RIVER PORT TERMINAL FOR BARO
(Integrating Forms and Spaces with the Immediate Port Environment)

by

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A THESIS SUBMITTED TO THE POST GRADUATE SCHOOL, AHMADU BELLO UNIVERSITY, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF SCIENCE (M. Sc.) IN ARCHITECTURE.

DEPARTMENT OF ARCHITECTURE
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ZARIA - NIGERIA.

OCTOBER, 1999

DECLARATION

I hereby declare that this thesis has been composed by myself and is a record of my own research work. It has not been accepted in any previous application for a higher degree. All quotations are distinguished by quotation marks and the sources of information are specifically acknowledged by means of references.



Mohammed Teni Ramatu

CERTIFICATION

This thesis entitled ***"River Port Terminal for Baro"*** (Integrating forms and Spaces with the Immediate Port Environment) meets the regulation governing the award of the degree of Master of Science in Architecture of Ahmadu Bello University and is approved for its contribution to knowledge and literary presentation.

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ACKNOWLEDGEMENT

Glory be to Allah, Subhana - wa Tahala, for all his numerous favours and blessings. He has made this work possible in His Infinite Mercy, bringing it to a successful completion.

I wish to acknowledge all those who have contributed in one way or the other to make this work successful. I wish to thank the head, Department of Architecture, Arc. Mas'ud Abdulkarim. To my Supervisors; Arc. M. D. Ahmed and Dr. (Mrs.) B.P. Ogunsote, I say thank you for all the countless constructiveness, and guidance throughout the period of this research. My sincere gratitude to all the academic staff of the department of Architecture, particularly Dr. W.B. Qurix, Arc. Salisu Abubakar and Dr. Mbina A.A. To Prof. O.O. Solanke of F.U.T. Minna,I say thank you for the encouragements.

My sincere gratitude to the staff of the Nigerian Ports Authority (N.P.A.) Abuja and Lagos, as well as those of Apapa Wharf and Tin Can Island Port. Particularly Alh. Isa Suwaid, Mr. Ihedioha and Arc. Dan Hassan all of N.P.A. Abuja and also Mal. Hafiz Abbas Rafindadi of N.P.A. Marina, Lagos.

I am most grateful to my husband, Alh. Suleiman Baba Agaie for all the efforts geared towards the success of this thesis.

My sincere thanks to my parents Alh. Mohammed and Hajiya Hafsat A. Wanigi for all the inspirations and care. To my elder sisters Hauwawu and Aishetu Y. Isah, I say thank you. I wish to appreciate the contributions and support of my brothers Arc. Mohammed S. Wanigi and Adamu Etsu Wanigi. Worthy of acknowledgment is the untiring assistance of my younger sisters Hauwa Ladidi and Khadijat Mohammed as well as all members of the Wanigi and Yunusa Kenchi family especiallyYaiye and Yahassana.

My invaluable thanks to my children, Abdulkadir, Fatima and Rahmatu for their patience throughout the pursuit of the time demanding programme.

I wish to acknowledge my colleagues particularly Suleiman Mohammed (Bobs) and all the members of the class of '91 as well as my friend Hauwa Aliyu.

And lastly, but not the least, I wish to acknowledge Repro Centre, Samaru for typing this work.

ABSTRACT

Efforts to develop river transportation by the Government of the Federal Republic of Nigeria have a long history. One of such efforts was the commissioning of the Netherlands Engineering Consultants (NEDECO) on August 21 1954 to study the conditions in the River Niger and Benue. The object was to determine how shipping can be most effectively improved. In a report submitted on February 7, 1959, NEDECO recommended among other things the dredging of River Niger and the construction of River Ports along the River at Baro, Lokoja, Idah and Onitsha.

These recommendations have not seen the light of the day for the past 40 years. Recently however, the Petroleum Trust Fund now (defunct) and the Federal Ministry of Transportation on February 10 1999 signed N8.3 billion contract for the dredging of the River Niger. Also plans are underway for the development of River Ports at Idah, Lokoja, Baro as well as completion of the port of Onitsha.

In the light of the above, this thesis is concerned with the proposal of River Port terminal at Baro, in Niger State, with an attempt to integrate the forms and spaces of the port buildings with the immediate environment. The writer is not unaware of the fact that port construction and river dredging are engineering works, but an architectural input is also required, and this forms the basis for the work. The buildings will be integrated with the water, ships, canoes as well as the paddle of the local canoe man which are components of the immediate environment.

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CHAPTER ONE

1.0 PREAMBLE

Transportation is that part of economic activity, which is concerned with the increase of human satisfaction by conveyance or changing the geographical position of goods and/or people. Various means of transportation are available to man; air, road, rail and waterways. At various intervals in history, rivers and sea routes have provided the easiest, cheapest and in many areas, the only means of entry and circulation of explorers, traders, conquerors and settlers. Civilizations have been born and spread along rivers of the world and rivers still influence the lives of a good percentage of the world population.

Nigeria is endowed with many natural gifts in terms of natural resources. One of these resources are waterways which are used as a means of transportation for both passenger and cargo. As a maritime state, Nigeria's southern boundary is a coastline of the Atlantic Ocean and some of its territorial waters include, the River Niger with Rivers Benue, Kaduna, Sokoto and Anambra as its main tributaries. Other rivers are Cross, Bonny, Ogun, Qua Iboe etc. As a means of transportation, the marine environment has a task of maintaining safety and efficiency in cargo handling to assure maximum protection to life and property.

1.1 PHILOSOPHY

The search for improved safety, efficiency and acceptability of more befitting port buildings by the users, the environment and the architectural task of providing comfortable working conditions in the operations of the maritime environment is central to this work. Carefully planned buildings enhance social and economic activities in the marine

environment. Architecture is advancing in all fields of human endeavour, maritime activities inclusive; many changes have occurred in the technology of ships and cargo handling and this development is likely to continue. This work is set to achieve a change in architectural modification of port buildings to meet the challenges of advancing ship technology. According to United Nations Conference on trade and development, (UNCTAD) (1983) " ideally, the facilities which a port provided should be designed jointly with the ships which will use them, the land transport and the port facilities at the other end of the route that is, as part of an integrated transport system". Buildings as part of port facilities should exhibit a positive response in line with this statement.

1.2. DEFINITIONS

Albert et al (1978) defined a port as " a harbor or haven; hence a place of customary entry and exit for vessels, as for commerce, consequently, any place designated as a point at which persons or merchandise may enter or pass out of a country under specified supervision. Morgan (1952), on the other hand held that:

> the port or port works, in the more restricted sense of the word, comprises the installations at which ships are dealt with and where especially the trans-shipment of mail, passengers and cargo takes place. A characteristics feature of all developed ports is the provision of quays and wharves alongside which ships can berth, together with great deal of ancillary equipment; transit sheds, warehouses, passenger and customs accommodation, offices, road and rail and water approaches. The shelter for ships is an essential provision for a port, but the convenient handling of goods and passengers is equally desirable.

Ports are of two kinds: a sea port is a harbour or port on a coast accessible to sea going ships. It is used for international trade as the sea is naturally prepared for harbouring of large vessels hauling heavy luggage from one port to another. A town located on such a harbour is called a sea port.

An inland port is one that is remote from the sea. It is located in or limited to the interior of a country. An inland port caters for transportation of people and merchandise in the interior of a country; on rivers or streams in the hinterland.

The major difference between the sea and inland ports is that the former is located on a coast of the sea while the later is located on inland waterways. It is quite obvious that the sea is a larger body of water and has a semi-circular catchment area simply because only half of its compass radii is on land. The river however does not have such semi- circular constraint as it can be attracted from all directions.

A port terminal, just like every other public building is a magnet to economic and social activities. It provides several facilities for smooth and efficient traveling by ships and vessels. By extension, it contributes in community development, by unifying people regardless of race, creed, economic status and discriminatory factors.

1.3 PROBLEM STATEMENT

The task of this work is to integrate the Architectural forms and spaces of the port terminal building with the immediate port environment at Baro.

The immediate environment of Baro Port is surrounded by massive rocks, the most notable being the Historical Baro Empire hill, which is flat topped and a tourist attraction in Niger

State. The water body with its ships in the port are also components of the immediate environment to be integrated in the port terminal.

Guy et al (1994) stressed that " there are many ways of expressing the interaction of structural materials with the physical and climatic forces in all surging seas of contemporary searching towards meaningful and diagrammatic expression. Forms are tied images in order to be consumed as information". Bird (1963) remarked that " A port reflects in its layout the influence of its immediate land and water site, whilst in functional terms a stronger force is exerted by its wider relationship with the hinterland and foreland areas".

1.4 MOTIVATION

The choice of the research problem was motivated by Federal Government's commitment to the implementation of the dredging of the River Niger as recommended by Netherlands Engineering Consultants (NEDECO). This is as a bid to developing or improving riverine transportation in the country. Government has realised the potentials of shipping in the hinterland and in improving rivers for commercial transport, port development becomes very important.

Another motivating factor is the fact that most of the nation's cargo, (about 80%) for both import and export are being carried by ships. The goods from the hinterland have to be transported by road or rail to the coastline or into the hinterland from the coastline; these means of transportation (road & rail) besides being more expensive than river transportation are not efficient as most roads and rail lines have been damaged as a result

of haulage of heavy goods on them. Therefore, the need for river port terminal becomes paramount for appropriate and efficient handling of cargo in the river ports.

In addition, local canoe men and passengers that travel on rivers face a lot of hardship in the area of goods haulage, for more economic performance in our economic arena from these riverine areas, river port becomes necessary with all the supporting facilities.

Furthermore, Architectural form and space as components of knowledge need to be understood in order to integrate them properly with the immediate port environment as this research is geared towards contributing to knowledge.

1.5 AIM AND OBJECTIVES

This thesis is expected to achieve an aim and a number of objectives. The aim of the work is:

(i) To integrate the buildings forms and spaces of the port terminal at Baro with the immediate port environment, to promote socio-economic activities in maritime operations.

The objectives are:

i) To document port architecture in Nigeria, and studying existing ports that facilitate the country's maritime activities.

ii) To incorporate into the port terminal recreational and tourists facilities for ships crew and port workers as well as tourists.

(iii) Create a good working environment and improve efficiency of river transportation architecturally.

(iv) To minimize handling time in the terminal building, provide and make for uninterrupted flow of traffic within the port premise.

(iv) To effect even economic development of areas accessible by water with other parts of the country as the Baro port has the advantage of proximity to the Federal capital territory.

1.6 SCOPE AND LIMITATION

This research entitled "RIVERPORT TERMINAL FOR BARO" is centered around the development of inland ports in Nigeria with special emphasis on port terminal buildings. In addition, the facilities of the port: will be laid down on site, though the actual sketch design will be the passenger terminal, port administration buildings, staff and passenger facilities as well as provision of lettable spaces and recreation.

The fact that port construction is principally an Engineering work cannot be undermined as it limits the thesis to the architectural aspects of the port only. The engineering works such as the dredging of the river, construction of the quays, wharves, docks etc are limits to which this work cannot extend. Presently, there is little emphasis on inland port terminal construction in this country and this severely limits the data acquisition process to existing seaports.

1.7 RESEARCH METHODOLOGY

The research format for this thesis is a scientific one. Information utilized will be acquired by means of primary data and studying the existing ports. Other means of data

acquisition include review of existing literature as obtained in journals, magazines and newspapers as well as site visits and case studies of existing similar facilities.

1.8 THE CLIENT SPONSOR AND USERS

The activities of seaports are run entirely by Nigerian Ports Authority (NPA). However the Inland waterways division, which is an organisation in the maritime industry is wholly responsible for river ports developments in this country. Presently, a contract for a life project at the Baro port is almost ready for tendering. The client is the Federal Ministry of Transportation.

The project is sponsored by the Petroleum (Special) Trust Fund (PTF). The users are companies, individuals engaged in the shipping business and the entire parties involved in transport and commercial activities in the country.

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CHAPTER TWO - HISTORICAL BACKGROUND OF WATER TRANSPORTATION.

2.0 PREAMBLE

According to Ofoedu (1990) "water in its very ordinariness, is extraordinary, it is everywhere in form of oceans, icefields, lakes, rivers and covers nearly three quarters of the earth's surfaces." Chorley (1969) is of the opinion that "water is viewed as a highly variable and mobile resource in the widest sense". Of all the substances that are necessary to life, as we know it, on earth, water is by far the most important, the most familiar and the most wonderful.

Transport is a service industry responsible for carrying or transferring people and goods from one place to another. Historically, water transportation has been as old as the early period of man's existence. The exact time in which maritime activities started cannot be ascertained, however, Egyptian civilization which is one of the world's early civilizations is related to transportation on the river Nile. Bowen (1972) highlighted that:

> scientific network of established sites and findings has clearified and augumented the ancient literary sources which first provided clues as to early maritime activities. Evidence gleaned from numerous acheological sites illustrates the ingenuity of prehistoric navigators who avoided sailing around stormy headlands in the frail- skin boats by disembarking on one side of the penninsula and then moving overland to the other side before resuming their journey by water. Ever since he deviced the primitive boats, man has made use of winds, tides and currents in order to migrate, explore and initiate trading routes on a scale that over land travel would not permit.

2.1 PORT ACTIVITIES IN AFRICA

Port activities in Africa are traced to the times when colonial masters started slave trading. The Europeans established the first maritime contact with the west Africa sub region in the 15th century. Hoyle (1967) remarked that:

> Sea Ports of African continent, like seaports elsewhere are principally significant as points of economic and cultural contact. In a historical context, the coasts of Africa have acted as vital links between the continent, the interiors of which was so long unknown to the rest of the world and the oversea traders , invader and ruler. Many of the forces that have influenced the modern development of Africa have entered through seaports, but at present time, the progress of African economic development has not yet reached a stage where internal rival external trade in quality or value. The developing economies of the countries of modern Africa are thus markedly oriented, through the sea ports, towards external export markets and sources of imported goods, and those countries which because of their inland situation, are devoid of seaports, find themselves at a significant disadvantage as compared to their neighbours equipped with direct access to one or more ocean terminals.

Capital goods and other commodities such as cement, metal products etc which the African countries needed to equip and sustain the expanding infrastructure and industries were imported through the seaports. The year 1945 has been characterised by a marked increase in tonnage of bulky raw materials exported and an even more spectacular increase in the volume of imports.

2.2 PORT ACTIVITIES IN WEST AFRICA

As part of the African continent, West Africa is the first sub region to establish maritime activities with Europe in Africa. Coastal trade in West Africa was centred from the 15th to the nineteenth centuries on numerous factories which were small ports with very restricted hinterlands. History has not made available the exact number of ports open at a particular date, but during the later part of the nineteenth century, an average of about 150 were in operation on 3,800km (2,400 miles) of West African coast. B.S. Hoyle and D. Hilling (1970) confirmed that "in West Africa, Port development is of vital concern to the thirteen states and one remaining colonial territory into which it is divided as much as to the three landlocked countries as to those with coastline". This is probably for two reasons; the first being that communication across the land-ward boundaries of West Africa are so poor and difficult that trade is negligible. Secondly, for sustaining their ambitious programmes of economic and social development, all west African countries are dependent on overseas trade. The stage of economic development reached in a given part of the continent today, is in considerable measure a function of the capacity and degree of sophistication of port facilities available.

2.3 PORT ACTIVITIES IN NIGERIA

Port activities in Nigeria also evolved in the 15th century, Ogundana (1970) said that "six periods of alternating concentration and diffusion have emerged from an empirical study of changing port significance in Nigeria. During the first period, European activity along the Nigerian seaboard was limited". Benin through its port of



Phase	*Time period*	*Composite form*	*Leading ports in hierarchy*	*Overall trend*
I	1500–1670	Initial concentration	Gwata, Bonny, Old Warri	Unstabilised port structure
II	1670–1750	Diffusion	Old Calabar, New Calabar, Bonny, Brass	
III	1750–1860	Concentration	Bonny, Lagos	
IV	1860–1910	Diffusion	Lagos, Akassa, Old Calabar, Sapele, Warri, Degema	Consolidation with Lagos as point of sustained port dominance
V	1910–1950	Concentration	Lagos, Port Harcourt	
VI	1950-	Diffusion	Lagos, Port Harcourt, Bonny, Okrika	

Table 2.1 Pattern of Sea Port Evolution in Nigeria.

Gwato was the leading area of trade, the Warri Kingdom, probably through Ode Itsekiri, also engaged in trade. Bonny was a significant port, and the Europeans had only relatively feeble contacts with the other rivers such as Brass and old Calabar. Lagos probably did not exist until towards the end of the period. Below is the tabulation of the pattern of sea ports evolution in Nigeria. See table 2.1.

2.4 THE RIVER AS A MEANS OF TRANSPORTATION.

A river is a large, natural stream of water, usually fed by converging tributaries along its courses and discharging into a larger body of water, such as an ocean, a lake or another stream. Chorley (1969) remarked that " many hundreds of rivers discharge to the sea, but most of the flow occurs in a few larger streams". This indicates that not all rivers can flow directly into oceans as some flow into larger streams which in turn flow into oceans or lakes. Not all nations have the fortune of being on the coastline of the seas and oceans , but nearly all nations are traversed by rivers.

Rivers have served as means of transport, communication and trade from place to place in different parts of the world. In Africa, economic problems have hindered the construction of roads. So people in the riverine areas are left with no alternative than to utilise canoes on rivers and streams to convey their goods, services and passengers to have a link with the other parts. Ferries have been used in Nigeria on Niger and Benue rivers to carry passengers etc, to link the people in the riverine areas with the other part of the country. Ezetulugu (1974) commented that "river transport is suitable for reaching the hinterland. In

Nigeria these rivers form a good network and traversed through almost all the states and can be used in improved conditions for local distributive trade". River port terminals will go a long way in improving domestic trade and distribution of goods. They will also serve to facilitate equitable distribution of local and foreign goods to all parts of the country accessible by water ways.

2.5 IMPORTANCE OF WATERWAYS AND PORTS

Besides the provision of food, mineral and energy resources, waterways serve as source of security and national defense, source of space, leisure, waste disposal and for trade, transport and communication. Shipping is one of the uses of the sea and waterways. It is the most important to the society as most of the world's foreign trade travel on ships, this is possible because about 72 percent of the earth's surface is covered by water serving as a bond for many countries. Sea transport is the cheapest of all forms of large scale transport, this is another reason why foreign trade is associated with maritime transportation.

Waterways played vital roles in the prehistory and civilization of many places in the world. They have been influencing commercial and industrial activities which are tools for economic development in different parts of the world. Morgan (1952) said that "the history of ports is in great measure the history of civilization. The Mediterranean was a cradle of civilization largely because it was a nursery of maritime trade, sea fearing means ports, and many of the early cities of the Mediterranean lands were ports as well as major cities". Examples are Tyre and Sidon, Certhage, Massilia, etc.

The multifunctional character of sea port extends to the industry as well as the commercial activities associated with the transfer of goods. The functional structure of a port in commercial, industrial and military terms in determined partly by the nature of the hinterland and partly by the water of the port in relation to the overseas maritime links; moreover, different port functions relate to different areas of the hinterlands, on an international, national or local scale.

2.5.1 INLAND WATER WAYS IN NIGERIA.

The Nigerian Inland waterway system, comprising the coastal creeks and lagoons and the major rivers, constituted an indispensable component in the development of the country's dynamic economy. However, the waterways are navigable with difficulty and even the better ones are usually troubled with great fluctuations. Shifting channels and interrupting rapids obstruct continuous operation of long stretches, while the silting up of the deltas and delta ports hinder access to the sea. Consequently, only a few stretches of the major rivers are navigable by high capacity power-craft. Although the Cross River is used to bring exports down to Calabar port, but it is the Niger and its main eastern tributary, the Benue, which are the leading Inland Waterways. Petroleum exploration and exploitation in the Niger Delta coupled with other oil related activities, now generates enormous traffic, and the oil companies, with the help of sophisticated watercraft, are making intensive use of the creeks and lagoons.

Significant improvement to river navigation began in 1910 when the British government took over the administration of Nigeria. Improvements were at first of an elementary kind and consisted of cutting the inside of bends, dredging, piling where banks

are weak and weed cutting. The completion of the Kainji Hydro-Electric Dam ushered in far reaching improvements. The reservoir provides an adequate all-year-round depth of water, with the result that the navigation period on the Niger has been extended into the dry season, while the navigable stretch has been extended as far as Niamey in the Niger Republic. The lake has also become locally significant as a route way, opening up possibilities for the carriage of bulk commodities that would otherwise be impossible.

According to Barbour et al (1982) "The Niger below Baro and the Benue up to Garoua in the Cameroun Republic have the largest volume of traffic. In recent years, about 180,000 tonnes a year have been handled on the Niger and about 78,000 tonnes of the Benue, with about two-thirds of the total moving seaward and one-third moving upstream".

2.6. DESCRIPTION OF RIVER NIGER

The River Niger rises in the eastern side of the Futa Jalon mountains in Guinea at 9° 05' N and 10° 47' W, some 150 miles from the Atlantic ocean. As its source is on the land ward side of this mountainous ridge, the river runs off in a north-easterly direction towards the centre of the Western Soudan depression. Up to Kourousa, which is 2,307 miles from the outlet into the Atlantic ocean, the river is obstructed by many small rapids and average slope amounts just over a foot per mile. The bed-becomes sandy from Siguiri, (2,209 miles) downwards and has an alluvial flood plain which is about one mile wide. Its upper tributaries include Mafau, Niandan, Milo, Sankarani andTinkiso. From Bamako, in Mali (mile 2,081), the second largest town in the whole of the Niger, direct down stream, there is a section of fourty miles with two major rapids. After Bamako, the

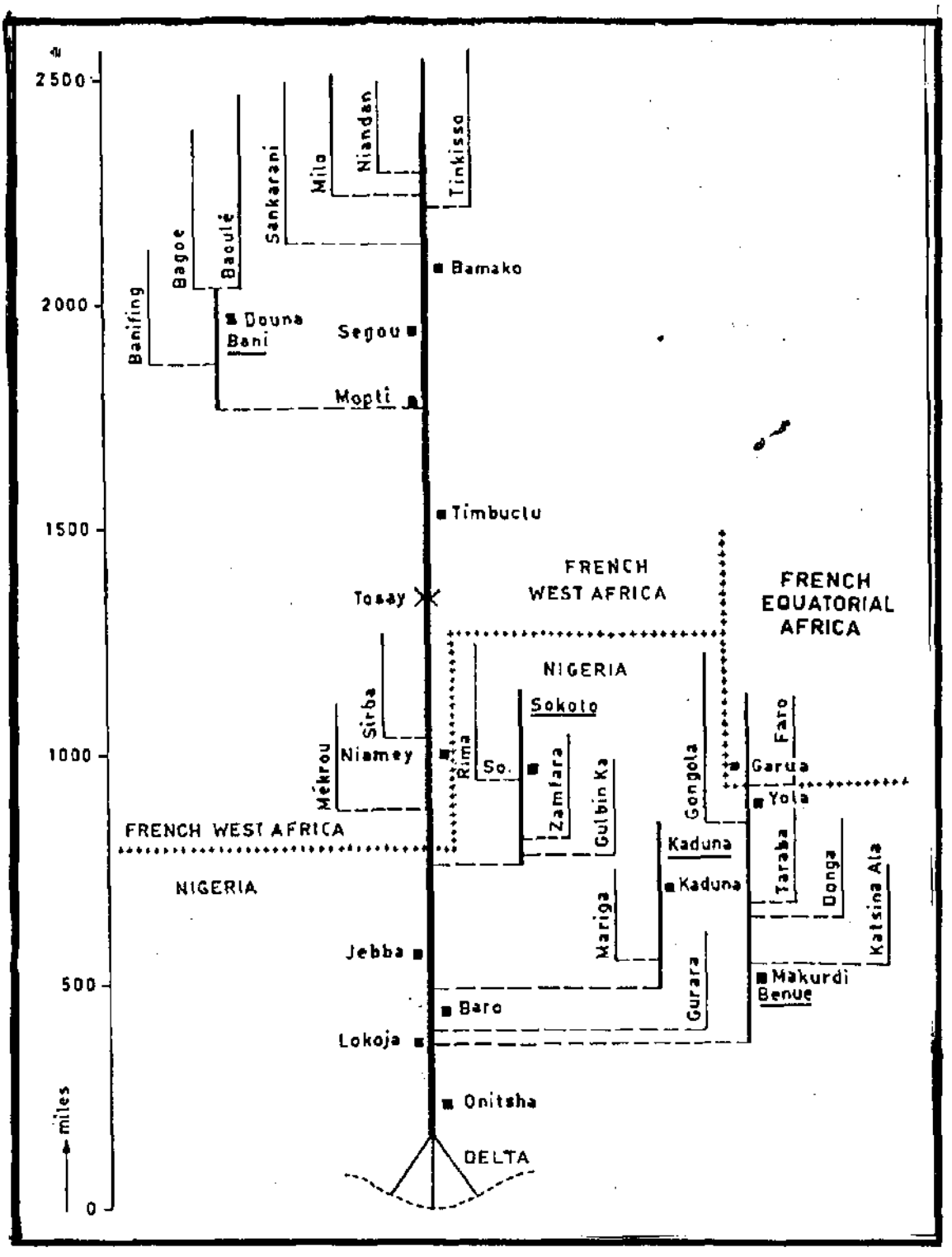


FIG.2.1 THE NIGER AND ITS MAIN TRIBUTARIES

Sotumba dam marks the end of the upper river. At Koulikoro (mile 2,041), the terminus of the railway line from Dakar, the river becomes navigable and can be used for shipping over a distance of more than 800 miles. A 2,650 feets long dam, the Markala, has been built in the Niger near Sansanding (mile 1,918) for irrigation purposes.

At Mopti, the Niger is joined by the Bani, its largest tributary on the right. The river next enters the swamp area which is the remainder of an old interior Delta, where the slope of the river decreases. Here, much Niger water is lost due to infiltration and evaporation, and at Dire (mile 1,574), only 35% of the annual discharge of the Niger is left. The Niger continues to flow from Timbuktu (mile 1,528) downwards in an area of sandy ridges and swamps, until its course is obstructed by a rocky ridge near Tosay (mile 1,341). The river then changes course and flows in a south-easterly direction through a semi desert area with hardly any rainfall, but near the Nigerian boarder, the rainfall increases again. Navigation is rarely possible owing to the presence of rapids between Labbenzenga (mile 1,149) and Tillabery (mile 1,068). The river becomes navigable again below this valley, for a distance of over 300 miles. The course of the Niger is disturbed by a rocky interference below Kirtachi (mile 930) and the river zig-zag with a few minor rapids. Before Yelwa, the river is joined by its first Nigerian tributary, the river Sokoto. Between Yelwa (mile 688) and Jebba (mile 556), the river is narrow with a rocky bed and a series of rapids occur. Down stream from Jebba the river is navigable as far as the sea, flowing through broad and shallow valleys five to ten miles wide with extensive swampy plains on each side and there are also many islands within the river. (See plates *2.1 - 2.6)*

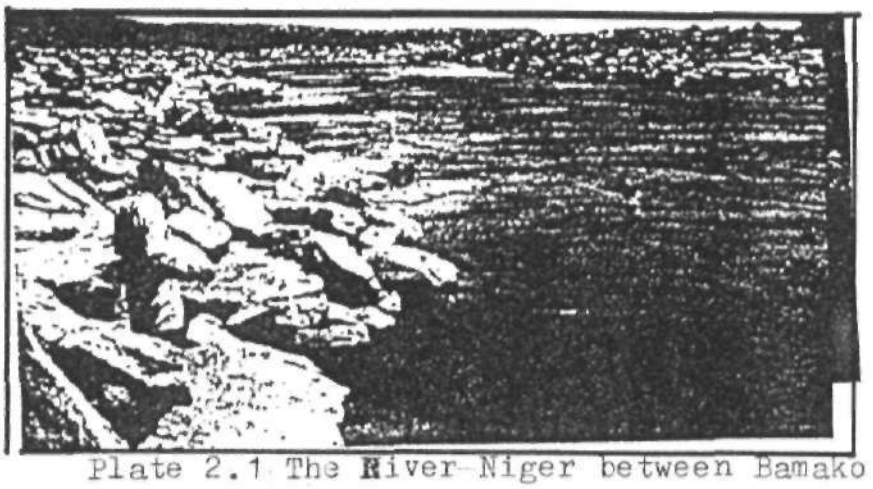


Plate 2.1 The River Niger between Bamako and Kou



Plate 2.2 The Railway bridge across the Niger, near Je



Plate 2.3 Niger between Jebba and Pattegi.

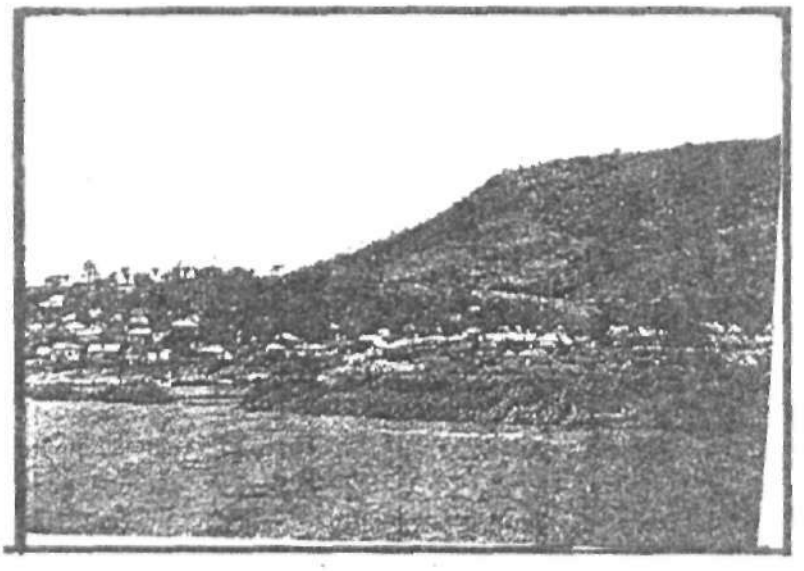


Plate 2.4 Mount Patti and Native Town of Lokoja (Mile 362)

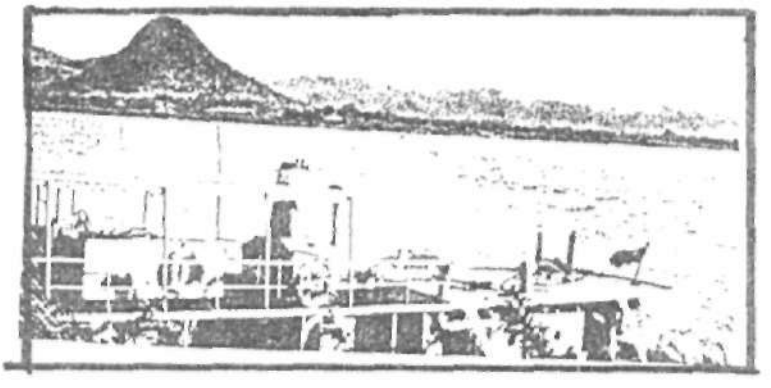


Plate 2.5 The Rocky Section of The Niger (Mile 350)



Plate 2.6 The Port of Idah during High Water.

Before Baro (mile 434) is reached, the river Kaduna joins the Niger which then turns southeast on the left. A few flat-topped hills are also seen . Some miles down stream from Baro, the table- mountains also appear on the right bank and at places the flat-topped hills still rise up over considerable distances in all their ancient grandeur, with precipitous slopes on each side. Gurara river also joins the Niger after Baro.

At Lokoja (mile 362) the Niger is joined from the east by its largest tributary, the Benue, which about doubles the annual discharge of the river. Downstream from Lokoja, the hills close in rapidly and the channel becomes narrow and rocky. Lofty granite domes and rounded hills separated by wooded valleys rise up on each bank and this part of the Niger, from Ogbo to Itobe, is considered the most picturesque section of its lower course.

After a short stretch where the river flows through its own alluvium, the Niger narrows again at Idah (mile 310) and flows between sandstone cliff, which pass into stretches of wooded rising ground. At Onitsha (mile 232) which is the largest town along the Niger, with very important and large market, the river-valley narrows for the last time. After passing the last rocky obstruction and still heading due south, the Niger flows in its own alluvial deposits, and finally bifurcates in many branches and reaches the ocean, into which its has built out a vast delta. *(See Fig. 2.1)*

The drainage area of the Niger amounts to 430,000 square miles, 75% or 1,930 miles of the total length of 2,550 miles of the main river, are useful for commercial shipping, divided into four navigable stretches. Below is the figure (2.2) showing the Navigability of the Niger.

