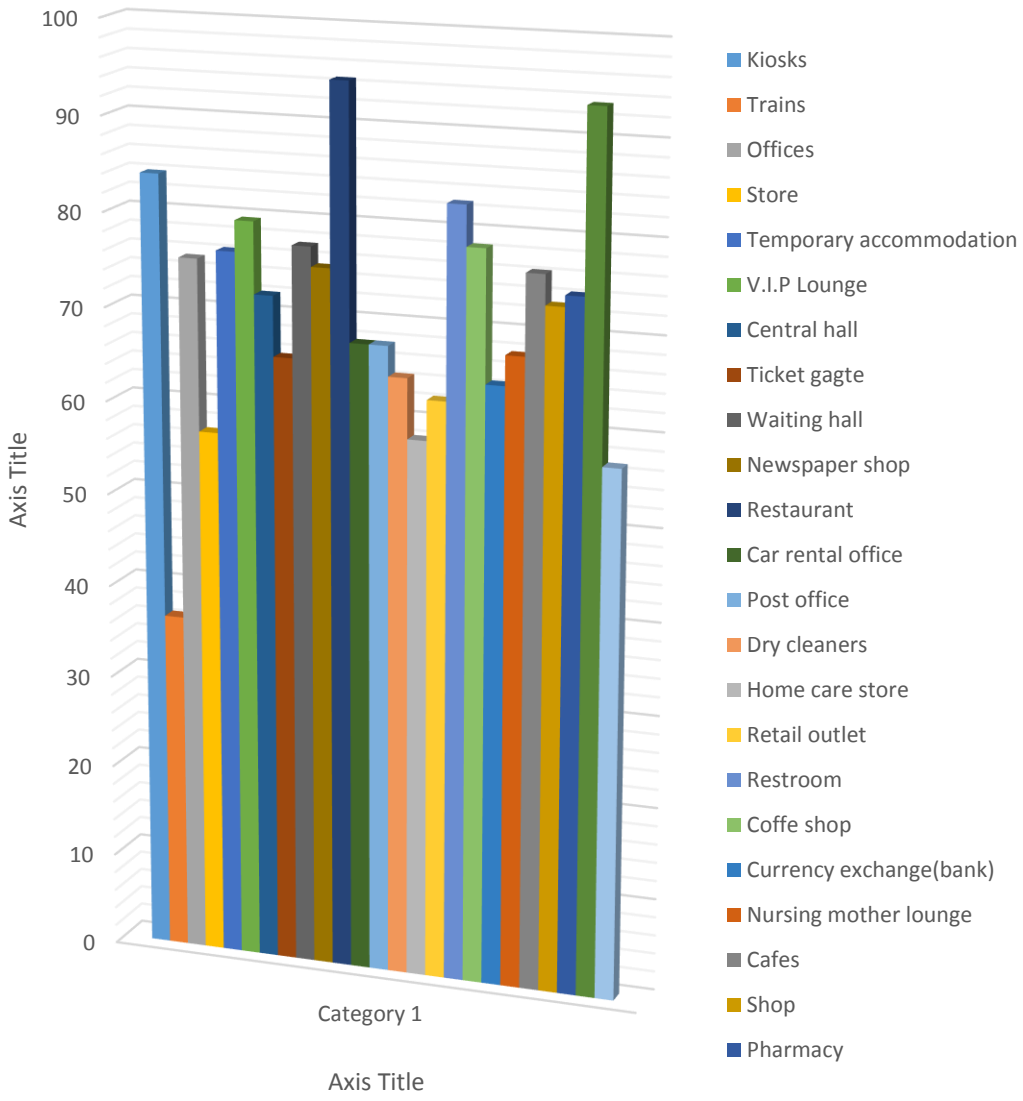


Figure 4.9: Contemporary User Facilities. Source: Field Study, 2016

4.2.9 Usability Pattern Questionnaire Related Data

Table 4.8 below shows the level of Importance of the respondents, relating to use pattern of the facilities in Iddo railway station as it affects their rate of patronage.

The (R.I.I) was used to determine the level of importance of each of the used pattern variable and it's derived from a formula. This entails a series of procedures taken-first; the average sum total of the attained importance scores was obtained, and then divided by the average maximum attained importance scores. This has been shown below:

R.I.I= $\sum AIat \div \sum PAImax$, this implies that R.I.I $= 306.4/465$ which is equal to 0.659

Table 4.8: Related Usability Pattern data for Iddo terminus station. Source: Field Study, 2016

S/N	FUNCTION	∑AIat	RII
1	Local area integration	347	0.747
2	Accessibility	331	0.711
3	Ease of navigation/ Way finding	331	0.711
4	Site planning and landscaping	327	0.703
5	Information	306.4	0.659
6	Security & Safety	301	0.648
7	Spatial Organization	298	0.641

Results from the Table 4.8 above further show that passengers within the Iddo terminus station agree more with employing local area integration with $\sum AIat$ value of 347 representing 0.747 R.I.I value, followed by accessibility and ease of navigation with the same $\sum AIat$ values of 331 representing 0.711; while site planing and landscape with $\sum AIat$ value of 327 representing 0.703. The variable with least R.I.I are information with $\sum AIat$ 306.4 representing 0.659, followed by security and safety with the $\sum AIat$ value of 301, representing 0.648 and finally spatial organisation with $\sum AIat$ value of 298, representing 0.641.

This shows that all the variables above will be considered satisfactory since they all score $R.I.I \geq 0.5$ and can be adopted for the proposed redevelopment of Jos railway station (See Figure 4.10).

PERFORMANCE RADAR CHART

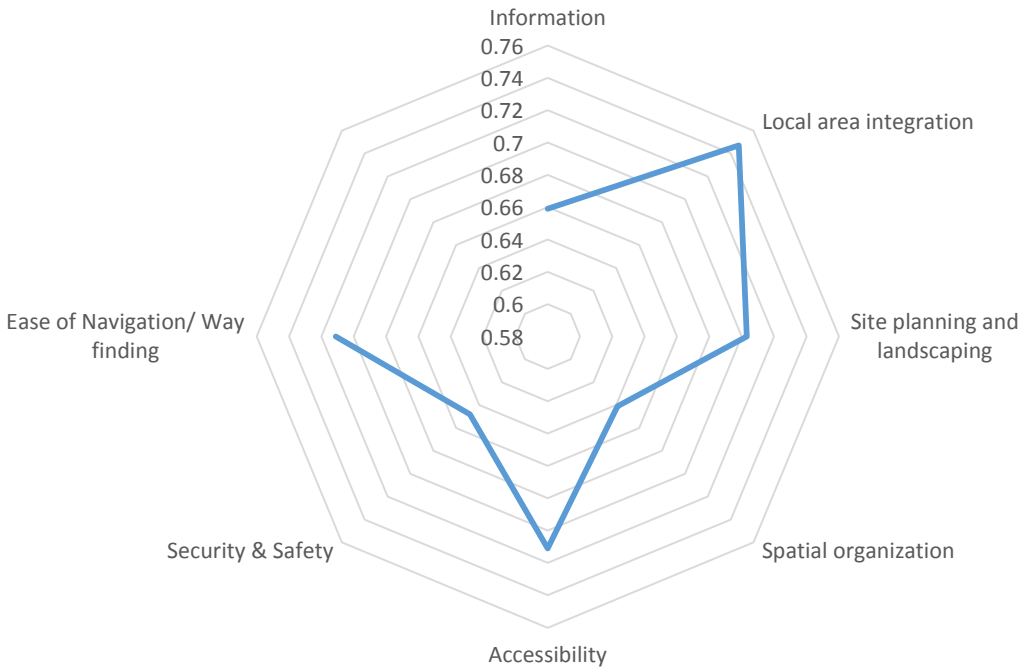


Figure 4.10: Usability Pattern Performance Radar chart. Source: Field Study, 2016

4.3 CASE STUDY II (Jos Terminus Station)

LOCATION: Jos, area of Plateau State, Nigeria

OWNERSHIP: Federal Government of Nigeria

CONSTRUCTION DATE: 1955

4.3.1 Brief History

The Jos railway station is located along Jos central business district, by Murtala Muhammad way, adjacent to Jos central main market and the old Jos University Teaching Hospital. It was commissioned by Sir Abubakar Tafawa Balewa in 1955. The site is easily accessible but too close to the main road with very small space for parking, as shown from Plate XXX below. It consists of two rail lines terminating at the station, originally built for mainly goods services.



Plate XXX: Approach at Murtala Muhammad Way. Source: Field Study, 2016

4.3.2 Facilities in Jos Terminus Station

The following were observed as the existing functional spaces and facilities in the main station area of the Jos terminus station (See Table 4.9): main concourse, ticket and booking office, goods shelf, canteen, south and north cabin, signal office, luggage and parcel unit, first and second class waiting rooms, public conveniences, long range "U' shaped station platform, station building office block (Train's office), security post, and Information and signal office.

Table 4.9: Characteristics of spaces studied in Jos Railway Station.

Spaces	Description	Location characteristics
Parking area	For both public and staff parking	Station front of house by the main entrance
Ticketing facility	Purchase of tickets by passengers	Located in the main station building
Concourse	General hall for passenger circulation and use	Adjacent to parking area
First class waiting area	Enclosed area with entertainment for passengers booked on first class	Adjacent to the station concourse along central corridor
Second class waiting area	Enclosed space for passengers booked on second class	On the platform adjacent the luggage and parcel unit
Platforms	"U' Shaped elevated concrete area for access to trains and short time waiting	Parallel to rail track
Information centre	Communication to the passengers	Located in the main station building
Restaurant and cafes	Refreshments & dinning	N/A
Accommodation	Temporary lodgment of passengers	N/A
Luggage and Parcel	Processing of passenger luggage & parcels	Between main concourse and platforms
Security unit	Security coverage & Insurance for safety	Located in the main station building
Conveniences	Passenger use	Outside the main station building
Lettable spaces	For commercial purpose	N/A

The Figure 4.11 below highlights the spaces in relation to spatial layout of the station.

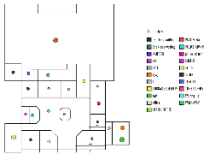


Figure 4.11: Jos terminus station map showing access roads to the precinct.
Source: Researcher (April, 2016).

4.3.2 Usability Pattern related Data (General Visual Observation)

This section presents data collected to enable the researcher answer the second research question (See Table 4.10)

Table 4.10: Usability Pattern related Data

Accessibility  Plate XXXI: Murtala Mohammed way. Source: Field Study, 2016	-It's accessed from Murtala Mohammed way and the Ahmadu Bello Way (Plate XXXI). This route serves as the major access for both vehicles and pedestrians stations. -Poor Connection with other mode of transport.
Spatial Organization  Figure 4.12: CAD Sketch of Jos Railway Station Layout. Source: Field Study, 2016	The spatial organization of Jos terminus station is similar to that of Iddo as they are both terminus station. An open concept layout was used for the main station building, which houses the ticket office, parcels office, canteen, police station, and the first class waiting hall, illustrated in Figure 4.12 below.
Ease of navigat  Plate XXXII: Double volume platform. Source: Field Study, 2016	Use of color coding and path makers in the station which will ease passengers' navigation. -Journey is not as seamless as expected. -signage placements were not Optimize. -Poor multiple access and exit points to platforms as only one access was provided (Plate XXXII). -Absence of landmark,
Local Area Integration  Plate XXXIII: Jos main market. Source: Field Study, 2016	-The station is very close to the JUTH and Jos main market (Plate XXXIII) -Footpaths, bike routes and public spaces are poorly integrated in Jos terminus. -Landscape design and public art are not integrated in Jos Terminus station.
Information  Plate XXXIV: Information Display Board in Jos Terminus Station. Source: Field Study, 2016	-Insufficient use of multiple format for Information including pictorial, symbols, audio announcement, tactile indicators and video announcement. (See Plate XXXIV). -Signages are not integrated in Jos terminus, which make commuters navigation difficult.
Safety and Security  Plate XXXV: Pedestrian Safety Bridge at Kaduna Station. Source: Field Study, 2016	Presence of police station at a corner of main concourse and the pedestrian cross over bridge (plate XXXV) to avoid direct crossing of train tracks. -Absence of security check-points at exit point to the platform.

4.3.3 Contemporary Requirements related data

This section presents data collected to enable the researcher answer the second research question (See Table 4.11)

Table 4.11: Contemporary User Facilities related Data

Ticketing office  Plate XXXVI: Ticket office located in the main concourse. Source: Field Study, 2016	-The ticketing booth is located at The centre of the main concourse (Plate XXXVIII). - The height of the counter can be Accessible by the physically challenged people. It is done manually.
Second class Waiting Hall  Plate XXXVII: The Jos station platform. Source: Field Study, 2016	-The waiting hall is shaded with a folded plate roof structure (See Plate XXXIX). The hall is open to the outside comprising fixed concrete seating and located very close to the main station concourse.
First class Waiting Hall	The Jos station first class waiting area was located adjacent to the ticketing booth located in the main concourse. It's completely enclosed and furnished with movable couches.
Platform Buildings  Plate XXXVIII: Platform at Lagos Station. Source: Field Study, 2016	The platform is a "U" shaped platform in (See Plate XL) and has two platforms for passengers. It houses the second class passengers and shaded by a folded plate roof structure. This is the main activity platform that accommodating arriving and departing passengers at the station. The platform is directly connected to the main station concourse and significantly poses considerable challenge in alighting and/or climbing the train.
Commercial Developments  Plate XXXIX: Hawking activities on Station platform Source: Field Study, 2016	Jos railway station is void of commercial activities except hawking activities which occurs at the waiting halls and platform before take-off (See Plate XLI).
Parking Areas  Plate XL: Jos Station Parking Space Source: Field Study, 2016	The Jos terminus station parking area is accessible directly from the Murtala Mohammed way. The parking space is tarred well defined and can only be used for the purpose of parking (See Plate XLII) but however the parking space is significantly small considering the population today.

4.3.4 Checklist for Assessment of Contemporary User Requirement in Jos Railway

Station (See Table 4.12). With the following assessment values (**5**-Execellent; **4**-Very good; **3**-Good; **2**-Fairly good; **1**-Poor**).**

Table 4.12: Checklist for the Assessment of the various variables relating to the Contemporary User Requirement in Jos Terminus.

S/N	Variables	Checklist	Level of Application					Remark
			1	2	3	4	5	
1	Information	Signage placement.						Absence of signage, symbol, audio announcement Etc. which make it difficult to locate facilities.
		Alternative information display systems.						
		Clarity of display and height of signage post.						
		Use of pictorial, symbols, audio announcement, tactile indicators and video.						
2	Local area integration	Connection of station to surrounding buildings.						Integration of station to its surroundings & other surrounding facilities is averagely good.
		Connection of station building to other supporting facilities.						
		Pedestrian connection to station building.						
3	Contemporary Requirements	V.I.P lounge, dry cleaners, coffee shops, newspaper shops, car rental outlet, post office, restrooms, shops						Absence of commercial activities Except hawking activities.
		Restaurant, cafes, bank, toilet, nursing mother lounge, offices, store, currency exchange unit, saloon.						
4	Site planning and landscaping	Use of soft landscape elements.						Absence of landscape elements.
		Use of hard landscape surfaces.						
		Consideration for future redevelopment/expansion.						
5	Spatial organization	Pedestrian means of circulation.						Undefined pedestrian routes. Poor zoning.
		Utilization of spaces and proper zoning of activities.						
6	Accessibility	Vehicular access to public spaces.						Tarred vehicular access road. Interior and exterior accessibility is poor.
		Pedestrian access.						
		Vertical access & universal design.						
		Visual access.						
		Access to manual ticketing.						
		Separation between front & back of house.						
7	Ease of navigation/ Way finding	Integration of interior & exterior transit routes.						Ease of navigation is very low.
		Connection of station to drop off/ pick up points						
		Use of colours to define space/function, Floor finish texture.						
8	Security & safety principles	Station security post.						Crossing of tracks to access station building unsafe. Station building not protected from harsh weather conditions.
		Staff presence						
		Lockable barriers						

The above Table 4.13 shows the checklist for the assessment of the various variables relating to the contemporary user requirement in Jos Terminus Station. Each variable and the various attached attributes were well studied before given the actual ranking.

The maximum score for any item per respondent is 5 (on a 5 point Likert scale with 1 for Very poor to 5 Excellent).

4.3.5 Discussion and Analysis of Results for Iddo Terminus station.

Table 4.13: Average scores for variables checked in Jos Terminus Station

S/N	VARIABLES	CHECKLISTS FREQUENCY OF SCORES/VARIABLE					AVERAGE SCORE/ VARIABLE	PERCENTAGE (%)
		1	2	3	4	5	(S/n)	
1	Information	1	2	1	0	0	2.0	4.0
2	Local area integration	0	2	1	0	0	2.7	5.3
3	Contemporary requirements	1	1	0	0	0	1.5	3.0
4	Site planning and landscaping	0	3	0	0	0	2.0	4.0
5	Spatial organization	1	1	0	0	0	1.5	3.0
6	Accessibility	0	3	3	0	0	2.5	5.0
7	Ease of navigation/ Way finding	0	3	1	0	0	2.25	2.25
8	Security & safety	1	1	0	1	0	2.3	4.7
	TOTAL	**13**	**13**	**7**	**0**	**0**	**16.35**	**27.65**

* (**S**- score value, **n**- number of sub-variables)

The result illustrated from Figure 4.13 shows the level of reflection of variable tested in Jos terminus station. It proved that the level of application of accessibility, security and safety and local area integration scores high; this was followed by information, site planning and landscaping. However, the level of application of contemporary requirement in Jos Railway Station is very low.

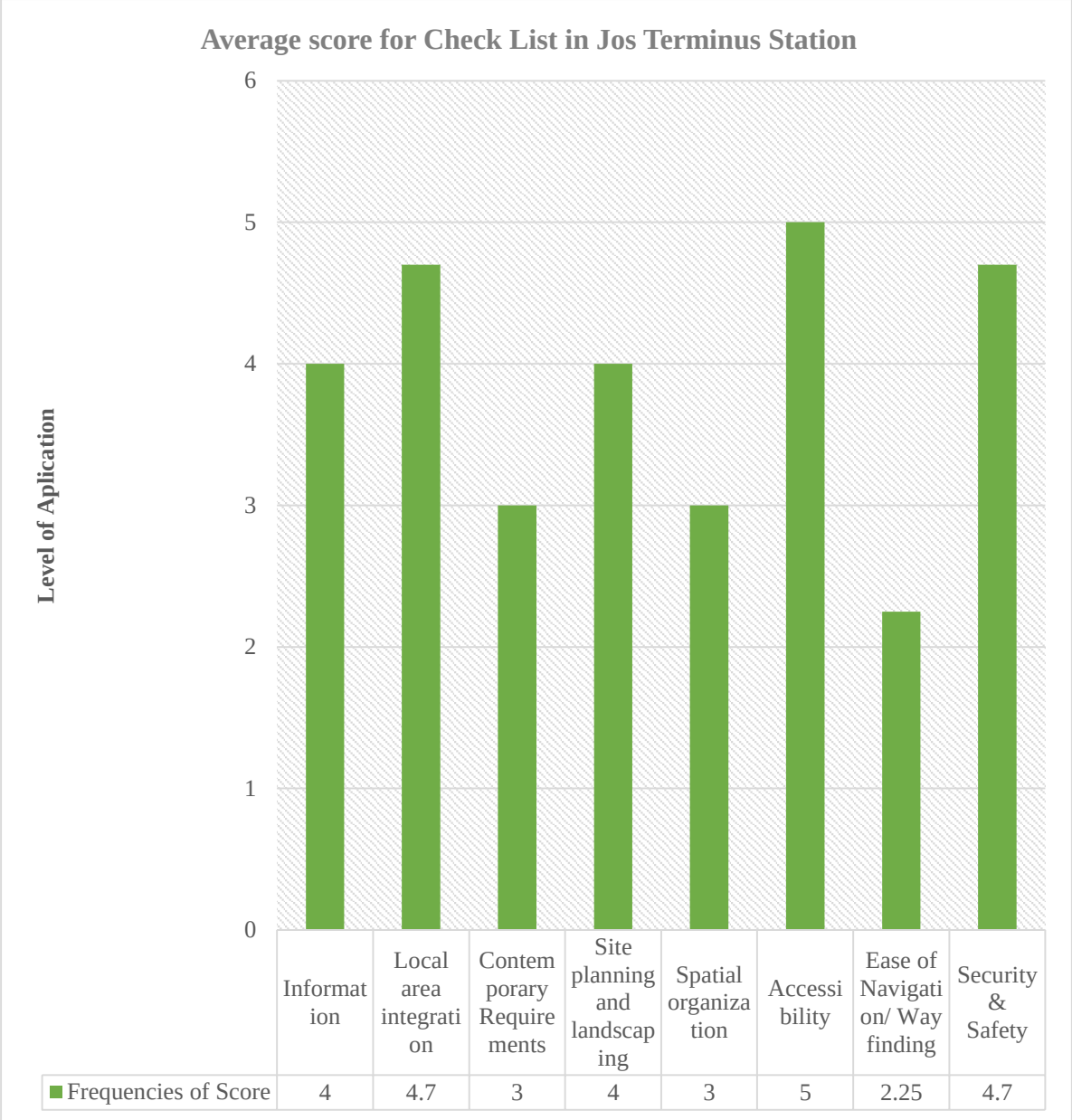


Figure 4.13: Frequency of scores of the visual assessment of Jos Terminus Station. Source: Field Study, 2016

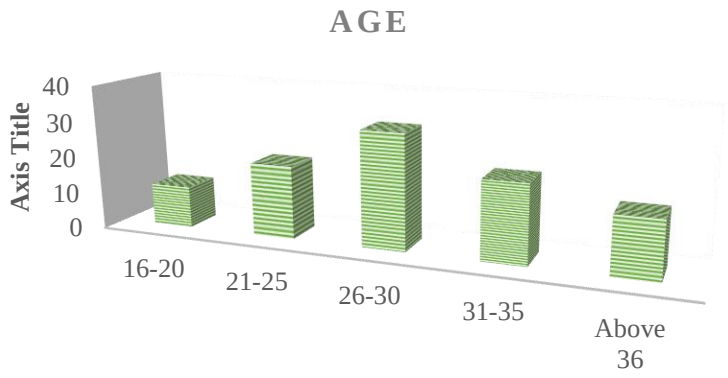
4.3.6 Questionnaire Related data in Jos Terminus

This section presents analyses of the first part of the questionnaire administered in Jos railway station (See Table 4.14). The section present the following variable; Age group, Nationality, Journey Purposed, Occupation, and Educational qualification.