NIGER	2,550 miles
Escravos	0
Burutu	40
Warri	44
Siama	88
Patani	130
Aboh	177
Onitsha	232
Illushi	272
Idah	310
Itobe	332
Lokoja	362
Badon	399
Baro	434
Jebba	556
Bussa	642
Yelwa	688
Frontier	790
Malanville	811
Say	955
Niamey	995
Tillabery	1,068
Labbenzenga	1,149
Ansongo	1,211
Gao	1,270
Tosay	1,341
Timbuctu	1,528
Dire	1,574
Mopti	1,765
Sansanding	1,918
Ségou	1,940
Koulikoro	2,041
Bamako	2,081
Siguiri	2,209
Kouroussa	2,307
Source	2,550

BANI	780 miles
Mopti	1,765
Douna	1,963
Source	2,465
SOKOTO	390 miles
Confluence	753
Birnin Kebbi	860
Sokoto	884
Source	1,143
KADUNA	360 miles
Confluence	485
Zunguru	565
Kaduna	705
Source	845
BENUE	810 miles
Lokoja	362
Umaisha	401
Bagana	434
Loko	454
Makurdi	510
Abinsi	528
Ibi	614
Kwatta Namido	712
Lau	778
Gamadio	815
Numan	846
Yola	888
Wuro Boki	916
Frontier	926
Garua	972
Riao	1,008
Lagdo	1,011
Source	1,172

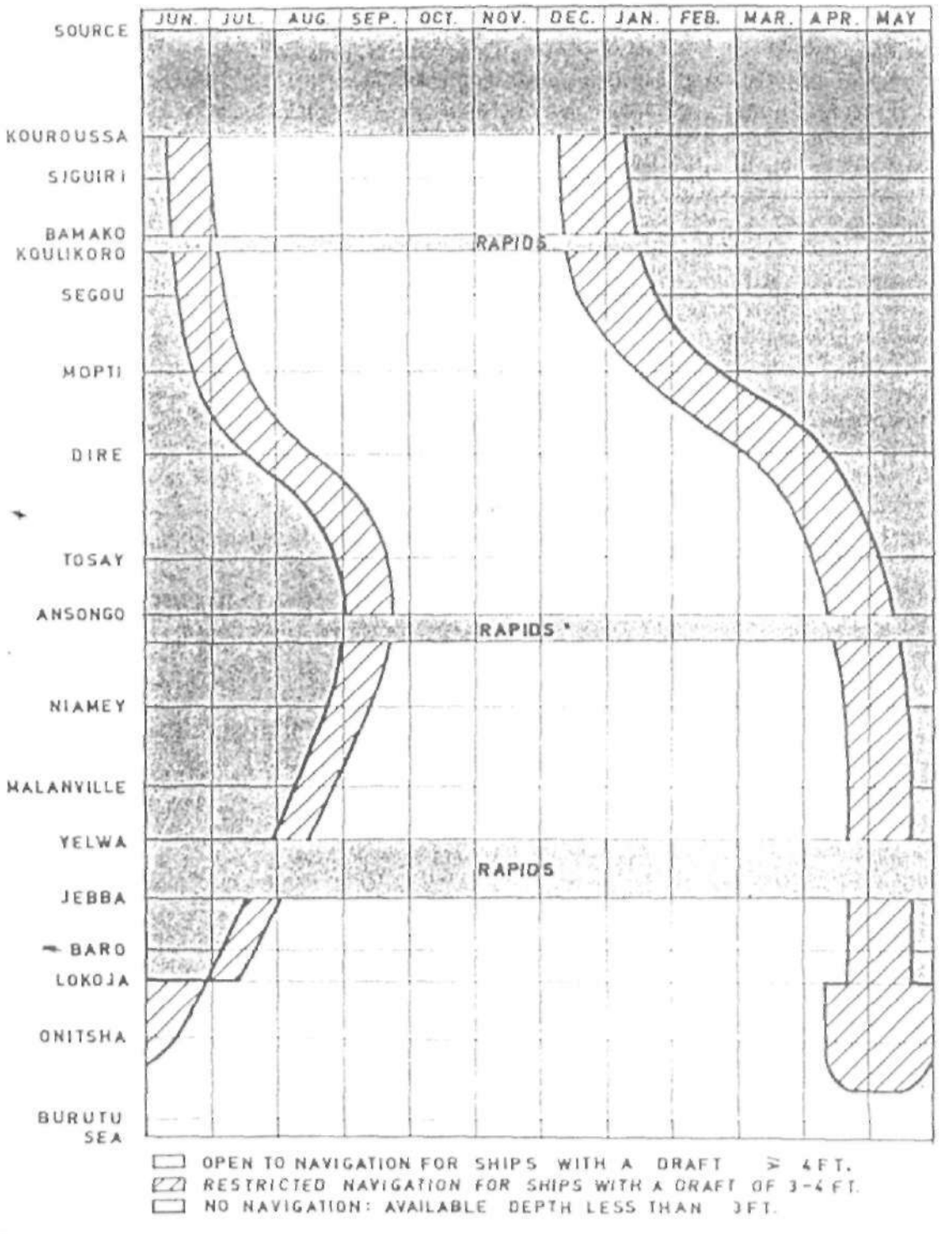
TARO	235 miles
Confluence	926
Beka	950
Safai	983
Source	1,160
GONGOLA	380 miles
Confluence	846
Bare	855
Shellem	877
Dadinkowa	935
Nafada	1,001
Source	1,226
TARABA	200 miles
Confluence	672
Gassol	691
Beli	753
Source	872
DONGA	210 miles
Confluence	636
Nyankwala	649
Donga	686
Source	846
KATSINA ALA	215 miles
Confluence	536
Sevav	570
Katsina Ala	610
Source	751

Table 2.2 MILEAGE OF VARIOUS TOWNS ALONG THE NIGER AND ITS MAIN TRIBUTARIES

2.6.1 Navigability of the Niger.

The Guinea area of West Africa has only one major navigable river, the Niger. This route to the interior, however was not discovered until 1830, although European ships had sailed along the coast for many decades. As should be expected, river transportation at the end of the dry season is at a minimum. In Nigeria, the seasonality of rivers restricts navigational transport. Canoes, which can operate in shallow water are important in local trade on certain parts in the river throughout the year, however, the canoes do not form part of the inland system for long distance freight and passenger traffic.

On the Niger above Lokoja (navigable up to Jebba) a clear distinction in high, middle and low water discharges can be made. The high water discharges occurs from August to November and are caused by the direct run-off of the large precipitation in these months. The high water is directly followed by the low water discharges, as the climatic conditions are such that after the rainy season precipitation is practically zero for the rest of the hydrological year. The flood in the reaches of the Niger is flattered to a practically constant discharge when the run- off from the basins of the upper catchment areas in the French West Africa reaches Baro, after 4 to 6 months of long distance journey. The fall from the high water to the sustained middle water (black flood) is rapid. Early in the black flood (December) navigation is influenced, which has been described as retarded scour. In the low water period (April- July) the discharge decrease to such small quantity that although scour of several feet may occur navigation is impracticable.



Navigability of the Niger

Thomas (1959) pointed out that "the rhythm of seasonal navigation in Nigeria is marked by the advance of commercial canoes from the lower part of the main Niger into the Benue as soon as it rises sufficiently. Medium size boats follow and then the powered craft enter with barges".

2.6.2 Dredging of the River Niger.

The award of the contract for the dredging of the River Niger by the Federal Government through the PTF and the Federal Ministry of Transport signed on the 10th of February 1999 is going to play a vital role in development of river transportation. This is in line with the recommendations made by NEDECO in a report submitted in 1959, to improve the navigability of the river. The dredging of the river will not only enhance navigation but will go further to enhance commercial activities in the riverine areas and therefore contribute tremendously to the economic growth of the country. In developed conditions, the river will provide even surface for smooth sailing making water transportation inland economical. This further necessitates the provision of port terminal and other port facilities.

Commenting on this Abubakar (1999) said "this will be a catalyst for the economic up-liftment and development of the hinterland". The new Nigerian (Feb. 11. 1999) reported that "when completed ships carrying 2,000 tonnes of cargo would be able to navigate into the interior of the country, the width of the dredging would be 100 meters to enable ships turn around at any point in the river the distance to be dredged at 537km from Warri to Onitsha, Idah, Lokoja and Baro. This would take the navigable part of the river to about 90km only from Abuja. The contract for the construction of river ports at

Idah, Lokoja and Baro as well completion of Onitsha port will be awarded soon". NEDECO (1959) pointed out that "dredging offers a direct way to improve the river bed by removing soil from it."

2.7 RIVER PORTS AND ECONOMIC DEVELOPMENT

River transport is about the cheapest means of transportation and has the advantage of heavy haulage. Transport facilities are the formative power of economic growth and lack of them are a major hindrance to rapid economic growth and social progress. To ensure that no part of the country is left behind in the economic development and progress, it is necessary to establish a means of researching all parts of the country. For efficient inter flow and distribution of both domestic and foreign products, river ports become necessary as they serve as a junction in the feeder and distribution routes between the production and consumption areas. A river port can be described as a place where there is little or no range of tide. In such an instance, the factor governing access to the port is the rise and fall of the river level.

2.8 PRINCIPAL RIVER PORTS IN NIGERIA

Principal river ports in Nigeria ,shown on plate 2.7, are those ports along the Niger and Benue rivers. They include the ports of Onitsha, Idah, Lokoja, Baro, Jebba/Rabba and yelwa on the river Niger. Those on the river Benue are Markudi, Ibi, Lau, Numan, Yola/Balmare and Garua.

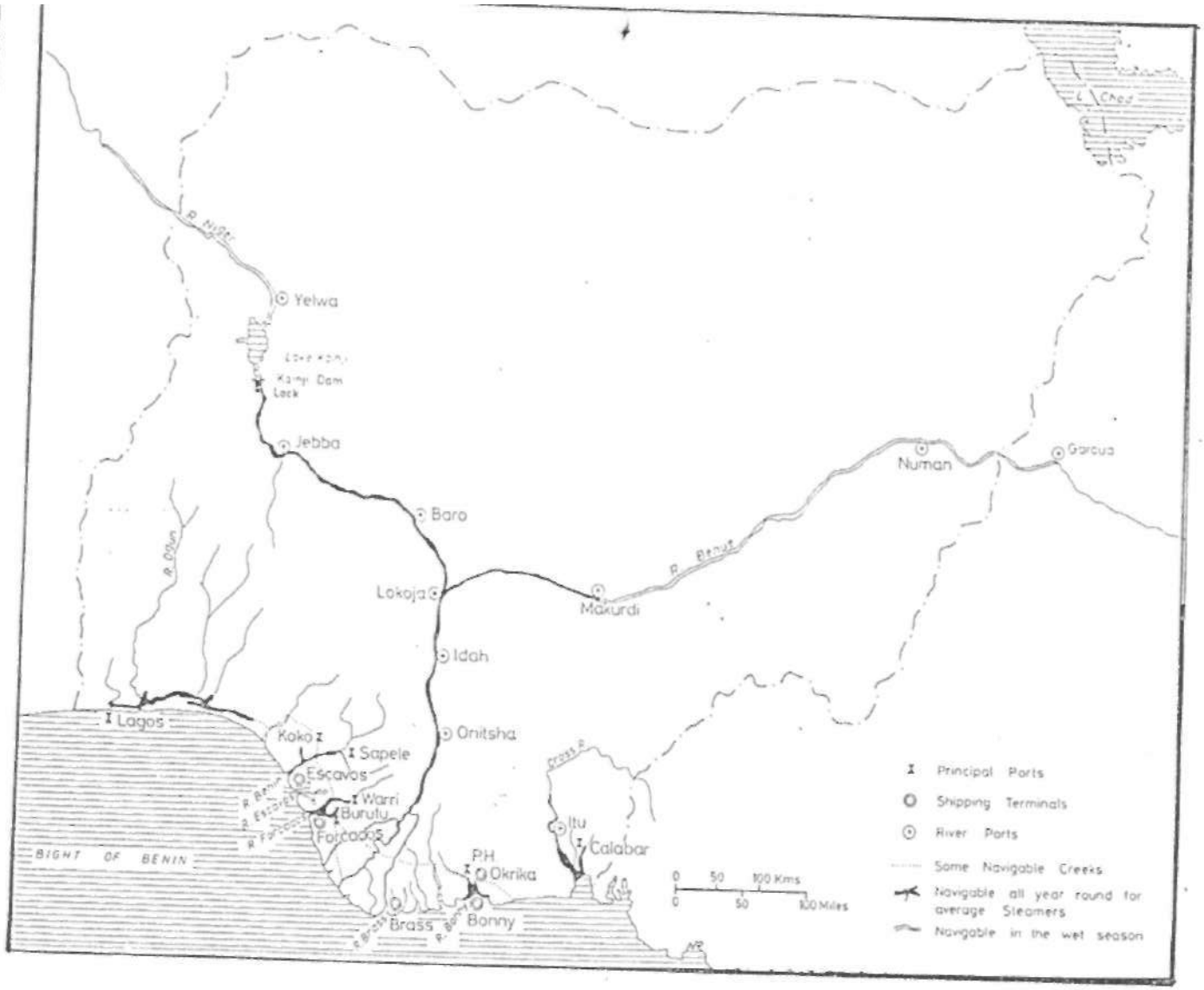


Plate 2.7 Principal River Ports in Nigeria.

2.8.1 The Port of Baro.

Baro port was one of the inland water ports used by the colonial masters to evacuate food and cash crops as well as slaves from the hinterland to the sea ports. On the coastline of Nigeria, the cargo was transported onward via the Atlantic Ocean to Europe.

Agaie Local Government (1993) reported that "the colonial inland water port of Baro was used right from the era of Western slave trade to 1960. It was used for military and commercial purposes, still in existence on the premise of this port are store and warehouses of European trading companies such as UAC and Royal Niger Company".

At the port of Baro, a rock embankment provides ample space for railway sidings. The cargo was man handled along improvised flights of steps, directly into cargo trains. Despite the absence of landing stages, quays, sheds, and other imperfections which delayed the quick turn around of ships in this port, daily totals of loaded products of 1,000 tonnes were still reached. There was also the problem of irregularity of arrival of goods train at the Baro port, as it is serviced by railway.

Baro has participated to a greater extend in the evacuation of cash crops from the north of Nigeria to the seaports, in the season 1957-1958 over 70,000 tonnes of groundnuts were handled at Baro. According to NEDECO's report (1959) "Baro in the rail head of the line from Kano and plays an important role in the evacuation of the groundnut crop from the Northern Region. In fact, it is one of the most important port on the Niger".

The route to Baro by water (i.e on the Niger) eventually is the most economic route for bulk products. Above all, if the improvement of th e Escavos Bar projected for

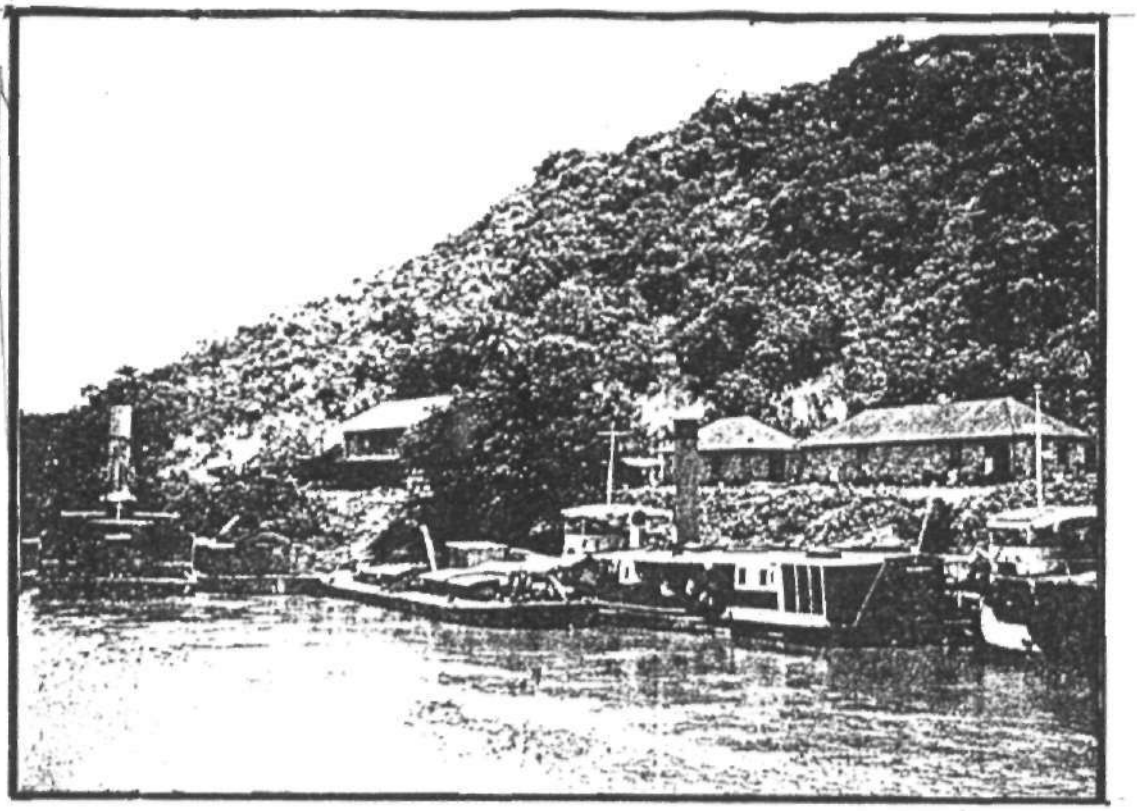


Plate 2.8 THE PORT OF BARO

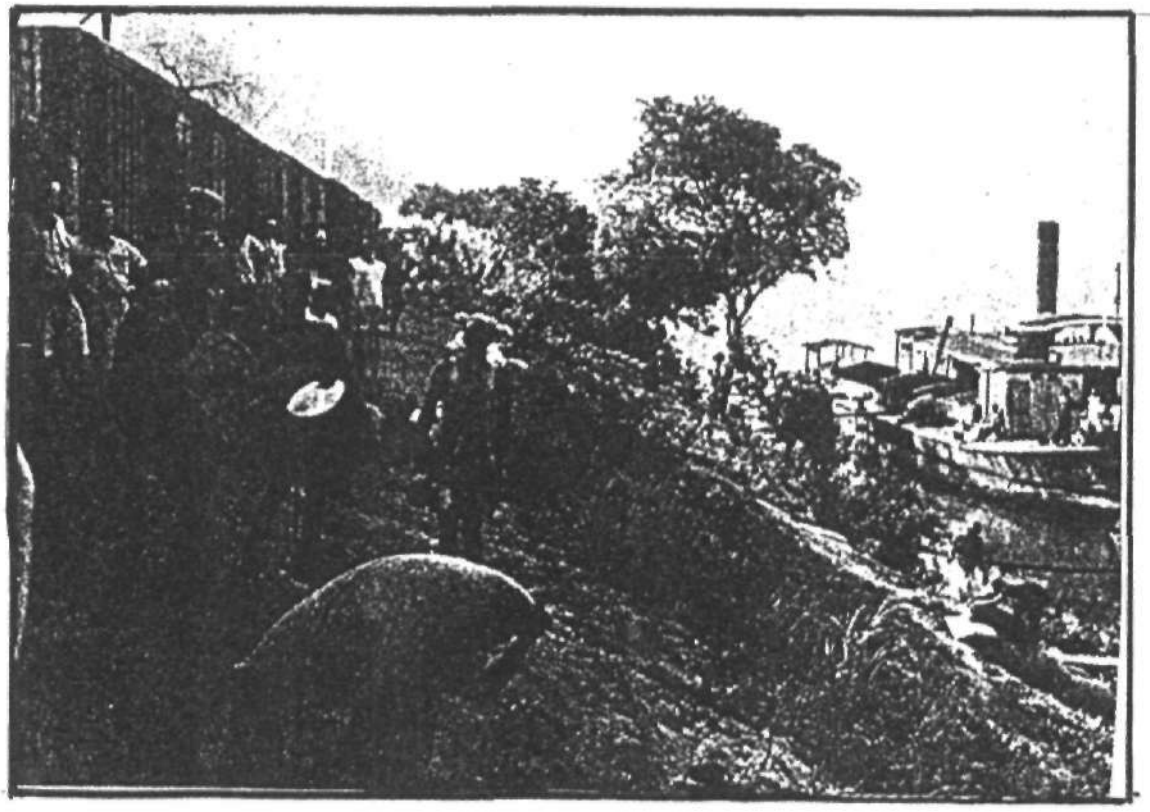


Plate 2.9 HANDLING AT BARO.

1960 had been implemented, it would have been of essential importance for Baro and other river ports.

To meet up the present rate of overall development of ports in Nigeria, improvements such as building port management office blocks, quays and berth in the river ports is necessary.

NEDECO (1959) reported that "all provisions already made in the river ports are the result private enterprise. Mention should be made of the building of sheds, quays and berths, the installation of the radio- telephone communication system, and improved organisation of ports management". Warri, Burutu and Onitsha ports have been considerably improved in the past decade and plans are in hand for building quays, berths and other supporting facilities at Baro.

2.8 CONCLUSION

From the exploratory studies above, the port of Baro has not been provided with important facilities that are required for smooth and efficient operations and it was able to handle a reasonable volume of cargo. With reference to Morgan (1963) "there are many ports which however, do not contain ship quays and these primitive ports carry on an apprecaible aggregate of world trade". Baro port is an example such a port referred to in Morgan's statement.

To make this port more efficient, it is necessary to provide the facilities which will improve productivity and commercial activities in Baro port. This work is expected achieve a maximum level in provision of buildings as part of the facilities in this port to improve maritime activities in the hinterland.

Making a remark, Hoyle et al (1970) stated that " the utilization of the resource of the land area influences the demand for port facilities and the provision of facilities in turn is a vital factor in the development and prosperity of the hinterland". The provision and improvement of port facilities cannot therefore be a matter of chance, but must become a high priority concern within the sphere of national and regional economic planning.

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CHAPTER THREE

PORT FACILITIES AND OPERATIONS

3.1 PORT FACILITIES

Port facilities are very essential installations which aid port operations, they maximise efficiency in port performance. Morgan (1952) said that "a port installation with an inferior habour suffers from drawbacks just as much as a good habour with an inferior port installation". In essence the two are complimentary for both naval and commercial ports.

The principal operations to which harbour works are dedicated is transfer of goods from one transportation to another, e.g. from ships to truck, train etc, this therefore make docks, wharves and quays the most important assets of any port. Other important ancillary port services are fire fighting facilities, rescue, medical, port security and policing services. Equipment maintenance areas, dangerous material areas, canteens, rest rooms and temporary living quarters, fuel bunkering facilities and minor repair facilities are equally important in ports. Others are ships provisions and spare parts, quarantine facilities, communication, services (water, light, sewage), pollution control, waste disposal and environmental protection (beaches, green areas, open spaces and landscaping). Recreational facilities for ships crew and port works, port administration and control offices as well as passenger services are also ancillary port services.

In this write up, attention will be paid to some port facilities that have direct link with architecture or that are architectural inputs in port development.

3.2 TRANSIT SHEDS

Transit sheds within the port serve the purpose of primarily providing buffer zone to harmonize the faster ship shore flow with the slower shore inland movement. They are provided for the purpose of temporary storage for goods discharged from vessels awaiting clearance and distribution to warehouse or Railways. Goods arriving by land and awaiting shipment are also kept in the transit sheds. In addition, these areas provide a safe place for checking the condition of all consignments and their correspondence with the manifest and bill of loading, and for accomplishing the necessary customs and delivery formalities. Transit sheds should not be used for long term storage in any event. This is the function of the warehouse. Transit sheds are located near general cargo docks adjacent to the water front.

Due to the location of transit sheds, the length is usually limited to about 110 to 120 metres or more by the average length of the berth (160 to 180metres). It is also necessary to leave wide access space between two neigbouring sheds, to give each shed the required amount of aisle space for rapid handling of goods. There is less restriction in selecting the width of the shed as compared to the length.

Experience in many developing countries has shown that sheds should preferably be not less than 60 metres wide, with 50 metres as an absolute minimum when there is shortage of available space on land.

There are divergent opinions on the appropriateness of multi- storey sheds for either transit shed or warehouse. Cargo handling is greatly simplified in single storey

sheds and the need for the expensive foundations and cargo lifts are obviated. Exceptions in multi- storey sheds are in situation where the second storey is used for a passenger terminal.

Quinn (1961) found out that " One thing most operating port staff and authorities appear to agree on is the unsuitability of using more than two storeys as a transit shed because of the difficulty in providing for rapid vertical flow of cargo".

Transit sheds should be devoid of excessive number of interior columns supporting the roof. This will impede the free movement of mechanical equipment in addition to reducing the usable space on the floor. Insufficient width of shed, below the absolute minimum of 50 meters should be avoided. Adequate provision for ventilation and lighting which makes cargo handling easier and faster should be given special attention. Floors should be of good quality; smooth and have enough resistance to wear and tear. An insufficient number of doors, and poor suspension of doors so that opening and closing is difficult or slow should be very much avoided. Offices should not be located on the ground floor of the shed as it results in waste of space within the shed, offices could be located in the upper floor.

Transit sheds should be flexible such that they can meet the changing terminal requirement, it is an advantage to be able to dismantle a transit shed and re-erect it in a different location. There is need for loading platforms on the rear of transit sheds for berths which are expected to continue to be used for break-bulk -cargoes for some considerable times. It is advantageous to have the rear loading platform running the whole

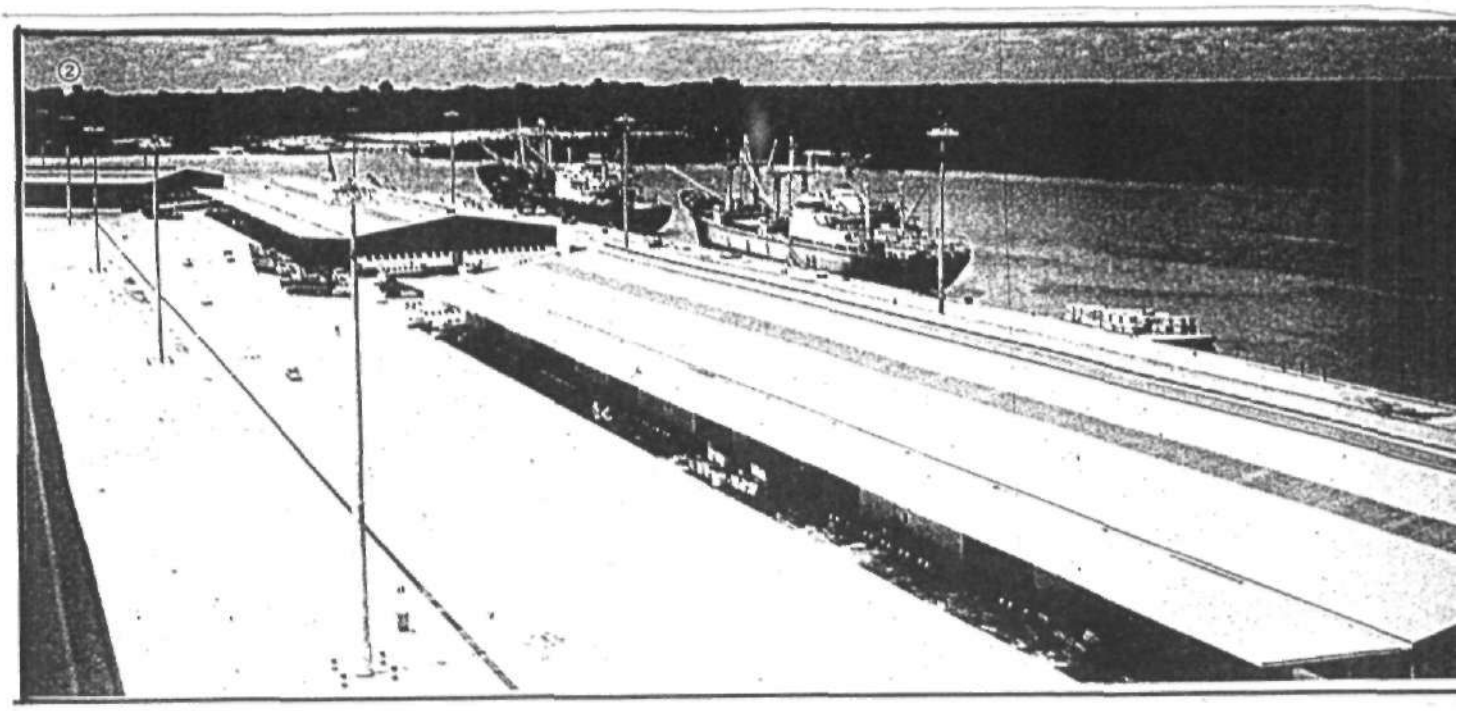


Plate 3.1 Transit Sheds, Calabar Port , near water front

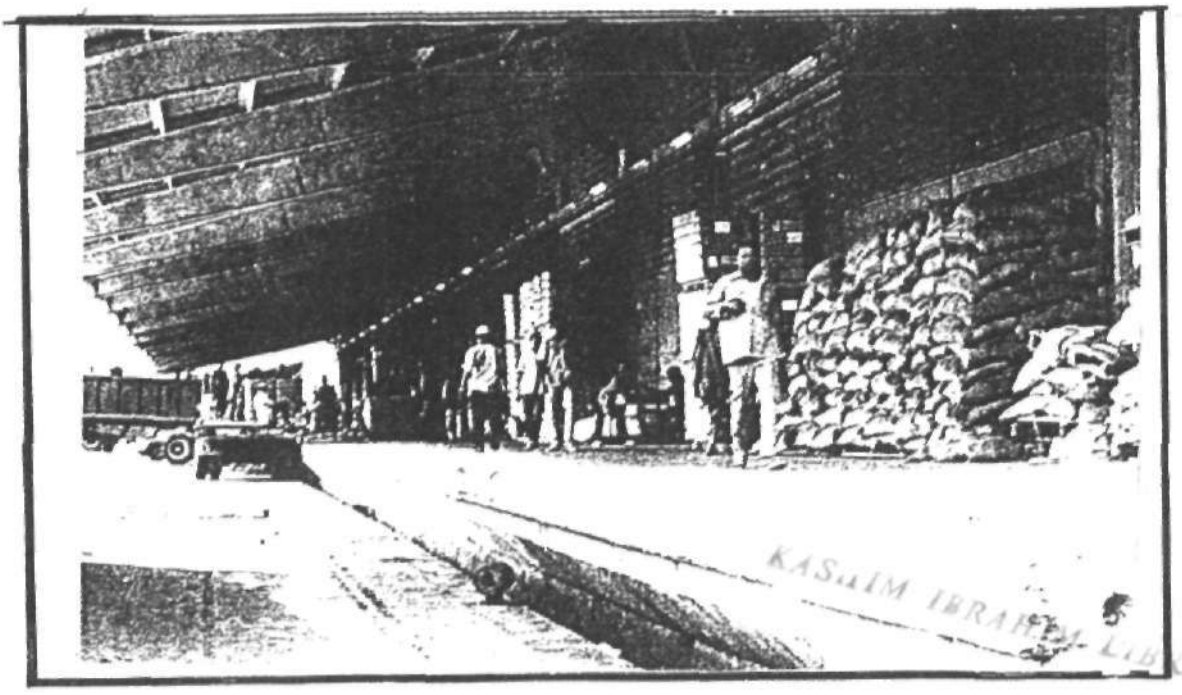


Plate 3.2 Trucks loading at transit sheds, Lagos port.

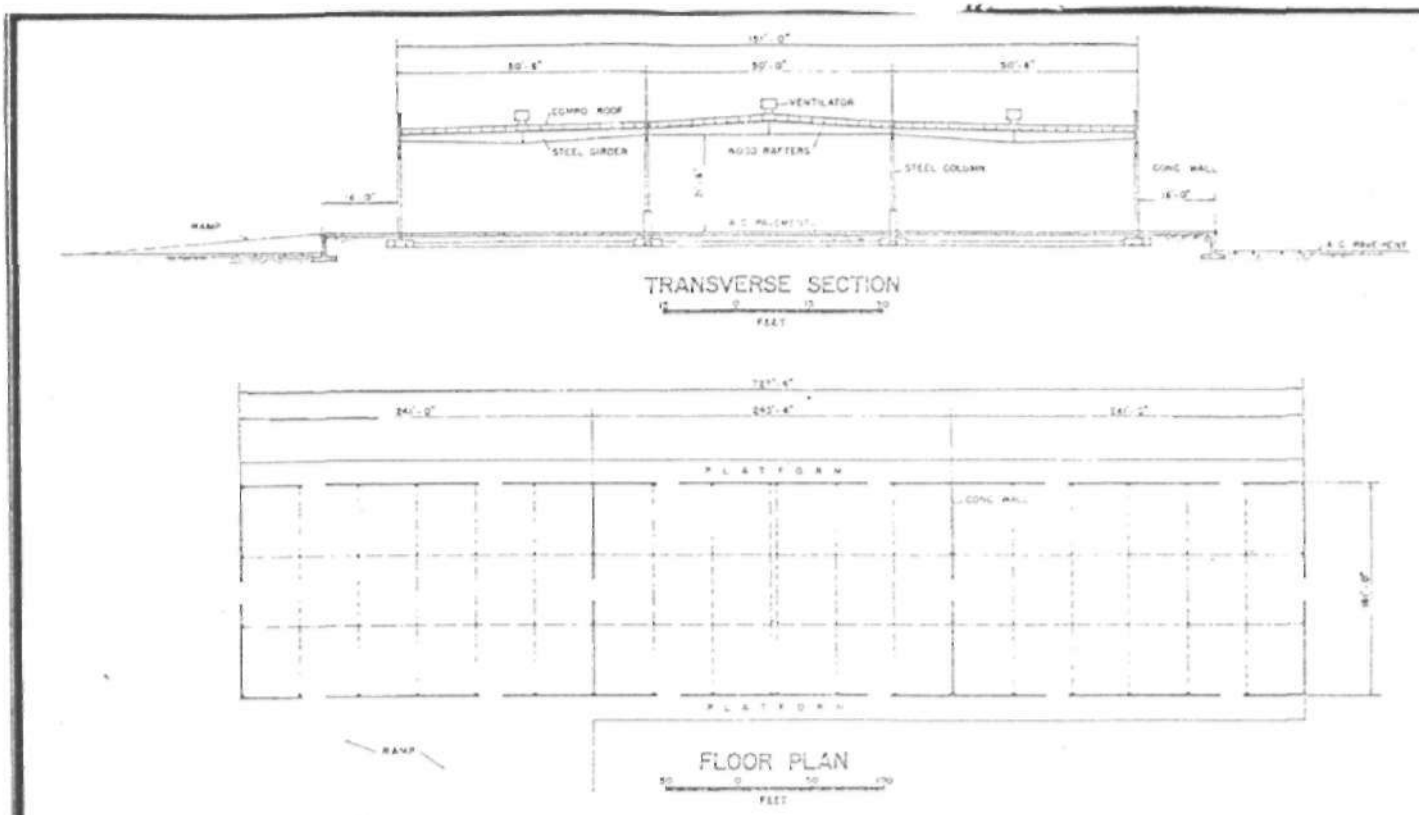
length of the shed, as trucks may be loaded or discharged without the use of fork lifts. (See plates 3.1 & 3.2)

3.3 WAREHOUSES

A warehouse means a building constructed in the general vicinity of a ship berth where cargo to be shipped out or which has come in by ship can be assembled for comparatively long term storage. Warehouse storage is needed when the maximum cargo flow exceeds the storage capacity of a reasonably sized transit shed. In essence it should be recognised that the transit shed and the warehouse are complimentary; their total makes up the storage capacity in a port. Therefore, care should be taken in deciding the reasonable size of warehouse. Warehouses are essential in a situation in which the port wishes to engage in the commercial business of long term storage of cargo. An example applies to the cargo which must be aged or cargo which is to be sorted, packaged and sold from the warehouse.

The minimum space needed for satisfactory operations, maximum shed dimension avoiding long internal travel distances and the cost of labour needed for the transfer of goods to the warehouse are factors which must be considered in deciding how to divide the total storage capacity between the warehouse and the transit shed.

The warehouses are located on the rear of the transit sheds, in no condition should the warehouse be located on the water front. This is because economic considerations do not justify their construction on or alongside the docks. Another reason is to avoid the possibility of using them as transit sheds, thereby changing their true two function.



Typical warehouse, Port of Long Beach, California.

FIG. 3.3

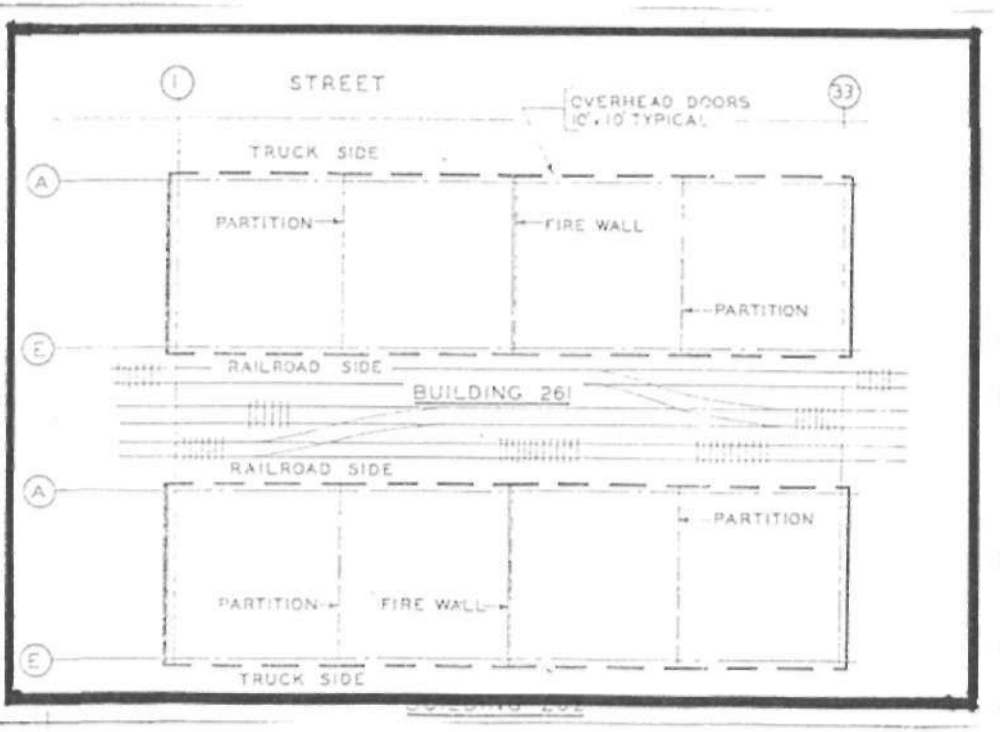


FIG. 3.4

Port Newark, New Jersey. Typical warehouse layout for efficient utilization of rail and truck service, cargo distribution buildings.

The overall dimension of a warehouse are quite often limited by the available space. However, the size can be best established by the use to which the warehouse is to be put, where space restrictions do not occur. The width and length can be determined from the dimensions of the site and the space required for access roads and rail road sidings. The building should be divided into compartments separated by fire walls and equipped with fire doors, to maintain fire protection. Interior columns should be widely spaced to achieve the advantage of less interference to cargo handling and stacking.

Loading platforms are particularly desirable at truck bed elevation at each side of the warehouse, and also railroad tracks for direct transfer of goods from rail car to warehouse and vice versa. These platforms should be wide enough to allow for easy maneuvering of mechanized equipment during loading and unloading operations.

Materials for construction of warehouse are steel frames, timber frames and reinforced concrete. (See Plate 3.3 & 3.4)

3.4. PORT ADMINISTRATION BUILDINGS

Port administration facilities vary considerably depending on the system of administration , the size of the port and its geographical location. It is generally accepted that a centralized administration machinery be put in place with a head appointed in each port. The port administration is normally under the control of the port manager.

Port administration buildings also house the following departments:-

i) General administration department

ii) Traffic and commercial department

iii) Harbour master's department

iv) Port Estates department

v) Accounts department

vi) Statistics department

vii) Communication and radio department

viii) Medical department

ix) Stores department

x) Customs department

xi) Port Police department

xii) Agents Offices

xiii) Engineering department

xiv) Port Maintenance department

3.5. WORKSHOPS

Workshops are important port facilities as they serve equipment maintenance as well as machinery repair and vehicular servicing purposes. The workshops in ports are multi-purposed buildings that are situated close to places that they service to minimize transport and speed up repairs. (See Plates 3.5 & 3.6)

3.6. COLD STORAGE BUILDINGS

A cold storage is provided for food items that require refrigeration. These items are shipped by refrigerated boats and distributed for use. Cold storage facilities are provided on the dock in such a position that the frozen goods can be taken from the refrigerated boat and placed inside the cold storage building in as short time as possible as

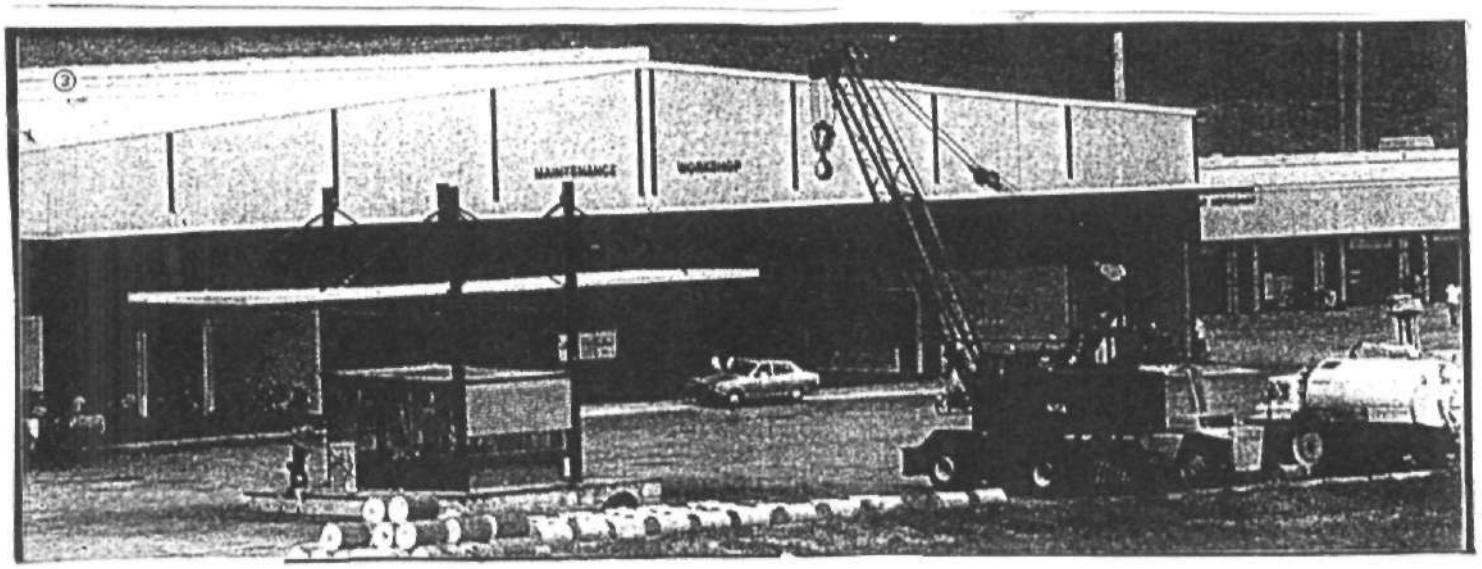


Plate 3.5 Worshop, Calabar port

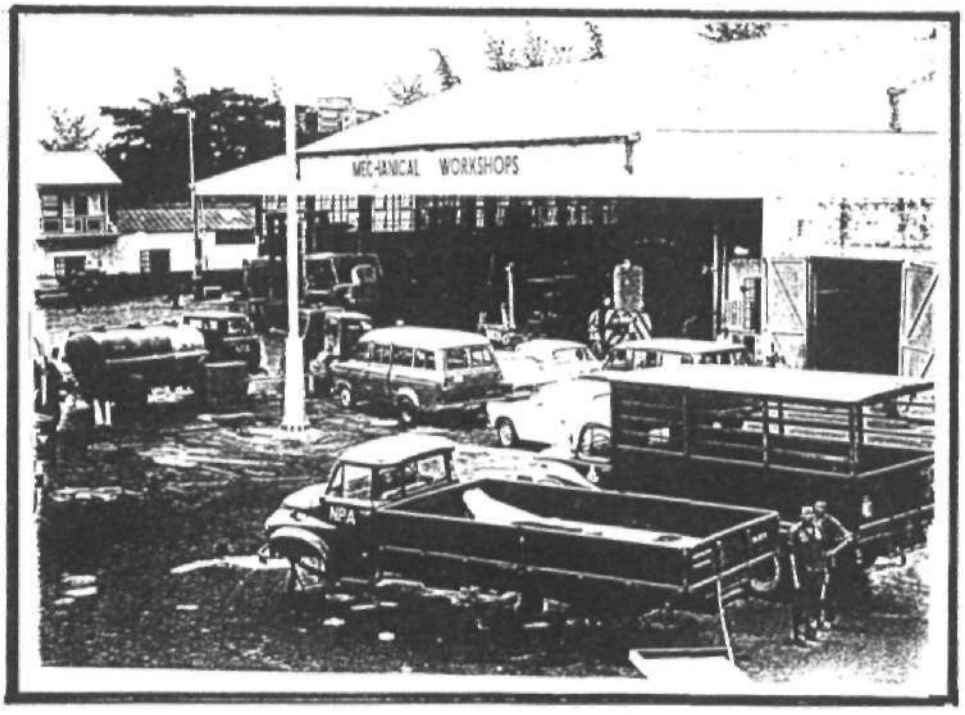


Plate 3.6 Lagos port, workshop.

to keep the possible temperature changes at a minimum. The basic principle of refrigeration is to keep deterioration of the goods at a minimum and at the same time, keep the same temperature and humidity as when it was first frozen. Fish, Meat, dairy produce, fruit and vegetable are the main commodities kept in the cold storage building. All these commodities have what is known as a critical temperature which is generated by the water content, and as a result some foods can be frozen while others have to be chilled, depending on their water content.

Cold storage buildings are designed to ensure maintenance of correct temperature, air circulation and humidity which are essential in food preservation. Adequate provision should be made for the area, and height of the cold storage building. Floors and columns should be able to stand the low temperature of refrigeration. Provision for insulation is also very necessary, and in most cases, cork is used to provide insulation around the entire storage area. Doors as also insulated appropriately. A heating element should be fitted on the meeting faces of the door and frame to prevent ice from forming, in order to ease the opening of the door. Each door should be with an air tight lock on the inside of the building to enhance self closing with rubber swing doors. The air lock helps to reduce loss of cold air from the building when the heavy insulated door is opened.

3.7 SHIPPING OPERATIONS

Shipping operations refer to the activities carried out in the handling of ships and cargo. The mode of action, specific act or transaction in ships collectively are known as shipping operations. The pilotage department of any port guides incoming ships and

outgoing vessels to avoid conflict between the vessels using the ports. This is also necessary to direct them safely through the port. Shipping operations are of two types; local and international operations.

Local operations are for vessels that ply between inland towns and require little customs formality. These operations are normally restricted to accepting, forwarding or delivering goods between the hinterland and the major sea ports. Depending on the distance to be travelled, the sizes of the ships operating in the river differ from those operating on the sea, passengers in small vessels move with their baggages through the customs office and are checked into the ship while boarding or into the exit while arriving. General goods are handled seperately.

International operations involve the larger ships sailing outside the boundaries of a country. Port operations in major seaports are similar, though the loneliness of water transport system, makes passengers prefer to travel by air or land while goods are shipped on the sea by sea going vessels. Passengers in large vessels surrender their baggages after customs check on their way to board the ship. Porters then carry the baggages to ships from conveyor belts. For arrivals, the baggages are collected from the baggages room by the owners and after customs check, the pasengers move with them into the lounge.

3.8 CARGO HANDLING

Cargo handling in ports is done in three major ways. The third is a combination of the two major ways.

i) manual handling

ii) mechanical handling

3.8.1 Manual handling.

Manual handling of cargo is very common in African countries as a result of cheap and available labour. Man-handling involves the transfer of loads to and from ships or vessels by men. Loads are carried either on head or shoulder. In Nigeria, man handling was employed in most of the river ports, and about 150 men are known to have loaded 1,200, tonnes of bagged groundnuts in one day, night hours not included.

3.8.2 Mechanical handling

Mechanization of cargo handling has high initial cost of installation than man handling and not all countries can afford the cost of installing mechanical cargo handling devices. This is the use of equipments and appliances to load and unload a vessel. Technological improvements recorded in the field of industry and commerce is responsible for this development. The equipments and appliances make handling of cargo easier and faster, all modern ports take the advantage of mechanization to hold down labour cost and to minimise the time that a ship remains in port.

Cargo can be classified into various categories depending on the type of handling equipment required. General cargo includes all items that are shipped as unit or packages eg bags, barrels, boxes etc. Bulk cargo refers to loose, unpackedmaterials that can be pumped or poured freely into vessel's holds, examples include grains, flour, palmoil, petroleum products, cement etc.

3.9 HANDLING EQUIPMENTS.

Cargo handling and evacuating equipment include fork lift truck, ship's gear, mobile crane and transverse fork lift truck. Others are trucks, trailers, multipurpose lorry mounted crane, conveyors etc. Handling equipment generally encompass all mechanical handling systems employed in ports to load and unload vessels.

3.9.1 Ships gear.

A cargo vessel has each of its hatch equipped with a pair of cargo booms. To load and unload a vessel, one of the hatches is strayed over the off-shore edge of the hatch, the other over hanging the wharf. There are cargo hooks hung from a link to reach both, hoisting lines are attached. The operator is able to drop the hook into either side of the vessels by joint manipulation, and manouvre the load vertically and horizontally to place of storage stacking.

3.9.2 Fork lift truck

These are small mobile machines which can pick up unit load and palletised loads off the apron and run them into the shed as well as stock them up to a height of 18 ft. For horizontal travel up to about 190 ft, fork lift trucks are considered efficient. Their efficiency diminishes beyond this distance because the trucks run at fairly slow speed.

3.9.3 Mobile cranes.

Mobile cranes perform a function similar to that of fork lift trucks. The limitation shared is with respect to horizontal travel as they are able to handle long object. Developed for operation in close quarters are compact, agile and pneumatic-tyred mile cranes.

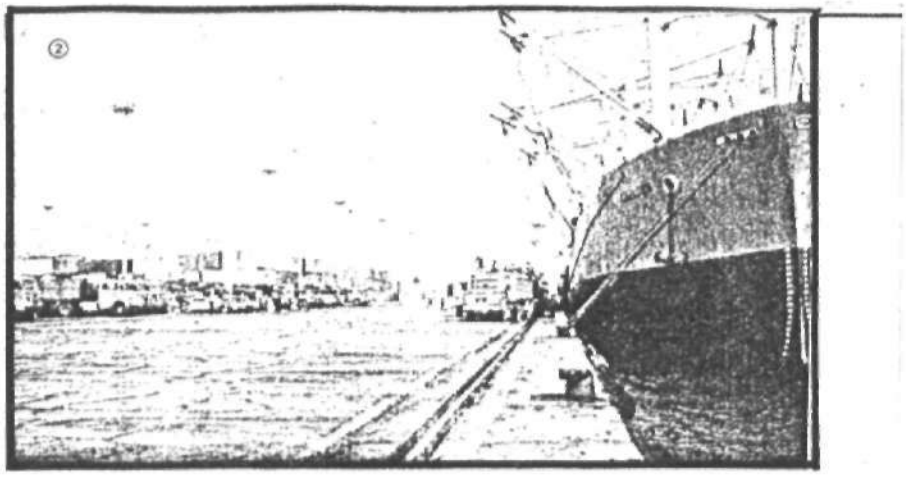


Plate 3.7 A vessel ready for loading, notice its gear.

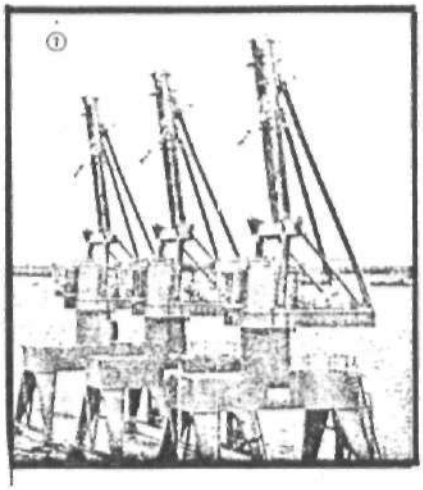


Plate 3.8 Heavy duty cranes for discharging/loading of cargoes.

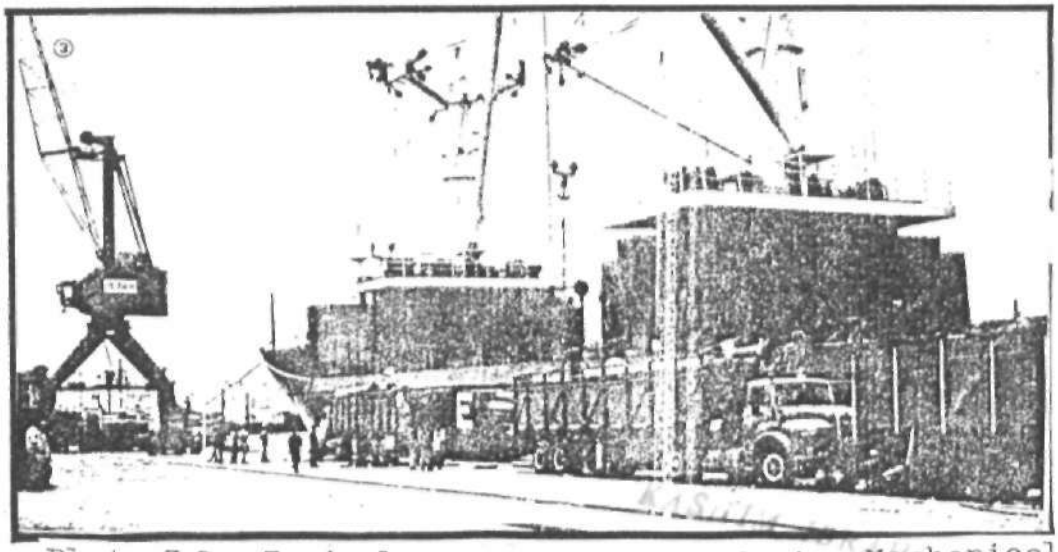


Plate 3.9 Typical scene at a Port during Mechanical Handling of cargo.

3.9.4. Conveyors

Conveyors are used in maintaining the flow of bulk cargoes from place of storage to vessels and vice versa. The different types of conveyors available for use in ports are belt or slat, overhead chain or manorail, pressure pipe and inclined plane conveyors.

3.9.5 Containerisation

The grouping together and packing of assorted items or bulk material into large re-usable containers is known as containarisation. Container are simply large boxes with doors that can be locked and sealed, they have been designed for almost any type of product and new innovations are constantly appearing on the market. There are many variations of the standard box container, however, they have in common modular sizes and standard fittings for handling and securing. They are special because they can be carried by any mode of transport, either land or sea transport - truck, train or ship, from one country to another. In addition, its size and certain basic features of its design have been standardized internationally. They can carry liquid cargo, dry bulk cargo, live animals - a mesh side with an open window allows fresh air enter. Some also are designed with special temperature and atmospheric controls for shipping fresh fruits and vegetables; others have low temperature refrigeration and insulation for cold cargoes.

There are many advantages in containerisation of cargo. With reference to Sturmey (1975) "containers can be filled and sealed in the factory or in a central yard for carriage to the port for shipment, thus reducing breakages and eliminating pilferage. At the port, the loading and discharging of ships is both quicker and easier". Another advantage is that

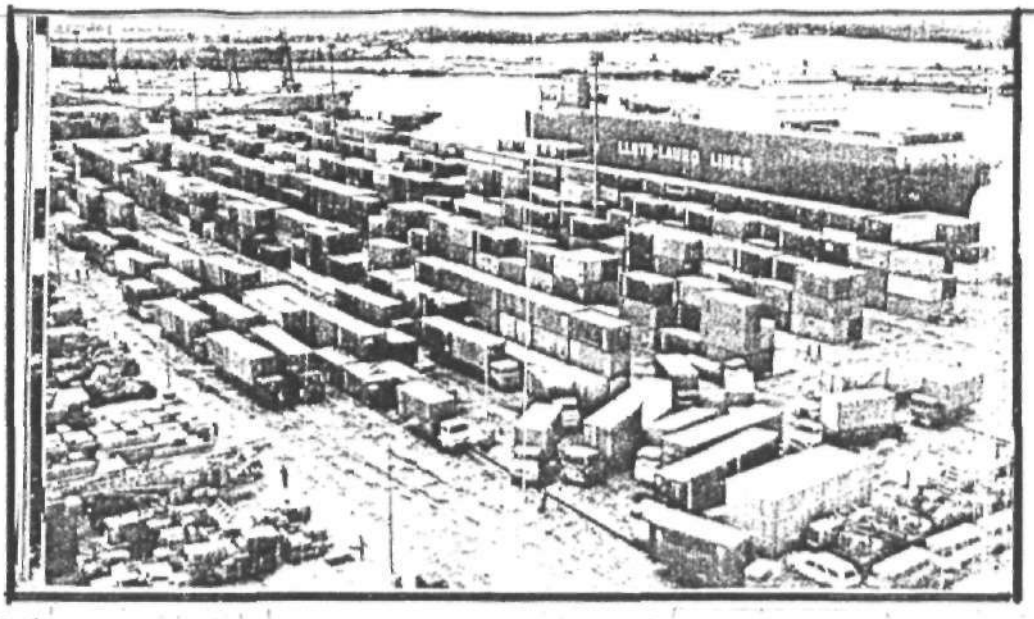


Plate 3.10 Assemblage of containers at contaner berth pending delivery/evacuation to contaner depot.

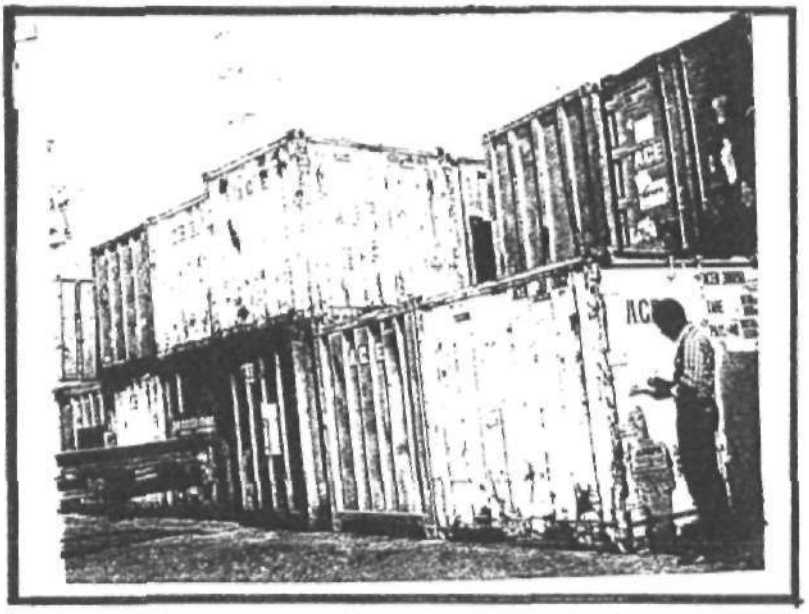


Plate 3.11 Stacked containers onwaiting delivery.

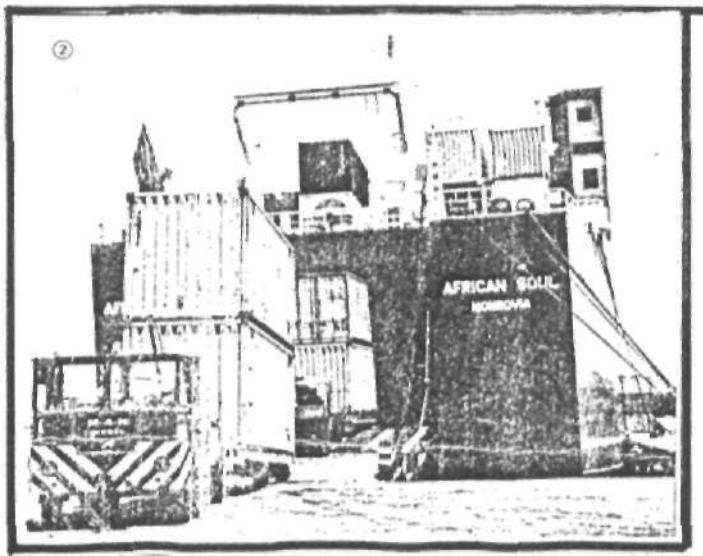


Plate 3.12 Containers transfered from a ship to trucks.

reduces shipping cost and speed up turn- around of ships. They are also easily off loaded directly on to trains or lorries for inland transport, or specially designed coasters or river craft for further water transport.

Hedden (1967) has pointed out that "a container berth is basically an area of hard standing alongside deep water and could be used for bulk cargoes, if container traffic does not materialise".

Containers can be made from steel aluminium or plywood.

3.9.6 Palletization

Traditionally, freight was either loaded in bulk or else as an assortment of items, each crated or boxed separetely. A pallet is basically a platform on which goods are stocked and secured for transport. Generally made of wood, pallets have top and bottom deck (or one dock with feet), leaving space that permits a fork lift truck or other mechanical handling equipment to ship its prongs under the load and easily move it around.

The palletization of good offer many advantages of containerisation. Its biggest advantage over conventional handling is that it cuts down damage by reducing handling time. In addition to shipment, well arranged and secured placement of goods on sturdy pallets offer savings in packaging. Port charges are sometimes lower for palletized goods and customs formalities are also simplified.

3.9.7 CONCLUSION

From the study of port facilities and operations, it can be concluded that a good harbour without facilities cannot perform the function of a port appropriately. Designers

and engineers therefore are charged with the task of effectively and efficiently providing such facilities to enable a port operate genuinely to contribute to economic development of a nation and or region.

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CHAPTER FOUR - CASE STUDIES

4.0 INTRODUCTION

Existing ports both within and outside the country have been taken as case studies to guide the researcher in the pursuit of this work. Three case studies have been taken in Nigeria while two others are foreign ones.

4.1 CALABAR PORT

Prior to the development of the port, the Calabar port was small and operated by many operators. The scope of its development was restricted by factors which include topography, economy and accessibility to hinterlands. The old Calabar port constructed at the mid part of this century is situated in the estuary of Calabar river and was used by many operators until 1969 when it was taken over by the Federal Military Government. This action of Government was dictated as a catalyst to national economic growth. Consequently considerable modernisation and expansion of the port of Calabar was then embarked upon in order to make the port facilities cope with ever increasing demand of our economic expansion.

The new port was opened on 9th June, 1979 and is expected to assist evacuation of agricultural products from other East and North-Eastern States of Nigeria as well as relief Port Harcourt Port of sizeable volume of imports meant for these states.

4.2 Facilities And Description

The Calabar port is provided with facilities which are intended to aid the smooth running of activities. Some of the facilities include: - administration buildings, workshops, transit sheds and warehouses, etc.

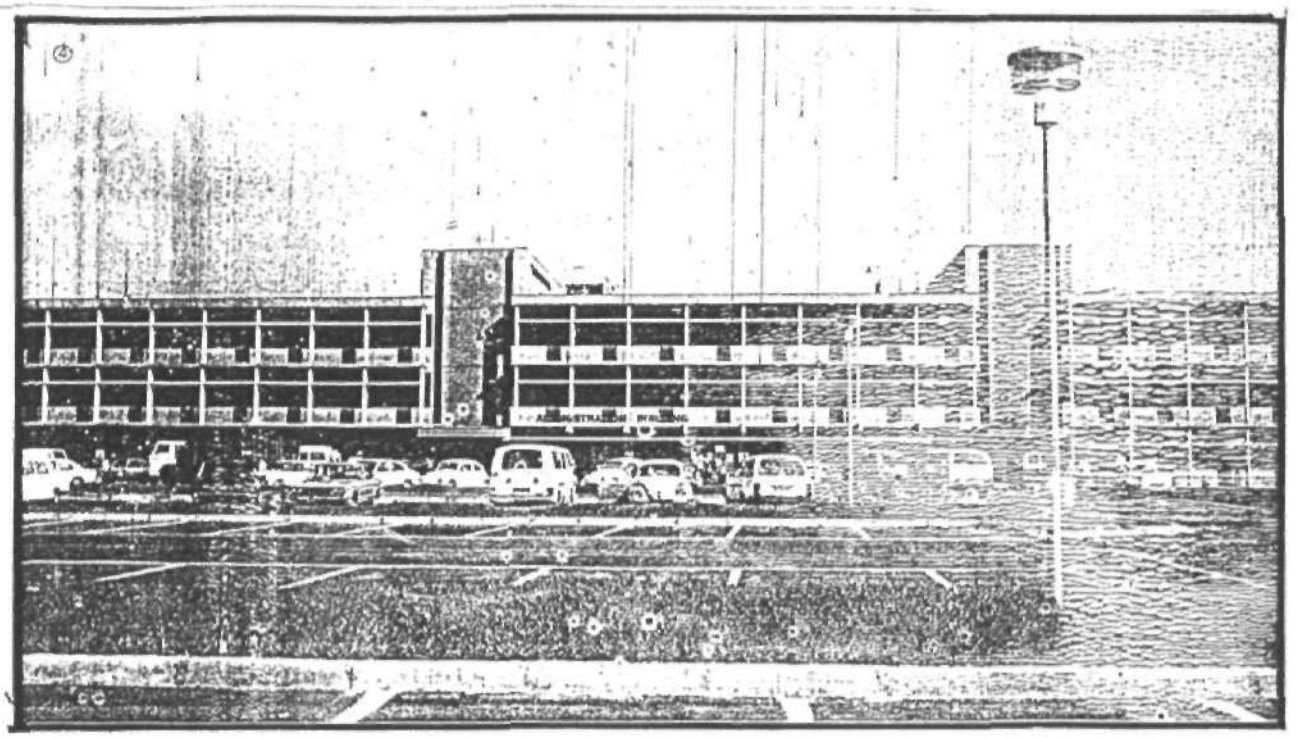


Plate 4.1 Calabar Port Administration Building.

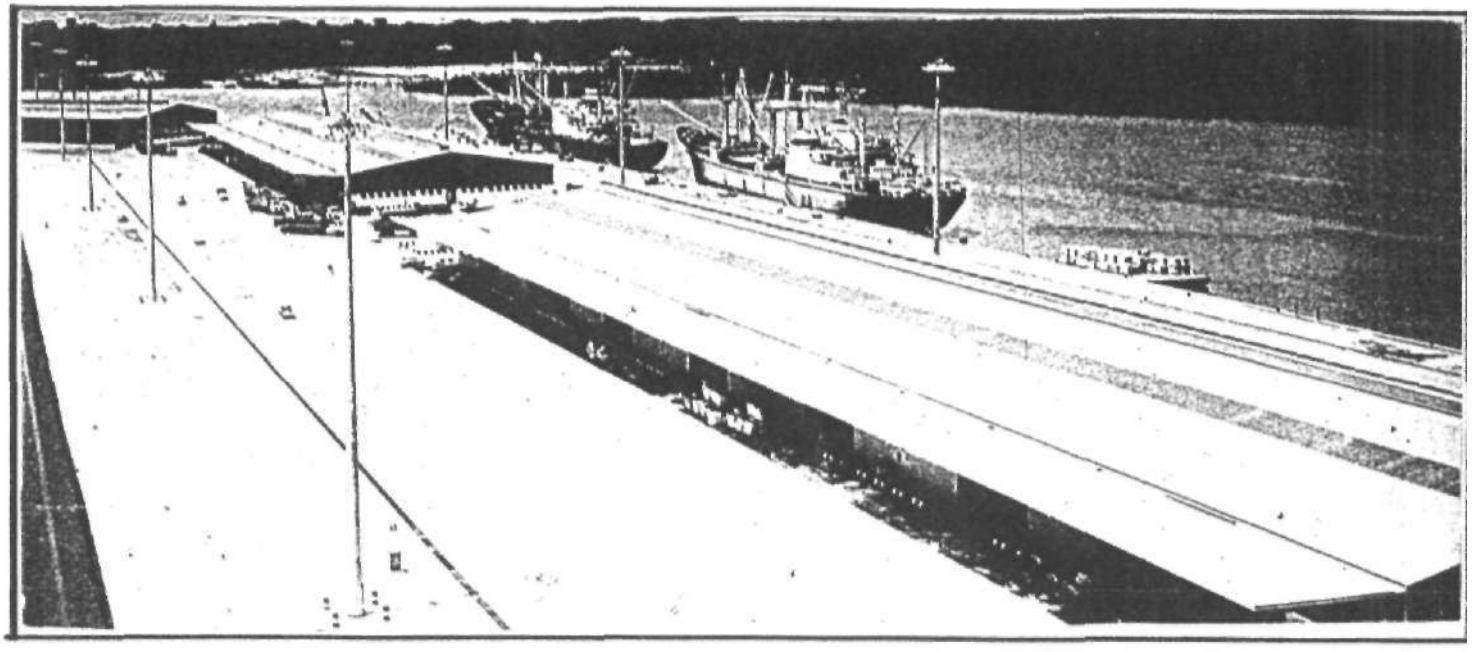


Plate 4.2 Transit Sheds, new Calabar Port.