Table 4.14: Passenger Characteristic data for Jos Terminus studied Source: Field Study, 2016

Passenger Demographics		% of Iddo Railway Station Users	Comments
Age group	16-20	11.4	Station design should cater for all age groups
	21-25	20.0	
	26-30	31.4	
	31-35	21.4	
	Above 36	15.7	
	Missing	0.0	
Nationality	Indigenes	65	The amount of foreigners patronage is insignificant to include foreign languages in the Design of information systems.
	Foreigners	4.0	
	Missing	1.0	
Journey purpose	Business	32.9	This affects the comfort principle
	Academic	25.7	
	Pleasure	18.6	
	Others	22.9	
	Missing	0.0	
Occupation	Civil Servants	15.7	Identifying groups of users and their specific needs enhances usability
	Small scale business	15.7	
	Students	28.6	
	Professional	25.7	
	Large scale business	14.3	
	Missing	0.0	
Educational qualification	WAEC	24.3	This affects the information principle
	Diploma	8.6	
	OND	27.1	
	NCE	2.9	
	HND	8.6	
	Bachelor's Degree	14.3	
	Master's Degree	8.6	
	PhD	4.3	
	Missing	1.4	

Figure 4.14 below, shows respondent age group in which majority of the users fall between all age group, with this respondent (16-20) representing 11.4%, (20-25) respondent representing 20%, (26-30) representing 31.4%, while (31-35) representing 21.4% and those that are above 36years representing 15.7%. This shows that averagely most of the respondents patronize the station. Therefore station design should cater for all age group.



	16-20	21-25	26-30	31-35	Above 36
AGE	11.4	20	31.4	21.4	15.7

Figure 4.14: Age Distribution in Iddo Terminus Lagos. Source: Field Study, 2016

The results presented in Figure 4.15 below shows that 92.7% users are indigenes that patronise the station and 5.7% users are foreigners. This implies that the number of foreigners is very low and therefore, its insignificant to incorporate foreign language in the information system of the station design.

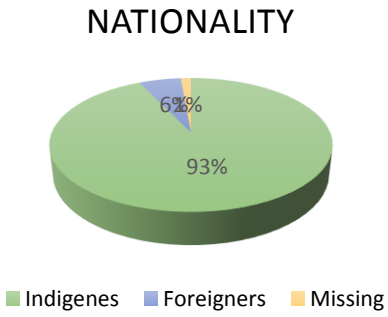


Figure 4.15: Nationality. Source: Field Study, 2016

It also shows that in Figure 4.16 below, that the literacy level of users is moderate, unlike Iddo terminus where there is a high patronage of elite. In Jos terminus 27.1% users are OND holders, 24.3% users are secondary school graduate, 14.3% users are degree holders, 8.6% users are HND and master's degree holders, while 2.9% users are NCE and 1.4% are PhD holders. Therefore, this will affect the information level in the design of the station.

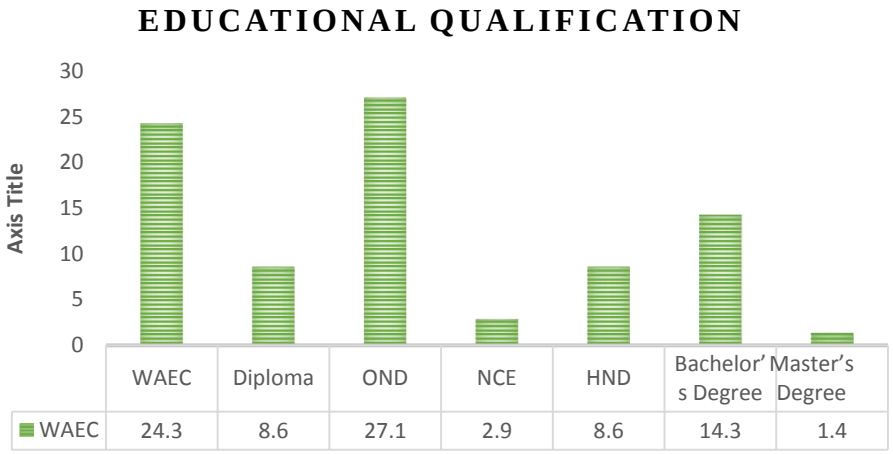


Figure 4.16: Educational Qualification. Source: Field Study, 2016

4.3.7 Passengers' Mode of Transport to the Station

The result presented in Figure 4.17 below shows that 39.8% use public cars to arrive at the station, 24.3% use keke napep, 18.6% use bike to arrive at the station, and 15.7% use private cars, while 8.6% comes by foot. This implies that there is a need to combine various means of transportation and improve vehicular and pedestrian path in the design of the proposed station. Efficient parking spaces and proper zoning should also be provided to avoid congestion.

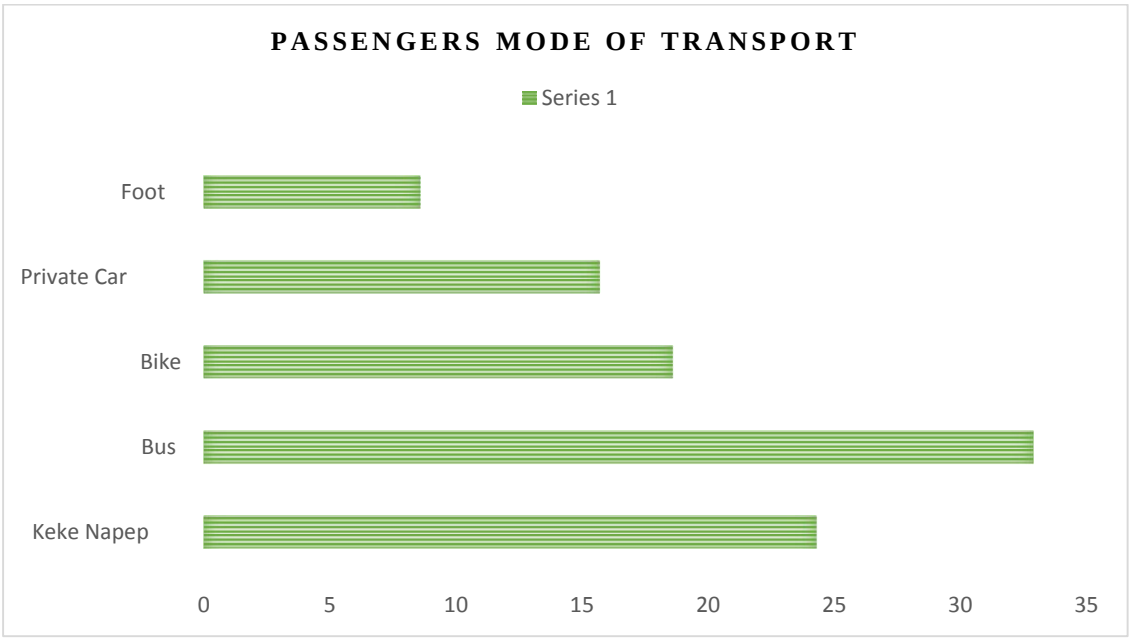


Figure 4.17: Passengers mode of transport to the station.
Source: Field Study, 2016

4.3.8 Contemporary User Facilities Questionnaire Related Data

Table 4.15 below is the list of contemporary User Facilities used for the research, in order to find out which of them are satisfactory for the users in Jos Terminus Station?

Table 4.15: Contemporary User Facilities. Source: Field Study, 2016

S/N	Contemporary Facilities	Percentages %
1	Restaurant	92.9
2	ATM gallery	87.1
3	V.I.P Lounge	85.7
4	Restroom	84.3
5	Kiosks	82.9
6	Waiting rooms	82.9
7	Car rental office	81.4
8	Coffee Shops	81.4
9	Temporary Accommodation	81.4
10	Newspaper shops	78.0
11	Cafes	75.7
12	Shops	75.7
13	Staff offices	74.3
14	Central Hall	72.9
15	Post office	72.9
16	Dry cleaner Space	72.9
17	Pharmacy	71.4
18	Store	68.6
19	Nursing mother lounge	65.7
20	Security post	65.7
21	Ticket gates	65.7
22	Retail outlet	64.3
23	Currency exchange (Bank)	62.9
24	Home care store	60.0
25	Train office	41.4

To answer the first research question, any space/functions that $scores \geq 50\%$ are considered satisfactory in this study, these spaces would be qualified for the proposed remodelling of Jos Railway Station. From Table 4.15 it can be deduced that the spaces/functions with the highest score are restaurant, ATM gallery, V.I.P lounge, restroom, waiting area, and temporary accommodation with the following scores; 92.9% representing restaurant, 87.1% representing ATM gallery, 85.7% representing

V.I.P lounge, 84.3% representing restroom while 82.9% represents waiting hall and 81.4% represents temporary accommodation, respectively.

The findings shows that most of the respondents agree more with the provision of eatery facilities, cash withdrawal ATM, V.I.P lounge, conveniences, large waiting hall, and temporary accommodation where they can spend their night (See Figure 4.18) .

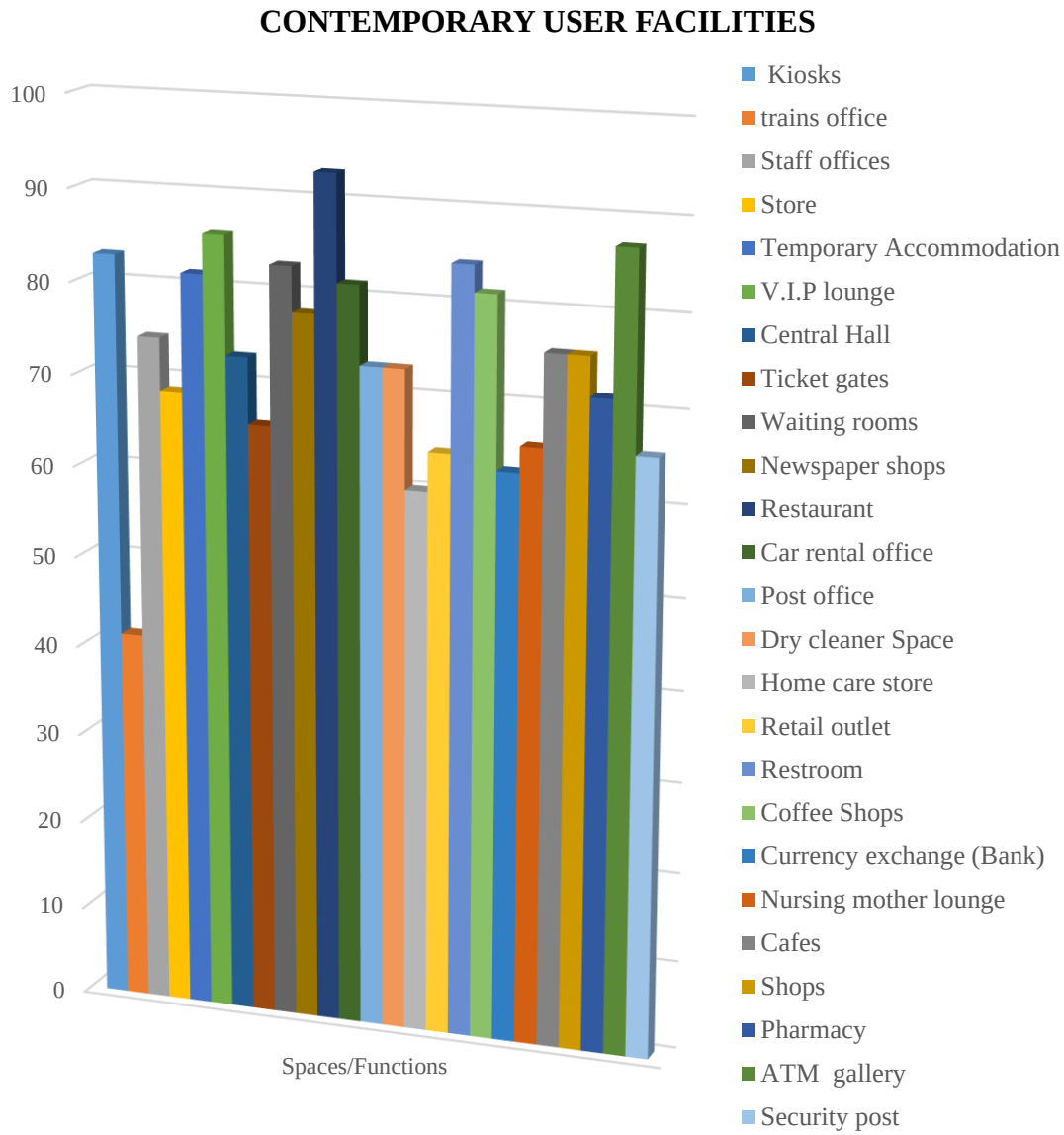


Figure 4.18: Contemporary User Facilities. Source: Field Study, 2016

From Figure 4.18 above the functions that are up to ≥50% were clearly illustrated in the bar chart and they can be used as design requirements in the redevelopment of Jos

railway station. These spaces include: kiosks, offices, store, temporary accommodation, V.I.P lounge, central hall, ticket gate, waiting hall, newspaper shops, restaurant, car rental office, post office, dry cleaners, home care store, retail outlet, restroom, coffee shops, currency exchange unit (bank), nursing mother station, cafes, shops, pharmacy, ATM gallery, and public security post.

Additionally, from the open-ended questions respondents mostly list the following spaces/functions that they feel should be available in railway station such as saloons, first aid and hotel.

4.3.9 Usability Pattern Questionnaire Related Data

Results from Table 4.16 below further shows that passengers within the Jos Terminus Station agree more with employing local area integration with $\sum AIat$ value of 278 representing 0.794 R.I.I value, followed by accessibility and ease of navigation with the same $\sum AIat$ values of 266, representing 0.759 while site planning and landscape with $\sum AIat$ value of 262 represents 0.749. The variable with least R.I.I are spatial organisation with $\sum AIat$ 252 representing 0.720, followed by information with the $\sum AIat$ value of 238 representing 0.683 and finally security and safety with $\sum AIat$ value of 234 representing 0.667

Table 4.16: Related Usability Pattern data for Jos Terminus Stations. Source: Field Study, 2016

S/N	FUNCTION	∑AIat	RII
1	Local area integration	278	0.794
2	Accessibility	266	0.759
3	Ease of navigation/ Way finding	266	0.759
4	Site planning and landscaping	262	0.749
5	Spatial organization	252	0.720
6	Security and safety	234	0.667
7	Security & safety	234	0.667

This proved that the above variable will be considered satisfactory since they all scores $R.I.I \geq 0.5$ and they can be adopted for the proposed redevelopment of Jos railway station, which is also presented in the performance Radar Chart (See Figure 4.19)

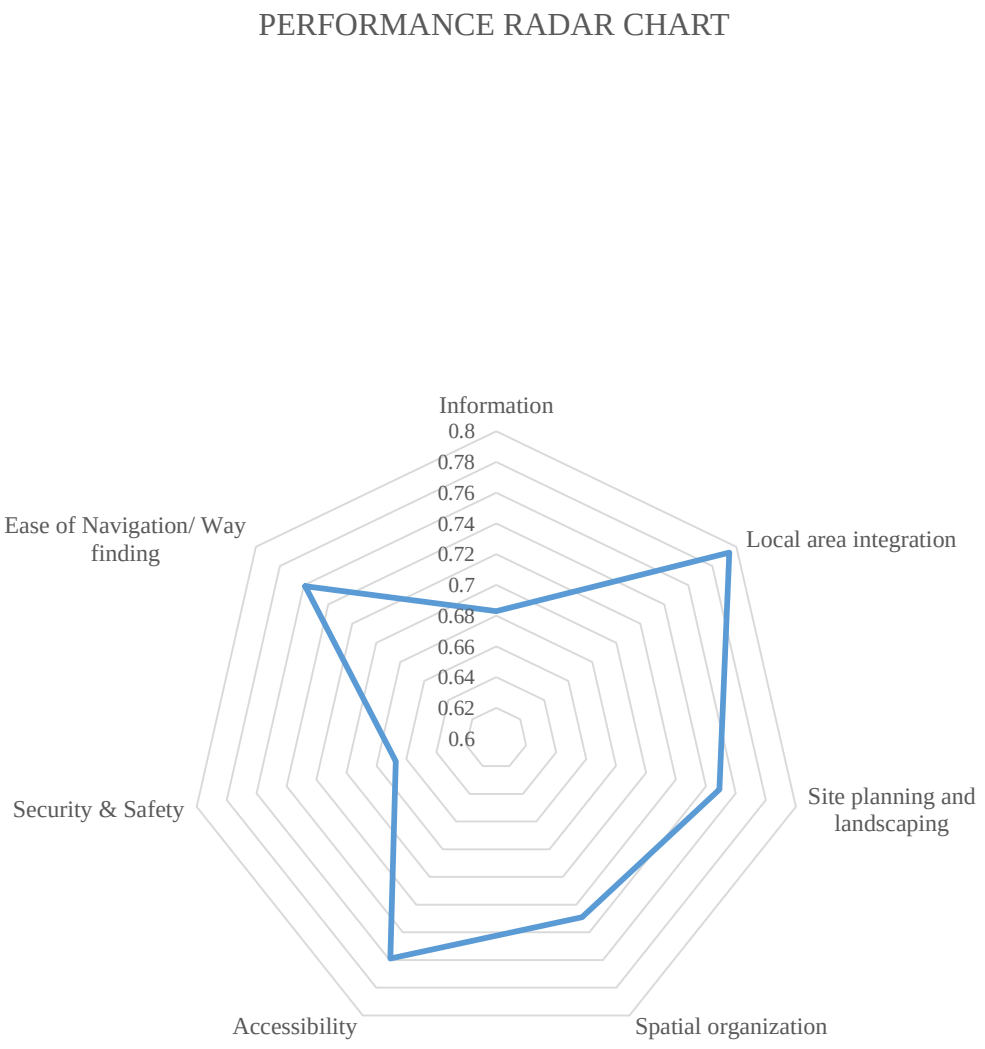


Figure 4.19: Usability Pattern Performance Radar Chart for Jos.
Source: Field Study, 2016

4.4 CASE STUDY III (Kauran Namoda Terminus Station)

LOCATION: Kaura, area of Zamfara State, Nigeria

OWNERSHIP: Federal Government of Nigeria

CONSTRUCTION DATE: 1926

4.4.1 Brief History

Kauran Namoda railway terminus is the point where the train terminates within Zamfara state (See Plate XLI). Kauran Namoda was a railway hub when trains ran regularly as it served as a major depot for agricultural produce like groundnuts and cotton as well as hides and skin among others, which were brought in from the hinterland for onward transportation to Lagos for export.



Plate XLI: Kauran Namoda Terminus Station. Source: Field Study, 2016

The return of trains on the route is certain to boost economic activities not only in Zamfara (Plate XLI) but also other states in the zone as some 14 villages would also benefit from the service, on board. Last 2015, the federal government announced plans to extend the rail line to neighbouring Niger Republic as part of efforts to enhance cross-border trade and restore the lost glory of the ancient city as a centre for rail activities in northern Nigeria. Many believe that easy movement of people and goods

around and out of the country would tremendously help in lifting the living standard of the people by reducing unemployment and poverty.

4.4.2 Facilities in Kaura Terminus

The following were observed as the existing functional spaces and facilities in the main station area of the Kauran Namoda terminus railway station (See Table 4.17).

I. Train office,
II. public conveniences
III. ticket office
IV. engineering office
V. drivers temporary lounge
VI. public relation department
VII. Signal cabin
VIII. Long range station platform.

Table 4.17: Characteristics of Spaces Studied in Kauran Namoda Station *(***Source**: (Moses 2014) modified by the Researcher.

Spaces	Description	Location characteristics
Parking area	For both public and staff parking	Station front of house by the main access
Ticketing facility	Purchase of tickets by passengers	Station front of house opposite the parking
Concourse	General hall for passenger circulation and use	N/A
First class waiting area	Enclosed area with entertainment for passengers booked on first class	N/A
Second class waiting area	Enclosed space for passengers booked on second class	Isolated on the same platform close to the ticketing area.
Platforms	Linear elevated concrete area for access to trains and short time waiting	Long range elevated area containing the train office
Information centre	Communication to the passengers	N/A
Restaurant and cafes	Refreshments & dinning	N/A
Accommodation	Temporary lodgment of passengers	N/A
Luggage and Parcel	Processing of passenger luggage & parcels	On the side platform adjacent the second class waiting hall
Security unit	Security coverage & insurance for safety	Isolated block at the north end of the platform
Conveniences	Passenger use	Isolated structure at the station premises
Lettable spaces	For commercial purpose	N/A

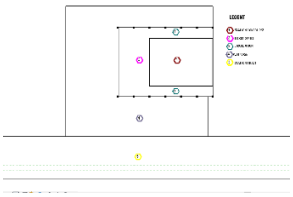
4.4.3 Contemporary Requirements related Data

Table 4.18: Contemporary Requirements related data. Field Study, 2016

Ticketing office  Plate XLII: Ticket Office. Source: Field Study, 2016	The ticket office is isolated in a separated building. The office is accessed directly from the parking space. The chief passenger booking agent (CPBA) is the person in charge. The ticketing system is a manual system similar to that of Jos and Iddo station in which the tickets are sold across a counter (See Plate XLII).
Second class Waiting Hall  Plate XLIII: Second class Waiting Hall. Source: Field Study, 2016	The waiting hall is an open platform structure (See Plate XLIII). The entire hall is open to the outside and has no seat attached to it.
First class Waiting Hall	The station does not make provision for first class passengers.
Platform Buildings  Plate XLIV: Station Platform. Source: Field Study, 2016	The station plat form is a linear platform and has single platforms for passengers. It houses the old second class waiting room (which is open). It's located adjacent to the ticket office (Plate XLIV).
Commercial Developments around Station	In Kaura station, no consideration was given to commercial facilities such as Shops, Restaurants, Saloon, Supermarkets, and so on except hawkers parading the station precinct.
Parking Areas  Plate XLV: Parking areas Source: Field Study, 2016	Parking area is accessible directly from the Stations Ticket office. The parking space is untarred not well defined and can only be used for the purpose of parking, as such the space is very rigid (See Plate XLV).