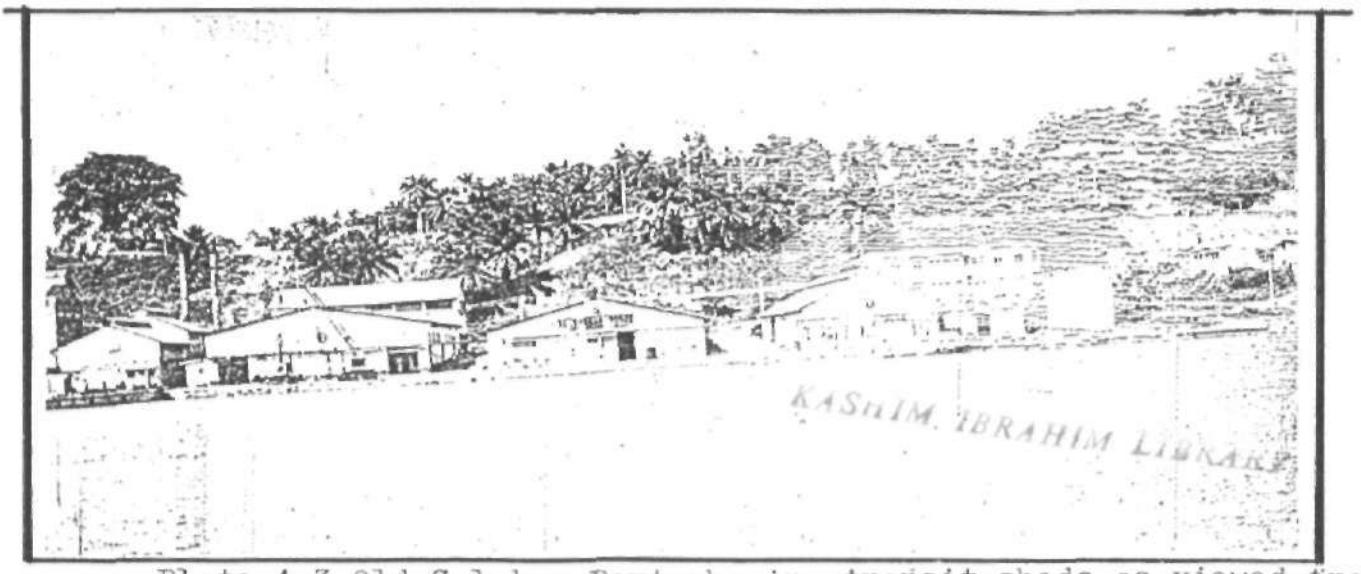

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Plate 4.3 Old Calabar Port showing transit sheds as viewed from the waterfront.

4.3 TIN CAN ISLAND PORT

The Tin Can Island port is a product of the oil boom era of the 1970s. This era which witnessed a tremendous increase in importation activities resulted in the congestion of the ports and threw port activities into confusion. The government therefore decided to build another port at Tin Can Island to decongest the Apapa Quays of the high volume of Lagos bound cargo. The port was constructed by Julius Berger Nigeria Limited and was commissioned on October 17, 1977. Located North - West of Apapa port with a bearing of latitude 6° 27' E, the port covers an area of 73 hectares.

4.4 Facilities And Description

The Tin Can island port is made up of administration buildings, control tower, 5 transit sheds, 3 warehouses, workshops, custom's clearance, social buildings, clinic, police and fire brigade stations, harbour cranes and crane tracks.

All the transit sheds in this port are single span structures with offices and toilet facilities at adjoining ends. They all have an equal area of 170 x 40 metres and the total storage space available in square meters for the 5 transit sheds is 34,000.

4.5 APAPA PORT COMPLEX

Formerly referred to as Lagos port complex, the Apapa port complex is Nigeria's largest and most important port. It is an ocean port and also the headquarter of the western zone of Nigerian Ports Authority. The complex encompasses the following ports: Apapa Quays, Apapa Dockyard, Fish Wharf; Ijora Wharf, Third Apapa Wharf extension, Apapa Petroleum Wharf, bulk vegetable oil wharf and Atlas cove tanker jetty.

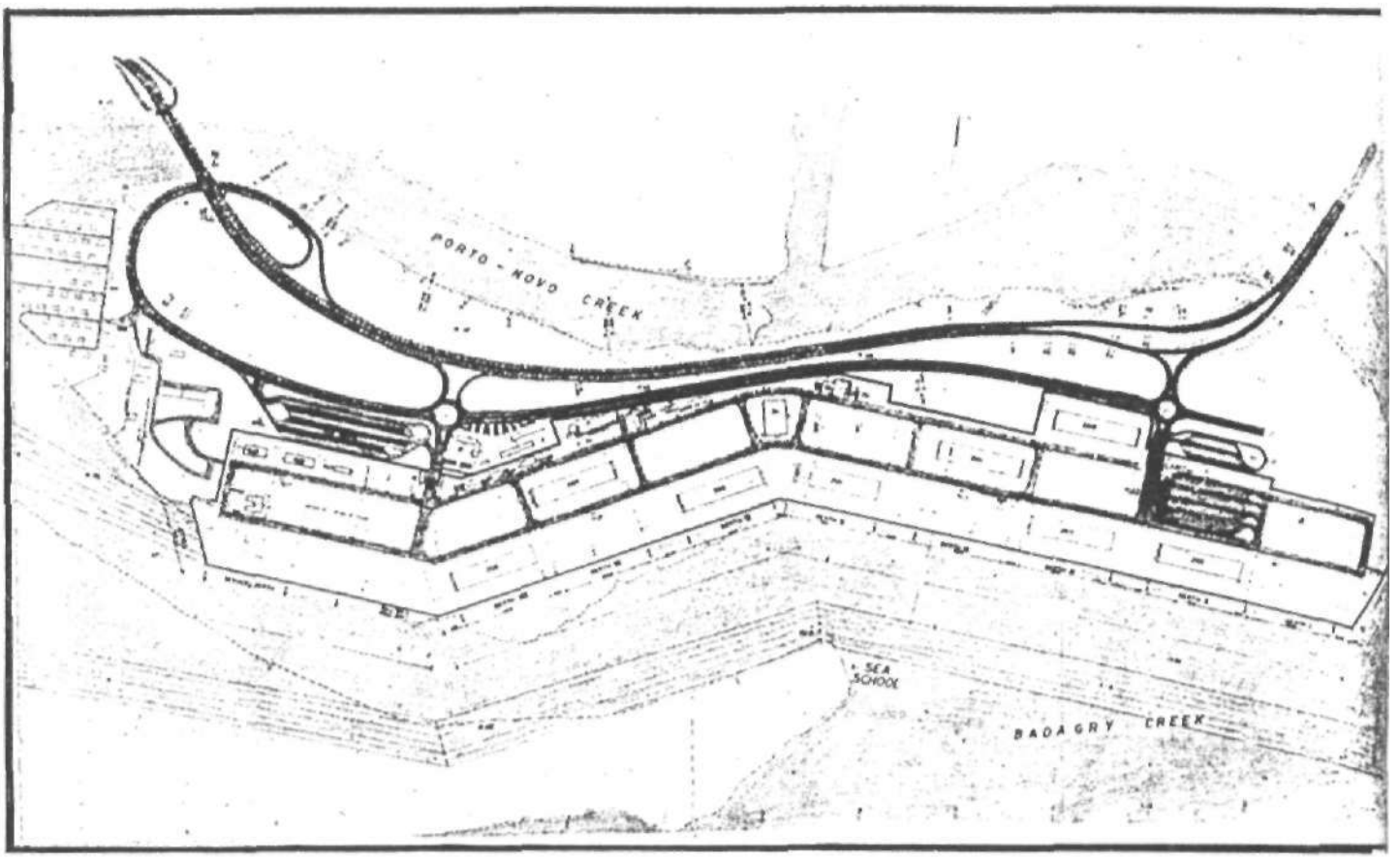


plate 4.4 tin can Island port, Layout.

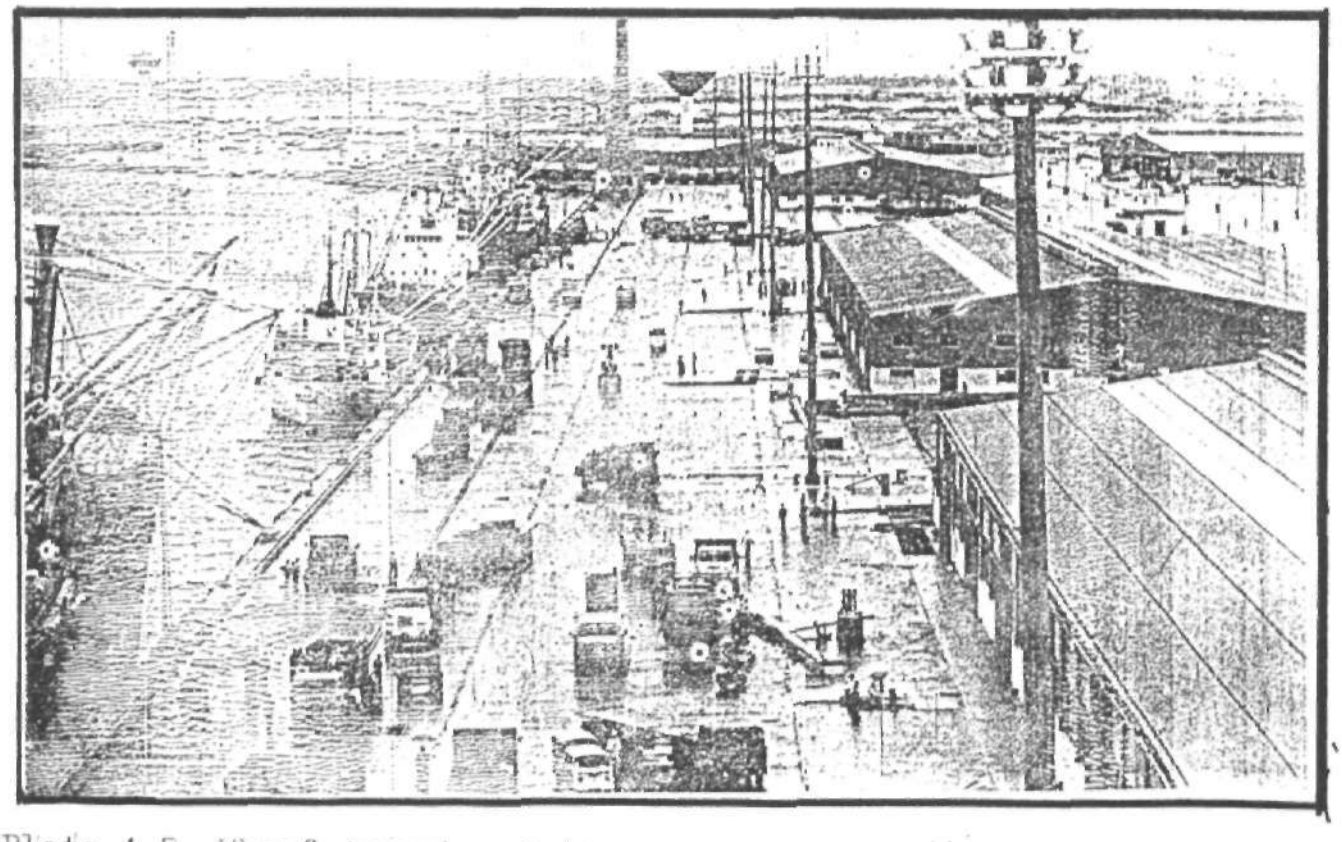
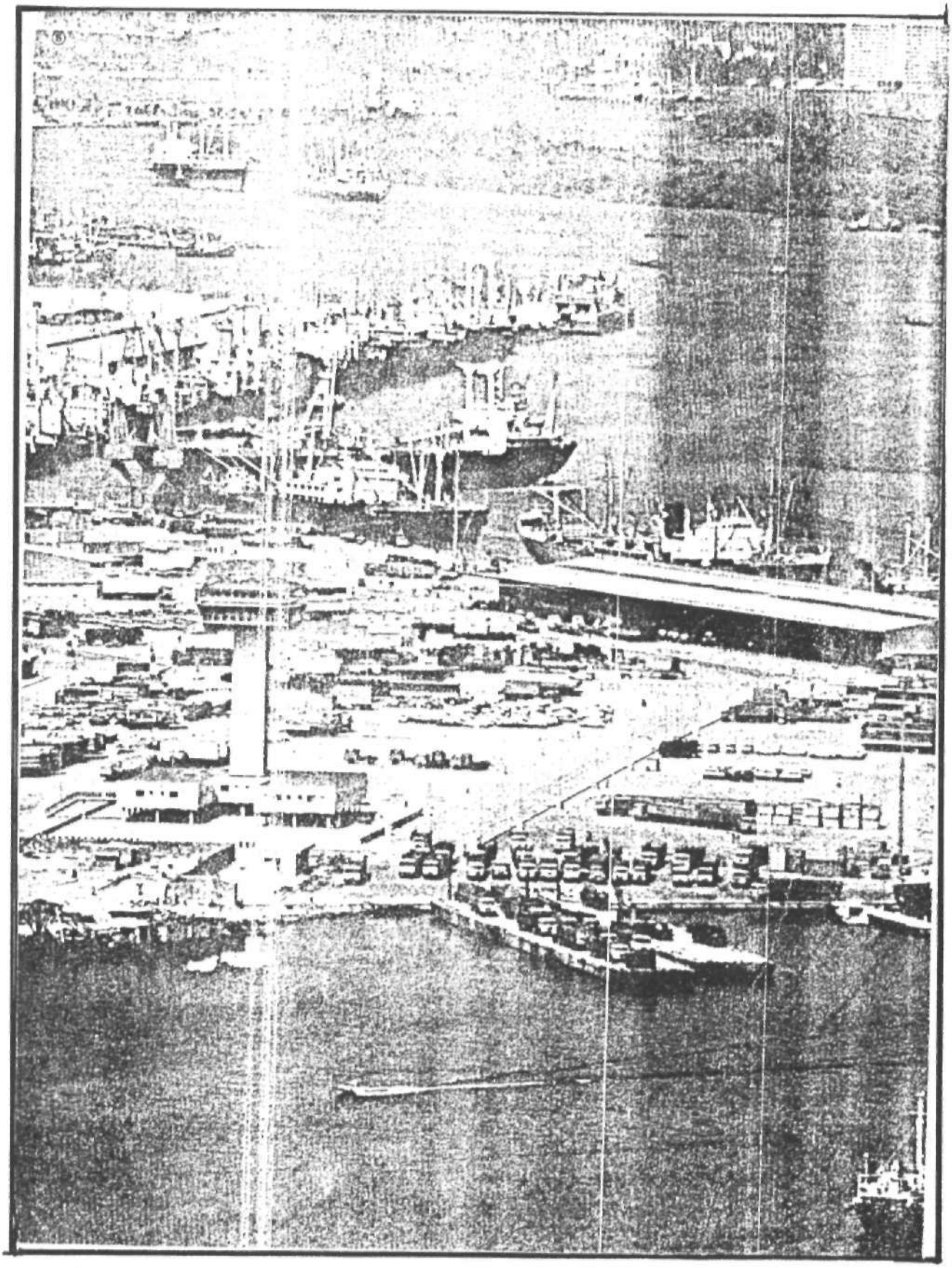


Plate 4.5 Wharf Apron, and transit sheds, Tin Can Island Port.



ate 4.6 Tin Can Island Port, control tower and Jetty.

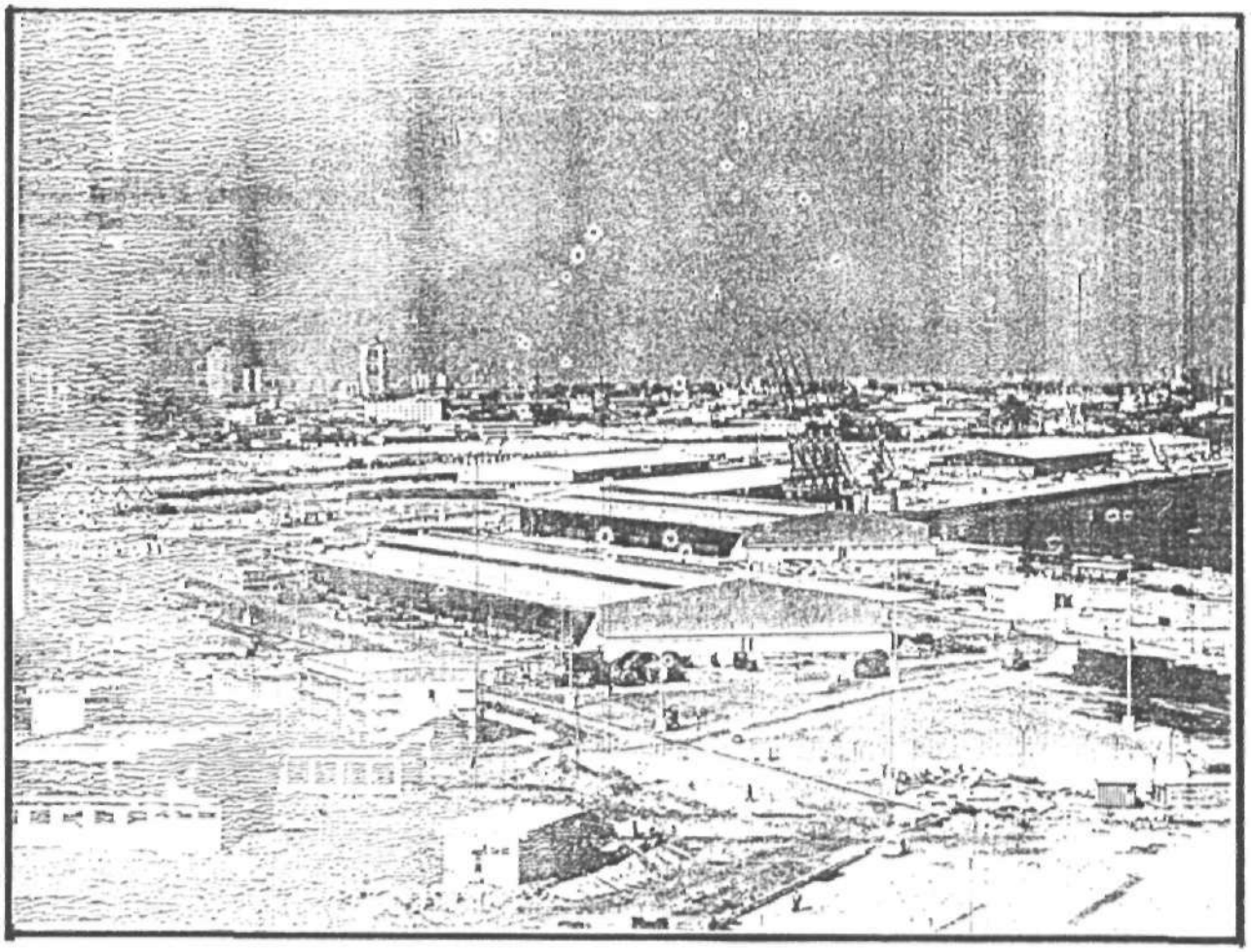


Plate 4.7 Aerial View of Tin Can Island Port.



Plate. 4.8 Control Tower, Tin Can Island Port.

4.5.1 **Apapa Quays**

The Apapa Quays is one of Nigeria's earliest wharves constructed in 1913, covering a land area of about 100 hectares with a total Quay length of 2,459 metres.

4.5.2 **Third Apapa Wharf Extension**

Commissioned on April 24, 1979, the third Apapa Wharf extension covers an area of 50.8 hectares of land. This was due to renewed needs to further extend Apapa ports to meet demand of the oil boom as pressures mounted on the existing Apapa Quays. Total covered storage accommodation is 6.400 square metres and 525 metres long of multi-purpose berths.

4.6 **Facilities and Description**

The site of Apapa Quay is adequately serviced by a complex network of road, rail and water transportation. It has a huge silo storage capacity of up to 76,600 tonnes. Berth 6 of the old Apapa Wharf is for passenger traffic. It was commissioned in July 1989 to meet this increasing demand for passenger ferry services within some West African routes. The Apapa passenger ferry services is run by two companies; SASCO Nigeria Ltd., and Koda International. Provision for office accommodation and other port facilities have been made. With the extension, the Apapa wharf was greatly modernised to meet the challenges of the time. The facilities available are the 200,000 square metres of storage space at the container depot, it is also well serviced by extensive network of roads and interchanges, railway tract system (400mm) container crane track, (457), water supply,

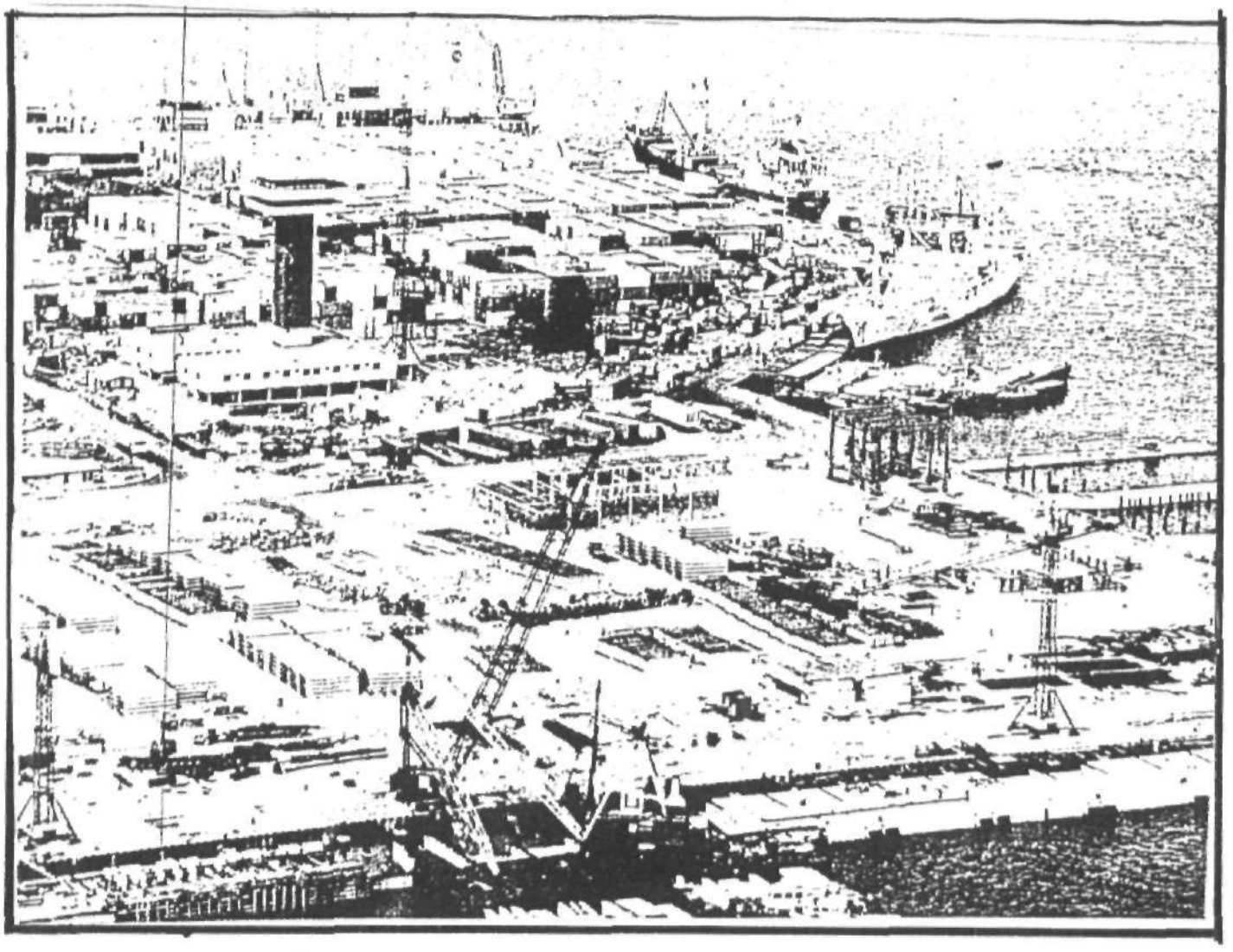


Plate 4.9 Aerial View, Apapa Port Complex.

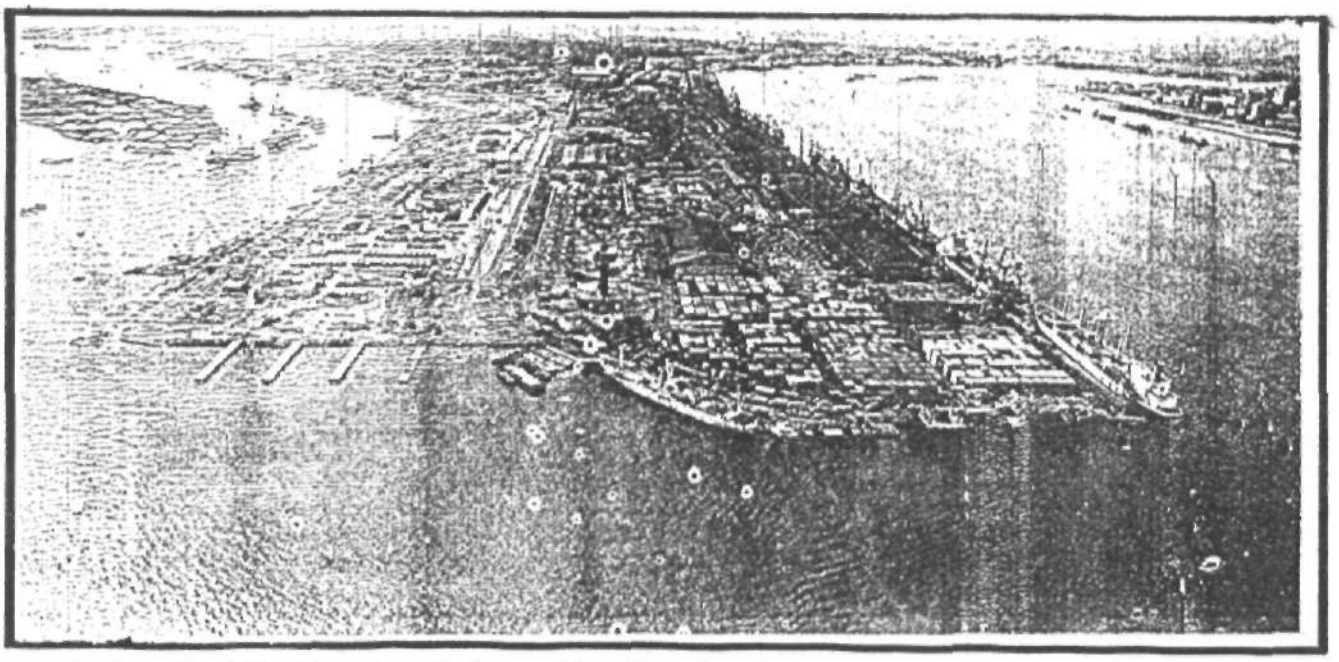


Plate 4.10 Aerial View third Apapa Wharf Extension.

port dewatering network, electrical supply network, warehouses, social buildings, fire brigade and police station, customs clearance and workshops.

4.7 DESIGN APPRAISAL

From the study carried out on ports in Nigeria in order to be in the proper perspective and to have an insight into existing situations and trends associated with port architecture, architectural deductions have been made on the subject matter. This is based on the parameters on which the buildings were analysed.

4.7.1 Facilities

The study carried out on port facilities in Nigeria has revealed the effort put in place by the Government of the Federal Republic of Nigeria to promote efficiency and effectiveness of port activities in the country. However, this effort has not attached much importance to architectural impact on promotion of port activities by provision of befitting architecture supporting office facilities which aid comfort and smooth operation in port structures. Participant observation also revealed very poor office environments, due to lack of use of trees and other organic landscape elements in port buildings.

4.7.2 Space Performance

Although the performance of space within office building in some ports is commendable, other buildings analysed exhibit poorly coordinated spaces which hinder smooth operation in ports. These is no free flow of movement from one office to another as they are not linked together by architectural approach.

4.7.3 Concept

All the ports studied have no well defined concept or expression in terms of activity, environment and functions of its users. There is a very significant problem observed in port buildings and exceptions were seen only in the port control towers, which serve as the architectural symbol in Nigerian ports.

4.7.4 Structure and Construction

The buildings studied exhibit clear and simple architectural structures. Moreso, their construction techniques and forms are relatively simple and similar. The only exception is the NPA corporate headquarters whose construction appears a bit complex due to the slanting columns and semi-circular sails used to achieve the desired shape of ships on ground. Development in economy also calls for architectural development of ports, therefore modern trends in architecture should be seen on port buildings too.

4.7.5 Accessibility and Circulation

The direct accessibility from adjoining roads into the respective port premises and the adequate service of these premises by good network of roads, rails, and water is very commendable. However, in most ports passengers and car hire services have not been adequately provided for.

4.7.6 Finishes

All Port buildings studied exhibit good finishes particularly the control tower of the Tin Can Island Port, the most peculiar problem noticed is the poor

maintenance culture that has turned some building into unpleasant appearances. Efforts should be put in place to renovate the building with maintenance problem.

4.8 CONCLUSIVE NOTES ON NIGERIAN PORTS

The paper will not round up without commending the efforts of the Federal Government of Nigeria in port development and the Nigerian Ports Authority for effective management of port activities. However, the government is required to look into proposals for the acceptance of architectural improvement of port buildings as a stimulant of increased port activities in the country. In the light of this port buildings should be given architectural consideration in order to create port architecture that will be widely accepted by the environment and to meet modern trends of development in architecture.

4.9 HAMBURG FERRY AND CRUISE SHIP TERMINAL, Germany.

4.9.1 General Information

This building was designed by William Alsop, it is 200 meters long; the longest office building in Europe. It was designed to maximise and epitomise the city's long standing affinity with the River Elbe and its connection to the sea. The creation of a building to reflect this relationship was the key consideration in the design and development of the project.

4.9.2 Description.

The water side of the building is visually open to and embraces the river and shipping, while the land side is less so, The green glass walls overlooking the river reflects the colour and pattern of the water, while the silver metal spandrel panels present a more solid face to the street. The exception is at the ground floor, where a double-height glass

wall allows a visitor a clear view through the water and ships beyond. (See plates 4.11 to 4.14).

There is a car parking area under the cruise terminal (phase 2) creating the effect of a moat spanned by bridges, which give visitors access to that part of the building. The floors above are for administration and office functions. The concrete 'A' shaped structural columns are reminiscent of the cranes and derricks along the quay side, but it is in the material and details of the structure, such as the support for the viewing balcony. And other buildings elements like the automatically adjustable sun visors, that the maritime feeling is really captured - though never allowed to become a pastiche.

According to the Architect, William Alsop, "This building gave us the opportunity to build by the water, what a piece of water! The Elbe Flows with life and created new images continuously. Our building facilitates views of this mighty river from a safe heaven. The building has eyelids on the south side. Sometimes it is necessary to close one's eyes to the external world. The building blinks as it creates an edge to help channel the Elbe. Every street needs an edge definition and in this aspect the Elbe is no exception. Our street edge offers a line of parallel platforms from which to both observe and hide from the River".

4.9.3 Design Appraisal

Merits

1. Good building-water and building - land relationships, as well as excellent marriage of materials.

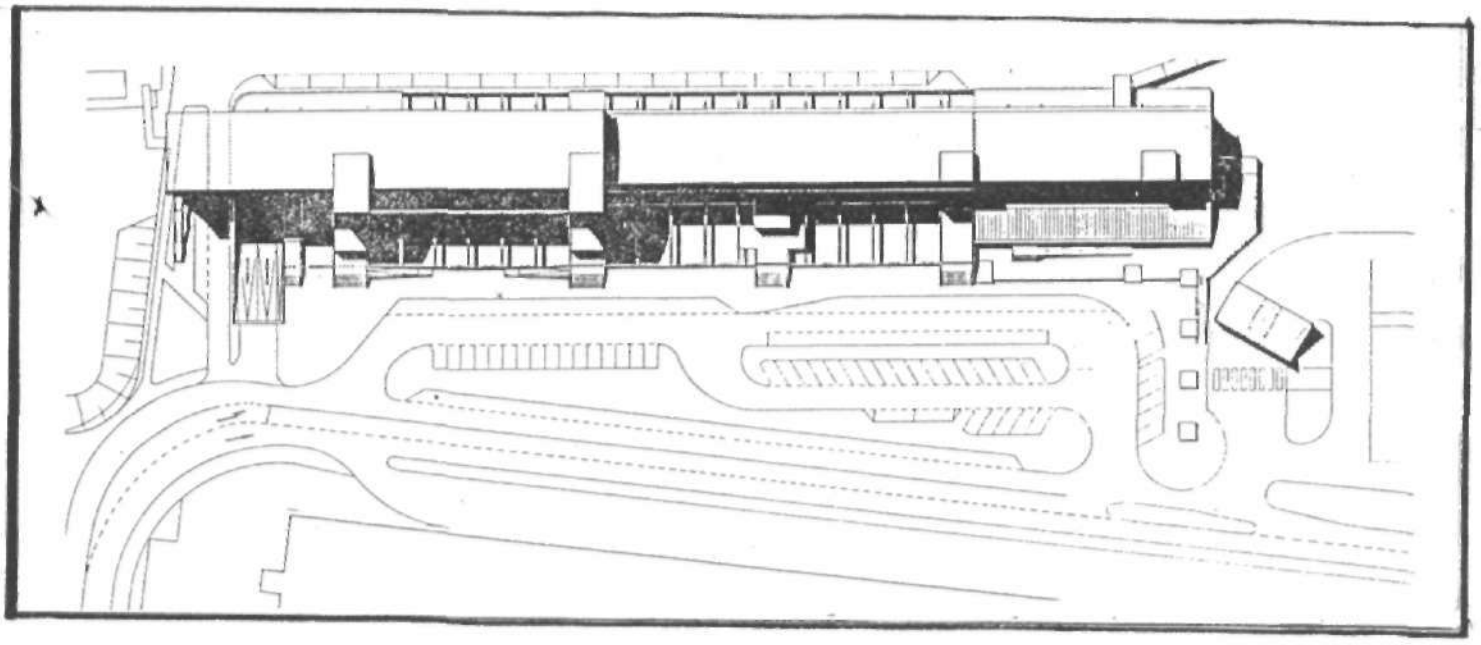


Plate 4.11 General Layout of Hamburg Ferry and Cruise Ship Terminal, Germany.

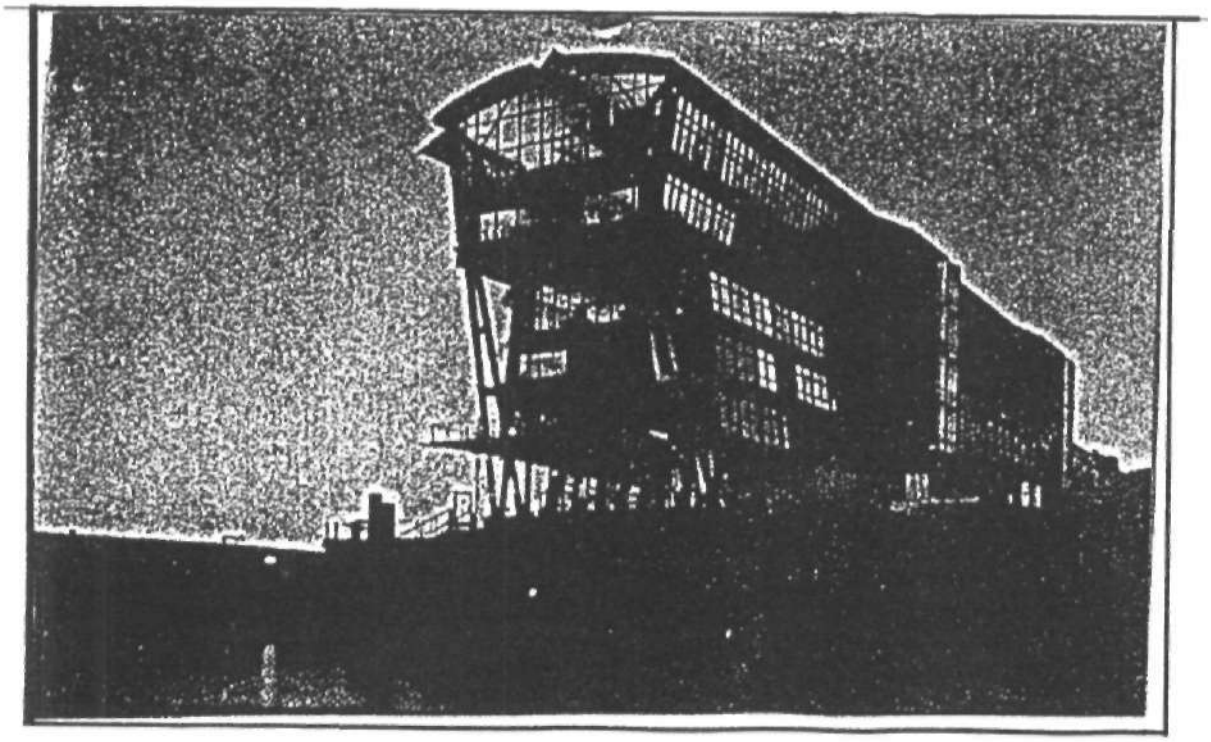


Plate 4.12 The Terminal building.

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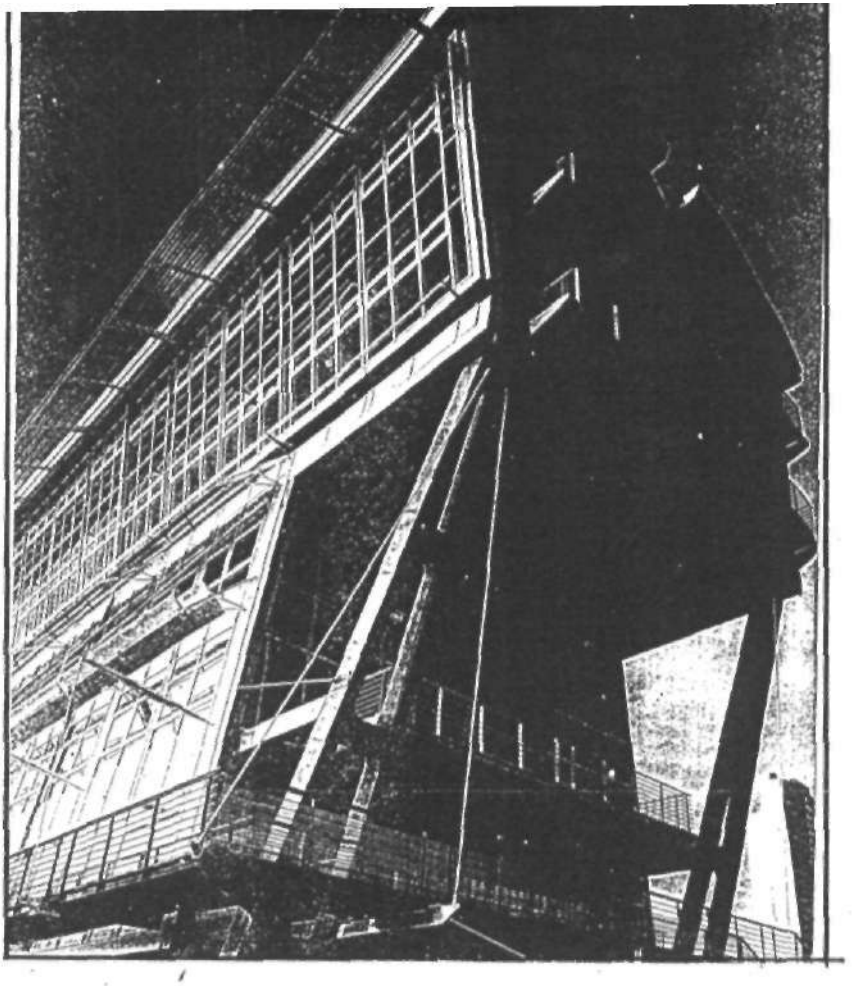


Plate 4.13 Observation deck, Hamburg Ferry and Cruise Ship Terminal.

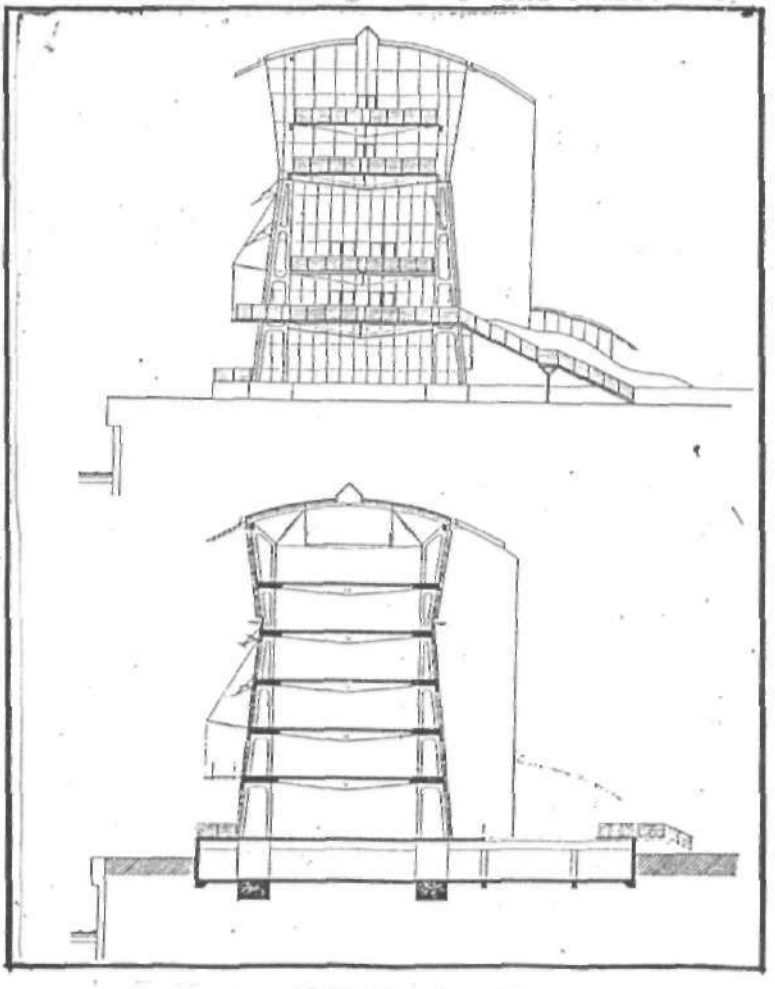


Plate 4.14 Sections.

2. Design concept quite visible and attempts to capture both functional and expressional motives of the architect, while blending with the city's affinity with the river Elbe.

3. Good location that gives it an attractive advantage to both the community and tourists.

Demerits

Inadequate use of plants for landscape especially on the land ward side of the building.

4.10 TOKYO HARUMI PASSENGER TERMINAL, Japan.

4.10.1 General Information

This is an international port terminal proposed by the Port Authority of the Metropolitan Government to commemorate the fiftieth anniversary of the opening of the Port of Tokyo.

The site is at the south-east corner of Harumi, one of the oldest reclaimed lands in the port of Tokyo. Geographically, Harumi belongs to the heart of the city, and became an important link with the development of the port side urban center on the most recently reclaimed land. The clients request was to make the terminal a symbol of the metropolis, to welcome passenger ships from abroad, and to be a point of urban animation along the waterfront which is now being redeveloped.

Designed by Japanese Architect Minoru Takeyama, the intention was to establish a syntactic context in the urban landscape based on the geomophomological elements to perceive the earth in an urban district.

4.10.2 **Facilities/description.**

1. Huge Suspension Bridge across the port, which connects the traffic system of the older and newer port;
2. Administration
3. Passport Inspection
4. Customs Inspection, Luggage handling, reception, greetings, farewells, etc.
5. Public facilities such a event hall, gallery, restaurant, observation decks, squares, etc.

Two superimposed axes orchestrate the complex: a land axis taken from the existing street network of Harumi; and a sea axis, which is the dramatised vista from the site to the Tokyoto, the Tokyo Bay, through the suspension bridge. The essential spaces of the terminal are laid out along the land axis, and relate to passenger movement and activities. The Public service area is laid out along the sea axis, and is the stage for visual discoveries created to excite the visitors imagination. (See plates 4.15 - 4.18).

The 'house like' form is located on the top of a manmade hill, and multiple terraces and platforms cover the main body, cascading down to street level. It is intended as a simple, dominant form identical from every direction. The commission was awarded in late 1988 as the result of an invited competition and construction completed in a remarkably short period.

4.10.3 Design Appraisal

Merits

1. Very good building - water relationship.
2. Good landscape use of water and plants.
3. Clear Design Concept and good link of spaces providing easy flow of movement within the complex.

Demerits

1. No recreational facilities such as cruising facilities, etc.
2. Excessive use of mosaic tilling on the frontage or approach bill of the building without the use of flowers has hindered a natural security of the landscape.

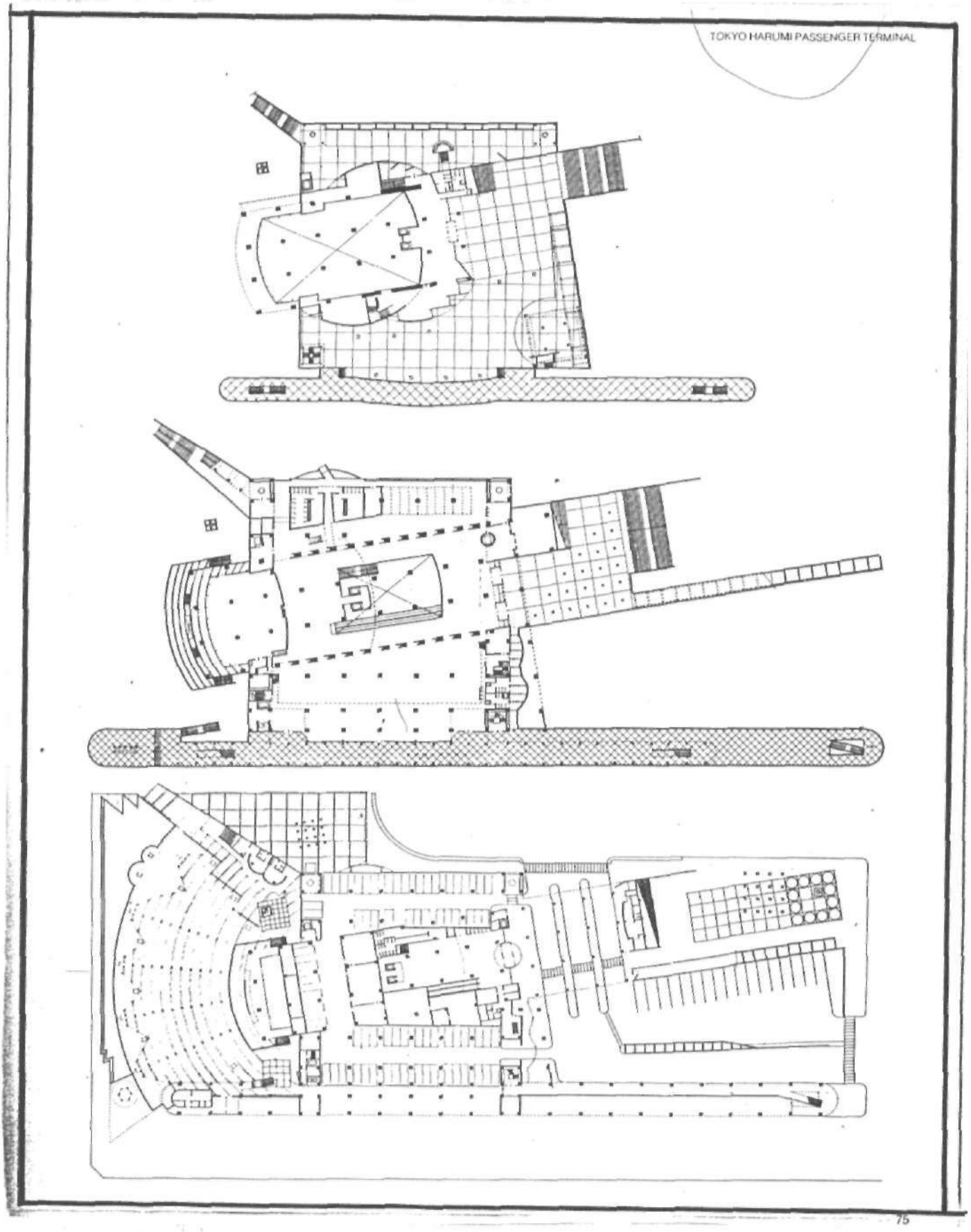
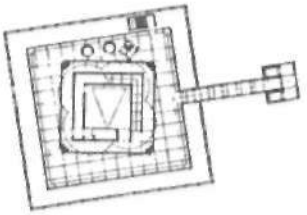
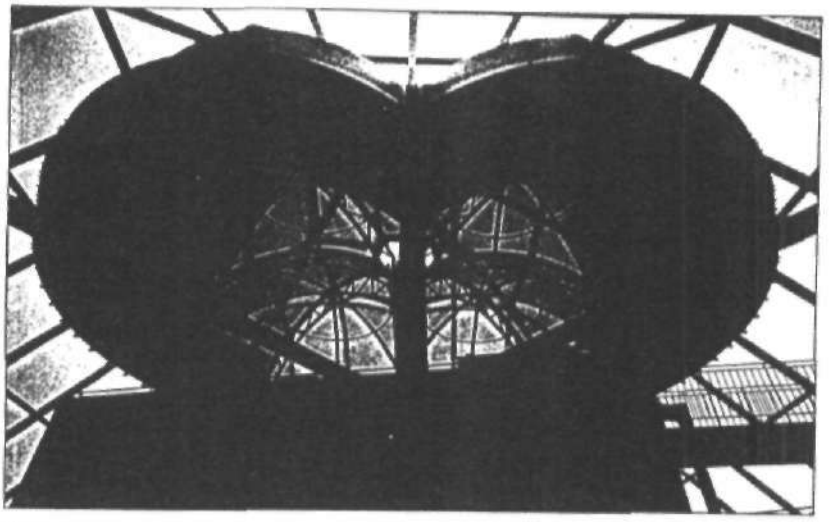
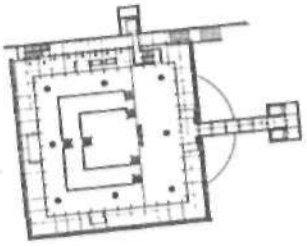


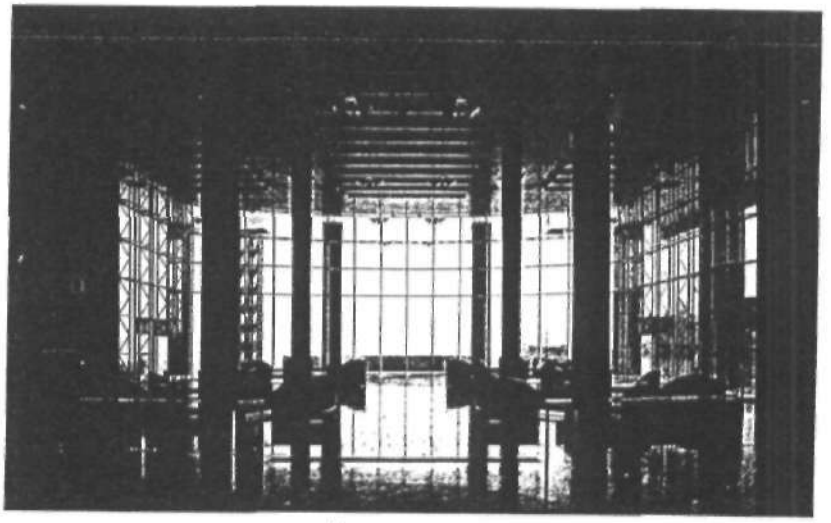
Plate 4.15 Floor Plans, Tokyo Harumi Passenger Terminal.

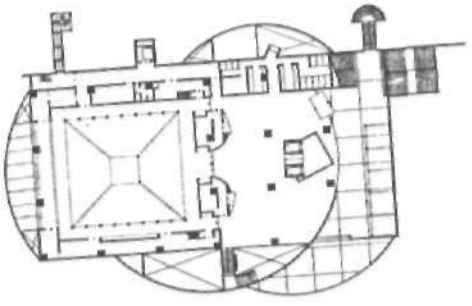
MINORU TAKEYAMA

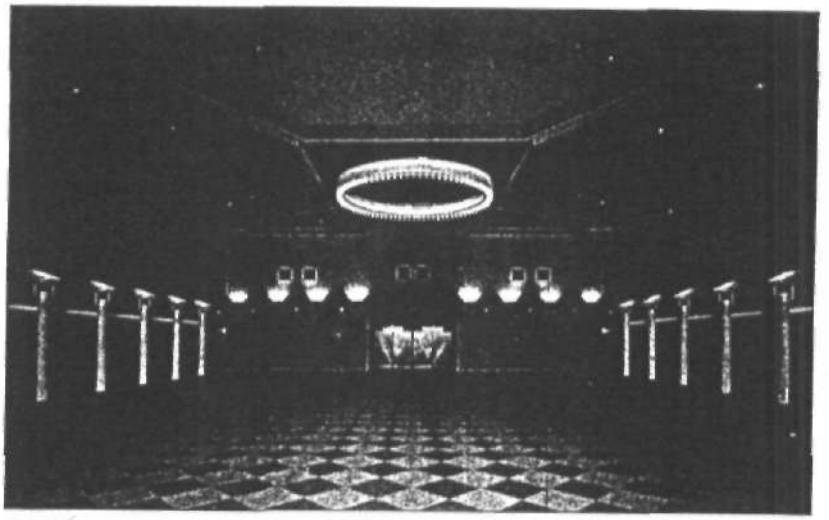












Fifth floor plan
Fourth floor plan
Third floor plan

FACING PAGE :
Second floor plan
First floor plan
Ground floor plan

Plate 4.16 Floor Plans and interiors; Tokyo Harumi Terminal.

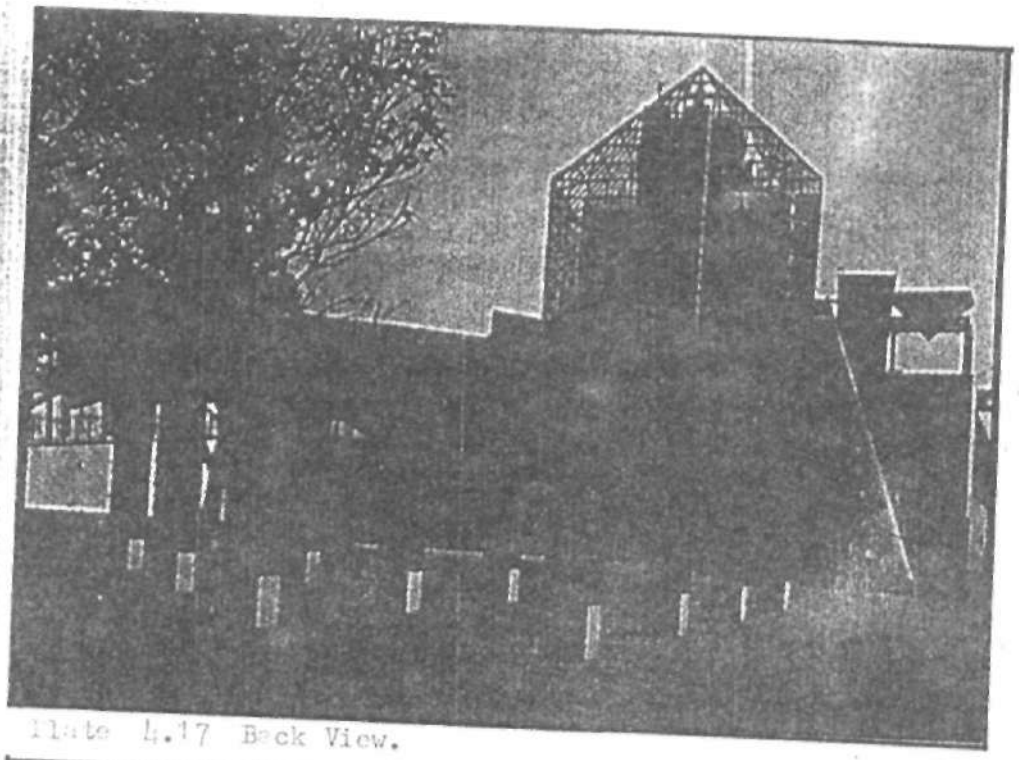
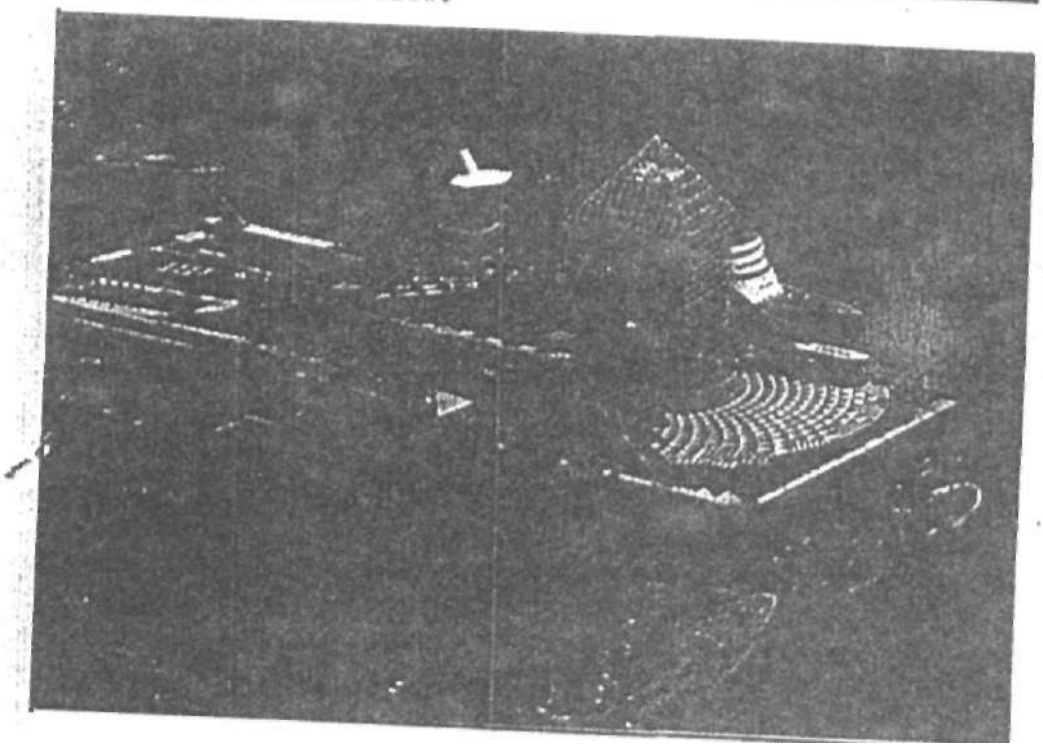


Plate 4.17 Back View.



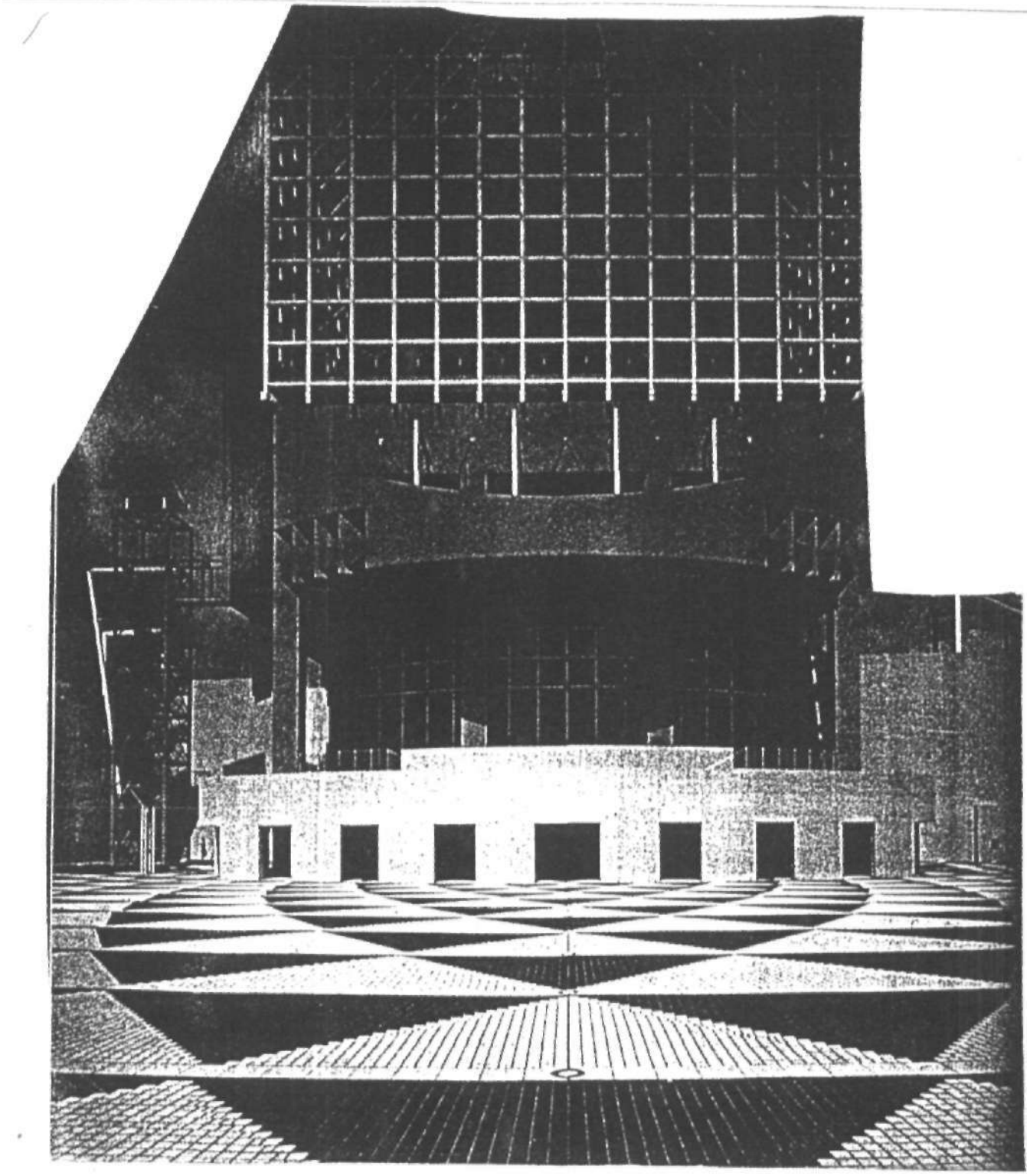


Plate 4.19 Approach View of the passenger Terminal.

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CHAPTER FIVE - PROBLEM SYNTHESIS

5.0 INTRODUCTION

The effective and efficient performance of ports in the economic arena is very important for the development of any nation, region or continent. This gives special regards to countries that have direct access to sea and ocean coasts. No nation is an Island, i.e. can be self sustaining with goods and services. Therefore the need for commercial exchange of merchandise cannot be compromised for no just cause. Even the landlocked countries have been liasing with their close neighbours that have access to the ports to enable them reduce importation cost by transporting goods through the other seaports.

The Inland water situation further aids the international flow of commercial activities within the interior of a country. It is quite obvious that port works involve huge financial investments, there is therefore the need for proper justification of the investment. In line with a popular adage which says "the end should justify the means", port buildings in the hinterland need improvement to create more commercially oriented setting which will boost economic situations in the locality as well as the nation at large.

The interaction of forms and spaces with the immediate port environment at Baro is aimed at attracting and stimulating more interest in the maritime environment both by investors, tourists, and other port users. The forms are expected to blend with the spaces thereby making the whole port building appreciable to the environment, users and the management. A look into the concept of architectural form and space would be essential to consolidate the architectural contribution to river port development in Nigeria.

5.1 THE CONCEPT AND MEANING OF FORM.

Form carries different meanings in different disciplines - accounting, law, music, athletics, sciences, etc. In architecture, form is what can be seen as prominent on the building, as door, wall, floor, ceiling, eaves or sometimes the entire building or even the entire city. However, Whyte (1868) is of the view that "form refers to shape of materials and objects, the arrangement in space of groups of them and the arrangement in space of their component parts."

Therefore, when form is spoken of in the art, not only the physical shape, size and mass of a work are meant, but also all elements that contribute to the works structure and composition. Many of these may be without a fixed form of their own, and gain significance only as they are organised into the finished product. The basic formal elements of architecture in this sense are space and mass. The process of organising these elements into an ordered form is called composition, and the principal means by which they are given expressive quality are scale, light, texture and colour.

Historians and architects have classified different forms into categories over the years. These categories include, Byzantine, classical, Revivalist, Gothic, Colonial, Organic, Modern, Geometric, etc. In addition an infinite number of hybrids exist.

Hugo (1925) once remarked that "the form of artifacts can be seen as desired partly from the needs of function and partly from those of expression. Factual demands conflict with aesthetic demands in the material medium as things take shape. The relative contribution and emphasis of these two influences varies according to the objects involved, the epoch, the country and the culture.

5.1.1 Functional Forms

The idea that, since form relates to functions, all artifacts, including buildings, are species of industrial, or applied art had, had wide influence. It is closely akin to the

theory of aesthetics; in that it regards all the visual arts as spherically related. This was popularised if not originated by German Gottfried Semper, an architect from Dresden.