4.4.4 Usability Pattern related Data (General Visual Observation)

Table 4.19*:* Usability Pattern related Data (General Visual Observation)

Accessibility  Plate XLVI: Accessibility Source: Field Study, 2016	-Access to the station is through Kaura Katsina arterial major road. -There is unrestricted untarred access road to the Kauran Namoda railway station for taxi, buses and general public (See Plate XLVI). -Poor Connection with other mode of transport
Spatial Organization  Figure 4.20: Spatial organization Source: Field Study, 2016	The spatial organization of functions/spaces on site observed to be bad. Unlike Iddo and Jos terminus station, the station facilities and the station building appeared to be scattered. Generally, facilities spatial organization in the Kauran Namoda station is very poor (See Figure 4.20).
Ease of Navigation  Plate XLVII: Ease of navigation Source: Field Study, 2016	-There was no clear separation between front and back of house which made navigation In Kaura station difficult (See Plate XLVII). -Poor multiple access and exit points to platform.
Local Area Integration  Plate XLVIII: Image showing Poor Connection of Facility. Source: Field Study, 2016	-The station is very close to kaura polytechnic and health care centre located adjacent to the station. -Poor integration of footpaths, bike routes and public spaces. -Poor integration of public art and landscape (See Plate XLVIII).
Information	-Signages were not integrated in Kauran Namoda terminus which make commuters navigation difficult. -Insufficient use of multiple format for information including pictorial, symbols, Audio announcement, tactile indicators and vedio announcement.
Safety and security	-The pedestrian cross over bridge was not integrated, therefore these made the commuters to cross over track. -Absence of security check-points at exit point to the platform. -Police station was not integrated in Kaura Station.

4.4.5 Checklist for Assessment of Contemporary User Requirement in Kaura Terminus

Table 4.18 shows the checklist for the assessment of the various variables relating to the

Contemporary User Facilities in Kaura terminus station

Table 4.20: Checklist for Assessment of Contemporary User Facilities in Kaura Terminus. Field Study, 2016

(5-Execellent; **4**-Very good; **3**-Good; **2**-Fairly good; **1**-Poor**)**

S/N	Variables	Checklist	Level of Application					Remark
			1	2	3	4	5	
1	Information	Signage placement.	■					Absence of signage, symbol, audio announcement etc. which make it difficult to locate facilities
		Alternative information display systems.	■					
		Clarity of display and height of signage post.		■				
		Use of pictorial, symbols, audio announcement, tactile indicators and video	■					
2	Local area integration	Connection of station to surrounding buildings.		■				Integration of station to its surroundings & other surrounding facilities is very low.
		Connection of station building to other supporting facilities.	■					
		Pedestrian connection to station building.					■	
3	Contemporary requirements	V.I.P lounge, dry cleaners, coffee shops, newspaper shops, car rental outlet, post office, restrooms, and shops.	■					Devoid of commercial activities except hawking activities.
		Restaurant, cafes, bank, toilet, nursing mother lounge, offices, store, first currency exchange, saloon.	■					
4	Site planning and landscaping	Use of soft landscape elements.	■					Absence of landscape elements, Island platform not encouraging expansion.
		Use of hard landscape surfaces.		■				
		Consideration for future redevelopment/expansion.		■				
5	Spatial organization	Pedestrian means of circulation.		■				Undefined pedestrian routes. Poor zoning.
		Utilization of spaces and proper zoning of activities.	■					
6	Accessibility	Vehicular access to public spaces.	■					Untarred vehicular access road. Interior tom exterior accessibility is poor.
		Pedestrian access.	■					
		Vertical access & universal design.		■				
		Visual access.	■					
		Access to manual ticketing.						
		Separation between front & back of house.						
7	Ease of navigation/ Way finding	Integration of interior & exterior transit routes.	■					There is moderate ease of navigating.
		Connection of station to drop off/ pick up points.	■					
		Use of colours to define space/function.	■					
		Floor finishes texture.	■					
8	Security & safety Principles	Station security post.		■				Crossing of tracks to access station building unsafe. Station building not protected from harsh weather conditions.
		Staff presence.		■				
		Lockable barriers.	■					

The maximum score for any item per respondent is 5 (on a 5 point Likert scale with 1 for Very poor to 5 as Excellent).

4.4.6 Discussion and Analysis of Results for Kauran Namoda station.

Table 4.21: Average scores for variables checked in Kauran Namoda station. Field Study, 2016

S/N	VARIABLES	CHECKLISTS FREQUENCY OF SCORES/VARIABLE					AVERAGE SCORE/ VARIABLE (S/n)	PERCENTAGE (%)
		1	2	3	4	5		
1	Information	3	1	0	0	0	1.25	2.5
2	Local area integration.	2	1	3	0	0	1.3	2.6
3	Contemporary requirements**.**	2	0	0	0	0	1.0	2.0
4	Site planning and landscaping.	1	2	0	0	0	1.7	3.3
5	Spatial organization.	1	1	0	0	0	1.5	4.0
6	Accessibility.	4	2	0	0	0	1.3	2.6
7	Ease of navigation/ Way finding.	4	0	0	0	0	1.0	2.0
8	Security & safety.	1	2	0	0	0	1.7	3.3
	TOTAL	**13**	**13**	**7**	**0**	**0**	**18.85**	**22.3**

* (**S**- score value, **n**- number of sub-variables)

The result presented in Figure 4.21 shows the level of application of variable tested in Kaura terminus station. It shows that the level of application of spatial organisation, security and safety and site planning and landscape scores high- this is followed by accessibility, local area integration, information. However the level of application of contemporary requirement and ease of navigation has the lowest scores in the station.

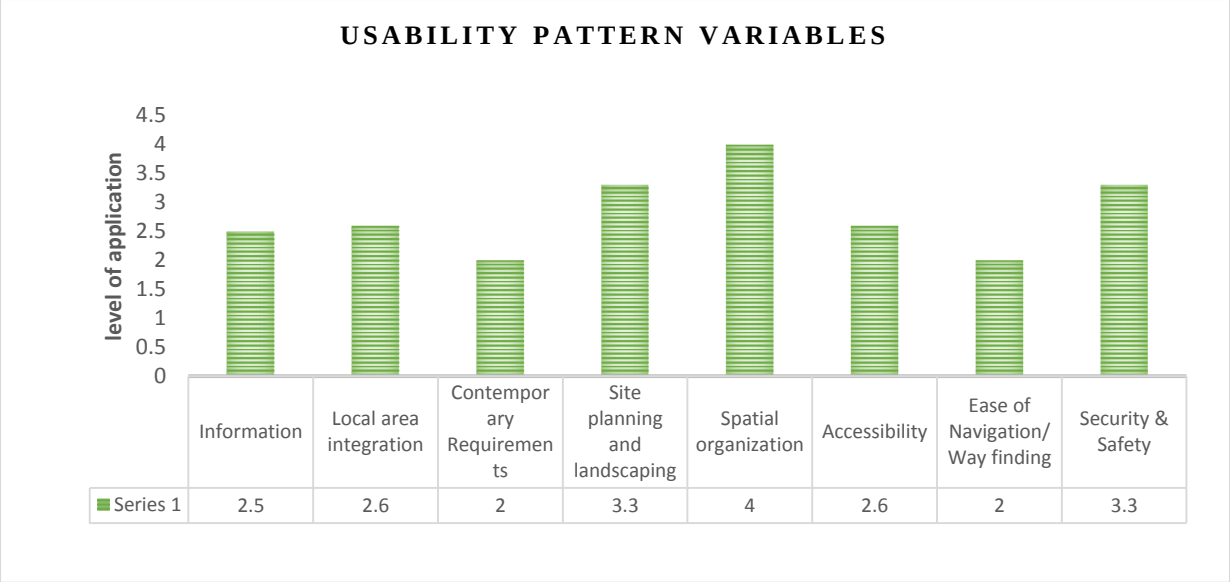


Figure 4.21: Frequency of Scores of the Visual Assessment of Kaura Terminus Station. Source: Field Study, 2016

4.4.7 Passengers' Mode of Transport to the Station

The result illustrated in Figure 4.22 above shows that 53.9% used public cars to arrive at the station, 15.4% used motor cycle, and private cars, while 7.7% used keke napep and foot. This implies that there is a need to combine various technologies of transportation and improving vehicular and pedestrian path in the design of the proposed station. Efficient parking spaces and proper zoning should also be provided to avoid congestion.

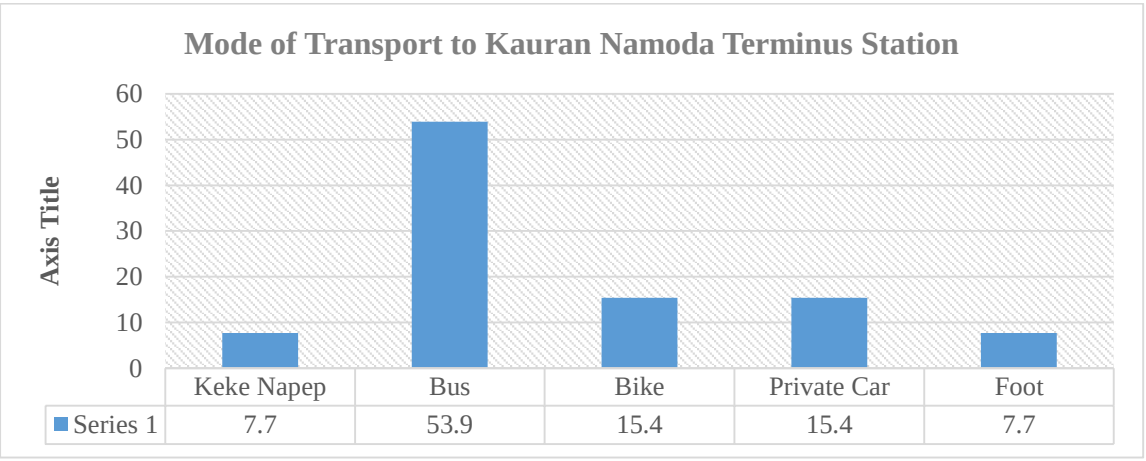


Figure 4.22: Passengers mode of Transport to the Station. Source: Field Study, 2016

4.4.8 Questionnaire Related data in Kaura Namoda Station

50 questionnaires were distributed in Kaura Namoda Station (See Table 4.22), Zamfara state Nigeria for the study, 39 were returned. Additionally, the following statistical procedure was employed to answer the research questions.

Table 4.22: Passenger Demographic data for Kaura Namoda Terminus Stations studied. Field Study, 2016

Passenger Demographics		% of Iddo railway Station Users	Comments
Age group	16-20	12.8	Station design should cater for all age groups
	21-25	23.1	
	26-30	28.2	
	31-35	15.4	
	Above 36	20.5	
	Total	100.0	
Nationality	Indigenes	94.9	The amount of foreigners patronage is insignificant to include foreign languages in the Design of information systems.
	Foreigners	5.1	
	Total	100.0	
Journey purpose	Business	41.0	This affects the comfort principle
	Academic	30.8	
	Pleasure	17.9	
	Others	0.3	
	Total	100.0	
Occupation	Civil Servants	7.	identifying groups of users and their specific needs enhances usability
	Small scale business	12.8	
	Students	30.8	
	Professional	23.1	
	Large scale business	25.6	
	Total	100.0	
Educational qualification	WAEC	25.6	This affects the information principle
	Diploma	12.8	
	OND	25.6	
	NCE	2.6	
	HND	15.4	
	Bachelor's Degree	15.4	
	Master's Degree	2.6	
	PhD	0.0	
	Total	00.0	

Table 4.22 above presented the gender of different users surveyed in the Kaura station. It shows that majority of the users (56.4%) were male compared to their female counterpart (43.6%), the result indicated that male patronise the kaura terminus station than the female, this is totally different from Iddo Jos terminus station.

4.4.9 Contemporary Requirements Questionnaire Related Data

In Table 4.23 below is the list of contemporary requirements used for the research, in order to find out which of them are satisfactory for the users?

Table 4.23: Contemporary User Facilities. Source: Field Study, 2016

S/N	Contemporary Facilities	Percentages %
1	Restaurant	97.4
2	Restroom	97.4
3	ATM gallery	92.3
4	Cafes	92.3
5	Pharmacy	87.2
6	V.I.P Lounge	87.2
7	Waiting rooms	87.2
8	Staff offices	87.2
9	Kiosks	84.6
10	Coffee shops	82.1
11	Currency exchange (Bank)	79.5
12	Central hall	79.5
13	Temporary accommodation	76.9
14	Post office	76.9
15	Dry cleaner Space	76.9
16	Ticket gates	76.9
17	Shops	76.9
18	Retail outlet	76.9
19	Newspaper shops	76.9
20	Car rental office	74.4
21	Home care store	71.8
22	Store	69.2
23	Nursing mother lounge	69.2
24	Security post	59.0
25	Train office	28.2

Spaces/functions that $scores \geq 50\%$ are considered satisfactory in this study, the spaces that pass would be qualified for the proposed remodelling of Jos railway station. From the table above it was found out that in Kaura Namoda station, restaurant and restroom have the highest scores, followed by ATM gallery and cafes with the same scores, then are followed by pharmacy, V.I.P lounge and waiting hall also have the same scores as shown in the table above. Then subsequent functions were then followed (See Figure 4.23).

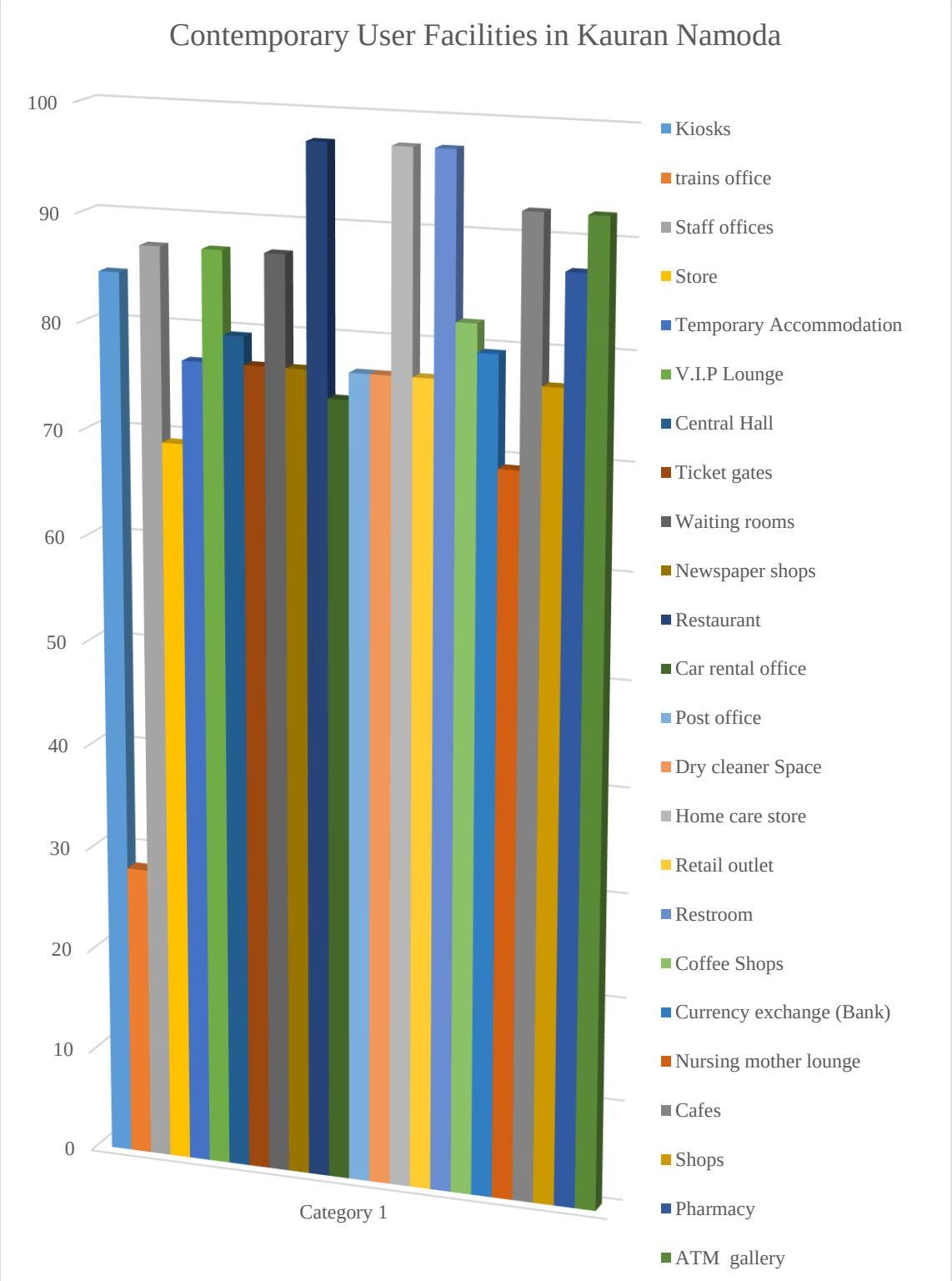


Figure 4.23: Contemporary user requirements in Kaura Station. Source: Field Study, 2016

4.4.10 Usability Pattern Questionnaire Related Data

Relative Importance Index (R. I. I) can be used to ascertain the research variable, which is a ratio of the sum of the total attained importance scores (∑AIat) and the maximum possible attainable importance score (PAImax) on a 5 point Likert scale for each of the pattern used for the research, for each of this (PAImax) is a multiplication of the highest attainable score of 5 (Very good) and the number of questionnaires analysed (Maina & Umar, 2015), in this case. $(i.e, 5 \times 93 = 465)$

Mathematically, the Relative Importance Index for each (R.I.I) is derived using the formula: $R.I.I = \sum AIat \div \sum PAImax$

Each of the use pattern is considered satisfactory if $R.I.I \geq 0.5$ in this study (See Table 4.24).

Table 4.24: Related Usability Pattern Data for Kauran Namoda Terminus Stations studied. Field Study, 2016

S/N	FUNCTION	∑AIat	RII
1	Spatial organization	169	0.867
2	Local area integration	157	0.805
3	Site planning and landscaping	155	0.793
4	Accessibility	149	0.764
5	Ease of Navigation/ Way finding	144	0.740
6	information	123	0.676
7	Security & Safety	129	0.659

Results from Table 4.24 above further show that passengers within the Kaura station agree more with employing spatial organisation with $\sum AIat$ value of 169 representing 0.867 R.I.I value, followed by Local area integration with $\sum AIat$ values of 157 representing 0.805 these are followed by site planning and landscape with $\sum AIat$ value of 155 representing 0.793. The variable with least R.I.I are accessibility with $\sum AIat$ 149 representing 0.764, followed by ease of navigation with the $\sum AIat$ value of 144

representing 0.740, information with $\sum AIat$ value of 123 representing 0.676 and finally safety and security with $\sum AIat$ value of 129 representing 0.659

This shows that all the above variable satisfied the condition and they will be considered satisfactory since they all scores $R.I.I \geq 0.5$ and they can be adopted for the proposed redevelopment of Jos railway station. Which are further presented in the performance Radar Chart (See Figure 4.24)

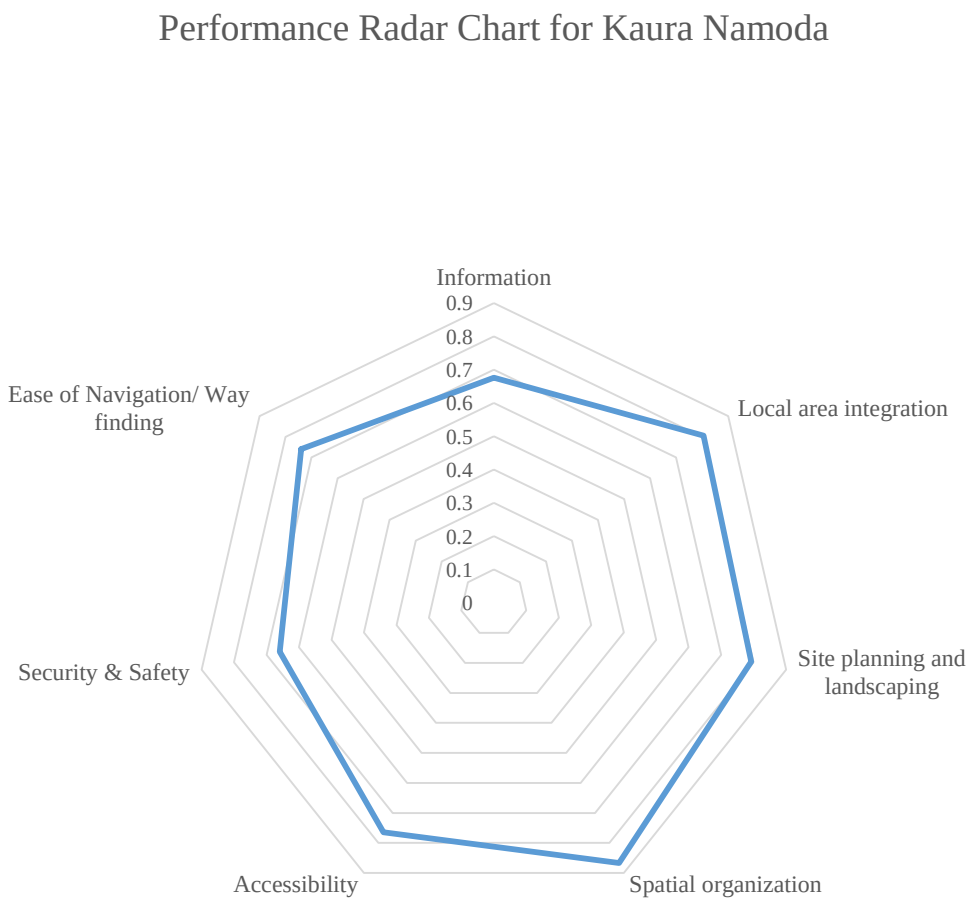


Figure 4.24: Usability Pattern Performance Radar Chart. Source: Field Study, 2016

5.0 DISCUSSION ON FINDINGS

5.1 Introduction

This chapter gives more detailed explanation of issues relating to the data presentation and analysis which helps in articulating those issues emanating from the analysis with respect to their implications on the subject of investigation.

5.1.1 Demographic Distribution of Respondents

The demographic characteristics of respondents across the three Terminus Stations are given below. This includes variables such as the gender, age group, nationality, journey purpose, occupation and educational qualification.

5.1.2 Gender of the Respondents in The three Case Studies

Table 5.1 presented the gender of respondents surveyed in the respective Terminus Station. It can be observed that majority of the respondents, about 44 representing (63%) were male compared to their female counterparts which are 24 representing (37%); the result is almost similar when looking at the individual stations in terms of percentage (See Figure 5.1).