Forms which result from functional criteria are created by life and therefore of elementary and natural kind. In essence , they are not originated by men, so they are the same throughout the world and throughout history. For the creation of fundamental forms, the track of nature is followed . In nature form is the organisation of many distinctive parts on space in such a way that life can unfold, fulfilling all its effects both in terms of integrated whole, whereas in geometrical culture, form is derived from the laws of geometry. Hugo (1925) went on to point out that "if we prefer to search for shapes rather than construct them, to discover forms rather than to construct them, we are in harmony with nature rather than against her. We as architects must create both organically and geometrically."

5.1.2 **Expression Forms**

Expression in architecture is the communication of quality and meaning. The functions and the techniques of building are interpreted and transformed by expression into art as sounds are made into music and words into literature. Great changes have been witnessed in attitudes towards expression in the past decades. The nature of expression varied with the character of culture in different places in different times, forming distinct modes or languages of expression that are called styles. Style communicates the outlook of a culture and the concepts of its architects.

The component of expression, which communicates the particular values of style, are content and form. Since content can be communicated only through form, the two are organically united. Forms chosen for the sake of expression derives from laws formed by the human intellect. In the words of Hugo (1925) "Expression forms are bound to "Blut

and Erkenntins" (blood and knowledge) and thus dependent on time and place" The history of form is, in reality the history of variations in expression. Content is the subject matter of architecture, the element in the architectural expression that communicates specific meaning that interprets to the society the functions and techniques of buildings. With reference to Jenks (1993) "Expression has a central idea which believes that there is a primitive language which is accessible to anyone who takes the trouble to feel the power of pure form, light and ordinary materials"

5.2 A BALANCE OF FORMS

Under and during the reign of geometrical culture, formal expression was derived from laws which were contrary to life, to movement and to nature; laws recognised in purely geometrical forms. It has been discovered that purely functional things have forms which can satisfy viewers in terms of expression. Indeed, some forms created solely out of functional necessity become more satisfying in terms of expression as they become purer and that is the kind of expression resulted in a new aesthetic. This discovery marks the turning point in the history of form.

The task ahead is to attempt not to allow our attitude towards function conflict with ours for expression, but to keep them side by side. The work will try to relate the ideas about expression to life creation, movement and nature.

5.3 THE CONCEPT AND MEANING OF SPACE.

Space is a boundless, three-dimensional extent in which objects and events occur and have relative position and direction. Space is also that immaterial essence that the

painter suggests and the sculptor fills, the architect develops, creating a wholly human and finite environment within the infinite environment of nature. The concept that space can have a quality, other than emptiness is difficult to grasp. However, the architectural concept of space is not definable but quantifiable in terms of its cross dimensions. Space is the concretisation of existential space which as a psychological concept denotes the schemata man develops, interacting with the environment in order to get on satisfactorily.

5.3.1 Space Perception

When a building is entered, floors, supports, walls and ceilings are seen, all of which can be studied and perhaps enjoyed, while the space, in the sense that one is accustomed to think of it, is void. The absence of mass, filled air. As a person enters the architect's space, he measures it in terms of degree and quality of his potential for movement. The concept of potentiality is important, first, because the observer can anticipate where he moves in merely looking about him and, second, because he can conceive movements, that he cannot execute.

Space is also predicted by the enclosing form, which has visual properties guiding perception of the magnitude. These visual properties include; shape, size, colour, texture, position in relation to the observer or user.

Most modern architecture, in its free organisation of space sequences, demand mobility; its techniques have made it possible to remove the heavy walls and supports of the past reducing the sense of compression. Walls become membranes to be arranged at will for spatial experience, and some are transparent and so extend one's potential for movement into the limitless out-of-doors. Spatial experience is not restricted to the interiors of

buildings, open spaces are also part of nature which the architect can plan or modify to satisfy the environment and visual needs. In general, space perception is the process through which organisms, humans inclusive,become aware of the relative positions of their own bodies and objects around them. Space perception provides clues, such as depth and distance, that are important for movement and orientation to the environment.

5.3.2 **Functions And Types Of Space.**

A space functions to accommodate the human activity that takes place within it. Without function, spaces can not be established as functions are predetermined before a space is even conceived. The type of activity as well as the need for circulation, furniture arrangements etc are important indexes in arriving at the numerical values of functions to be carried out within the proposed space. In architecture, function co-ordination within and among set of spaces is an important phenomenon particularly in the design of spaces anticipated for multifunctional or related uses.

In design of multifunctional spaces, it is important to group spaces into public, semi-public and in some cases private areas. This is necessary to avoid the experience of difficulty of one function by the other. Therefore, similarities between various activities should be used as the basis for space determination and flow, and in which function each activity belongs.

Static and dynamic spaces are the two distinct kinds of spaces. A static space is one which has no opening, and it gives a feeling of enclosure. A dynamic space on the other hand is one which has openings that link the outside with the inside, it exhibits fluidity in flows and out flows. The inner spaces in a dynamic space feels or looks larger

than its actual size, though this reflects effectual scale. Architecture is the only tangible expression of space of which human spirit is capable. Augustet Paret has remarked that "architecture is the art of organising space, its means of expression, its structure".

5.4 COMPOSITION OF FORM AND SPACE

The compositional meaning of form and space are different in spite of the fact that they are often used together. Form composition is the arrangement of elements - by the extension, addition or subtraction of certain elements. Space and mass are the raw materials of architectural form; from them the architect creates an ordered expression through the process of composition. Composition is the organisation of the whole out of its parts. The conception of single elements, the interrelation of these elements and the relating of them to the total form.

Spaces are phenomenally created by the architect when he gives a part of free space, shape and scale composition, and visually contain elements within frame work or pattern. Spaces are contracted or expanded to create a perceptual impact on an observer.

5.5 INTEGRATING FORMS AND SPACES WITH THE PORT ENVIRONMENT

The essential task of architecture is to combine the beauty with the useful, and indeed to achieve the most complete possible satisfaction of both demands. In the sphere of function and technique the architect is responsible to the pattern of his culture on one hand and pattern of technology on the other. However, in the expression of form, he is free to communicate his own personality and concepts. The Architects principal

responsibility in the formation of style is to create meaningful forms enclosing useful and functional spaces that are directly related to the purpose for which the work is designed.

Architecture, unlike most of the other arts, is not often conceived independently of particular surroundings. The problem of design extend beyond the organising of space and mass complexes to include the relating of the total form to its natural and architectural environment. In site planning; a primary function of architectural design, the architectural aims are to create harmonies with existing elements in the landscape and "towns scape". The province of the architect is however, not limited to the conception of single structures in harmony with given setting. Throughout history, architects have been employed in giving new form to the environment itself. Planning the urban environment into areas of residence, assembly, commerce etc. Both to increase their utility and to give them unique expressive qualities, through the interrelationship of groups of buildings to the open areas about them. Omotosho (1992) is of the opinion that "Architectural practice involves the manipulation of spaces to suit different functions and so relate to one another in social realm in order to create a suitable environment, that offers favourable conditions for creative thinking, communication and storage results".

Port architecture in particular is responsible for space relationship in ships, usually enhanced by the creativity of the Marine Architect, for comfortable stay during long distance travel on water. On the land ward side of ports, a reflection of these spaces is not only convenient, but necessary for commercial activities to have the forward thrust. More spaces are needed in ports to cater for increasing human needs, expectations such as shopping services, water borne transport system, accommodation, tourist, user and worker

socialization etc. Unlike in other parts of the world, existing ports in Nigeria have not fully utilized the commercial capacity,which are believed to be sources of more revenue. It is believed that the advantage of waterside and other natural features with integration with the port environment and needs will encourage the involvement of public and private developers,who will aid the formation of a balanced community. These spaces would be flexible and capable of being changed rapidly to meet the changing needs of port operations and function. The open space network also needs to be planned in relation to the river side and retained area of water.

The forms would not be rigid on geometry, but will also be tied to functional and expression needs, as modern trends in architecture are concerned with this combination to achieve aesthetically genuine forms. The forms of building proposed for Baro Port will be moulded from the spaces and integrated to the water, the ships, canoes, and other natural features on site.

5.6 CONCLUSION

According to Dennis (1991) "twentieth Century Architecture had witnessed dramatic and fundamental changes in almost every branch of architecture". Ship building and port structures are not left out of this change Calendar. The proposed port of Baro is also faced with the challenges of the next millenium, the buildings will employ technological and cultural influence to achieve the integration of forms and spaces with the immediate port environment.

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CHAPTER SIX - THE THESIS SITE, ITS ENVIRONS AND CRITERIA FOR DESIGN.

6.0 INTRODUCTION

The defunct North Western State gave birth to Sokoto, Niger, Kebbi and Zamfara states. The former Niger province that became Niger State had five divisions one of which was formed by Agaie and Lapai with headquarters at Agaie. With the local government reforms, in April, 1976, the division became a local government government named Etswan comprising still of Agaie and Lapai native Authorities. Later in the same year, Etswan Local Government Area (LGA) was splitted into two LGAs namely Agaie and Lapai.

Presently, Niger State is made up of 25 LGAs including Agaie LGA, with headquarters at Agaie, which is strategically located along Bida - Abuja trunk 'A' road. Baro is the headquaters of the Kintako district of Agaie LGA. Until the last statewide proliferation of districts in Niger State, Kintako was one of the three districts in the LGA, others being Kintifin with Headquarters at Kutiriko and Agaie district with Agaie as its headquarters as well as the LGA's seat of power. With the creation of new districts in 1991, Kintako is now made up of Baro, Fobage, Kusoyaba and Tagagi as well as Tsakpati Districts.

6.1 GEOGRAPHICAL LOCATION OF SITE.

The Kintako area lies between latitude 6° 20' and 6° 35' East and longitude 8° 35' North. It is bordered to the North by the rest of Agaie LGA, North-West by Bida LGA, West and South-West by River Niger; the natural boundary between Niger and Kogi



Fig.6.1 MAP OF NIGERIA WITH 36 STATES & THEIR CAPITALS



Fig. 6.2 Political map of Niger State.

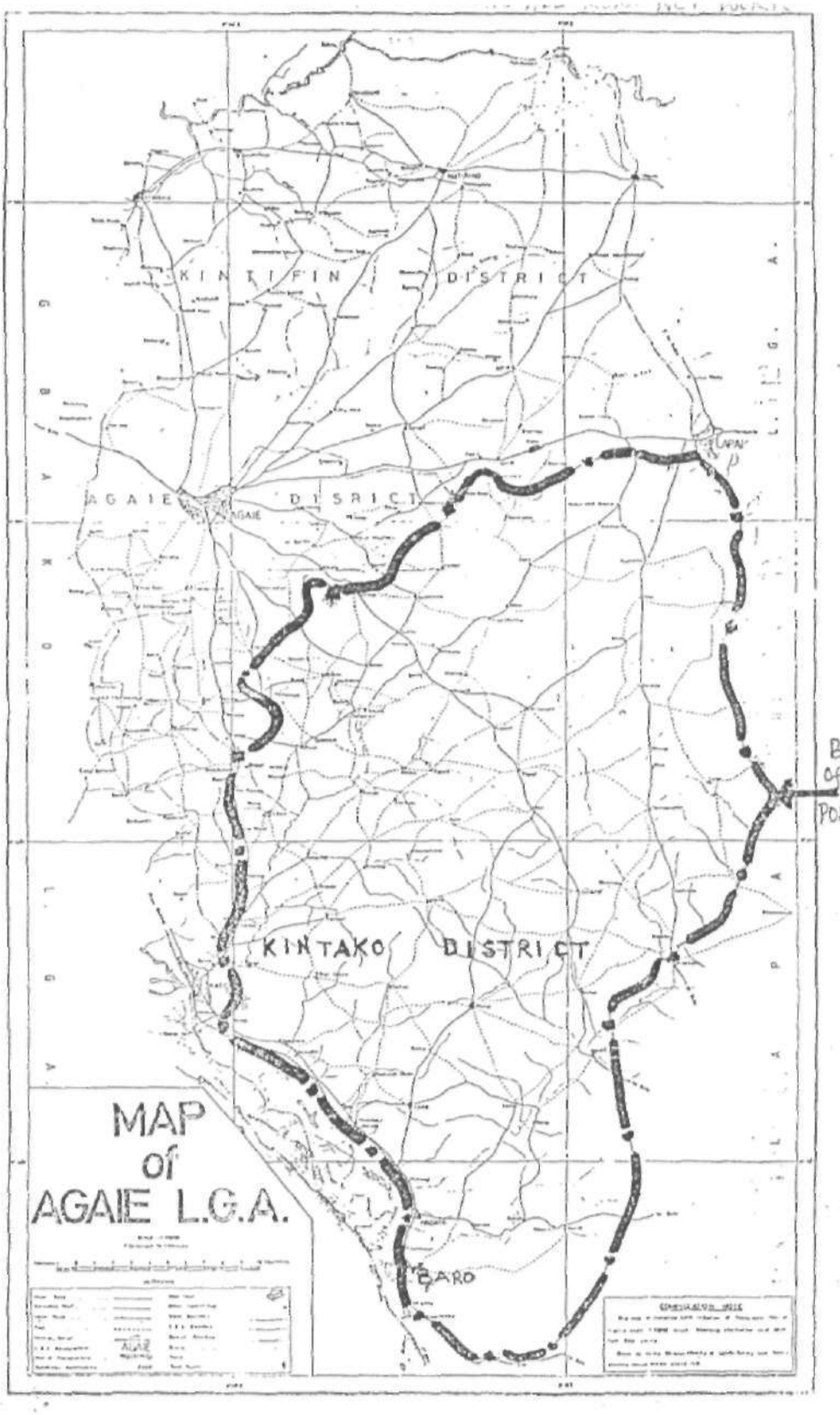

KINTIFIN DISTRICT
AGAIE DISTRICT
AGAIE
KINTAKO DISTRICT
GARO
MAP
of
AGAIE L.G.A.

Fig 63

States, South and East by Lapai LGA. The area harbours a number of town/villages and the important ones include Baro, Zago, Fobge, Kusoyaba, Wanigi, Tsakpati, Kiban etc. (See Map of Agaie LGA showing the Kintako area.)

6.2 CLIMATIC CHARACTERISTICS

Baro in Kintako Area of Agaie LGA lies in the South Savannah region, which comprises nearly the whole north of the forest zone and has the following climatic characteristics.

6.2.1 Precipitation

The rainfall on the Niger drainage area between Jebba and Baro experiences high rainfall between the months of April and October with annual range of about 1300mm. Monthly rainfall varies between 20mm and 200mm with two peaks, one in June - July and the other at Sept-October.

6.2.2 Temperature

In Nigeria, the ocean has a stabilizing effect on temperatures over land. The annual mean daily maximum temperatures is about 87oF on the coast rising to about 94oF over southern Nigeria, but falls to 66oF in the North. Hence the mean range on the coast is 15oF and in the north 28oF. In the South, maximum temperatures are highest in February to April, in the North, from March to June. They are lowest in July and August over most parts of the country. In the south, minimum temperatures are highest in February, march and April, and lowest either in January or in August but the variation throughout the year is small. In the North, seasonal variations is considerable, minimum temperatures are highest in April, May and June, lowest in December, January and February.

Baro has a mean annual temperature of 27.5oC with mean monthly temperature which is highest in March at 30.5oC and lowest in August at 25.1oC.

6.2.3 Relative Humidity.

As the wind blowing Inland loses moisture, it will be clear that the humidity will decrease with the increase of altitude. This humidity shows seasonal variations depending on whether the locality is under the influence of the moist south-westerly or the dry easterly current. There exists a relationship between temperature and relative humidity prevailing over the Baro site. Relative humidity experiences a rapid change as temperature changes, a situation that is often influenced by equatorial mass. It is highest during the rainy season at about 80% in August and September and lowest during dry season months of January and February. The two extremes of relative humidity experienced by the site are in August and February. High humidity brings thermal comfort to human body and it is witnessed in the mornings.

6.2.4 Prevailing Winds

These are essentially the North-East trade winds (dry tropical continental air), and the south westerlies (moisture laden equatorial air). The former is dust laden, cold, dry and form harmattan. It originates from the Sahara and lasts from November to January, this wind is accompanied with a dry season and normally provides dusty uncomfortable environment. The later being cool, and of equatorial maritime origin-are rain bearing, lasting from February to October, the monsoon winds blows warm humid air on the site.

6.2.5 Sunshine

Bright sunshine is experienced for a longer period of time, i.e. about 8 hours time lag per day in March more than any other Month. August has the lowest period of 5.5hrs; average period of sunshine for all months is 6 hours.

6.3 PHYSICAL CHARACTERISTICS AND SITE ANALYSIS.

The site is located in Baro, situated along the navigable stretch of the River Niger between the sea and Jebba and the river in turn is the natural boundary between Niger and Kogi States. The river has little tide, this was a facilitating condition for loading and unloading at the port despite the lack of essential port facilities at the time it was in use.

6.3.1 Site And Topography

The site is relatively flat and slopes gently towards the river. However, due to the eroding influence of the river coast, and the human activities going on along the river bank at Baro, heaps of pilled sand can be seen. Surrounding areas are rocky with flat topped hills, the most notable being the historical Empire hill which is about 3.5 kilometers long and 2 kilometers wide. The top of the hill houses the relics of Lord Lugard's first headquarters and a disused first H.F radio station in Nigeria.

6.3.2 Site And Vegetation

The natural vegetation is the result of the simultaneous action of a number of conditions obtaining in a region: the physical environment which comprises the distribution of mineral and water resources and the topographical and climatological conditions. Baro vegetation is a south Savannah type which is characterised by thick

bushes of grasses and scantily spread fire-tolerant trees and shrubs. The Niger bank area after the port is however, richer in trees as compared to the other parts, perhaps because of the water and the very low flood plain.

6.3.3 Geology And Soil.

The Niger between Jebba and Lokoja, within which Baro lies, is bordered by flood plains and low-lying river terraces covered with soils of varying nature and fertility. Some of the soils must be considered fossil, this and the different geological conditions in several parts of the valley, explains the variety of soils found. In view of the circumstances of regular flooding and the relatively reduced width of the valley, these soils do not play an important role in the country's economy, and the farmer areas are mainly situated on the hills and on the plateau, e.g. the Empire hill.

The hills around Baro have guarantees for profitable mineral explorations, proven available minerals include Columbite, Iron Ore, Gold, Chalk and Limestone which are reliable raw materials supply for mineral processing industries. Also found are Pragmatic Veins, where blocks of Quartz of diameter 40cm (about 1 foot) have been observed in the gravel. The soils is generally mixed volume of sand and gravel.

6.3.4 Site And Services.

Services potential of the site is highly commendable, especially the water side of the site. Baro is presently electrified by the Rural Electrification Board (REB), there are plans underway to connect the town to the national grid electrification line. The rail facilities and the colonial settlements are interesting historic utilities on site, of special interest is the HF radio station on the empire hill. This can be developed or improved for

telecommunication services. There exist a road connecting Baro to the Bida-Abuja trunk 'A' via Agaie. There are also plans to link Baro to Abuja at a shorter distance which necessitates arrangement for the expansion and construction of the Baro-Gulu-Yaba-Abuja road. Baro also has a functional water supply scheme.

6.3.5 Site And Sound.

By location, the site is quiet and therefore noise and sound waves are limited to engine boats occasionally sailing across the river especially on the market days when high passenger traffic is witnessed.

6.3.6 Site And Views

Interesting views exists on the North-Western side of the site, i.e. on the opposite bank of the river into the neigbouring Kogi State. Also to the south-east of the site is an interesting view of the Empire hill as well as the railway terminus at Baro.

6.3.7 Drainage And Flood Zones

Surface water drainage is gradual towards the river on the site, this owes greatly to the sloping nature of the site towards the water body.

The river Niger at Baro has little tide, as the water area downstream of the port break into channels very much close to one another and separated by trees and shrubs, this sometimes cause floods which are in turn resisted by the hilly nature of the farm lands and render them harmless to both life and Agricultural produce.

6.4 ECONOMIC ACTIVITIES.

Farming and fishing constitute the major economic activities of the Baro people. The subject of fish and fisheries play an important role in the economic life of the Niger.

An important part of the local inhabitants of Baro live near the river. They therefore are amphibious people who spend a large part of their day upon the water with fishing as one of their main activities. The method used is Net fishing from small dug-out or engine roared canoes and fishing by hooks positioned from canoes. This offers gigantic resources by the naturally endowed fish industry which has remained largely untapped. Kintako is the richest Agricultural belt in Niger State. Crops produced include Rice, Guinea-Corn, Millet, Maize, Groundnuts, Pears, Potatoes, Yams, beans, Melon, Cassava, etc.

Baro market is taken as the center of trade in the whole of Kintako area, this attracts commercial exchange of merchandise amongst the people and their neighbours from Kogi State.

The Baro valley is a tourists delight up to the early 70s and the establishment of tourist facilities will allow for holidaying on the bank of river Niger, travelling by boats to see surrounding vegetation, visitation to the Empire hill to see the conveniences of European Settlers and also for hunting and games in surrounding forests.

6.5 SITE SELECTION CRITERIA

The general conditions, which govern the choice of the site for the port can be classified as follows:-

(a) Baro port is located on the navigable stretch of the 3rd longest river in the African continent and the longest in the West African sub-region, i.e. the Niger, and also has access to the seaports of Nigeria.

(b) The location of the site on the river bank has given it a historic influence in the development of the Nigerian international trading activities and the role it has also played in the colonial era gives it a great advantage.

(c) The chosen site has the advantage of availability of different types of transportation means which include water, rail; constructed in 1911, road routes and also the Na'i Air-strip that could be used to bring goods for both export and import as well as raw materials for the likely industrial activities. The rehabilitation of the railway lines going on across the country will open avenues for easy transfer of cash crops from the north as well as circulation of industrial goods between various parts of the country.

(d) The proximity of the site to the Federal Capital Territory is another advantage especially with the efforts of the Federal government to tar Baro-Katcha road and to rehabilitate Katch Agaie road. The expansion of Yaba-Abuja road and the construction of Gulu - Baro road to link up with the Yaba road is of important advantage to the site as it will ease evacuation of export goods and incoming imported goods within the hinterland.

6.6 DESIGN PARAMETERS

The design parameters of water based buildings and installations such as those required for effective functioning of the Baro port involves considerable work and thorough examining of various influencing parameters this has been carried out as enumerated above. Therefore, logical and functional solutions can be achieved as a few parameters are outlined below:-

6.6.1 **Planning Considerations**

(a) Layout and spacing - the orientation should ensure protection from solar gains by placing long axis east-west. In the site planning, open spaces should be used for ventilation, but there must be protection from hot and cold winds. Rooms should be single banked and permanent provision made for air movement.

(b) Openings - Should be composite and occupy 20 to 35% of wall area. These openings should be able to catch the breeze and improve body cooling, with permanently open ventilation vents. The openings must also be protected against sun and rain penetration.

(c) Structure and materials - walls floors and roofs should be provided with high thermal capacity; there is need to protect buildings against rain as a result of the intensity of downpours when they finally arrive. Cold nights and hot days alternate for six to ten months of the year. This is accentuated during the harmattan and thermal storage is needed for cooling interiors in the day and for providing warmth at night.

(d) Accessibility - the most easily accessible areas to be zoned within the same area.

(e) Good Service network - good network of roads and walkways to link different units are important aspects to be considered. This is necessary to ensure easy flow of functions and activities within the port complex, putting in mind the existing railway lines.

6.6.2 **Planning Concept.**

The planning concept is based on the following:-

(a) Location of facilities where they will have greatest impact e.g. the transit sheds near the quay which in turn are located near the water route. Another example is locating passenger terminal facilities also near water.

(b) Functional relationship between facilities, identifying zones or sections that share common facilities

(c) Circulation planning for users, operational services and maintenance including provisions for vehicular traffic with a separation of pedestrian and vehicular traffic.

6.6.3 **Environmental Considerations**

The influence of environmental conditions of wind, temperature, rain and thermal comfort as well as lighting in buildings is of paramount importance to this thesis., In addition immediate port environment with its envisaged activities and facilities shall be part of the design. The canoes on the water, the ships, the buildings - water and building - land relationship shall be given much emphasis. The busy port environment, which calls to relaxation after work for both staff, private entrepreneurs and tourist should be taken into consideration.

6.7 **CONCLUSION.**

The site is an ideal environment for any office or industrial as well as recreational developments. It will therefore not be too much to say that Baro is the central core for economic development in the hinterland of Nigeria.

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CHAPTER SEVEN - DESIGN BRIEF AND REPORT

7.0 PREAMBLE

Dramatic and fundamental changes witnessed in architecture especially in the twentieth century poses more challenges, especially as we move into the next millenium. But port Architecture in Nigeria has not witnessed any such remarkable changes since the construction of the first port. The However, there is an urgent need to make them more commercially oriented by improving services as well as providing lettable spaces to improve revenue generation. This will further encourage private sector participation in shipping activities in the country.

This thesis is an architectural proposal and contribution towards ensuring profitable marine trade between the North and southern parts of the country. A port terminal facility is hence proposed to ensure effective office functions, passenger flow and tourist activities at Baro.

7.1 THE DESIGN BRIEF

The design deals with the client's brief and functional requirements of the project. The clients brief includes:-

(a) Quay facilities for handling cargo

(b) Storage facilities

(c) Administration Facilities

(d) Passenger Terminal Facilities

(e) Workshops and fire services station

(f) First Aid

(g) Fuel tank farm

(h) Accommodation for staff

It will be appreciated that the marriage of the clients brief and the professional role of the designer is always a tedious part. This work is concerned with the composition of the facilities that are of architectural importance to the port and its activities. The brief is therefore:

(a) A typical office development where proper attention is given to spaces on hierarchical basis;

(b) Effective floor commercialisation as well as efficient passenger space requirement coupled with exciting tourist facilities. All these are to give aesthetic appeal, to command and portray advancement from long history of boating to shipping.

7.2 Facilities

Facilities herein anticipated and provided in the proposed administration and passenger terminal buildings are based on different requirements of the occupants in buildings. In addition, these facilities are inferences deduced from studies on existing similar buildings both within and outside the country. However, because of the multi-tenantable floor space anticipated within the proposed development, it will be necessary that floor space be flexible enough.

7.3 Administration

The port is composed of a management body of administration charged with the task of running its activities and ensuring that the set down aims are achieved. Offices are

primarily provided in order to create space for working in. Both buildings will be provided with spaces based on the operational procedures of a typical port. Facilities here are further categorised into commercial, welfare, technical, security and environmental.

7.3.1 Commercial

Besides ensuring effective shipping services in the hinterland of Nigeria, as well as her trade partners, the Inland ports are established to make profits, this in turn results into economic upliftment of the country at large. The provision of lettable banking and open plan lettable office floors for unknown and anticipated tenants will provide space for group workers.

7.3.2 Welfare Facilities

These cover several facilities deemed necessary to boost the social life, as it meets the basic needs of the workers and the business community at large. Welfare facilities provided include canteens and a restaurant to serve the managerial staff and visitors/tourists respectively. The canteen is a catering unit to serve food and refreshment to the entire users of the building. The kitchen will be designed to receive and store food supplies. Food preparation and washing of dishes and utensils will also be carried out here. Planted terraces, shall be provided for workers, visitors and other users for relaxation at break time.

7.4 Technical Facilities

These facilities are necessary to ensure the proper functioning of the building with minimal automation. They include access stairs, lifts, mechanical and electrical

installations. Others are service ducts, machine room, water storage system and air conditioning facilities.

7.5 Security

These are facilities necessary to ensure the security of the building, its users and their properties. They include automation, within the building to prevent fire harzards effectively located near escape stair-wells for its users to provide adequate security to life and property.

7.6 Environmental

These are facilities necessary to ensure the general well being of the building premises. They include a well landscaped environment, adequate car parks, a well lit premises, etc.

7.7 Passenger Terminal

The terminal building is the service centre for the transfer of passengers and baggage between automotive vehicles and river craft and will house facilities and concessions for passenger comfort, ticket office and weighing scales. In addition, offices and post office can be located within it. A good circulation network which will allow simple and direct boarding and unloading of river crafts for passengers and baggage is an essential requirement.

The area of the ticket lobby is governed mainly by the required length of ticket counter which is in turn determined by the volume of peak hour embarking passengers. Sufficient space will be provided to permit passenger queuing and the inevitable cross flow of traffic. Peak hour passenger represents the total of the highest number of passengers embarking and disembarking during the busiest hour of a busy day of a typical week.

7.8 Tourist Facilities

The existing colonial buildings on the site which were used during the colonial era when shipping activities were carried out at the port of Baro will be preserved for tourism. Baro empire hill as well as the river Niger itself are important places of tourist interests. Additional facilities to be provided include a garden park near the existing buildings, a restaurant and observation deck.

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7.9 Recreational and Social Facilities

Life at working places and riverside becomes very tiring and tiresome following recurrent nature of activities and may lead to poor work output especially in a small town like Baro. It is in view of this development that recreational facilities such as boating and sailing have been provided, access is from the boat lounge provided. A multi purpose hall is important for social gatherings and occasions. A park area around the passenger terminal is provided for picnicking and outdoor relaxation near water.

7.10 SCHEDULE OF FACILITIES

The entire port complex is made up of the following units:-

a)	Dock or Quay Side	-	Wharf Apron
			Passenger Jetty
b)	Transit Sheds	-	Open Area for Stacking
			Warehouses
c)	Passenger Terminal Building		Passenger Facilities
			Tourist Areas
			Recreational Areas
d)	General Administration	-	Traffic and Commercial
			Departments
		-	Security Department
		-	Stores Department
		-	Estate Department
		-	Admin. Department

- Customs Department
- Project/Research Department
- Establishment Department

e) Engineering Administration - - Central Administration
. Civil Engineering Department
- Mechanical Engineering Dept.
- Planning and Control Dept.
- Electrical Engr. Department

f) Reserved Colonial Facilities existing on the site for tourist interest.

g) Provision of housing accommodation for staff.

7.11 SCHEDULE OF ACCOMMODATION

The area of the port to be designed in detail is the passenger terminal port administration building and a tourists garden; to be sited near preserved colonial facilities.

		(in m^2)
(A)	Ground Floor - Administration	
	Entrance Porch	50.27
	Reception, Stairs, lounge. Lifts and Toilets -	100.83
Courtyard		117.83
Total		268.93
Branch Bank		
Customers' Lounge	-	33.52
Staff Area	-	25.66

Strong Room	-	12.83
Counting	-	12.83
Manager	-	12.83
Assistant Manager	-	12.83
Accountant	-	12.83
Tea Room	-	12.83
3 No. Toilet and Lobby	-	11.5
Archives	-	17.5
Toilets	-	7.5
Circulation	-	28.5
Total	-	187.83

Canteen		
Junior Staff Canteen	-	67.83
Kitchen & Servery	-	16.76
Senior Staff Canteen	-	40m
Kitchen/Servery	-	14.4
Total	-	138.99
General Store and Security		
Store	-	33.52
Store Clerk	-	16.26
Security Office	-	39.27
Total		89.05

Circulation

Reception from Terminal	-	50.0
Corridor	-	94.34
2 No. Escape Stairs	-	16.8
Total	-	161.14

Overall

Service Core	-	100.83
Total Useable floor area & Circulation:	-	560.22
2 No. Escape Stairs	-	16.8
Total	-	$677.85m^2$

Ground Floor - Passenger Terminal

Linking Corridor	-	39.0
Entrance Porch	-	18.0
Concourse Hall (Reception, Ticket Lobby, Waiting, Arrivals and Departure)	-	300.0
Postal Agency	-	16.23
Telephone Services	-	16.25
Ticket Office	-	16.25
2 No. Baggage offices	-	134.0
Circulation	-	46.14
2 No. Escape Stairs, Toilets and Reception area	-	80.0
Boat Lounge	-	56.93

	Customs General Office	-	32.5
	Shop	-	23.45
	Lockers and changing	-	23.45
	Entrance Porch (Water side)	-	65.0
	Total	-	868.97m^2
	Water Side		
	Jetty	-	132.0
	Paved area	-	120.0
	Total	-	252.0m^2
D.	**Overall**		
	Service Areas + Stairs and Reception.	-	202.0
	Jetty and Paved Area	-	252.0
	Total Useable area + Circulation	-	667.07
	Total	-	1121.1m^2
E.	**Tourist Garden**	-	**1134.262m2.**
F.	**First Floor - Administration**		
	Reception, Stairs, Lounge, Lifts and Toilets	-	125.0
	9 No. General Offices (41.66x9)	-	374.94
	Project Research/Library	-	40.0
	Librarian	-	14.4
	Reception (from Terminal)	-	50.0

	2 No. Escape Stairs	-	16.8
	Toilets	-	7.8
	Statistics	-	46.0
	Computer Room	-	39.273
	Circulation (Corridors)	-	94.34
	Void	-	117.83
	Total	-	927.83m^2
G.	**Passenger Terminal - First Floor**		
	Reception and Stair Case	-	67.8
	Observation Deck & Circulation	-	67.0
	Multi-Purpose Hall	-	90.1
	Shops (2 Nos)	-	32.5
	Restaurant	-	83.0
	2 No escape stairs & Curculation	-	80.0
	Corridor	-	54.0
	Traffic Office	-	32.5
	Catering	-	32.5
	7 Nos. Lettable office areas (32.5x7)	-	227.5
	Lobby	-	32.5
	Lettable area in semi circle	-	47.52
	Total	-	846.82m^2

H.	**Second Floor - Administration**		
	Reception, Stairs, lifts and toilets	-	133.53
	2 No Escape Stairs	-	16.8
	Project Manager	-	30.0
	Secretary	-	20.0
	Chief Port Engineer	-	30.0
	Engineering Superintendents	-	30.0
	Planning Officer	-	30.0
	Estate Manager	-	30.0
	Maintenance Officer	-	30.0
	Port manager	-	30.0
	Secretary	-	21.0
	Port Admin. Officer	-	30.0
	Chief Accountant	-	30.0
	Traffic Manager	-	30.0
	Commercial Manager	-	30.0
	9 No. Secretaries (15.0 x 9)	-	225.0
	Void	-	117.83
	Circulation	-	94.34
	Conference	-	89.3
	Statistician	-	14.4
	Total:	-	1062.2m^2

I.	**Third and Fourth Floors - Lettable Floors**		
	Reception, Stairs, lounge, lifts and toilets	-	100.83
	2 No escape stairs	-	16.8
	Circulation	-	94.34
	Toilets	-	7.5
	Total lettable area	-	574.9
	Void	-	117.33
	Total	-	911.7m^2
	Overall area (excluding void) x 2	-	1588.74m^2
J.	**Pent House**		
	Manager's bedroom + Toilet	-	40.0
	Manager's Guest Room + Toilet	-	39.275
	Manager's Office	-	20.0
	Dining and Kitchenette	-	24.0
	Living Room	-	25.0
	Stairs	-	14.0
	Engine Room + Stairs + Circulation	-	84.07
	Total	-	246.37m^2

7.12 **FLOOR ANALYSIS**

Floor	**Total Area Excluding Void**
Ground Floor Admin.	677.85m^2
Passenger Terminal	869.1m^2



FIG. 7.1 DESIGN PROGRAMME -

7.15 Functional Relationship

This is aimed at relating the different functions in the proposed developments. Locating facilities where they have the greatest impact, e.g centralising the administration block, so that it can be easily located from all angles of the port.