Table 5.1: Gender of the Respondents' Source: Field Study, 2016

Passenger Demographics		93 Respondent in Iddo Railway Station	70 Respondent in Jos Railway Station	39 Respondent in Kaura Railway Station	Average for the three Terminus Station
Gender	Male	62 (65.6%)	47 (67.1%)	22 (56.4%)	**44 (63%)**
	Female	32 (34.4%)	23 (32.9%)	17 (43.6)	**24 (37%)**

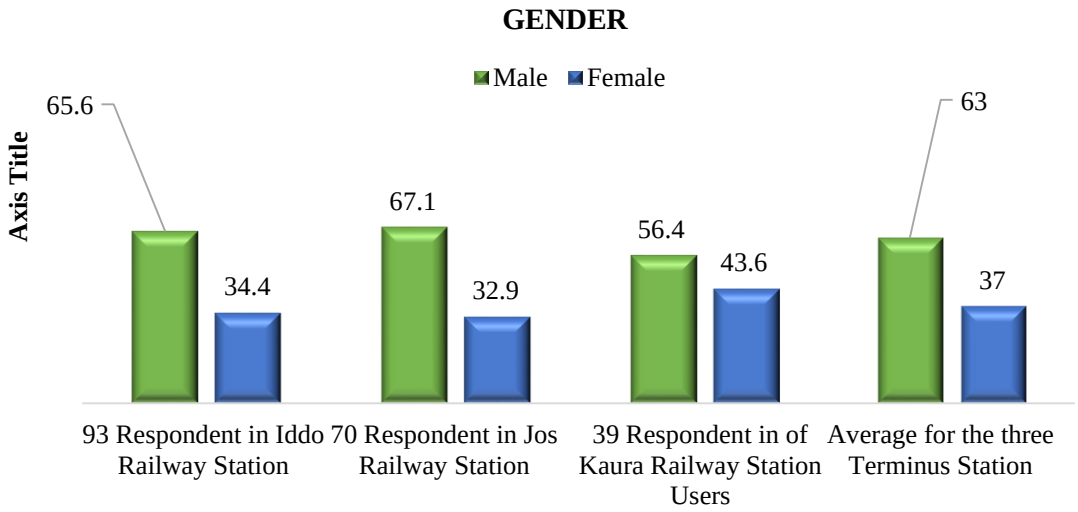


Figure 5.1: Gender Distribution. Source: Field Study, 2016

5.1.3 Respondents' Age group

Table 5.2 shows the slight difference in average percentages of respondents that fall within the age bracket of 26-30 with 24 (31.4%), followed by the age bracket 21-25 with 14 (20.8%); 12 respondents representing 17.6% fall within the age bracket 31-35. The least percentages of the respondents fall within the age bracket above 36 with 11(12.6%) and 16-20 with 7(11%). This indicated that Station design should provide user facilities that would cater for all age groups since the percentages of each age bracket is reasonable (See Figure 5.2).

Table 5.2: Respondents' Age Group. Source: Field Study, 2016

Respondents 'Age group	93 Respondents in Iddo Railway Station	70 Respondents in Jos Railway Station	39 Respondents in Kaura Railway Station	Average for the three Terminus Station
Age group				
16-20	8 (8.6%)	8 (11.4%)	5 (12.8%)	7 (11%)
21-25	18 (19.4%)	14 (20%)	9 (23.1%)	14 (20.8%)
26-30	39 (41.9%)	22 (31.4%)	11 (28.2%)	24 (31.4%)
31-35	15 (16.1%)	15 (21.4%)	6 (15.4%)	12 (17.6%)
Above 36	13 (14%)	11 (15.7%)	8 (20.5%)	11 (12.6)

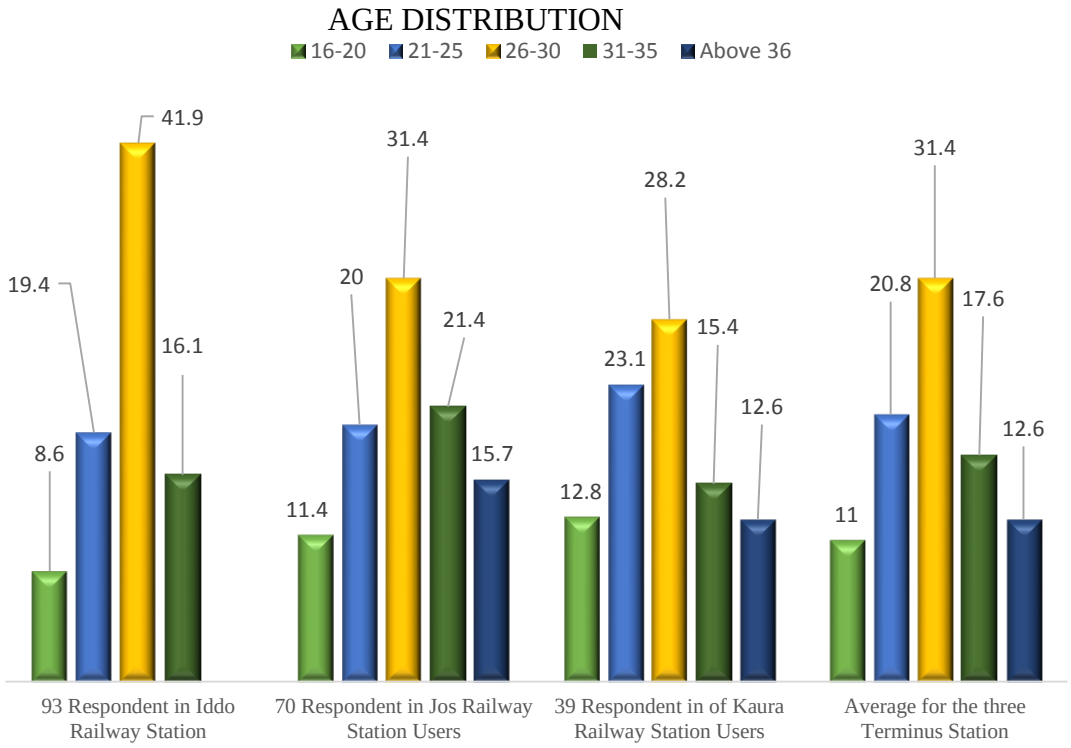


Figure 5.2: Age Distribution. Source: Field Study, 2016

5.1.4 Respondents' Nationality

Table 5.3 presented respondents Nationality with 57, (representing 66%) indigenes. Others were foreigners 4(5.6%).This has shown that majority of passengers that patronise the station are Nigerian citizens with only a minimal number of foreigners as many of them prefer using airports that have better contemporary user facilities, this underscore the importance of integrating contemporary user facilities within modern Nigeria Railway Station (See Figure 5.51).

Table 5.3: Respondents' Nationality. Source: Field Study, 2016

Respondents' Nationality		93 Respondents in Iddo Railway Station	70 Respondents in Jos Railway Station	39 Respondents in Kaura Railway Station	Average for the three Terminus Station
Nationality	Indigenes	82(88.7%)	55(78.6%)	35 (89.7%)	57 (66%)
	Foreigners	7 (7.5%)	3 (4.3%)	2 (5.1%)	4 (5.6%)

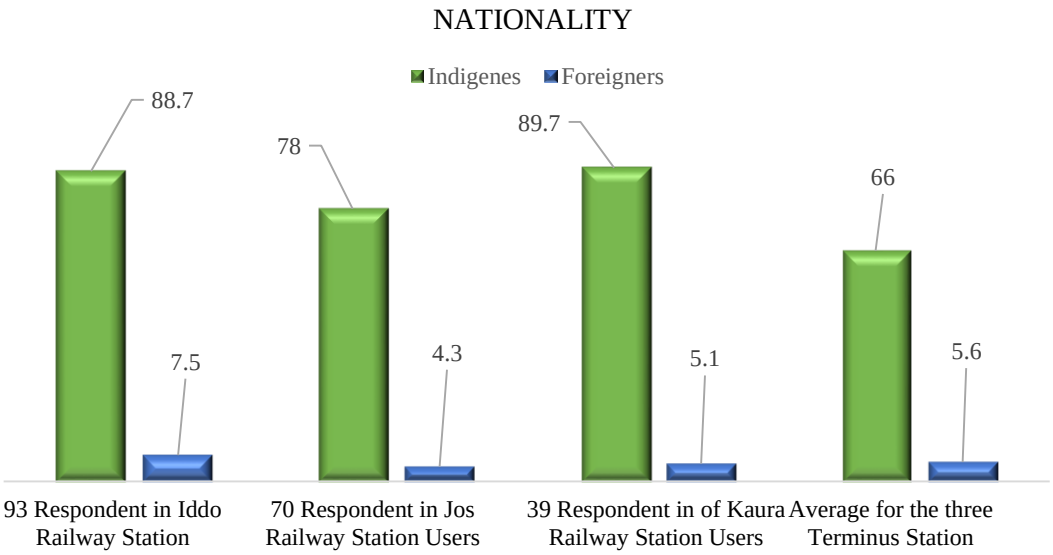


Figure 5.3: Nationality. Source: Field Study, 2016

5.1.5 Respondents' Journey Purposes

The results shows (See Table 5.4) that majority of respondents 28, (representing 41.1%) patronises the station for business purposes. Others use it for academic reason 15(24.2%), while pleasure and others each accounted for 11(16.7%).Statistics has shown that majority of the users that patronised the station are those that travelled for business purposes. However this had been undermined within the Railway Stations when there is no provision for contemporary user Facilities that would aid or cater for this. It's obvious that globalization is fast spreading and the world is becoming more digital, hence business transactions and decisions are being made quickly. Thus businessmen demand for additional services such as banks, ATM gallery, currency exchange accommodation, shopping facilities and to connect with other mode of transport in a seamless and convenient way. This affects the comfort level of each category of the respondents due to their purpose of journey (See Figure 5.4).

Table 5.4: Respondents' Journey Purposes. Source: Field Study, 2016

Respondents' Journey Purpose		93 Respondents in Iddo Railway Station	70 Respondents in Jos Railway Station	39 Respondents in Kaura Railway Station	Average for the three Terminus Station
Journey Purpose	Business	46 (49.5%)	23 (32.9%)	16 (41%)	**28 (41.1%)**
	Academic	15 (16.1%)	18 (25.7%)	12 (30.8%)	**15 (24.2%)**
	Pleasure	14 (15.1%)	12 (17.1%)	7 (17.9%)	**11 (16.7%)**
	Others	16 (17.2%)	12 (17.1%)	4 (10.3%)	**11(16.7%)**

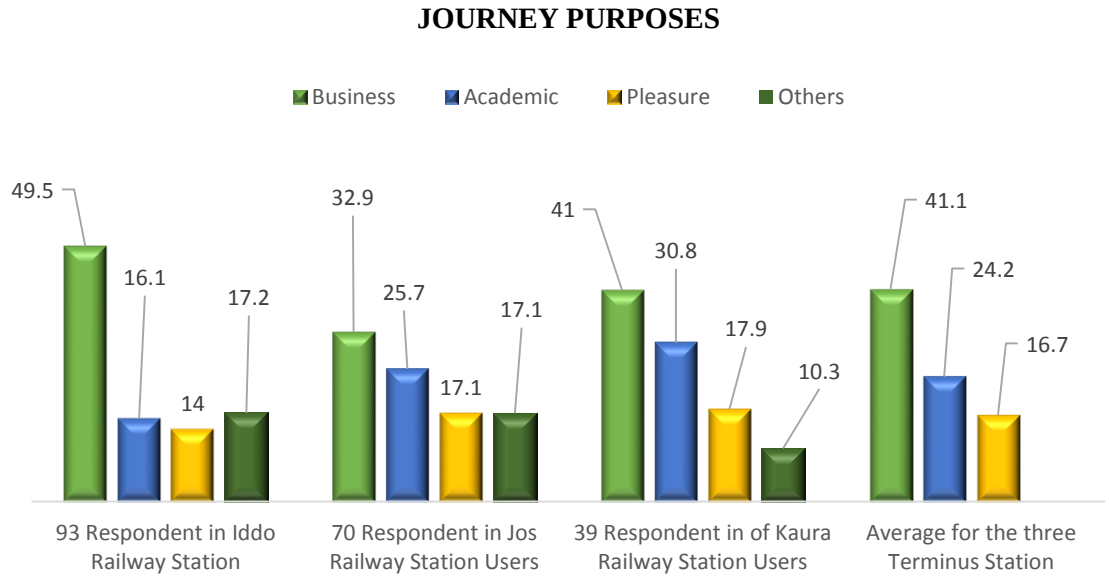


Figure 5.4: Journey purposes. Source: Field Study, 2016

5.1.6 Respondents' Occupation in the three Case Studies

Data from questionnaires (See Table 5.5) show that respondents representing 9 (11.7%) were civil servants, 10 respondents representing 14.5% belong to small and medium enterprises (SMEs), while 12 respondents representing 18.3% were mainly students. Other 15 respondents representing 22.7% are professionals, while 23 respondents representing 32.7 % engage in large scale business (See Figure 5.5).

Table 5.5: Respondents' Occupation Source: Field Study, 2016

Respondents' Occupation		93 Respondents in Iddo Railway Station	70 Respondents in Jos Railway Station	39 Respondents in of Kaura Railway Station Users	Average for the three Terminus Station
Occupation	Civil Servants	11 (11.8%)	11 (15.7%)	3 (7.7%)	9 (11.7%)
	Small scale business	14 (15.1%)	11(15.7%)	5 (12.8%)	10(14.5%)
	Students	14(15.1%)	10(14.3%)	10(25.6%)	12(18.3%)
	Professional	18(19.4%)	18 (25.7)	9 (23.1%)	15(22.7%)
	Large scale business	36 (38.7%)	20 (28.6%)	12(30.8%)	23(32.7%)

This identified groups of users and their specific needs, which would trigger the architects to establish a safe, efficient, affordable and seamless intermodal transport system in line with global best practices while creating an enabling environment that would enhances usability pattern.

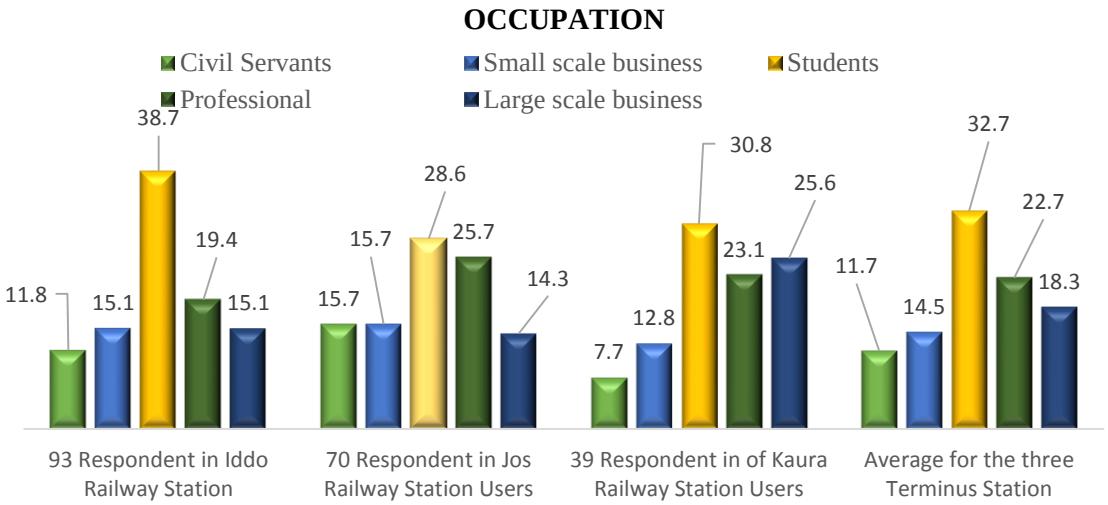


Figure 5.5: Occupation. Source: Field Study, 2016

5.1.7 Educational Qualification of the respondents'

The results on Table 5.6 shows that 15 respondents, representing the highest occurrence of 22.5% obtained OND (Ordinary National Diploma) and WAEC (West African Examination Council school certificate), followed by 14 respondents representing 18.6% with bachelor's degree, while Diploma and HND (Higher National Diploma) each account for 7 respondents (11.2%). Other 5 respondents representing 6.6% were

master's degree holders while PhD and NCE account for 2 respondents (2.6%). However, the respondent's with the highest qualification are those with OND (22.5%), meanwhile the least score is (2.2%) for both NCE and PhD. The general response shows that majority of the respondents in the three study area are literate (See Figure 5.6). This would affect the modern information system (audio, visual, Signages, pictures, colour coding etc.).

Table 5.6: Educational Qualification of the Respondents' Source: Field Study, 2016

Educational Qualification of the respondents		93 Respondents in Iddo Railway Station	70 Respondents in Jos Railway Station	39 Respondents in in Kaura Railway Station	Average for the three Terminus Station
Educational Qualification	WAEC	18 (19.4%)	15 (21.4%)	10 (25.6%)	**15(22.1%)**
	Diploma	11 (11.8%)	6 (8.6%)	5 (12.8%)	**7 (11.2%)**
	OND	15 (16.1%)	18 (25.7%)	10 (25.6%)	**15(22.5%)**
	NCE	2 (2.2%)	2 (2.9%)	1 (2.6%)	**2 (2.6%)**
	HND	9 (9.7%)	6 (8.6%)	6 (15.4%)	**7 (11.2%)**
	Bachelor's Degree	27 (29%)	8 (11.4%)	6 (15.4%)	**14(18.6%)**
	Master's Degree	8 (8.60)	6 (8.6%)	1 (2.6%)	**5 (6.6%)**
	PhD	2 (2.2%)	3 (4.3%)	0 (0%)	**2 (2.2%)**

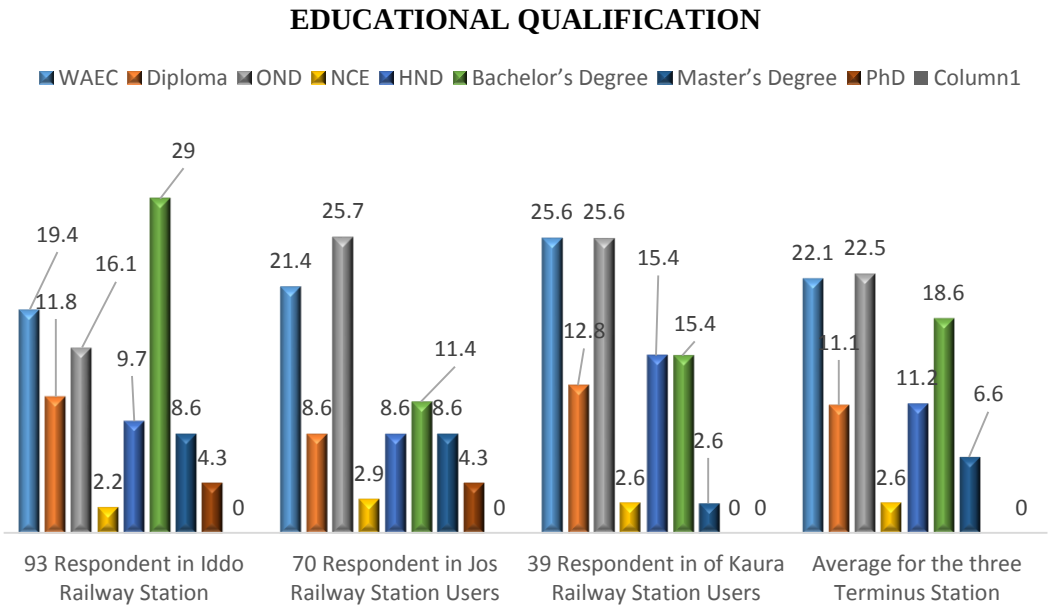


Figure 5.6: Occupation. Source: Field Study, 2016

5.2 Passengers' mode of transport to the station

Table 5.7 below shows how passengers get to the various Terminus Stations from their various locations. The result also illustrated in Figure 5.7 shows the average scores in percentage for the three stations; from the analysis it reveals that 42.2% used public transit to arrive at the station, 18.1% used motor cycle to get to the station, while 17.5% used Keke Napep and 6.9% used private cars to reach to the station (See Figure 5.55). Statistic has shown that most of the passengers prefers to use bus as means of transport to get to the station, with a percentage of 37.6%, 32.9% and 53.9% for case study one, two and three respectively. Result also shows that passengers going to the station by foot have the least means of transportation with percentages of 4.3%, 8.6% and 7.7% and an average of 6.9% in case study one, two and three respectively. This presented the need that architects should design station facilities to integrate with surrounding public spaces with human scale, landscape design and public arts, and also develop an integrated network of streets footpaths, bike routes and public space that would connect with the urban city. Other findings shows 20% of users use Tri cycle, 17.1% use motor cycle and 14% use private cars, this initiate the need to integrate various means of transport, which coincides with earlier findings that most passengers travel for business purposes and might therefore, required efficient transportation system that would convey them and their freight in a convenient and seamless way. Data obtained and already discussed, to a large extend agrees with the view of renown architects that Modern Railway Station serve more than just for transportation, they include well-designed buildings providing various kinds of integrated services, such as restaurant, newsstands, small shops, shopping facilities, temporary accommodation etc. This implies that there is need to combine various means of transportation such as light rails, buses, taxis, private cars and so on in the design of the proposed station.