7.16 Design Concept.

The concept of design is akin to the associated problems of site vis-a-vis zonning function of similar and related units around the same area. The important aspect in this concept is that of integrating the spaces and form with the immediate environment. For this reason development and concept or zoning of site was based on site circulation and approach, the priority of functional approach and priority of units. A paddling Canoe man and waves generated as a result of the movement was adopted as the concept of the design of the port administration building and the passenger terminal. A Canoe man holding a paddle, ready to sail, generates waves as he moves while paddling. The waves are linked to the Canoe by the Paddle and are circular in shape. The Canoe itself forms the port passenger terminal plan, the paddle, the jetty and also links the Canoe to the circular administration building, forming a centralised gangway between the land and water side of the proposed development .

7.16.1 Planning Principles

The ultimate aim of every designer is to create and allocate space for satisfactory use by both the client and other users. The proposal aims at creating an environment which can easily be absorbed through the maximum number of senses. This creates the deepest, most significant and lasting impact through taste, feeling, smell, hearing and movement, etc. A good design is that which satisfies all criteria reasonably.

7.16.2 Site Concept

It will be appreciated that the site, undoubtedly is the backbone of the entire design. It marks the point of departure to the task as a whole. Traditional concept of space organisation is based on hierarchy and security. The celebration of dominant spaces and functions was adopted in the conception of the site. Security and space integration as well

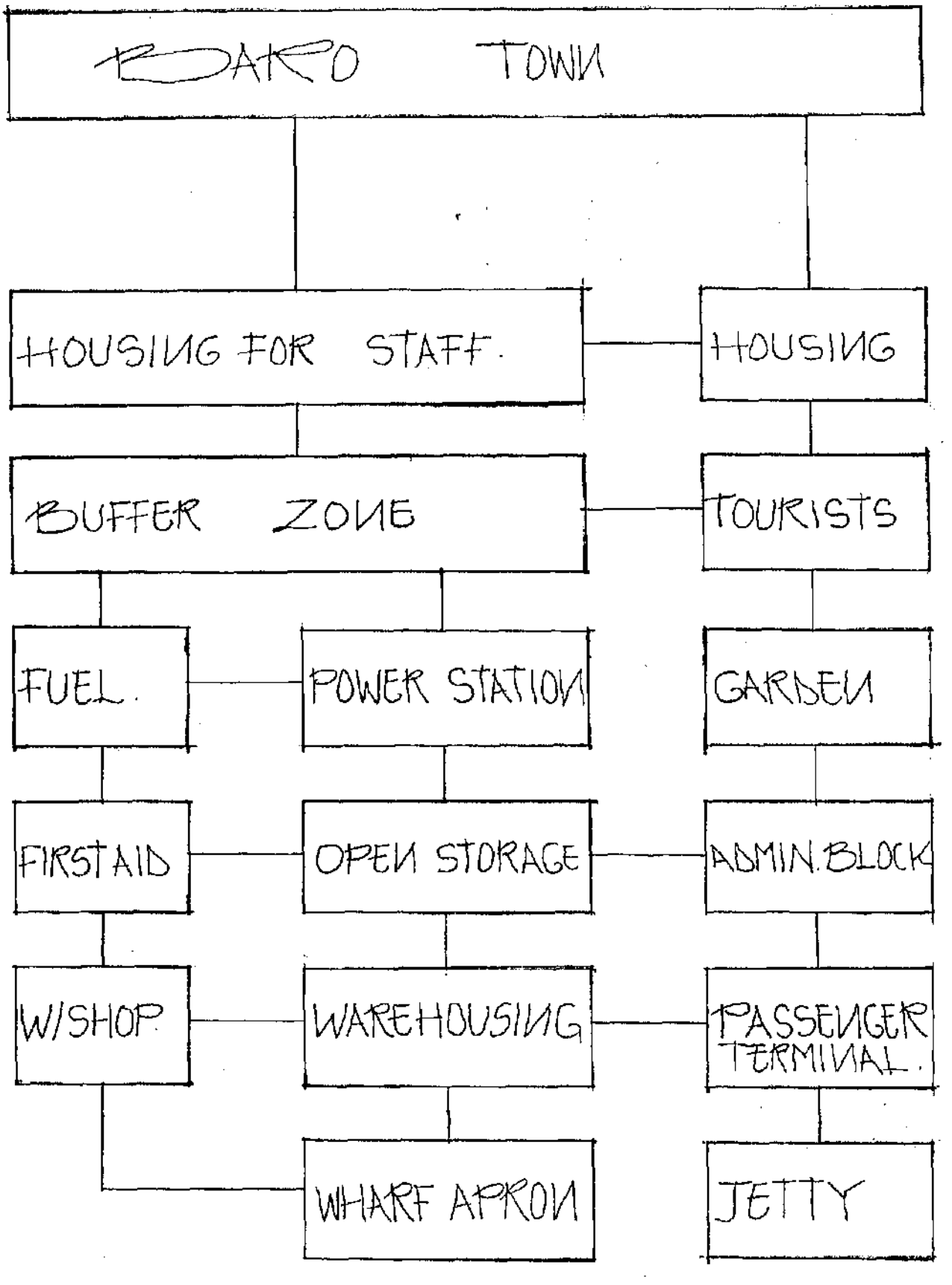


FIG. 7.2 FUNCTIONAL RELATIONSHIP DIAGRAM.



A Paddling canoe man moving on a body of water. Note the waves generated from the tip of the paddle in relation to the canoe.

FIG. 7.3 DESIGN CONCEPT.

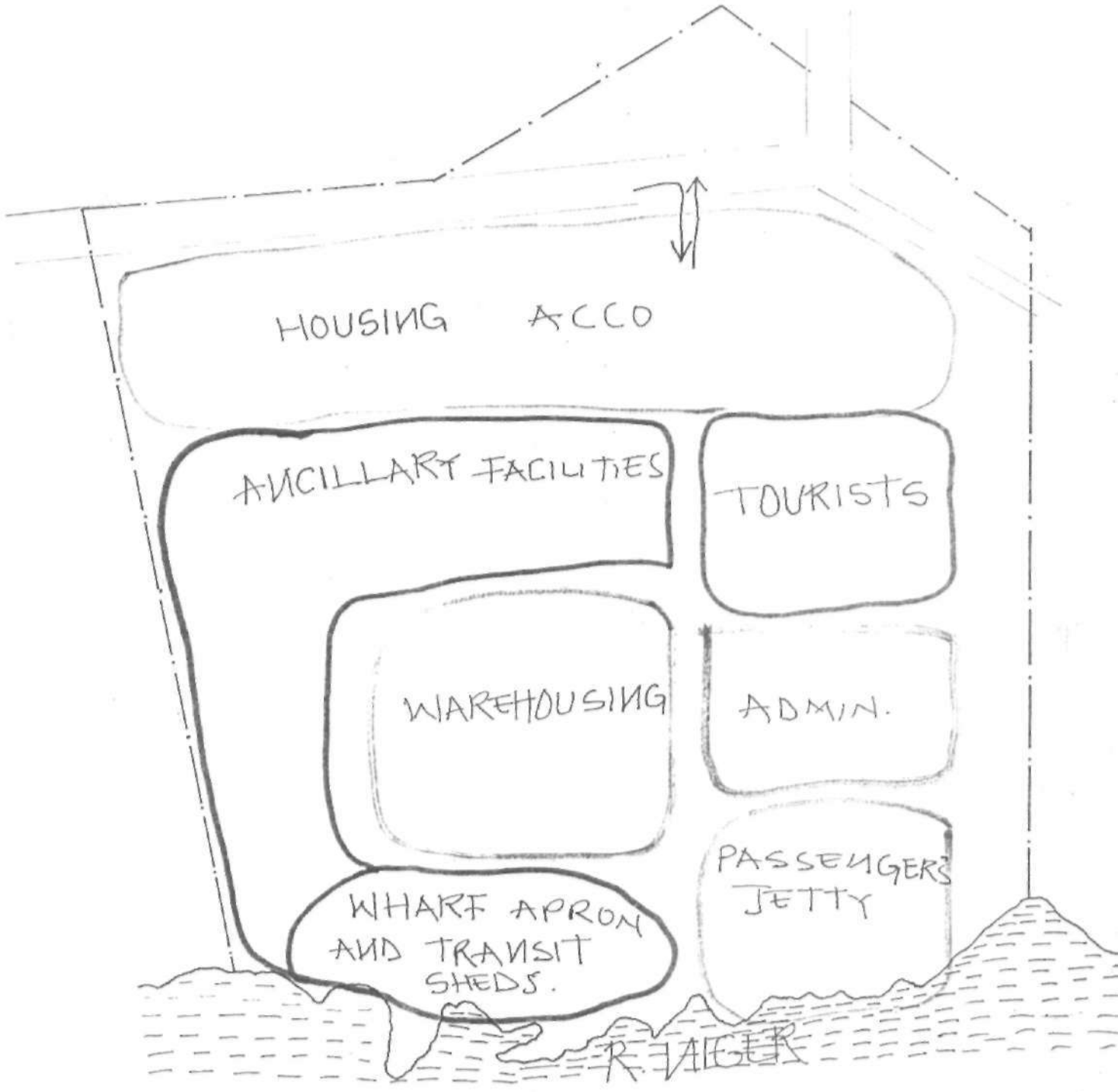


FIG. 7·4 SITE CONCEPT.

as functionality and easy flow of relationship was viewed to reflect the nature and functions of the different parts in the proposed development.

Series of site concepts were attempted and the concept eventually adopted in a dynamic flow of space on parameter of accessibility and security. Accessibility, the paddle of the canoe about sailing away from the river bank is stretched or extended out on as a central link between the passenger terminal and the port admin building.

7.17 FLOOR PLANS

The floor plans of the proposed development were based on the operational procedures of the passenger terminal and administrative office, and the facility requirement of a typical port terminal. The flow of space from water to land and vise versa is clear through the connecting paddle to the ripples generating strong waves linking the canoe to the landward side. Upper limits of standards were adopted and where, necessary, a utility factor is added for optimal space allocation.

7.18 Ground Floors

The ground floors of both the passenger terminal building and the administration are the first parts that welcome visitors or passengers from ships and visistors from land respectively into the entire complex and first impression is usually made here. To this effect the entrances and reception areas on these floors were carefully designed and landscaped to portray the fuctions and activities of the port. There are escape stairs located at the extreme ends of the building to bring users to a distance of 16 - 18 meters away from the escape stairs as set by standards. In the administration building, the ground floor

accommodate mainly a reception, a branch bank, canteens/kitchenette, general store, security and service areas.

In the passenger terminal, the ground floor accommodates the ticket office, customs office, postal agency and telephone services, baggages unit, concourse hall, boat lounge and a separate reception for tourists. The floors of the two buildings are linked by a central gangway directly following the stretch of the paddle in the canoe.

7.19 First Floors

The Administration wing of the port has accommodated on the first floor the junior and semi executive staff of the port. The floor has a well defined reception and waiting lounge incorporated within the service core and research offices, computer rooms are located here.

The passenger terminal has on the 1st floor a large reception and waiting area for passengers and a small reception for tourists. A restaurant with a good view of the water located on this floor is the observation deck for tourist a multi-purpose hall and shopping facilities. Others include offices for staff and leftable office spaces. The ground and 1st floors are linked by a central gangway.

7.20 Second Floor

The second floor of the administration is the senior managerial floor designed to accommodate the top management staff of the port. The floor is composed of series of cellular single zone offices. There is a reception and waiting area comprising other service areas.

The passenger terminal is does not have a second floor.

7.21 Third and 4th Floors

These are lettable floors forming 35 - 40% of the total usable floor area. These floors are linked to all the service facilities provided in the previous floors. There are access stairs, lifts, reception and waiting area and toilets.

7.22 Fifth Floor

The fifth floor accommodates the pent house. It can easily be accessible by the escape stair and the services stairs. It offers a fantastic and wide spread views towards the entire site.

The roof top consists of the drainage gutters, machine room and water tanker accessible through the escape stairs.

7.23 Elevations

The elevations projected for the proposed development are no doubt a clear demonstration of the triumph of form integration with the environment, using available building materials, good method of construction and interplay of forms relating them to the activities of a port environment. The elevations of the passenger terminal are in fact the replica of a canoe ready to sail into the river with its paddle stretched out to aid movement.

The administration building's elevations towards the water side represents two cargo ships placed side by side and showing transverse sections. The approach represents the rounded transverse sections of sailing ship with a canoe like porch carried by heavy paddle partly dipped or immersed in water. This relays a transformation from the long

historic use of canoes to shipping on the river. The penthouse and the roof top represents a mast of a cargo ship about to sail into the river. Side elevators partly show the longitudinal replica of a rounded transverse edged ship loaded and awaiting signals to sail.

7.24 Structural Systems

The sections shows a clear vista of the building structure. The building features series of vertical columns and beams linked together to form a rigid network.

Owing to differing bearing capacity of the soils present, pile foundation is recommended for areas close to the water front with loose sub-soil while areas like the administrative office, that are not close to water will have foundations due to soil conditions.

7.25 SERVICES

7.25.1 Drainage

The site exhibits a gently sloping topography towards the River Niger. Storm water on the site is proposed to be channeled towards the river using concrete gutters that will be located near the buildings and fences. The building in itself exhibits a fantastic drainage pattern. Around the upper floors of the administrative block, are aesthetic columns into which drainage pipes will be fitted to drain water from the sky onto the podium. The aesthetic columns around the podium are also fitted pipes, which finally discharges the water on to concrete gutter around the building and finally empties into the river.

On the passenger terminal buildings, the rain water is also collected over roofs and emptied into pipes hidden in the aesthetic columns and discharged into gutters.

7.25.2 Fresh Water

Fresh water pipes have to be installed to supply water into the site. Water will then be conveyed to the building top by means of a pumping machine. Force of gravity naturally aids water supply to the different floors through pipes. Waste water exit from the building follows services voids incorporated in the building.

7.25.3 Electricity, Telecommunications and Air Conditioning

The electricity, telecommunications and air conditioning services to the buildings will be hidden in the ceiling, which is a suspended one. A generator equipped with all handling facilities is provided on site, to assure all day round electricity supply in advent of failure, from the electricity poles. The central air conditioning system is recommended in the design proposal.

7.25.4 Sewage Disposal

Sewage disposal is to be effected by piping at various collecting points from inspection chambers, to septic tanks and finally soak away pits.

7.25.5 Fire Control

The use of breakable glass on windows positions and smoke detector sensor system is recommended to check fire hazard within the building. Water hydrant points will also be located and other users for relaxation at break time.

7.26 Technical Facilities

These facilities are necessary to ensure the proper functioning within and outside the buildings. Security posts along the fence is further provided for all night vigil.

7.27 MATERIAL USAGE AND CONSTRUCTION METHODOLOGY

Reinforced concrete, sandcrete block, panel walls, curtain walls, and glass are the chief materials to be employed in the construction

Construction method is by cast-in-situ for structural elements like columns, beams and floor slabs.

Glazed ceramic murals will be employed as wall finish over the entire exterior facade of the building, internal and partition walls will be treated with emulsion paints.

7.28 MAINTENANCE

The assessment of the value of a building over a period of time is dependent on the maintenance culture demonstrated on the building. The use of strong, durable and replaceable materials for construction and finishes is recommended to ensure the overall well being of the building. The discharge of unwanted products from the building structure as soon as they are produced and carrying out of maintenance at regular intervals will guide against the complete collapse of the building.

CHAPTER EIGHT - CONCLUSION AND RECOMMENDATIONS

8.1 CONCLUSION

River Port Termmal for Baro is a proposal motivated by the Federal Governments move to develop river transportation and to construct river ports in selected riverine areas along the river Niger. The fact that Baro port played a vital role in the economic development of Nigeria cannot be over emphasised. The rail terminus at Baro which linked the North to the inland port enhanced easy transportation of goods to and from the Northern part of the country to Baro and further to the Southern seacoasts. Baro was a centre for commerce between 1912 and 1960 as a result of heavy passenger and goods traffic. The design proposal is an attempt to reinstate the commercial glory of Baro port towards profitability and private sector participation.

The facilities used by the colonial masters at the Baro port are essential tourist potentials in addition to the Empire Hill which houses Lord Lugards first colonial headquarters some few kilometers away from the port. The Warehouses of UAC and Royal Niger Company as well as workshops and accommodation facilities are still in existence on the site. We are all aware that an environment caters for man's basic needs and expresses man's activities around it. Water as a basic need of man, serves his transportation, recreational, aesthetic pleasures as well as solve human needs for security, circulation, space etc. This stimulated the

choice of the sub-topic for the project-integrating forms and spaces with the immediate port environment. For this reason, the colonial facilities used in the old port have been preserved for Tourist interests.

The design and planning of a proposed inland water port in a developing country like Nigeria has not been an easy task. Although most of the brief and data for the design are based on the client requirements, they are comparable with those of existing larger ports both within and outside the country. While ports sampled outside the country define clearly cargo, passenger and leisure facilities in ports, Nigerian ports face poor location of facilities. In Nigeria, more attention is paid to cargo handling, neglecting passenger and leisure facilities which are also essential characteristics of a developed port. Generally, in existing Nigerian ports, administration facilities are inappropriately located in relation to other port facilities resulting in poor output.

The proposal has centralized administration facilities such that they can be easily accessible from all the other parts of the port. Tourist and leisure facilities have been provided, in addition, forms and spaces have properly organised to allow for free and uninterrupted flow of traffic. Forms and spaces have further been employed as tools for integrating the buildings with the immediate environment to enhance profitability. Passenger Terminal facilities have been clearly defined from cargo quay facilities. A landing jetty for passengers alighting from a ferry has been proposed from the tip of the canoe man's paddle used as the

design concept. The provision for multiple tenancy in both the Administration and Passenger Terminal buildings is an over sight of accommodation constraints for private sector participants. It is also deliberate in order to incur the construction cost and portray investment potentials to the private sector, in an attempt to reflect the reality of the project.

Nigeria as a developing country is striving to meet up economic problems and challenges. We as Nigerians owe our country a duty to manage the resources wisely to the best of our ability. For this reason, Tourist and leisure facilities have been incorporated in the proposed port Terminal for Baro. This is also to enable users tap the other resources of water, apart from its transportation potential. In the words of James (1963) "A port reflects in its layout the influence of its immediate land and water site. A canoe-like porch supported by a massive paddle-like column has been proposed for the entrance porch of the Administration block. Also from the Passenger Terminal, paved areas have been proposed for relaxation and to aid clearer view of the water from a safe water front.

It is indisputable that in the sphere of function and technique, the architect is responsible to the pattern of his culture on one hand and the pattern of technology on the other. According to UNCTAD (1983), "Ideally, the facilities which a port provides should be designed jointly with the ships which will use them, the land transport and the port facilities at the other end of the route that is, as part of an integrated transport system". The designer has a positive reasoning

in this direction, putting in mind buildings as essential port facilities. In the expression of form and its integration with the immediate port environment, A ship-like administration office and a canoe-like Passenger Terminal have been proposed in an attempt to integrate the building with transportational aids in the immediate water environment. This has also successfully achieved a blend of cultural craftsmanship with modern Technological advancement.

The essential task of architecture, as we know it, is to combine the beauty with the useful and indeed to achieve the most complete possible satisfaction in both demands. The architects principal responsibility in the formation of style is to create meaningful forms enclosing useful and functional spaces that are directly related to the purpose for which the work is designed. The River Port Terminal proposed for Baro has forms and spaces, which have been developed from transportational aids on water; ship and canoe, that will be used in the port. The idea is to link up culture with technological advancement and to produce befitting buildings to suit the gigantic commercial set up anticipated for an inland water port at Baro.

8.2 RECOMMENDATIONS

Transport facilities are apparently the formative power of economic growth and lack of them are a major hinderance to Economic development and progress, it is necessary for reaching all parts of the country. River ports are important

junctions in the feeder and distribution routes between the production and consumption areas. Having realised all these, the Federal government owes it a duty to Nigeria to make the dredging of River Niger and construction of river ports a reality. In the light of this, the Government has given the defunct PTF the mandate to execute the contract for the dredging of the river and is also preparing vigorously for the construction of the River ports. It should however be noted that buildings are essential facilitators of marine transport and their design and construction should reflect architectural advancement and cultural sovereignty of the Nigerian people.

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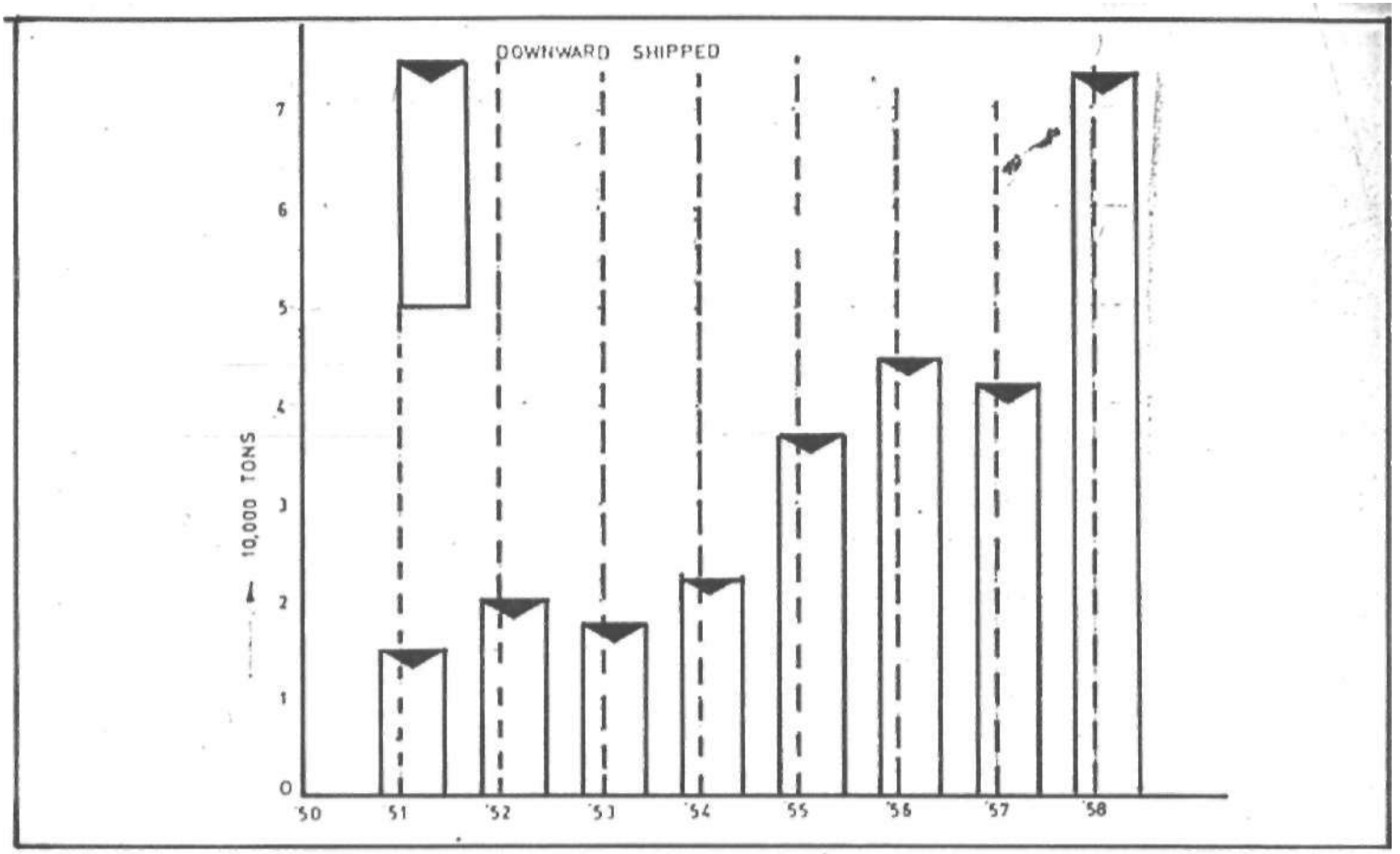
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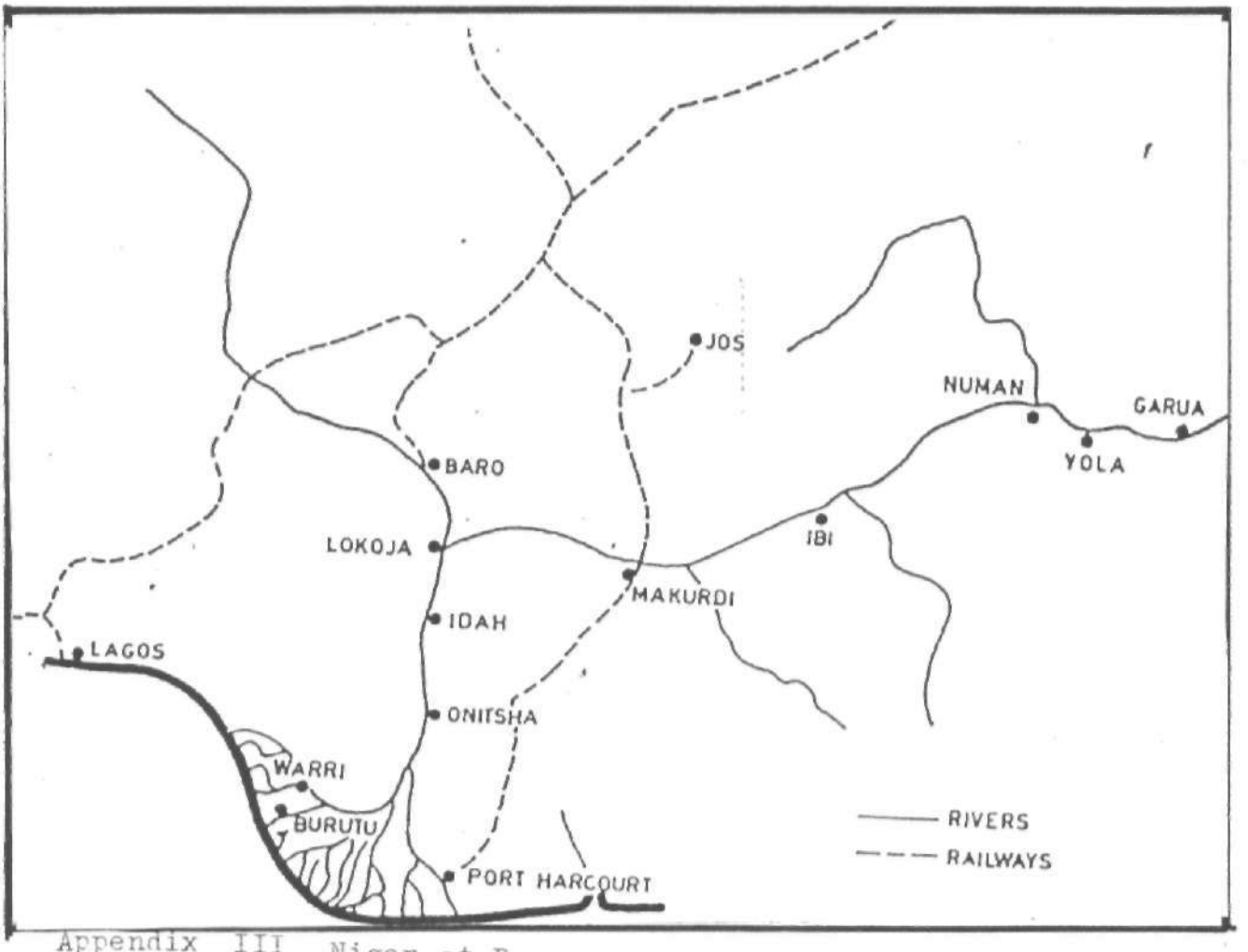
	approx. annual tonnage handled	covered storage near waterside	facilities	remarks
Warri	100,000	12,000	Q B L M	Q quay
Burutu	350,000	40,000	Q T M	B berth
Onitsha (1	80,000	25,000	Q T L M	T tanks for petroleum products
Idah (2	20,000	6,000	L	L man-handling
Lokoja	10,000	8,000	T L	M mechanised handling
Baro	75,000	10,000	L R	R railway connection
Makurdi	12,000	10,000	L R	(1 including Asaba opposite Onitsha
Ibi	3,000	4,000	L	(2 including Agenebode opposite Idah
Numan	7,000	8,000	L	(3 including Dalmare opposite Yola
Yola (3	8,000	9,000	L	(4 large covered storage away from waterside
Garua	35,000	17,000 (4	Q T L M	

Appendix 1V - River Portsin Nigeria, Facilities available and the Tonnages handled as at 1959.



Appendix II

Baro tonnages in the past decade



Appendix III Niger at Baro.

Table 5.1.5-3 (1 shows the average annual tonnages transported by the Niger River Transport fleet during the periods 1935—1939, 1945—1947 and 1951—1953, while the river stations are divided into three river-stretches, namely, the Niger below Lokoja, the Niger above Lokoja, and the Benue River.