Table 5.7: Passenger Mode of Transport to the Station. Source: Field Study, 2016

S/N	Facilities	93 Respondents in Iddo Railway Station	70 Respondents in Jos Railway Station	39 Respondents in Kaura Railway Station	Average for the three Terminus Stations
1	Keke Napep	26 (28%)	17 (24.3%)	3 (7.7%)	**15.3 (20%)**
2	Bus	35 (37.6%)	23 (32.9%)	20 (53.9%)	**26 (41.5%)**
3	Motor cycle (Bike)	16 (17.2%)	13 (18.6%)	6 (15.4%)	**12 (17.1%)**
4	Private car	10 (10.8%)	11 (15.7%)	6 (15.4%)	**9 (14.0%)**
5	Foot	4 (4.3%)	6 (8.6%)	3 (7.7%)	**4 (6.9%)**

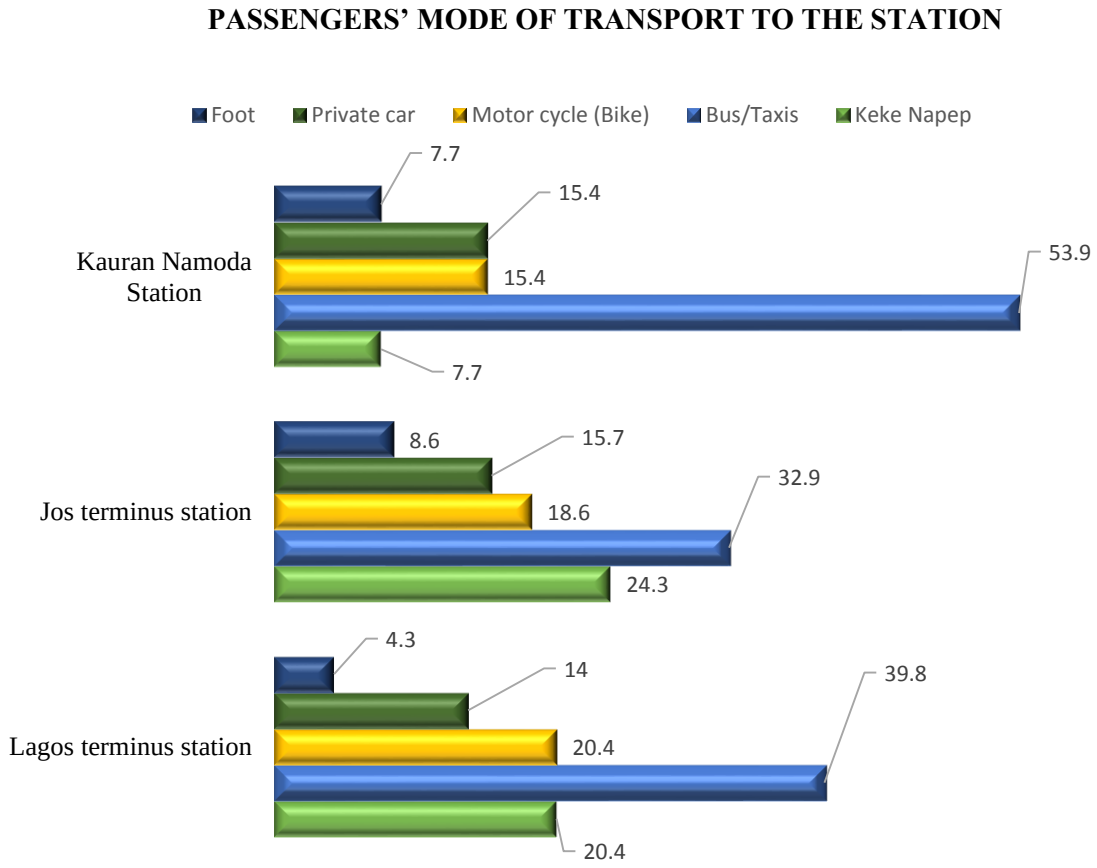


Figure 5.7: Bar-chart showing Mode of Transport. Source: Field Study, 2016

5.3 Contemporary User Requirements Questionnaire Related Data

Table 5.8 presented the list of contemporary user facilities that can be used for the sake of this research. It was found out that the spaces/functions with the highest score are restaurant, ATM gallery, restroom, V.I.P Lounge, kiosks, Waiting rooms, Cafes and coffee shop with the following scores 95.0%, 91.0%, 88.2%, 84.2%, 83.7%, 82.5%, 81.4% and 80.7% respectively (See Table 5.28). Its shows that most of the respondents agree more with the provision of eatery facilities, coffee shops, place where they can do

their window shopping and conveniences. It is increasingly the case that travel facilities are being mixed and integrated with other social and commercial activities (See Figure 5.8). As long as these activities do not hinder the safe and efficient operation of the stations, they will have a very positive effect on the economic viability and the public perception of the rail industry. The extent of these activities will be very much be determined by location.

Table 5.8: List of Contemporary User Facilities for the three Case Studies. Source: Field Study, 2016

S/N	Contemporary Facilities	93 Respondents in Iddo Railway Station	70 Respondents in Jos Railway Station	39 Respondents in of Kaura Railway Station	Average scores for the three Terminus Stations
1	Restaurant	94.6	92.9	97.4	**95.0**
2	ATM gallery	93.5	87.1	92.3	**91.0**
3	Restroom/Conveniences	82.8	84.3	97.4	**88.2**
4	V.I.P Lounge	79.6	85.7	87.2	**84.2**
5	Kiosks	83.9	82.9	84.6	**83.7**
6	Waiting rooms	77.4	82.9	87.2	**82.5**
7	Cafes	76.3	75.7	92.3	**81.4**
8	Coffee Bars	78.5	81.4	82.1	**80.7**
9	Lettable offices	75.3	74.3	87.2	**78.9**
10	Temporary Accommodation	76.3	81.4	76.9	**78.2**
11	Pharmacy	74.2	71.4	87.2	**77.6**
12	Newspaper/Magazines	75.3	78.0	76.9	**76.7**
13	Shops to let	73.1	75.7	76.9	**75.2**
14	Art and Craft shop	72.0	72.9	79.5	**74.8**
15	Car rental office	67.7	81.4	74.4	**74.5**
16	Post office	67.7	72.9	76.9	**72.5**
17	Dry cleaner space	64.5	72.9	76.9	**71.4**
18	Snacks Bar	65.6	65.7	76.9	**69.4**
19	Currency exchange (Bank)	64.5	62.9	79.5	**69.0**
20	Retail /Apparel store	62.4	64.3	76.9	**67.9**
21	Nursing mother station/baby Changing	67.7	65.7	69.2	**67.5**
22	Store	57.0	68.6	69.2	**64.9**
23	Home care store	58.1	60.0	71.8	**63.3**
24	Security post	57.0	65.7	59.0	**60.1**
25	Train office	36.6	41.4	28.2	**35.4**

In city centres there is increasing scope and demand for this kind of activity as evident in Iddo Terminus, Lagos as example. However, even small stations can benefit from the

addition of a contemporary user facilities inside or outside the station. In a small station this can have a very positive effect of increasing surveillance, promoting social interaction and satisfying basic customer needs.

In the case of the large and managed stations there is a clear need for each station to have a master-plan to allow any commercial development to be integrated with the station's operational requirements. With the increase of activities around the station there will also be an increased demand on the operators to provide additional services such as car and cycle parking, rest rooms, change rooms and additional toilet facilities.

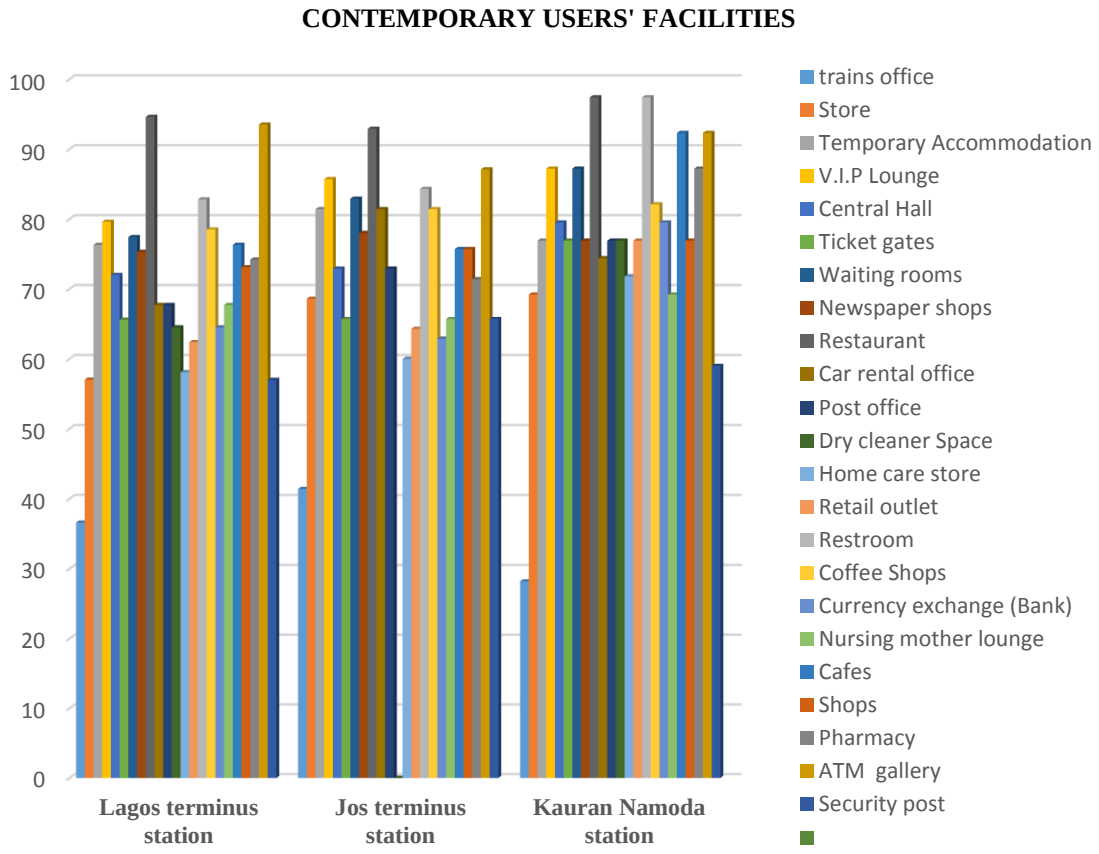


Figure 5.8: Contemporary User Facilities. Source: Field Study, 2016

From Fig. 5.8 above, the functions that are up to ≥50% were clearly illustrated and they can be employed as the design requirements in the redevelopment of Jos Railway Terminus. These spaces/functions include; kiosks, offices, store, temporary

accommodation, V.I.P lounge, central hall, ticket gate, waiting hall, newspaper shops, restaurant, car rental office, post office, dry cleaners, home care store, retail outlet, restroom, coffee shops, currency exchange(bank), nursing mother station, cafes, shops, pharmacy, ATM gallery, and public security post. In addition, from the open-ended questions, respondents demanded to provide certain spaces/functions that include barbing saloon, first aid, and temporary accommodation. This will be duly considered in the redevelopment design for contemporary railway terminus in Nigeria.

5.4 Usability Pattern Questionnaire Related Data

Table 5.9 below shows the level of importance of the respondents from the three railway stations.

Table 5.9: Related Usability pattern data for the three stations studied. Source: Field Study, 2016

S/N	FUNCTION	Lagos station		Jos station		Kauran Namoda station		Average RII scores
		∑AIat	RII	∑AIat	RII	∑AIat	RII	
1	Local area integration	347	0.747	278	0.794	157	0.805	**0.782**
2	Site planning and landscaping	327	0.703	262	0.749	155	0.793	**0.748**
3	Accessibility	331	0.711	266	0.759	149	0.764	**0.745**
4	Spatial organization	298	0.641	252	0.720	169	0.867	**0.743**
5	Ease of navigation/ Way finding	331	0.711	266	0.759	144	0.740	**0.737**
6	Information	306.4	0.659	238	0.683	132	0.676	**0.673**
7	Security & safety	301	0.648	234	0.667	129	0.659	**0.658**

In response to the second research question of this study (Which architectural features address contemporary user facilities in railway station design in the study area?), the Relative Importance Index (R. I. I) can be used to ascertain this variables, which is a ratio of the sum of the total attained importance scores (∑AIat) and the maximum possible attainable importance score (∑PAImax) on a 5 point Likert scale for each of the use pattern used for the research, for each of this (∑PAImax) is a multiplication of

the highest attainable score of 5 (Very good) and the number of questionnaires analysed (Maina & Umar, 2015), in this case. $(i.e, 5 \times 93 = 465)$

Mathematically, the Relative Importance Index for each (R.I.I) is derived using the formula: $R.I.I = \sum AIat \div \sum PAImax$

The overall variables accessed for the usability pattern shows that the variables are all satisfactory since they all meet the average requirement of $R.I.I \geq 0.5$ and therefore, they can be adopted for the proposed redevelopment of Jos terminus station. However, preferences had been highlighted according to individual variables. Local area integration, shows the highest RII scores of (0.782), it is followed by Site planning and landscape (0.748 RII), Accessibility (0.745), spatial organisation (0.743), ease of navigation/wayfinding (0.737), information (0.673) and security (0.658). This indicated that, contemporary user facilities can be enhances in railway station when this usability pattern variables are well integrated.

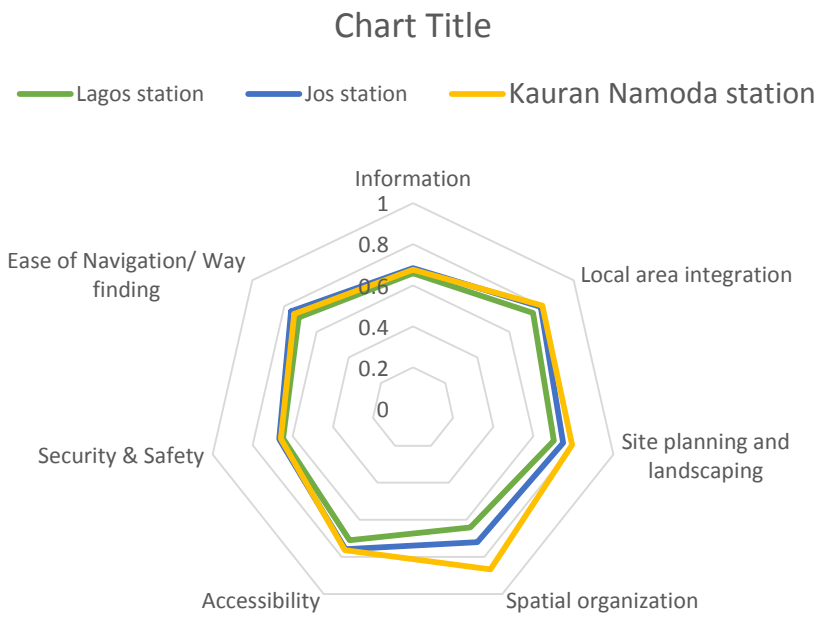


Figure 5.9: Performance Radar chart for the three stations. Source: Field Study, 2016

5.5 Summary of Findings

The summary for this research work on the following findings;

- Absent of integration of public transport modes to the station buildings.
- Commercial facilities were not incorporated in the three stations studied.
- Inadequate station concourse in two of the stations.
- Foreigners patronage representing (5.6%) in the three stations is very low.
- Lack of accommodation to accommodate late arrival Passengers.
- About 53 respondents representing 77.8% chooses public mode of transport (taxi, keke napep and motor cycle) as their mode of transport to the station. This suggest that there is need to integrate intermodal facilities in the proposed remodelling
- 95% respondents prefer restaurants, having the highest scores.
- Results also shows that respondents representing 0.782 R.I.I value agrees more on improving local area integration, while respondents representing 0.748 R.I.I value agree more with improving the site planning while respondents representing 0.745 R.I.I value agree more on enhancing landscape and spatial integration.
- Arrival and departing hall were not defined
- Commercial and shopping facilities were absent in the three station.
- Poor provision of an integral network of streets, footpaths, bike routes and public spaces.
- The ingress and egress to the stations were not defined
- Absence of multiple access and exit points to the platform in three of the stations.
- Absence of checkpoints for security checking in three of the station

6.0 DESIGN REPORT

6.1 Introduction

This chapter focused on the redevelopment of Jos railway station which reflects the fifth research objective, that is; to demonstrate findings from the research in the design of similar railway station. The station needed to be rebuilt in anticipation of the increase in passenger numbers in the future, where high numbers of travellers are expected to use the station every year. The proposed design would house waiting areas, arrival and departing hall, restaurant, cafes, coffee shop, temporary accommodation, car rental office, post office, police station, laundry, ticket offices, information displays, reception, first class and second class waiting room, circulations, intermodal facilities, fast-food restaurants, kiosks, vending machines and ATMs, services as well as retail outlets and a car park facility.

The report is presented in four (4) sections: design framework, brief development, site analysis, design proposal development.

6.2 Design Framework for the Redevelopment of Jos Railway Station Employing Contemporary User Requirements

This section encompasses part of the second research question which is; to develop a framework from literature and case studies on contemporary user requirements and functional features in railway station design?

According to Kande (2010), the design and planning of railway station encompasses four main functional areas typically housed in most stations; core, transition, peripheral, and administrative areas. However, a research titled “Integrating Contemporary Functional Requirements in Redevelopment of Jos Railway Terminus” revealed that Contemporary User Facilities need to be incorporated in the planning and design of

railway station thereby changing the old approach to design in Nigerian railway station design (See Figure 6.1).

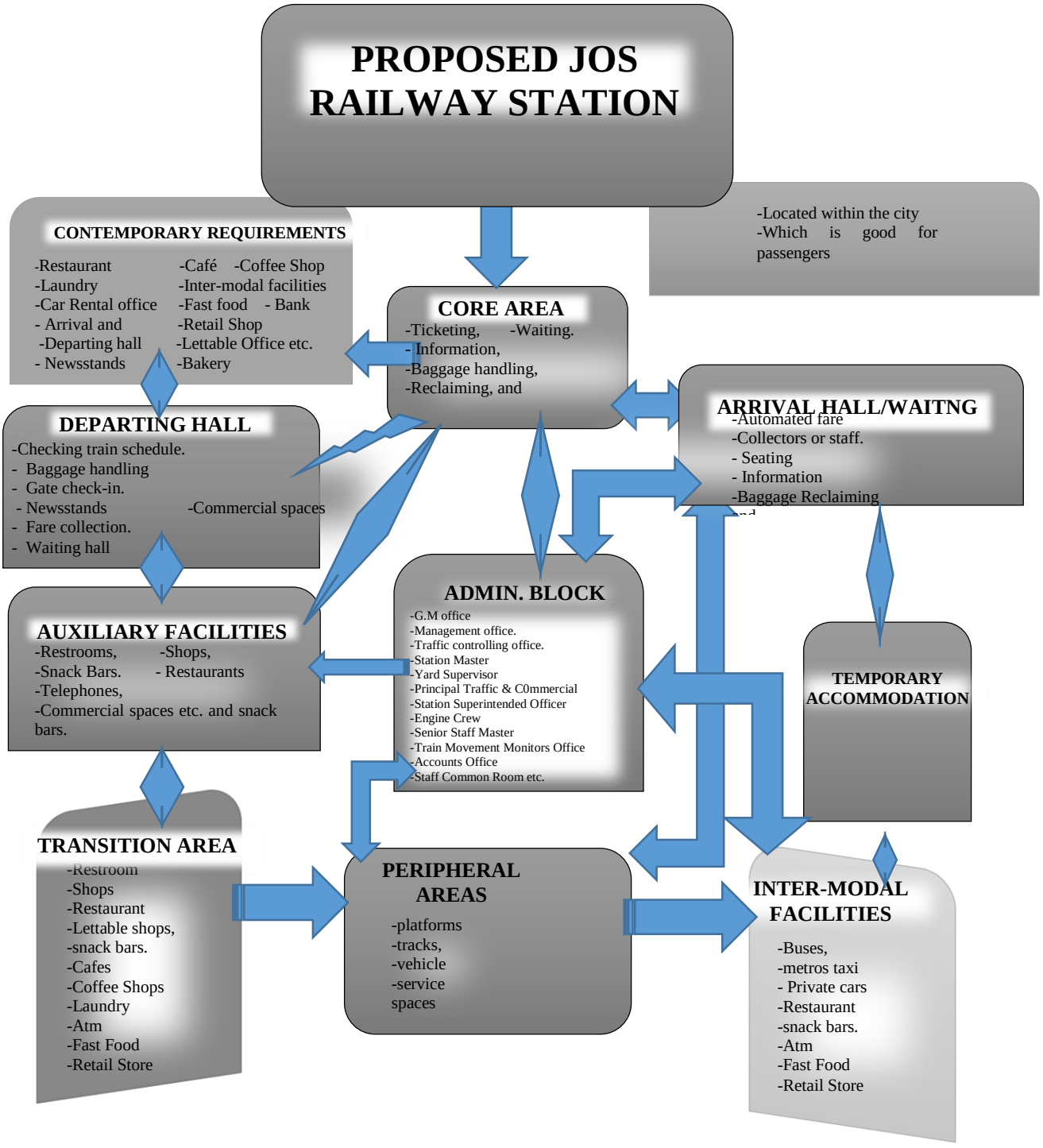


Figure 6.1: Proposed Design Framework based on Contemporary User Requirements. Field Study, 2016

6.3 Design Brief

Due to the rise in advancements in railway innovation, on-going development of increasing road traffic, growing car ownership, individual mode choices, increased concern for the environment, and the need for a cheap and reliable source of mass transportation of people and goods in Jos, Plateau State. Therefore, the federal government has graciously granted approval for the redevelopment of Jos Railway Stations to incorporate modern commercial outlets under public private partnership (PPP) arrangement. The researcher proposed to design for 8000 passengers' capacity per day railway station; the new station design will take into consideration the current concept of design and also incorporate cotemporary user requirements and other facilities that are needed in the railway station.

6.4 Description of the Study Area

Jos is located on a mountainous plateau that rises more than 1,000 metres over the surrounding plain. To the south and south-east, the plateau falls off into savannah lowlands. The region is of scenic beauty, with gigantic rock formations arising from the plains. Given its high altitude, Jos offers a temperate climate and has long attracted both foreign visitors and retired elites. Its surroundings are known for its hillsides, spectacular waterfalls, and wildlife parks. Until the regime change in 1999, it was also known for its relatively harmonious communal relations. It shares boundary to the West with Kaduna State, to the North with Bauchi State, to the Southern part with Benue State, and to the East with Taraba and Nasarawa State (See Figure 6.2).



Figure 6.2: Map of Plateau State, Nigeria. Source: Krause, 2015

The State has seventeen Local Government Areas and has Jos town as its headquarters. It lies between the latitude of $80^{0}24^{1}$ and longitude of $80^{o}32^{I}$ and $10^{0}38^{I}$ east of the Greenwich Meridian. It is situated in the tropical zone with a higher altitude ranges from 12 metres, about 400 feet to a peak of 1829 meters above sea level. The State covers a total land area of 53,585 square kilometres (FOS, 2006). It has a population of 3,178,712 persons consisting of 1,593,033 males and 1,585,679 females with a population growing rate of 2.7 % per annum (NPC, 2006). The projected population for 2014 is 3,933822. The state is classified into three senatorial zones which are Northern, Southern and Central zones. Plateau State is a multi-cultural and multi- ethnic state and the main ethnic groups include: Berom, Ngas, Jukun, Wase, Fulani, Kanke.

6.5 Climatic Data of the Site

The climate of the study area is characterized by two distinct seasons (wet and dry). Wet season last from April to October, while dry season lasts from November through to March (See Figure 6.3). The study area has an average temperature of about 20C. However, maximum temperature may reach 31C, while minimum temperature can be as low as 11C during the harmattan. Relative humidity also varies seasonally in the study area, with a low value of about 20% to 30% between January to march, increasing to a peak of 40, 80% between May to August and declining again in October, (Nigeria Metrological Headquarters (NIMET) Oshodi, Lagos).

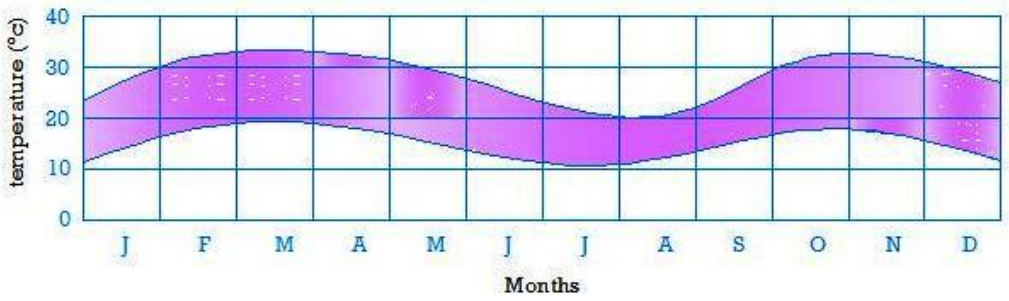


Figure 6.3: Temperature Data for Jos. Source: Gambo, 2015

i.Site Vegetation

Plateau State is located in the northern guinea savannah belt with scattered vegetation with grasses of different species. Farming is the major occupation in the area and agricultural production is mostly at subsistence level. The soil is developed from undifferentiated complex metamorphic and igneous rocks (See Plate LI). The top soil coupled with reasonable organic matter enhances the fertility status of the soil. The physical properties of the soil are moderately good and allows continuous cropping of wide variety of crops such as tomato, cabbage, maize, Irish potatoes, etc. Non farming activities of the people in the state include mining and civil service with majority of the government workers engaging in part-time farming.

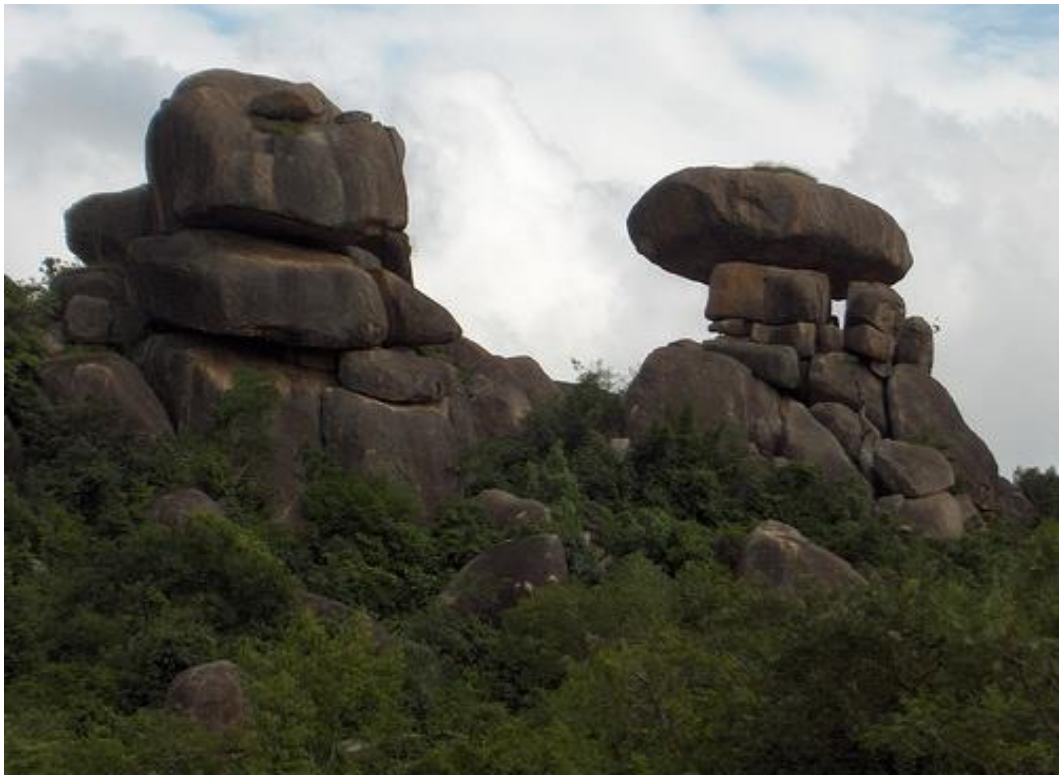


PLATE XLIX: A View of some of the Rock Formation at the Shere Hill Range near Jos. Source: Gambo, 2015

ii.Rainfall

The rainfall is seasonal with a mean annual rainfall of about 1524mm, the wettest month being between Junes to August. The mean annual rainfall varies from 131.75 cm in the Southern part to 146 cm on the Plateau, and highest rainfall is usually recorded in the months of July and August while the highest precipitation is recorded in April (See Figure 6.4).

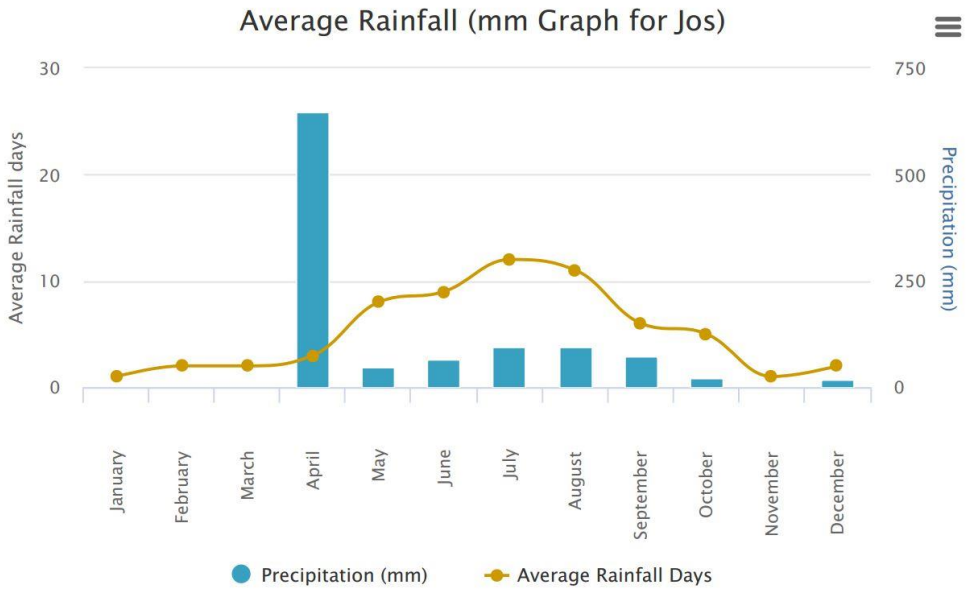


Figure 6.4: Rainfall graph of Jos Plateau State. Source: Gambo, 2015

6.6 Site Location

The Jos railway station is located along Jos central business district, by Murtala Muhammad way, adjacent to Jos central main market and the old Jos University Teaching Hospital (See Figure 6.5).

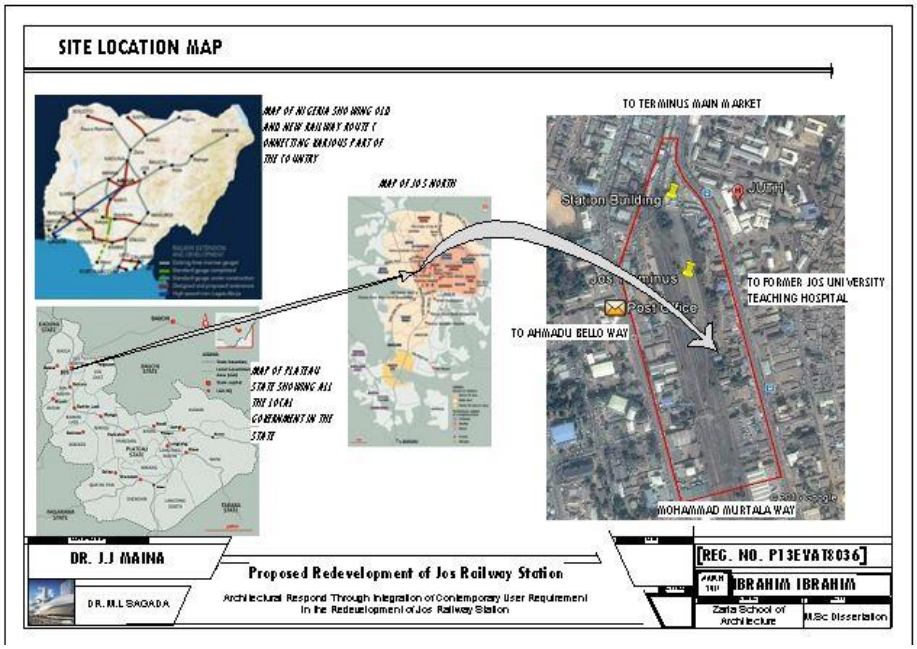


Figure 6.5: Site Location Map. Source: Field Study, 2016

6.7 Selection Criteria

Based on the contemporary user requirements the following criteria were used to determine the best site for the proposed design to meet the study's third objective. These sites were preselected based on existing or proposed railway routes that exist within the country. The criteria include:

1. Urban location
2. Role of station in modal share
3. Existing and proposed transit corridors
4. Commuter statistics

These criteria have been established to compare the relative viability of each site to house the proposed facility.

Below is an itemized list of the criteria outlined by (Shitu, 2015) along with specific questions that were considered when evaluating each variation and option. After each question was answered, a relative score was assigned to each criterion and recorded on the scoring sheet summary below. Scores were awarded using a range of 1 – 5, as follows: 5 = excellent, 4 = above average, 3 = average, 2 = below average, 1 = poor

A score of 1 to 5 was used to grade the stations as shown below

6.8 Architectural Design

In this section, a report is presented on the general architectural design of the proposed Jos Railway Station. This section covers the following: space analysis, site plan, floor plans elevations, sections, fire safety and building materials.

6.8.1 Site Zoning Based On Accessibility Analysis

The proposed site was zoned based on convenience of access into four (4) zones (See Figure 6.6).

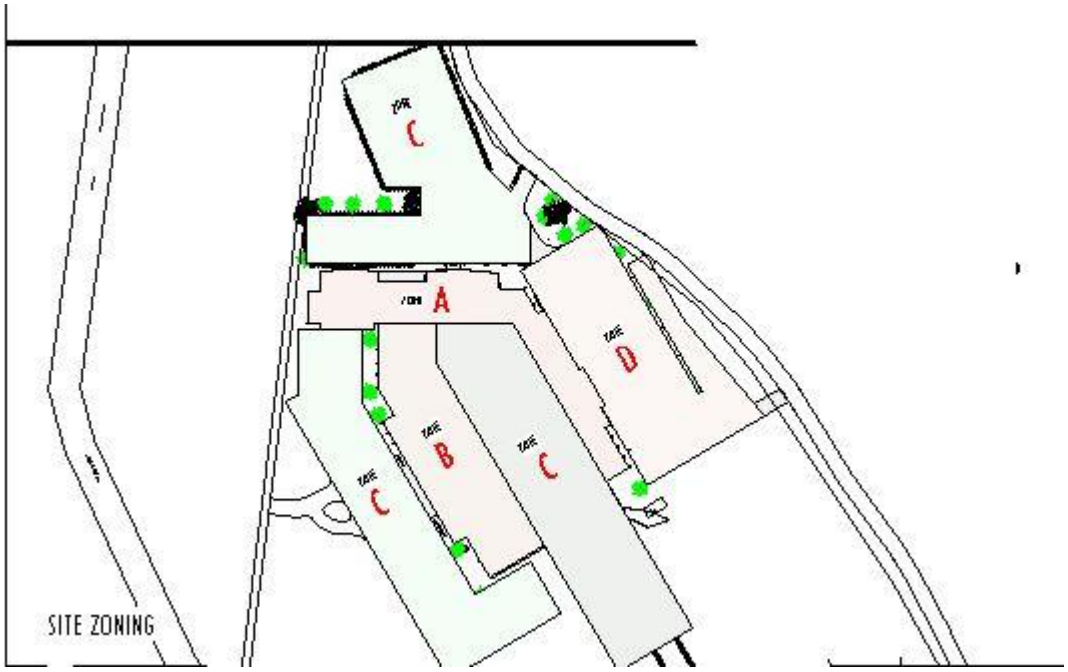


Figure 6.6: Site Zoning Based on Accessibility. Source: researcher, 2017

Zone A: Zone a focus on processing passengers. Conceptually, they can be considered as a circle surrounded by closely related areas that includes ticketing, information, baggage handling, reclaiming, and waiting (See Figure 6.6).

Zone B: Zone B connects transit facilities in the core areas to the transportation modes. They usually include facilities such as, restrooms, telephones, commercial spaces, shops, restaurants and snack bars (See Figure 6.6) etc.

Zone C: support circulation outside the main buildings. They often include platforms, tracks, and vehicle service spaces (See Figure 6.6).

Zone D: Intermodality denotes a passenger's ability to use more than one transportation mode for a single trip in a convenient and seamless way. It includes bus, tricycles popularly known as keke napep, introduced into Jos in 2012 and also the most

preferred means of transportation within Jos- then the taxis, sitter bus (See Figure 6.6) etc.

6.8.2 Functional Flow Diagram

The relationship between the facilities to be incorporated within the main station building is shown in (See Figure 6.7).

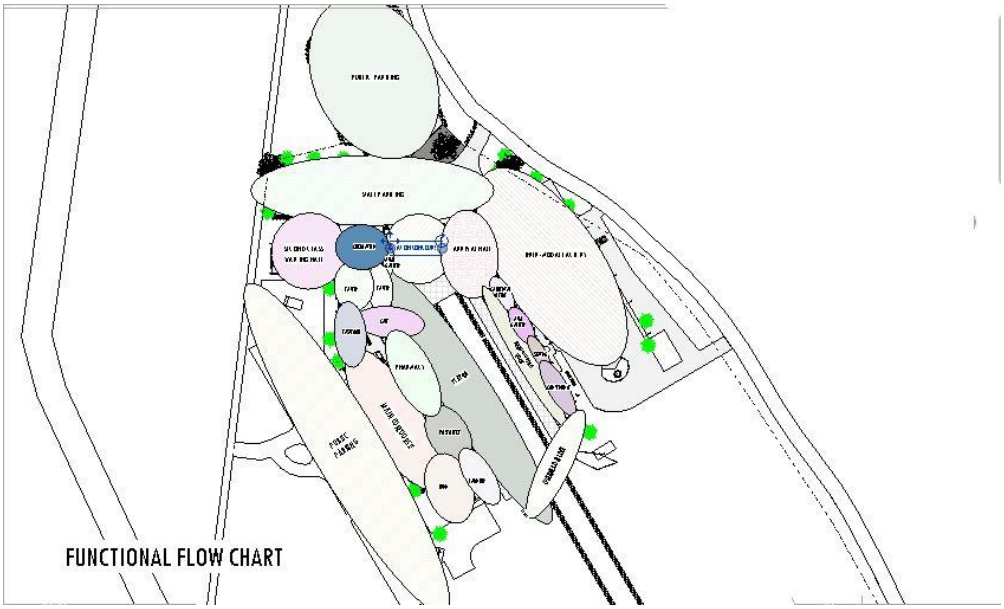


Figure 6.7: Bubble Diagram of Spatial Relationships of Proposed Facilities on Site. Source: researcher, 2017

There is a clear connection among the Core areas, Transit areas, Peripheral areas and Administrative area within the station environment to other transport modes through intermodal transfer.

6.8.3 Site Planning

The site plan aimed at incorporating strategies that will minimise Solar Heat Gain Coefficient (SHGC) by creating various plantings on the site. Also water bodies such as fountains were built in order to improve evaporative cooling. The trees around the building and within the site will provide adequate shading to the

Environment. This will create a micro climate that is favourable for transit (See PLATE LI).

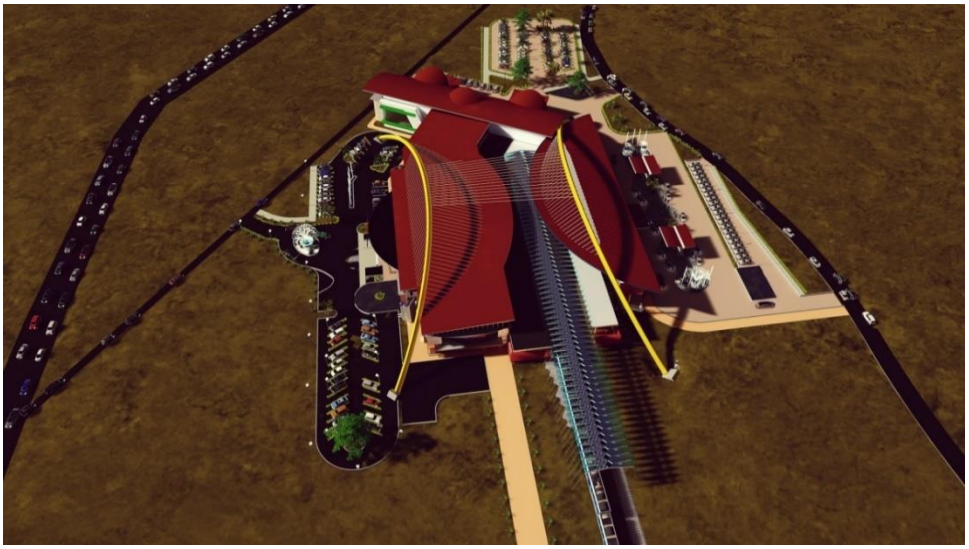


PLATE L: Site Plan of New Jos Terminus Station. Source: researcher, 2017

The site layout at ground level includes the following features: the station building, bus drop-offs, Tricycle drop-offs, train tunnel for NRC train operations, general parking areas, staff parking, service road, pedestrian bridges, and buffer zones.

The site can be accessed from Murtala Muhammad way and Ahmadu Bello Way. The Murtala Mohammed way serves the main entrance to the station.

However, the proposal for Jos Railway Terminus seeks to produce an iconic architecture that, beyond creating an impression, will be able to communicate the function of the building and the character of its location at the very centre of Jos City, to the public. To achieve this it is proposed to provide expression to the dynamic nature of the railway theme (See Plate LI).



Plate LI**:** Perspective View of the proposed Jos Railway Terminus. Source: researcher 2017

The design approach aims to re-establish consistency between form and expression in the new station design, both in the material and in the re-organization of the building. The design of the façade has been related to the exterior space, making the building an instrument to intensify the perception of urban life in Jos inner city, as opposed to trying to reveal its inner structure (See Plate LII).



Plate LII: Perspective View along Murtala Muhammed Way.
Source: researcher 2017

This approach is an evolution of the modernist transparency towards a more pragmatic and strategic approach necessary to address the complexities of contemporary railway station design.

Because of its transparency the widened traveller's passage, in lined with commercial functions, forms a natural part of the station. Escalators, lifts and stairs lead up commuters to the new level (See Plate LIII), with feature that invites passengers comfort. Incorporation of natural light, contemporary use requirements, the warmth of the sun's rays and a modern look are important elements in the proposed redevelopment Jos Terminus.



Plate LIII: Interior View Showing Escalators' and Staircase.
Source: Field Study, 2017

6.8.4 Floor plans

The station has two levels: ground level and first floor level. The ground level is at 600mm above ground level (GL) while the first floor level is at 6000mm.

a. Ground Floor Plan;

The ground floor plan connects train, tricycles, bus and taxes. The Jos Terminus is designed for passenger comfort, which is visible in the different zones of the station (See Figure 6.8).

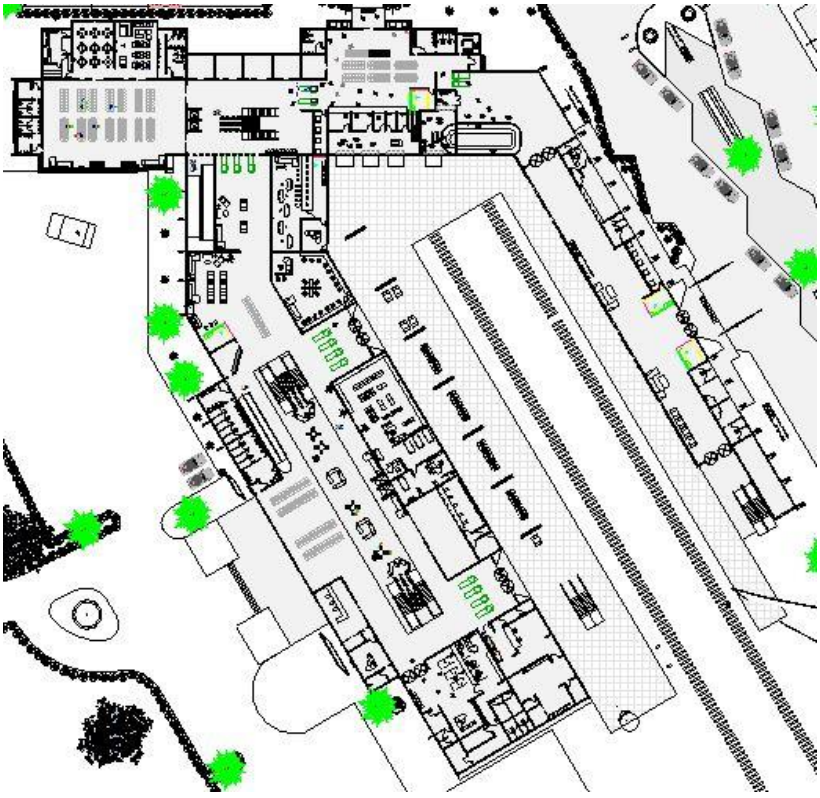


Figure 6.8: Ground Floor Plan of the proposed Jos. Source: Field Study, 2017

It includes commercial spaces, a lounge, restaurants, ATMs, cafes, eateries, post office with mailbox gallery, pharmaceutical, gift shop and general stores. The concourse hosts all travel-related services (ticket offices, information displays, reception, waiting areas etc.). In the spacious concourse the passenger service functions are conveniently arranged. Within the station there is a travel information point with an impressive cafe and a lounge which offers spectacular views across the hall and the adjacent tracks. The ground floor plan is an open concept plan which is surrounded by facilities in a courtyard arrangement; this enables smooth interaction and passengers can easily locate facilities and connect with other mode of transport in a seamless and convenient way (Plate LIV).



Plate LIV: Ground Floor Plan of the New Jos Terminus.
Source: Field Study, 2017

Another driving force behind open-plan station arrangement was the desire to assist passenger orientation in the station planning. The use of spans create column-free waiting rooms on the elevated concourse while passengers on other levels have good visual connection with escalators, lifts, entrances, ATM gallery and similar other facilities (Plate LV).



a)



b)



c.)



d)

Plate LV (a, b, c&d): Waiting hall, ATM Gallery, Shops & Inquiry Section
Source: Field Study, 2017

b. The First Floor Plan

The facilities located on this level include, spacious second class waiting hall for greater passengers comfort, lettable spaces for special offices like MTN, Glo etc. Circulations, services as well as retail outlet, shopping spaces, eateries, fast food (Figure 6.9).

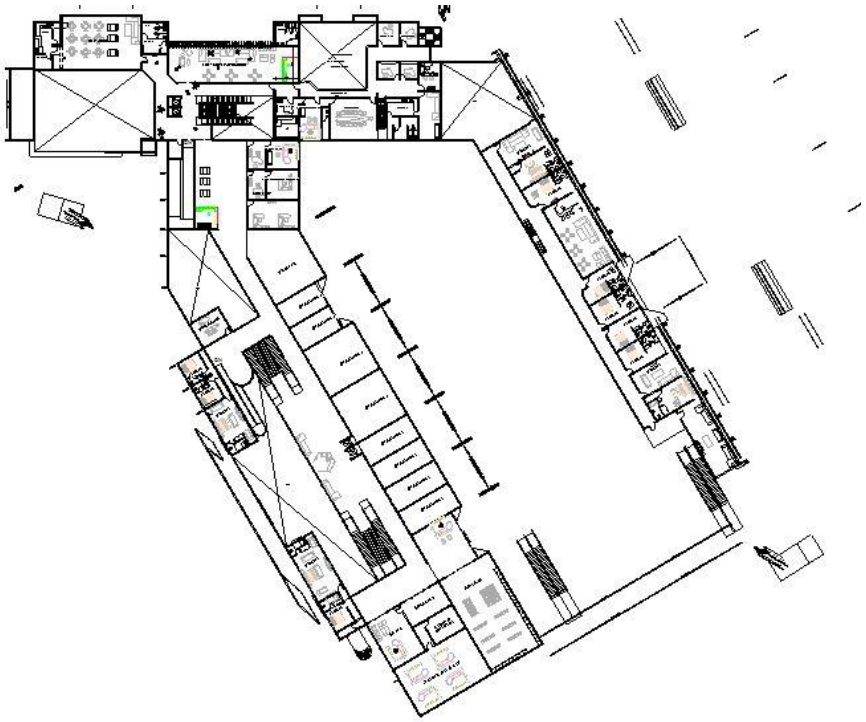


Figure 6.9: First Floor Plan of the Jos Terminus. Source: Field Study, 2017

The plan shows the ticket sales office, temporary accommodations, eateries, fast food joint, information display, retail outlets and the administration section (Plate LVI).



Plate LVI: First Floor Plan of the Proposed Jos Terminus Station Building.
Source: Field Study, 2017

A network of pedestrian pathways links through the building was designed to minimise congestion, which also connect the surrounding district by pathways and sky bridges and create a dynamic, multi-functional public space.

c. Platforms:

The platform serves as a bay for departing and arriving commuters (Plate LVII). It houses entrance gates, ticket validation office platform exit, emergency exits, seating area, restrooms/baby changing facilities, waiting areas and bicycle parking. Arrival and departure activity for train travel occurs at the platform.

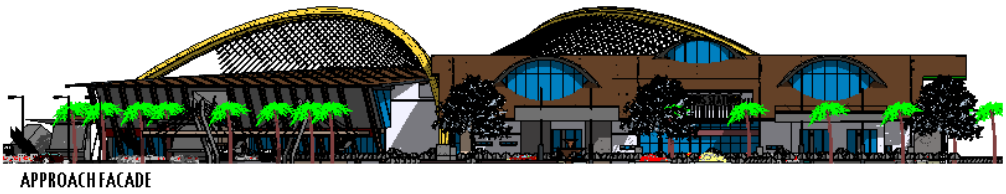


Plate LVII: Layout of Platforms at Ground Floor. Source: Field Study, 2017

The commuter can only access the platforms through the ticket gates and the ticket validation office check point before accessing either a train going north or south. This validation point serves as a filter to prevent people from accessing trains without having a valid ticket.

6.8.5 Elevations

The elevations of the new proposed Jos terminus display the use of structural arches together with cables to support the roof and make the building an iconic structure. The facades are clad with clear, transparent glass framed in steel structures (Plate LVIII).



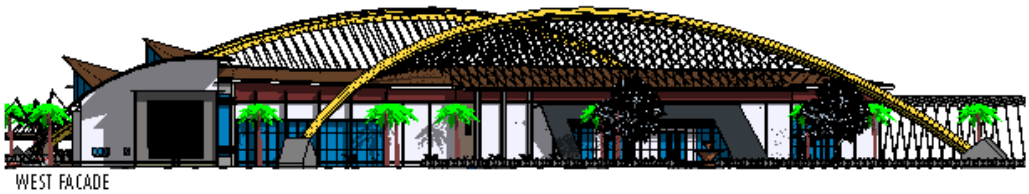
a.)



b.)



c.)



d.)

Plate LVIII (a, b, c&d); Building Façade. Source: Field Study, 2017

6.8.6 Main Concourse

The vast concourse and the walkways leading to the U-shape platform are suited to deal with, mainly, commuter travels and peak time loadings occurring over the same periods during the day and night (Plate LIX).



Plate LIX: Main Concourse of Jos Railway Station. Source: Field Study, 2017

The concourse hosts all travel-related services (ticket offices, information displays, reception, waiting areas etc.) as well as a bank and laundry at the tail end of the station. Vertical circulations pass through a central floor opening and link the main concourse with the first floor, which completes the retail outlet (fast-food restaurants, retail store, lettable space, kiosks, and ATMs) by providing food court areas and some retail outlets. The main passenger pathways are equipped with automatic doors which allow for fluid movements while minimising air draughts. Upper and lower levels are linked by lifts, escalators and ramps (Plate LX).



a. b.



.c. d.

PLATE LX (a, b, c&d &d): Vertical Service lift and Ramp and Escalators.
Source: Field Study, 2017

The whole building can be accessed by people with visual and cognitive impairment, those in wheel chairs, older people, people with bulky baggage, young children and their carriers and those with bicycles overloaded with luggage or carrying pushchairs and strollers.

Additionally, the proposed station would create an environment that is comfortable, inviting, and engaging so that all whom use it are left with a good experience.

6.8.7 Section

The section shows that the escalators end at first floor and the staircase, this is due to the traffic density reduction going floor to floor (Figure 6.10).

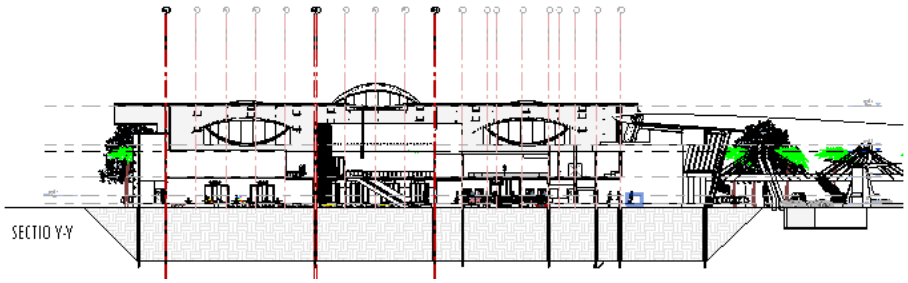


Figure 6.10: Section. Source: Field Study, 2017

6.8.8 Building materials

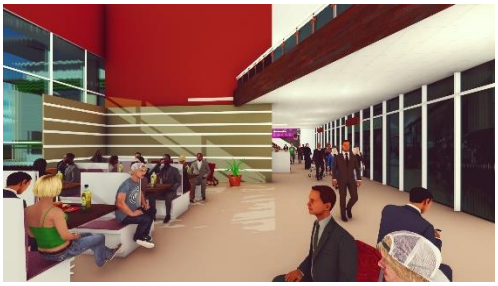
Materials and lighting draw on the architectural modernity while benefitting from the main principles of Jos traditional architecture (geometric patterns, lighting design, simple and noble materials, use of traditional techniques both the station and the forecourt are paved with Benslimane limestone slabs (a province about 80km north of Jos North), thus extending and unifying the pedestrian areas beyond the concourse. The pillars supporting the floor slab consist of light-coloured concrete and extend into a steel bole and an aluminium casting bearing the eight branches of the "capital". The underside of the roof is made of wood. The facades are clad with clear, transparent glass framed in steel structures. The mashrabiyya is made of fibre-reinforced concrete. Kiosks housing shops and services are designed as easily modifiable objects featuring metal structures and glass panels. Their expected lifespan is shorter than that of the building as they should be easily modulated to adapt to the potential development of new programmes in the future, and to reflect changing life styles and the evolving relations between the national rail operator (ONCF) and its users. The main passenger pathways are equipped with automatic doors which allow for fluid movements while minimising air draughts. Upper and lower levels are linked by lifts. The whole building can, thus, be accessed both by mobility impaired users and by people laden with luggage or carrying pushchairs and prams. Reinforced concrete was used for the main structure of the building; these include the arches, abutments, and the anchor blocks as well as pad foundations for the substructure. Folded plate was used to cover the station platform which permits natural lighting into the platform, therefore improves passengers navigation (Plate LXI).



a)



b.)



c,)



d.)

PLATE LXI: Folded Plate & Abutment. Source: Field Study, 2017

The opacity of this material creates the required privacy needed in some of the spaces. However, for section of the interior where visual access is important, such as the shopping concourse and the ticketing area, glass partition was used.

6.9 Usability-Principle-Based Design Strategies

In this section, a report is presented on the design strategies based on usability principles and other elements employed by the researcher in improving station Usability through architectural design.

6.9.1 Accessibility

The design strategies employed to meet this principle are reported based on the following; Vehicular access to public transport modes; Pedestrian access; and Vertical access and universal design;

a) Vehicular access to public transport modes

The proposed Jos railway station provides well defined connection between station building and other modes of transportation. This was achieved through provision of defined lay-off bays along the access roads for tricycle; Mass transit buses (BRT), taxis

as well as provision of general parking for private car owners (Plate LXII). The design approach increases the buildings interaction with the urban



PLATE LXII: Intermodal Section. Source: Field Study, 2017

landscape by bringing it closer to the access as opposed to conventional design where the station building is recessed in order to accommodate the driveway and private parking. This approach makes the building an integral part of the urban landscape.

b) Pedestrian access

In order to enhance circulation around station environment, pedestrian walkways are used to link the station entrances and exits. The walkways were designed without steps to enhance its usability by people with disabilities or the elderly. The walkways also have signage located at intervals providing information on possible destination. For commuters with luggage, the provision of walkways without steps makes for easy dragging of luggage. Also, luggage racks were provided at each drop-off/pick-up point to allow commuters move their luggage within the station with ease. The counter for the proposed station was produced having two levels thereby enabling access for all users.

c) Vertical access and universal design

In order to maximize usability in stations, vertical circulation elements such as ramps and lift were spatially integrated in the proposed designed. These vertical elements make it easy for those that are physically challenged. Nursing mothers with baby carriages may use the ramps as opposed to escalators or stairs.

6.9.2 Information display

Information is a fundamental requirement for a positive passenger experience in railway station and the design strategies employed in station design was that the information displays were located in strategic points such as the ticket gate, station concourse, station environment and the station platform (Plate LXIII).



a.



b.



c,



d.

Plate LXIII (a, b, c&d): Location of Information Display at Ground Level
Source: Field Study, 2017

The information medium used in the proposed station involved the use of multiple formats including audio announcements, tactile indicators and video which serves both arriving and departing passengers and allows access to information even while transiting.

6.9.3 Ease of navigation

As a design input, sections of the interior space were varied using colour and texture in order to define sections of the open plan layout. This design input enable easy description and way finding for users who may have reading deficiency or reading barrier (Plate LXIV).



a.)



b.)

PLATE LXIV (a&b): Interior Views Showing used of colours to define space
Source: Field Study, 2017

In order to facilitate ease of navigation by passengers, the floor finishes specified for the building were non-slip. To this end, granolithic floor finish was used throughout the building with various variables in colour and texture at certain zones of the building. Also, signage as well as direction arrows were integrated into the floor finish to further complement the information display principles and help guide users though the station.

6.9.4 Security and safety principle

The Closed Circuit Television (CCTV) system was strategically installed in various locations in the station layout to monitor the activities carried out within the station (See Plate LXV).



PLATE LXV (a&b): Checking Point Source:Field Study, 2017

Also police station was provided, which is located at the ground floor plan in order to scrutinize the activiies carried out in the main concourse. Additionally, the use of transparent partitions for commercial facilities and the provision of checking machines at each exit of the station (Plate LXV).

6.9.5 Local area integration

The major design input regarding this principle is the connection of pedestrian route to both ground level concourses and the first floor level. The integration of overhead crossing to major pedestrian routes and bus pickups enables smooth transition of commuters. The pedestrian routes were designed to ultimately lead to station entrances and exits thereby increasing traffic flow through the building and the exit routes were placed to effectively lead the user to surrounding developments. Thus Signages that display data of such facilities are integrated in these circulation paths.

7.0 SUMMARY , CONCLUSION AND RECOMMENDATIONS

7.1 Summary of Research Findings

The research work was built on providing user facilities that will enhance constant use and patronage in most of the Nigerian railway terminus. In chapter one the basic problems were identified with the objectives that outlines steps to fulfil the aim of the study. Relevant literature were extensively review on classical design and modern design of railway station looking at their contemporary user facilities that enable the researcher to come up with a conceptual frame work. Mixed methods was employed for the study that involved 280 questionnaires and physical observation. In addition, the following statistical procedure was employed to answer the research questions. Data for this study were analysed using descriptive statistics. Data gathered were edited coded and analysed using SPSS and Microsoft Excel

7.2 Contemporary User requirements related Issues that constitute design challenge:

The study found the following major issues in the cases studied:

1. Commercial facilities such as eateries, fast-food restaurants, retail store, Lettable space, kiosks, ATMs etc. are not integrated in the three case Studies.
2. Absent or poor integration of public transport modes to station Buildings.
3. Inadequate waiting hall for passengers in two of the station.
4. Lack of temporary accommodation for users in case of late arrival.
5. Absence of clear separation between arrival and departing passengers.
6. The station building cannot support the current Jos population.

7.3 Contribution to Knowledge

There are two major contributions to knowledge produced by this study. These are:

1. A conceptual research and design framework was developed to guide researchers on the design of railway stations in Nigeria using contemporary user facilities (see page 57 & 128) respectively;
2. A proposed railway station was designed, displaying all the needed features for contemporary user requirements in Jos railway station.

7.4 Areas for Further Research

The proposed station design employing contemporary user requirement opens doors for further studies to determine its adaptability in different regional and cultural context that exists within the country.

7.5 Conclusions

Railway Terminus appear to hold substantial potential for creating significantly larger, more interconnected public transport transit systems that can effectively bolster urban sustainability and livability as well as contributing to solutions for traffic congestion and the worsening problems related to energy use, petroleum availability, and greenhouse gas emissions.

As a result, conventional stations are gradually replaced by station complexes, which do not serve travel alone but also incorporate well-designed buildings providing various kinds of integrated services, such as restaurants, newsstands, pharmacy, small shops, eateries, lettable offices, flexible spaces, station bank, supermarkets ATMs galleries, travel information systems etc. this will help to generate revenue, attract users and encourage constant patronage.

7.6 Recommendations

1. Railway station should be well designed as an urban landmark providing various kinds of integrated services, such as restaurants, supermarket, newsstands, pharmacy, small shops, eateries, lettable offices, flexible spaces, station bank, ATMs galleries, hotels and shopping centres etc.

2. The design of Railway station should combined various mode of transport such as tri cycle, bus, taxes light rail transit, people movers in a seamless and convenient way.

3. The framework developed from the study could be used as template to guide future researchers in the development or redevelopment of similar terminus station design.

4. Station facilities should be designed to integrate seamlessly with the public realm, including adjacent office buildings and shopping facilities, and to facilitate cross as well as through movement.

5. The designer is expected to ensure that journeys are as seamless as possible. The station design has to take into account that passengers do not start and end their journey in a station.

6. Legible railway station design for passenger information and way finding from the outset will result in places that are easy to use, require minimal signage and are well integrated with their surroundings.

7. Railway station design is about making places easy to use for all passenger and station users. Therefore station should be design for all users that include people with visual and cognitive impairment, those in wheel chairs, older people, people with bulky baggage, young children and their carriers and those with bicycles

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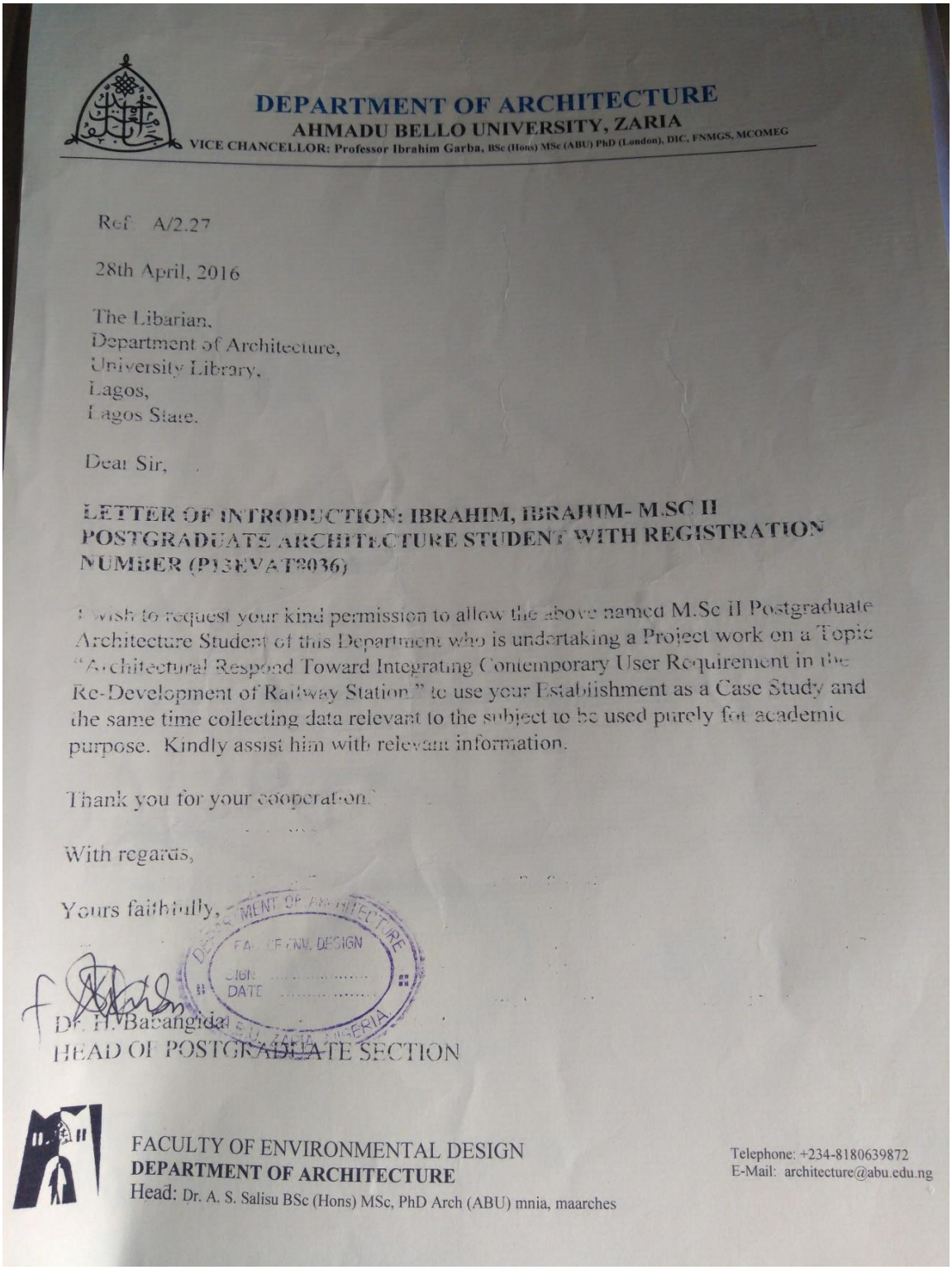
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APPENDICES

APPENDIX I:

Iddo Terminus, Lagos Introductory Letter



DEPARTMENT OF ARCHITECTURE
AHMADU BELLO UNIVERSITY, ZARIA
VICE CHANCELLOR: Professor Ibrahim Garba, BSc (Hons) MSc (ABU) PhD (London), DIC, FNMGS, MCOMEG

Ref A/2.27

28th April, 2016

The Libarian,
Department of Architecture,
University Library,
Lagos,
Lagos State.

Dear Sir,

LETTER OF INTRODUCTION: IBRAHIM, IBRAHIM- M.SC II POSTGRADUATE ARCHITECTURE STUDENT WITH REGISTRATION NUMBER (P13EVAT8036)

I wish to request your kind permission to allow the above named M.Sc II Postgraduate Architecture Student of this Department who is undertaking a Project work on a Topic "Architectural Respond Toward Integrating Contemporary User Requirement in the Re-Development of Railway Station" to use your Establishment as a Case Study and the same time collecting data relevant to the subject to be used purely for academic purpose. Kindly assist him with relevant information.

Thank you for your cooperation.

With regards,

Yours faithfully,

DEPARTMENT OF ARCHITECTURE
FA... OF ENV. DESIGN
SIGN .....
DATE .....
A.B.U. ZARIA NIGERIA

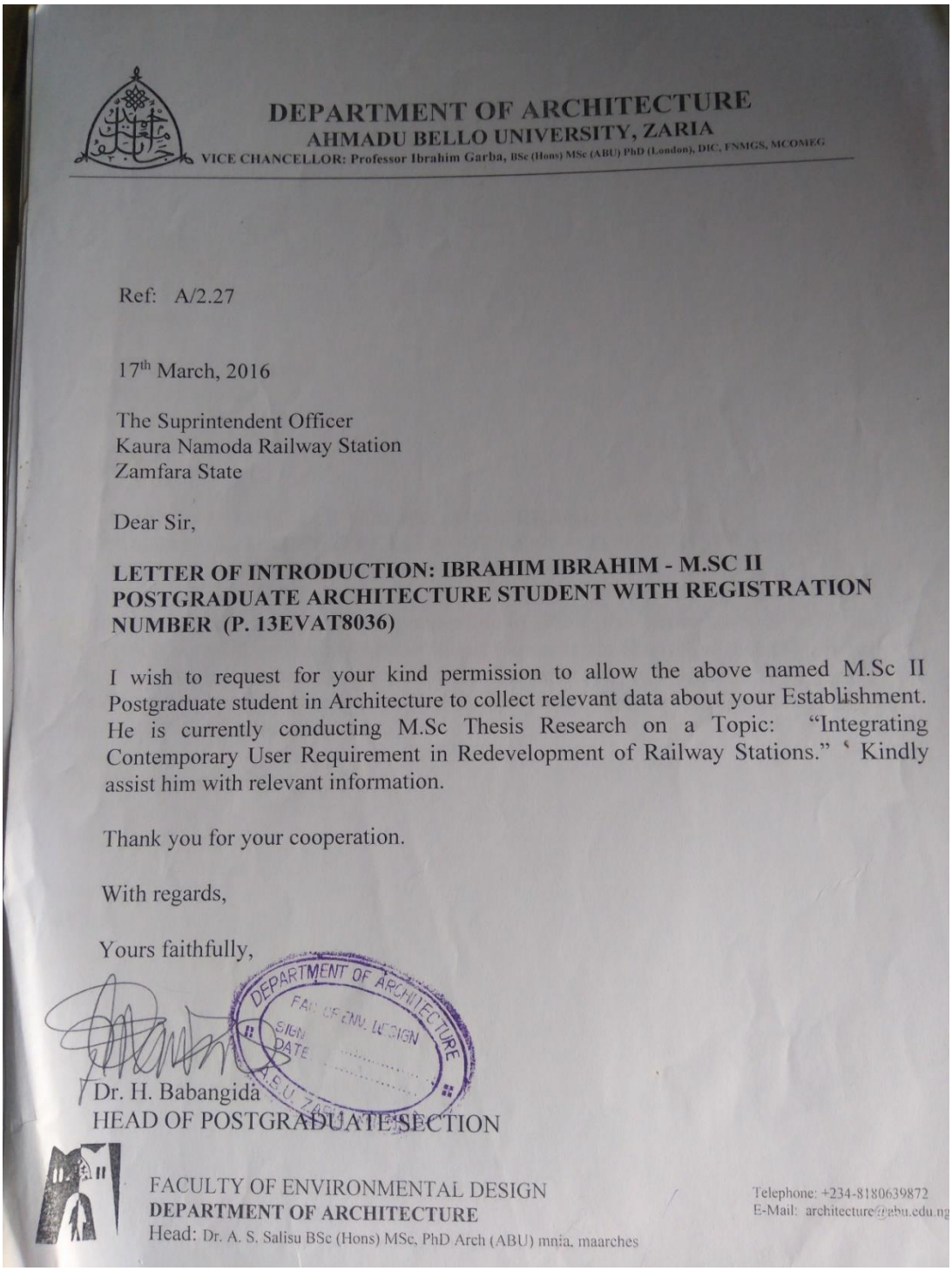
Dr. H.Babangida
HEAD OF POSTGRADUATE SECTION

FACULTY OF ENVIRONMENTAL DESIGN
DEPARTMENT OF ARCHITECTURE
Head: Dr. A. S. Salisu BSc (Hons) MSc, PhD Arch (ABU) mnia, maarches

Telephone: +234-8180639872
E-Mail: architecture@abu.edu.ng

APPENDIX II:

Kaura Terminus, Zamfara State Introductory Letter



DEPARTMENT OF ARCHITECTURE
AHMADU BELLO UNIVERSITY, ZARIA
VICE CHANCELLOR: Professor Ibrahim Garba, BSc (Hons) MSc (ABU) PhD (London), DIC, FNMGS, MCOMEG

Ref: A/2.27

17th March, 2016

The Suprintendent Officer
Kaura Namoda Railway Station
Zamfara State

Dear Sir,

LETTER OF INTRODUCTION: IBRAHIM IBRAHIM - M.SC II POSTGRADUATE ARCHITECTURE STUDENT WITH REGISTRATION NUMBER (P. 13EVAT8036)

I wish to request for your kind permission to allow the above named M.Sc II Postgraduate student in Architecture to collect relevant data about your Establishment. He is currently conducting M.Sc Thesis Research on a Topic: "Integrating Contemporary User Requirement in Redevelopment of Railway Stations." ' Kindly assist him with relevant information.

Thank you for your cooperation.

With regards,

Yours faithfully,

DEPARTMENT OF ARCHITECTURE
FAC. OF ENV. DESIGN
SIGN
DATE
A.B.U. ZARIA

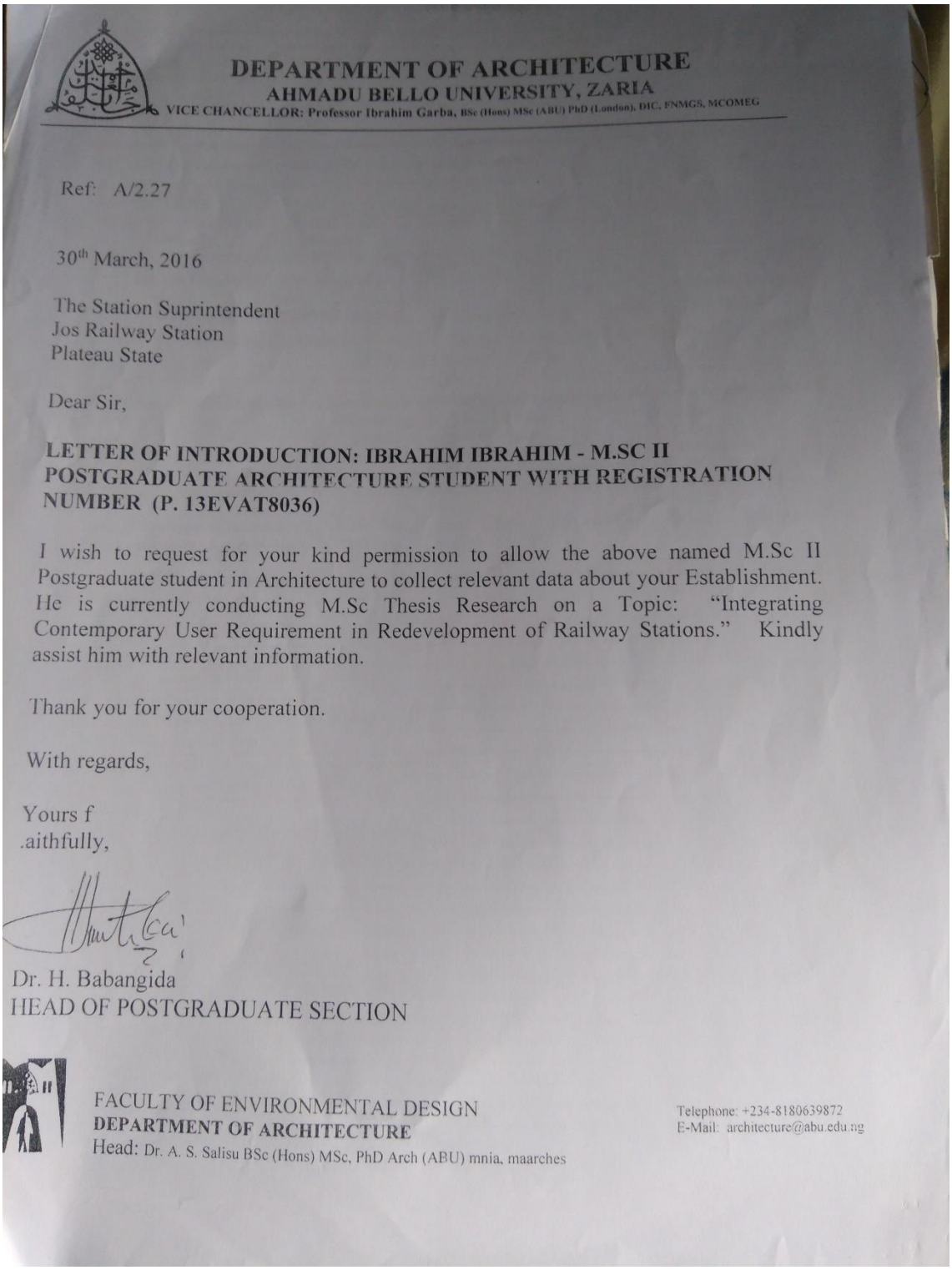
Dr. H. Babangida
HEAD OF POSTGRADUATE SECTION

FACULTY OF ENVIRONMENTAL DESIGN
DEPARTMENT OF ARCHITECTURE
Head: Dr. A. S. Salisu BSc (Hons) MSc, PhD Arch (ABU) mnia, maarches

Telephone: +234-8180639872
E-Mail: architecture@abu.edu.ng

APPENDIX III:

Jos Terminus, Plateau State Introductory Letter



DEPARTMENT OF ARCHITECTURE
AHMADU BELLO UNIVERSITY, ZARIA
VICE CHANCELLOR: Professor Ibrahim Garba, BSc (Hons) MSc (ABU) PhD (London), DIC, FNMGS, MCOMEG

Ref: A/2.27

30th March, 2016

The Station Suprintendent
Jos Railway Station
Plateau State

Dear Sir,

LETTER OF INTRODUCTION: IBRAHIM IBRAHIM - M.SC II POSTGRADUATE ARCHITECTURE STUDENT WITH REGISTRATION NUMBER (P. 13EVAT8036)

I wish to request for your kind permission to allow the above named M.Sc II Postgraduate student in Architecture to collect relevant data about your Establishment. He is currently conducting M.Sc Thesis Research on a Topic: "Integrating Contemporary User Requirement in Redevelopment of Railway Stations." Kindly assist him with relevant information.

Thank you for your cooperation.

With regards,

Yours f
.aithfully,

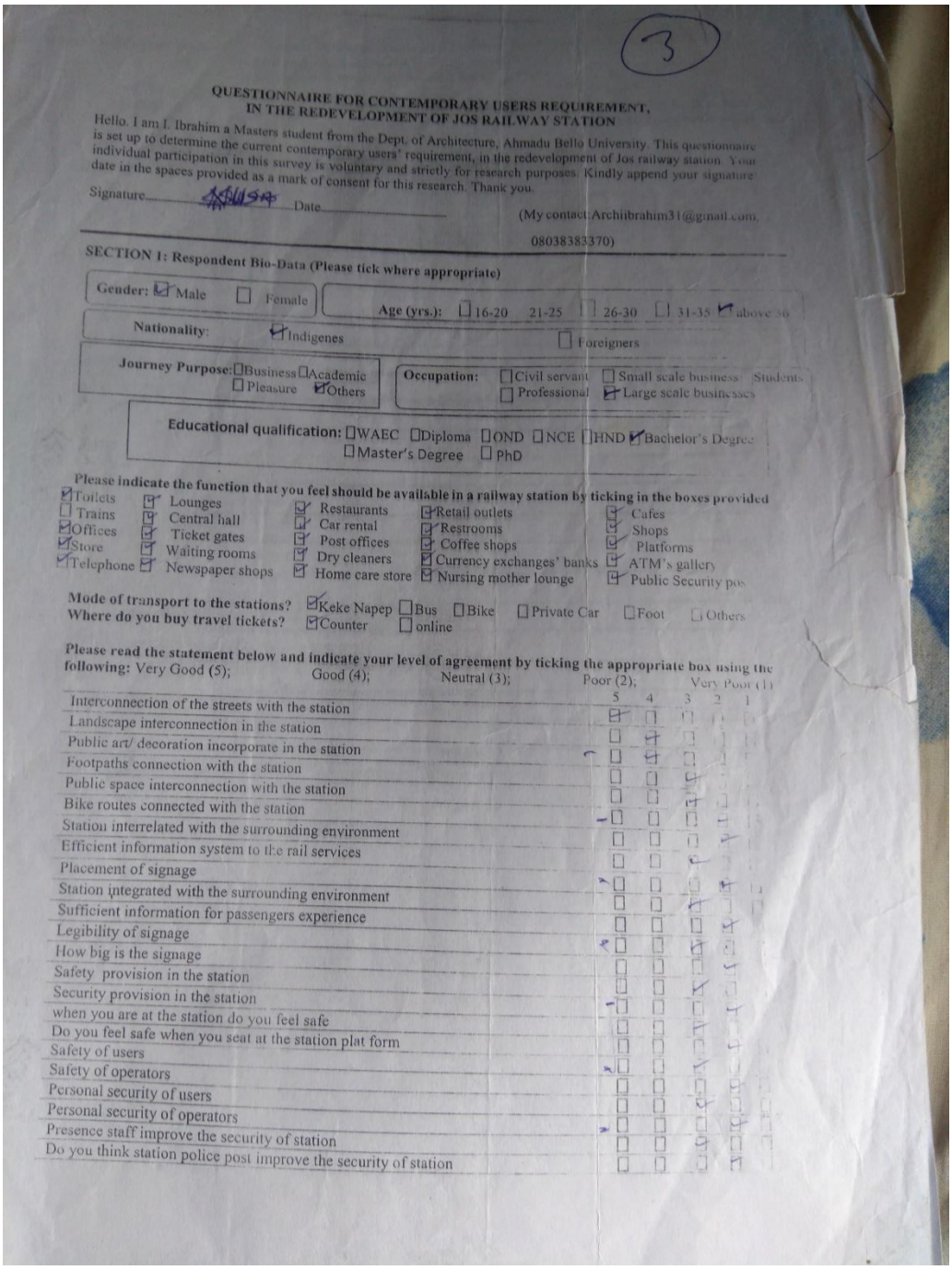
Dr. H. Babangida
HEAD OF POSTGRADUATE SECTION

FACULTY OF ENVIRONMENTAL DESIGN
DEPARTMENT OF ARCHITECTURE
Head: Dr. A. S. Salisu BSc (Hons) MSc, PhD Arch (ABU) mnia, maarches

Telephone: +234-8180639872
E-Mail: architecture@abu.edu.ng

APPENDIX IV:

Questionnaire for Contemporary User Facilities



3

QUESTIONNAIRE FOR CONTEMPORARY USERS REQUIREMENT, IN THE REDEVELOPMENT OF JOS RAILWAY STATION

Hello. I am I. Ibrahim a Masters student from the Dept. of Architecture, Ahmadu Bello University. This questionnaire is set up to determine the current contemporary users' requirement, in the redevelopment of Jos railway station. Your individual participation in this survey is voluntary and strictly for research purposes. Kindly append your signature/ date in the spaces provided as a mark of consent for this research. Thank you.

Signature [signature] Date _____ (My contact:Archiibrahim31@gmail.com, 08038383370)

SECTION I: Respondent Bio-Data (Please tick where appropriate)

Gender: ☑ Male ☐ Female

Age (yrs.): ☐ 16-20 ☐ 21-25 ☐ 26-30 ☐ 31-35 ☑ above 36

Nationality: ☑ Indigenes ☐ Foreigners

Journey Purpose: ☐ Business ☐ Academic ☐ Pleasure ☑ Others

Occupation: ☐ Civil servant ☐ Small scale business ☐ Students ☐ Professional ☑ Large scale businesses

Educational qualification: ☐ WAEC ☐ Diploma ☐ OND ☐ NCE ☐ HND ☑ Bachelor's Degree ☐ Master's Degree ☐ PhD

Please indicate the function that you feel should be available in a railway station by ticking in the boxes provided

☑ Toilets	☑ Lounges	☑ Restaurants	☑ Retail outlets	☑ Cafes
☐ Trains	☑ Central hall	☑ Car rental	☑ Restrooms	☑ Shops
☑ Offices	☑ Ticket gates	☑ Post offices	☑ Coffee shops	☑ Platforms
☑ Store	☑ Waiting rooms	☑ Dry cleaners	☑ Currency exchanges' banks	☑ ATM's gallery
☑ Telephone	☑ Newspaper shops	☑ Home care store	☑ Nursing mother lounge	☑ Public Security post

Mode of transport to the stations? ☑ Keke Napep ☐ Bus ☐ Bike ☐ Private Car ☐ Foot ☐ Others

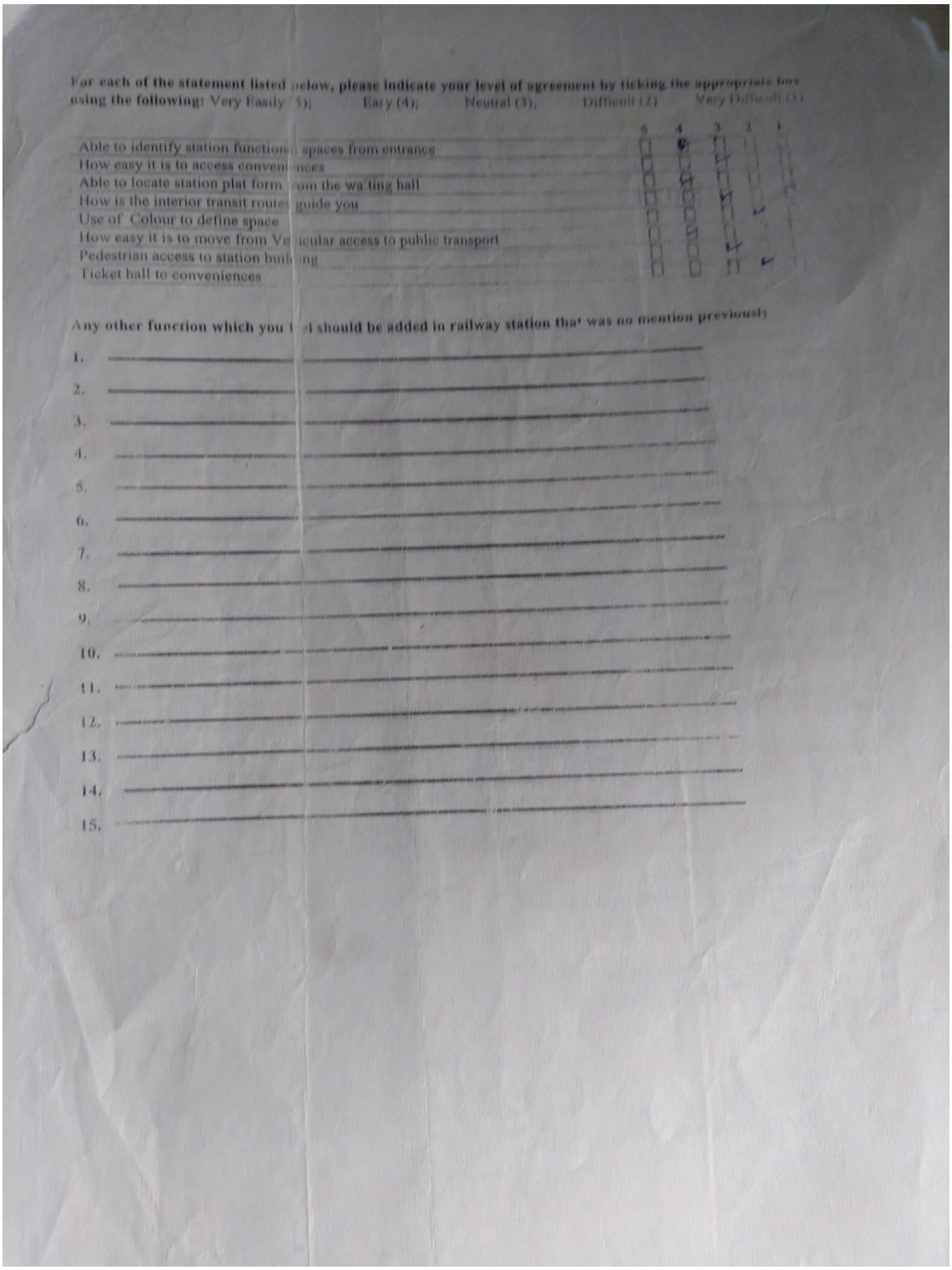
Where do you buy travel tickets? ☑ Counter ☐ online

Please read the statement below and indicate your level of agreement by ticking the appropriate box using the following: Very Good (5); Good (4); Neutral (3); Poor (2); Very Poor (1)

	5	4	3	2	1
Interconnection of the streets with the station	☑	☐	☐	☐	☐
Landscape interconnection in the station	☐	☑	☐	☐	☐
Public art/ decoration incorporate in the station	☐	☑	☐	☐	☐
Footpaths connection with the station	☐	☑	☐	☐	☐
Public space interconnection with the station	☐	☐	☑	☐	☐
Bike routes connected with the station	☐	☐	☑	☐	☐
Station interrelated with the surrounding environment	☐	☐	☐	☑	☐
Efficient information system to the rail services	☐	☐	☑	☐	☐
Placement of signage	☐	☐	☐	☐	☑
Station integrated with the surrounding environment	☐	☐	☑	☐	☐
Sufficient information for passengers experience	☐	☐	☐	☑	☐
Legibility of signage	☐	☐	☐	☐	☑
How big is the signage	☐	☐	☑	☐	☐
Safety provision in the station	☐	☐	☐	☑	☐
Security provision in the station	☐	☐	☐	☑	☐
when you are at the station do you feel safe	☐	☐	☐	☑	☐
Do you feel safe when you seat at the station plat form	☐	☐	☐	☑	☐
Safety of users	☐	☐	☐	☑	☐
Safety of operators	☐	☐	☐	☑	☐
Personal security of users	☐	☐	☐	☐	☑
Personal security of operators	☐	☐	☐	☐	☑
Presence staff improve the security of station	☐	☐	☐	☐	☑
Do you think station police post improve the security of station	☐	☐	☐	☐	☑

APPENDIX V:

Questionnaire for Contemporary User Facilities



For each of the statement listed below, please indicate your level of agreement by ticking the appropriate box using the following: Very Easily (5); Easy (4); Neutral (3); Difficult (2) Very Difficult (1)

	5	4	3	2	1
Able to identify station function spaces from entrance					
How easy it is to access conveniences					
Able to locate station plat form om the waiting hall					
How is the interior transit route guide you					
Use of Colour to define space					
How easy it is to move from Ve icular access to public transport					
Pedestrian access to station buil ng					
Ticket hall to conveniences					

Any other function which you t ol should be added in railway station that was no mention previously

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____