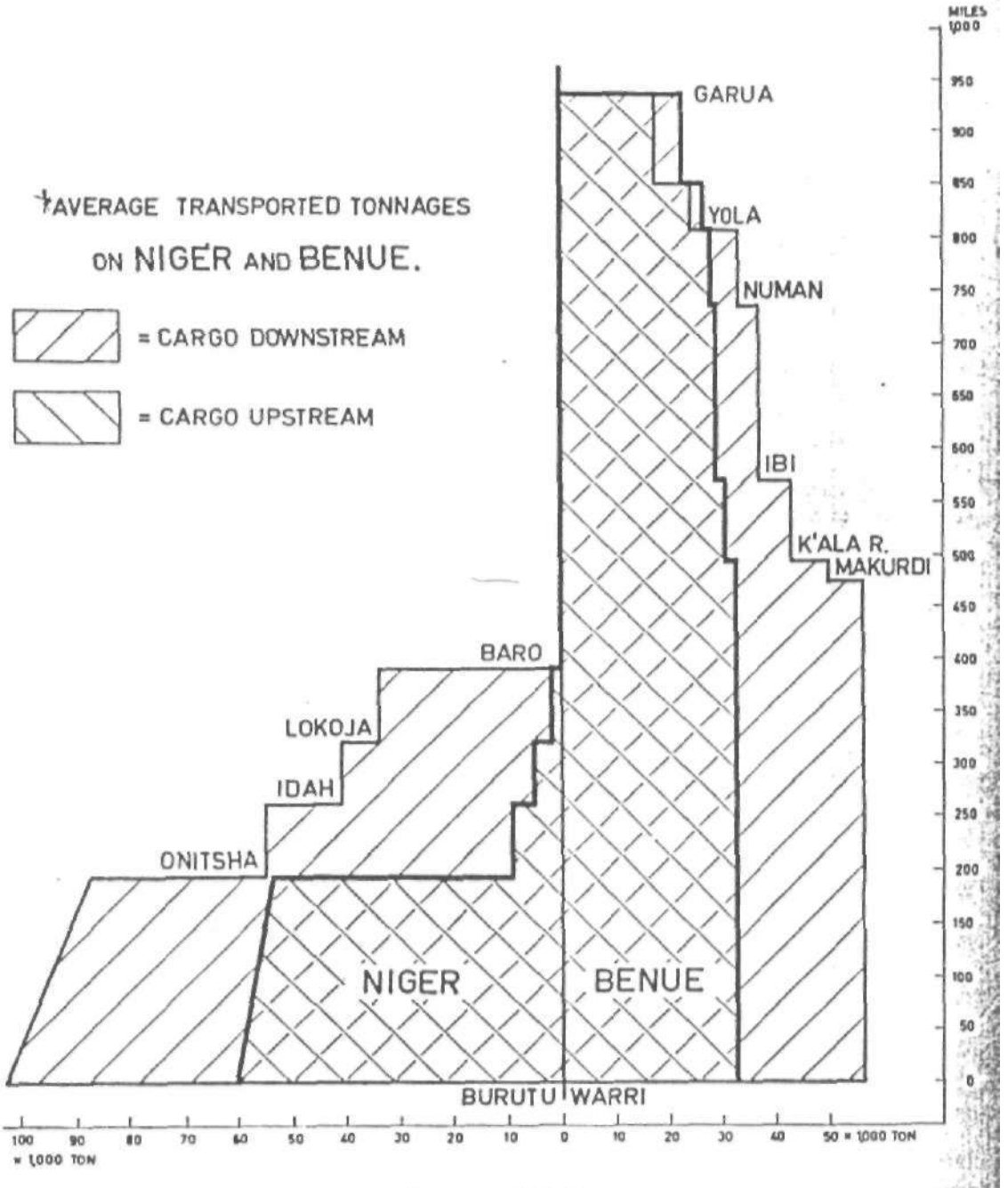
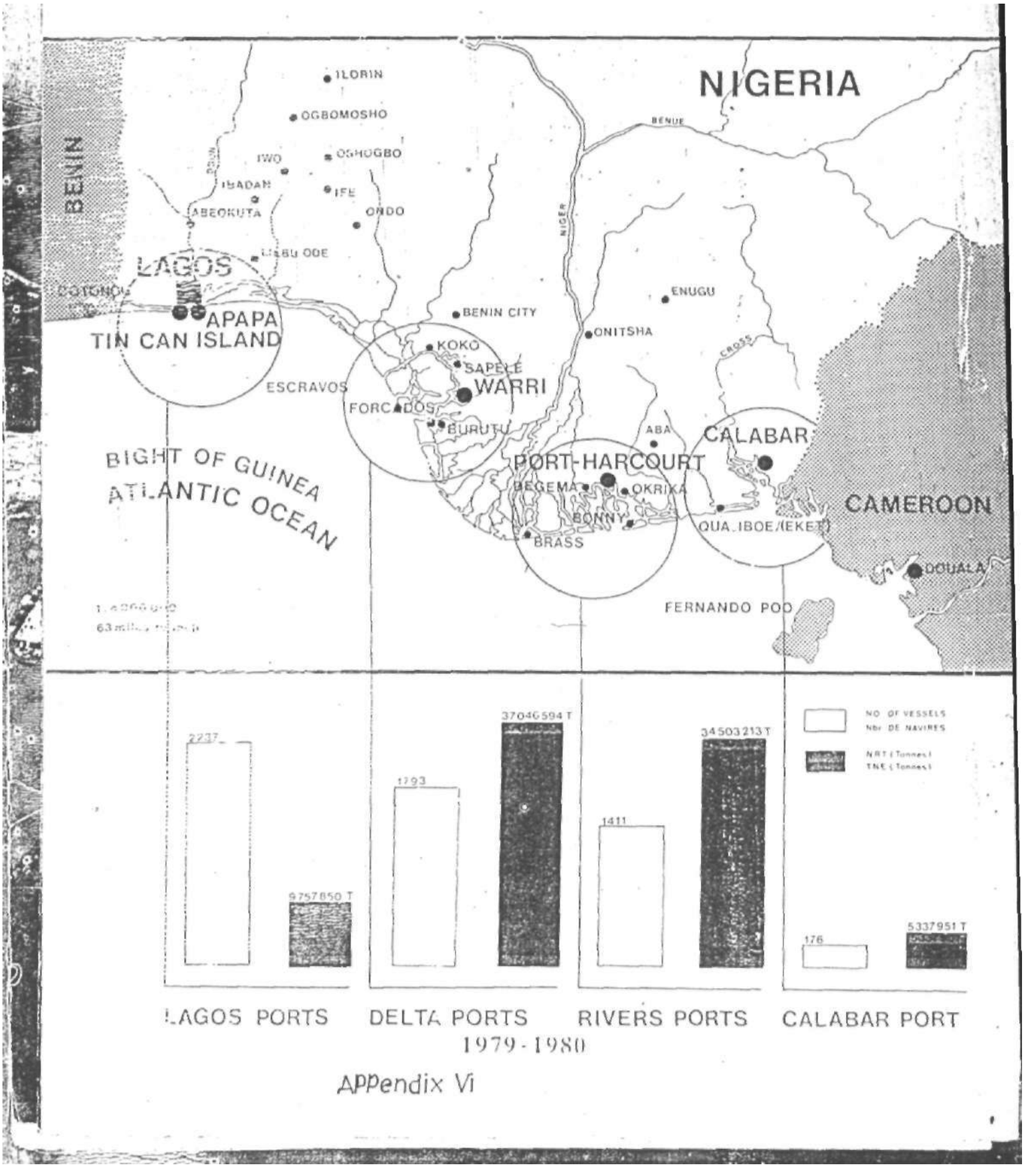


DIAGRAM 5.1.5-2

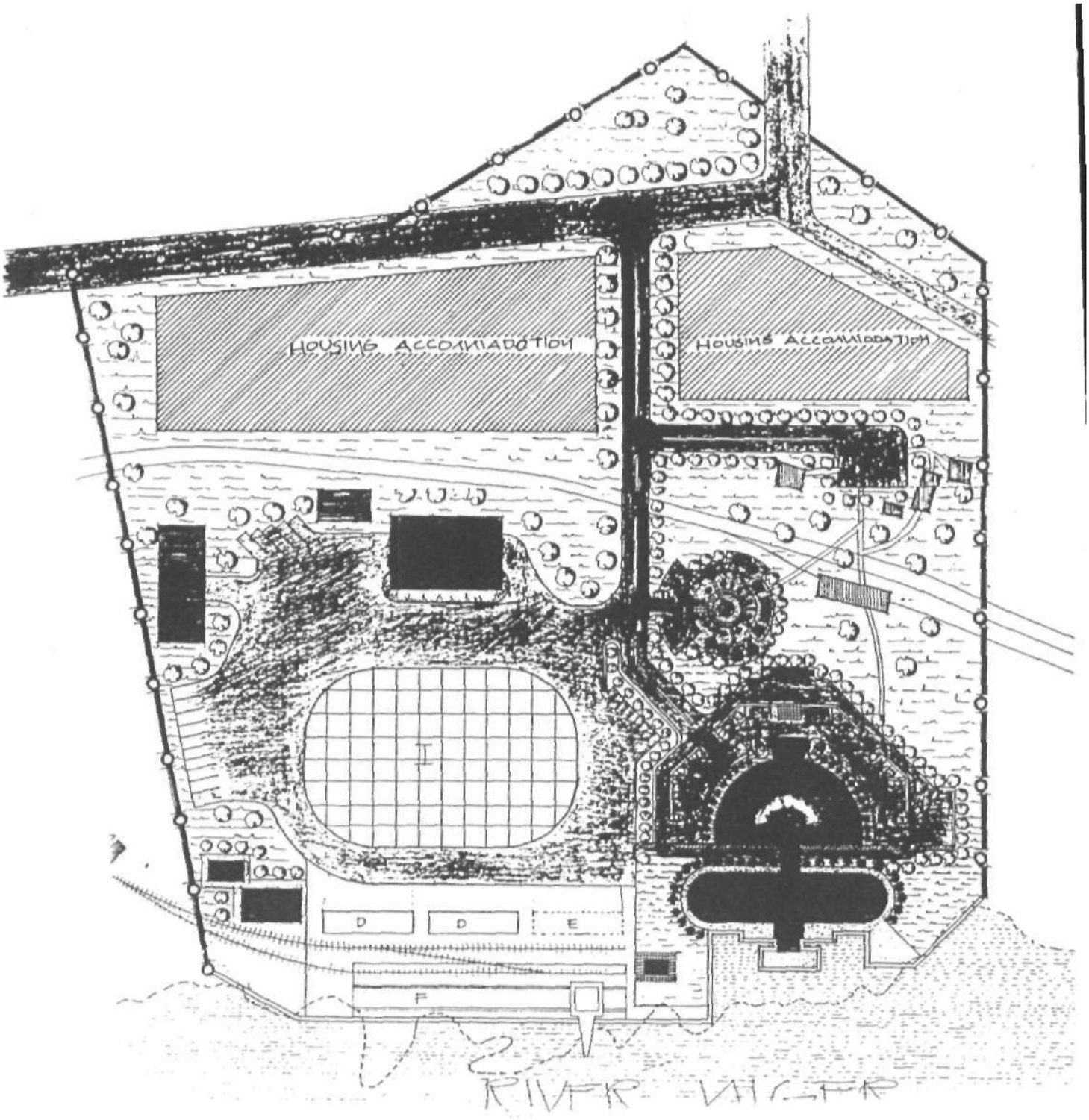
Average transported tonnages

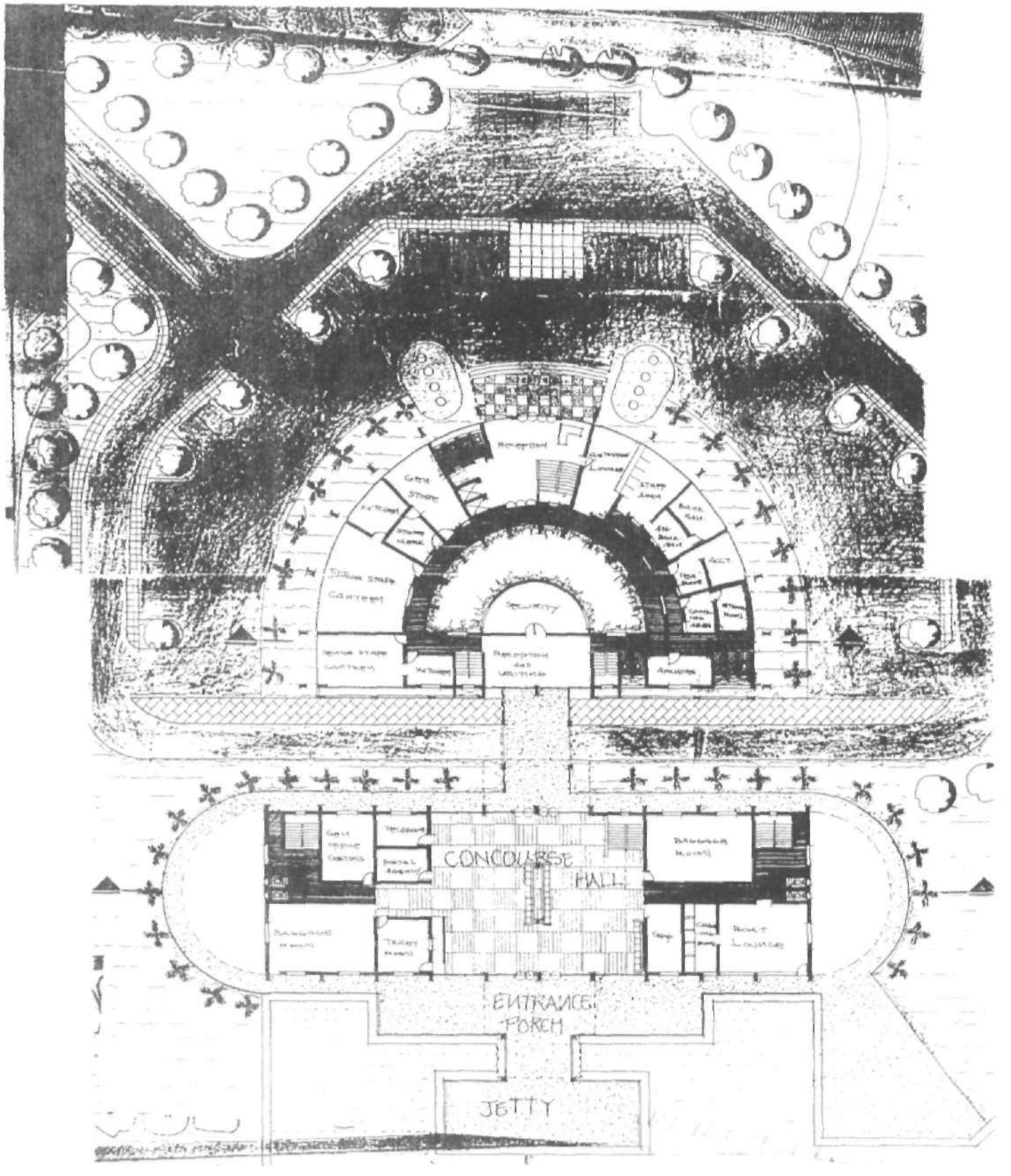
(1 U.A.C. STAT. & ECON. REVIEW, No. 14, 1954. GEN. 36

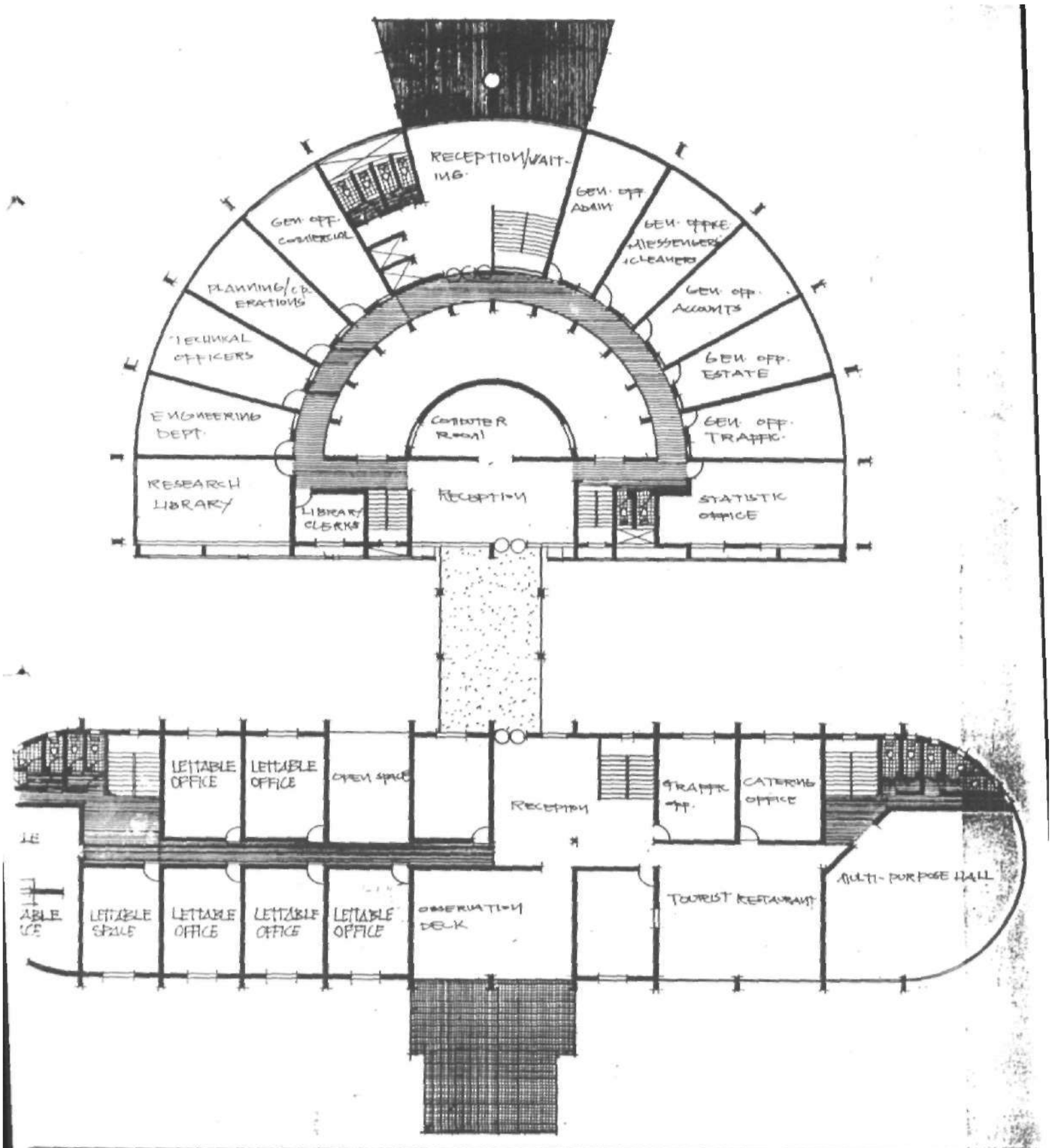


1979-1980

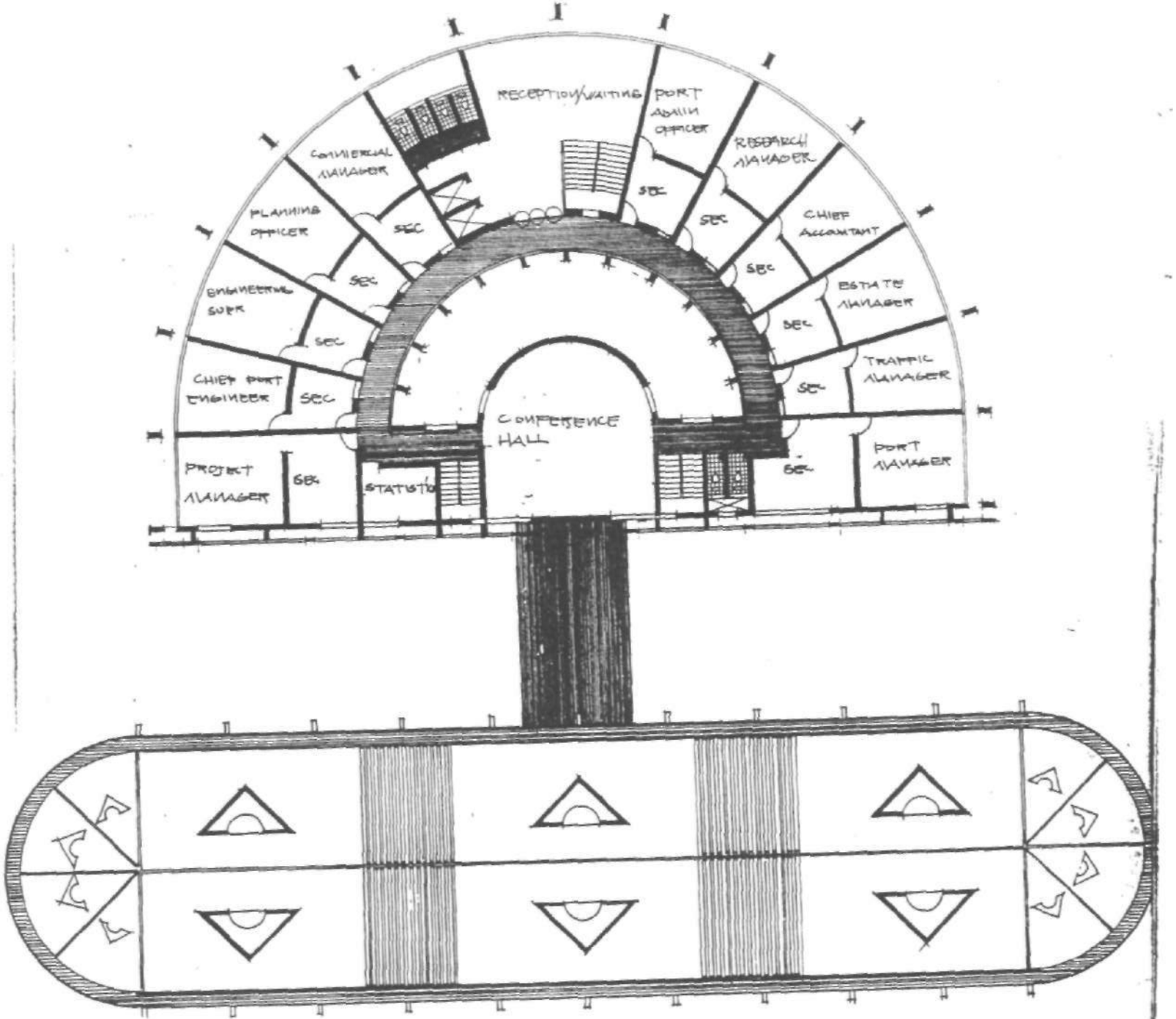
APPendix Vi

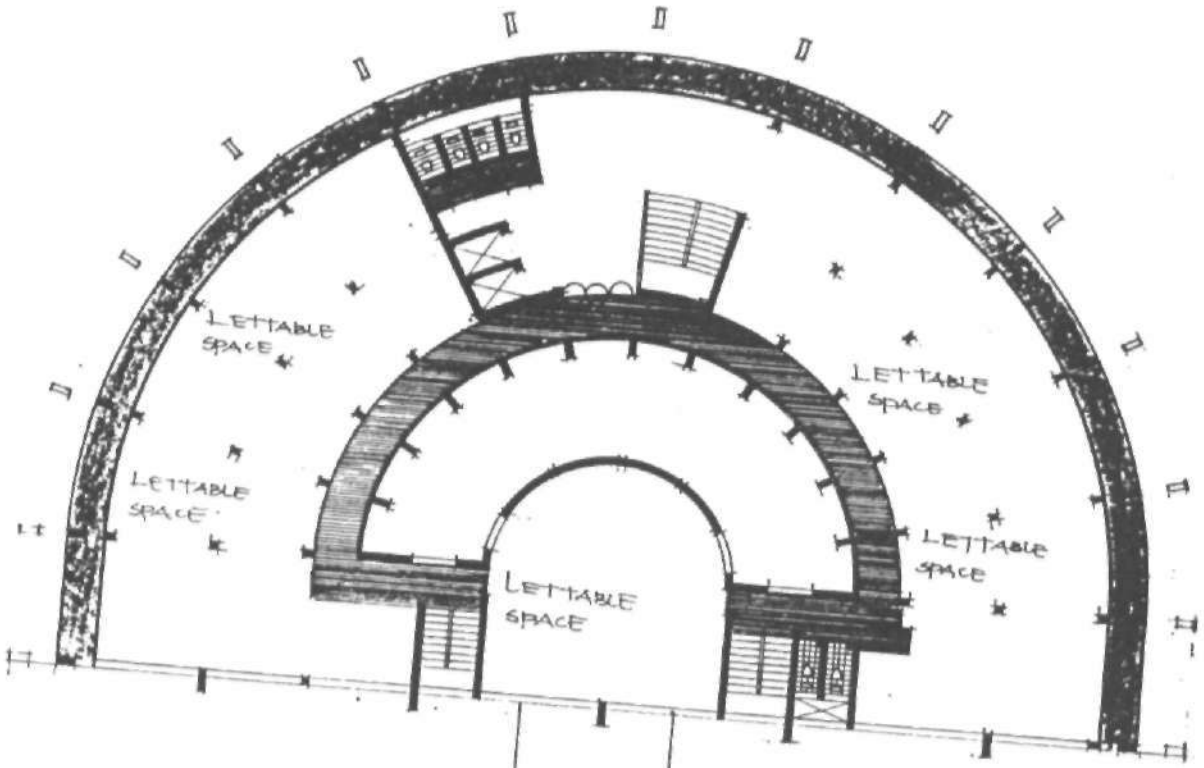

HOUSING ACCOMMODATION
HOUSING ACCOMMODATION
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D
E
F
RIVER WATER


CONCOURSE
HALL
ENTRANCE
PORCH
JETTY

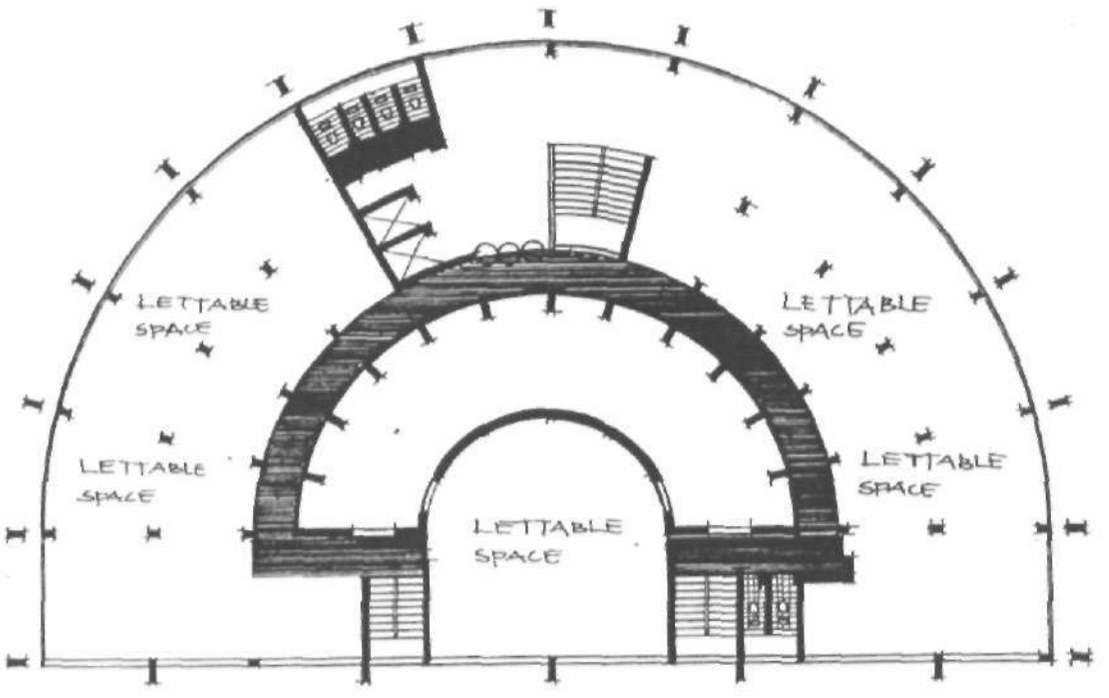


PORT TERMINAL FOR BAIRD


RECEPTION/WAITING
PORT ADMIN OFFICER
RESEARCH MANAGER
CHIEF ACCOUNTANT
ESTATE MANAGER
TRAFFIC MANAGER
PORT MANAGER
COMMERCIAL MANAGER
PLANNING OFFICER
ENGINEERING SUPR
CHIEF PORT ENGINEER
PROJECT MANAGER
STATISTICIAN
CONFERENCE HALL
SEC

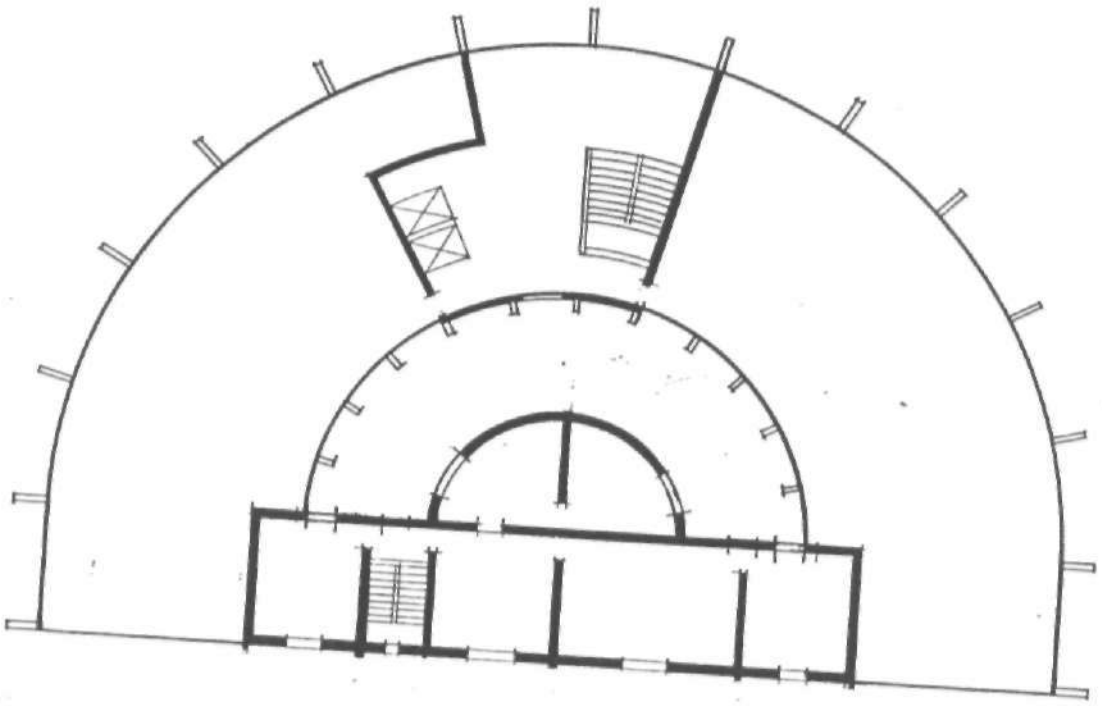


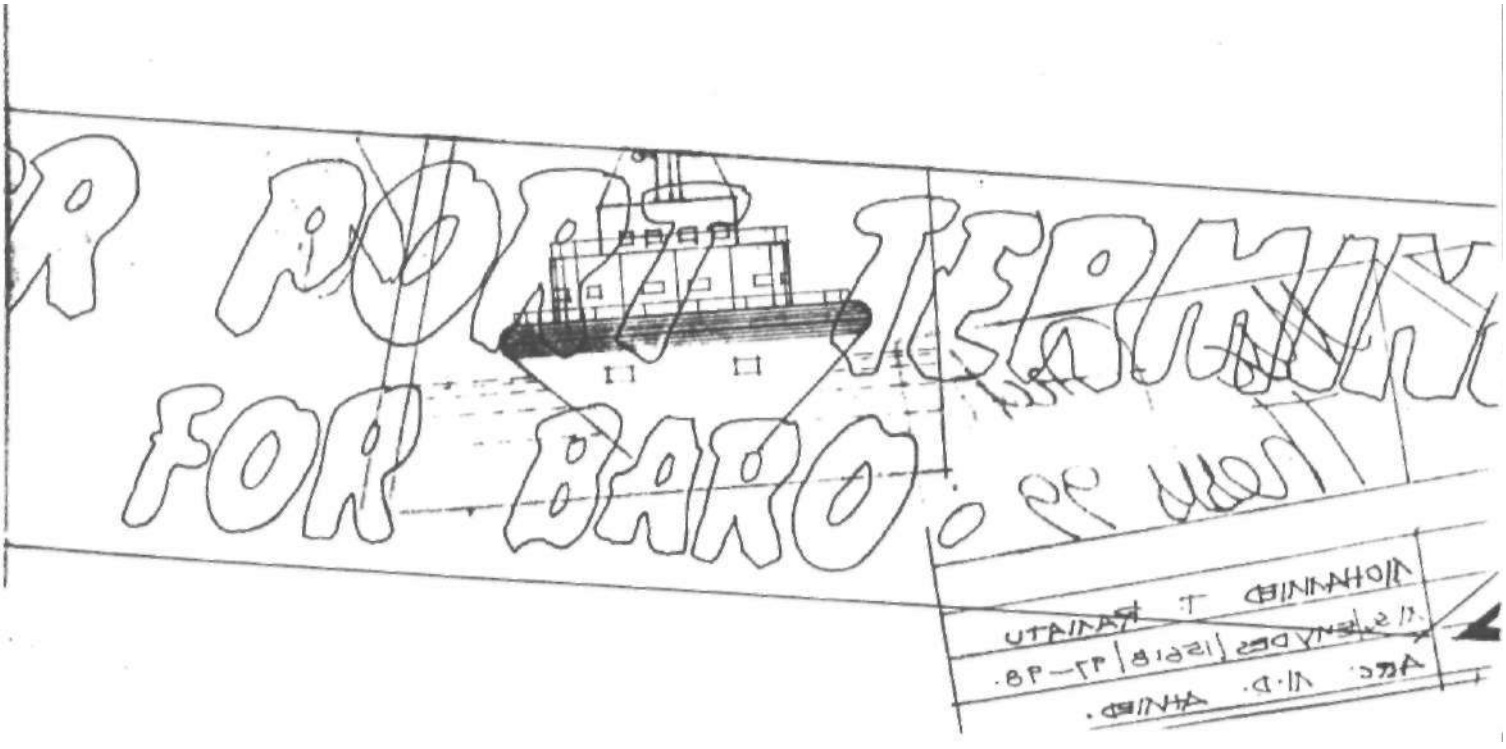
R PORT TERMIN.
FOR BARO.

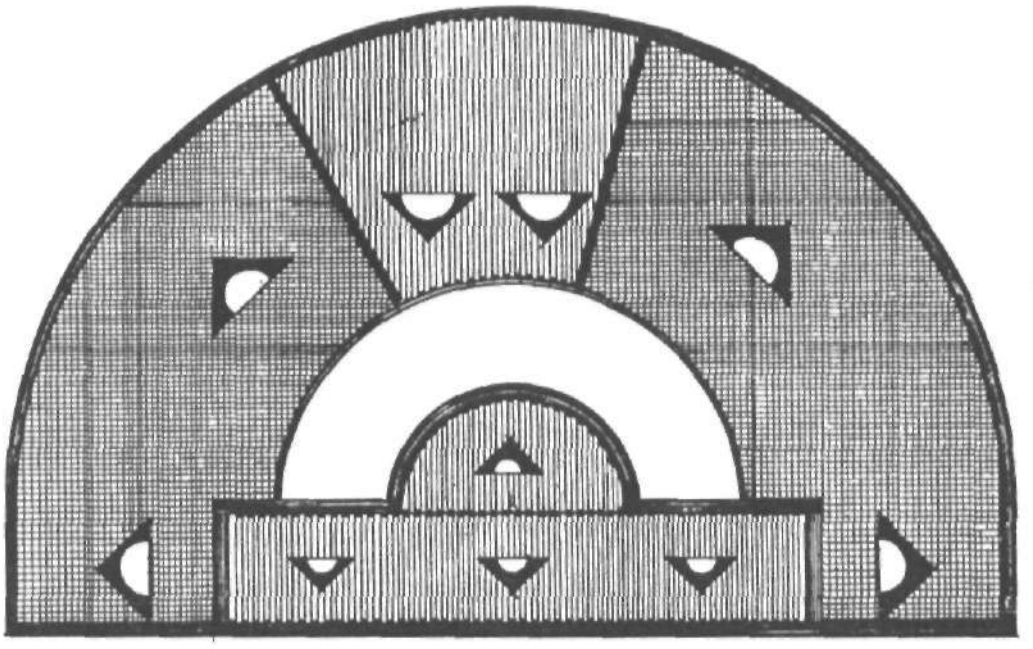


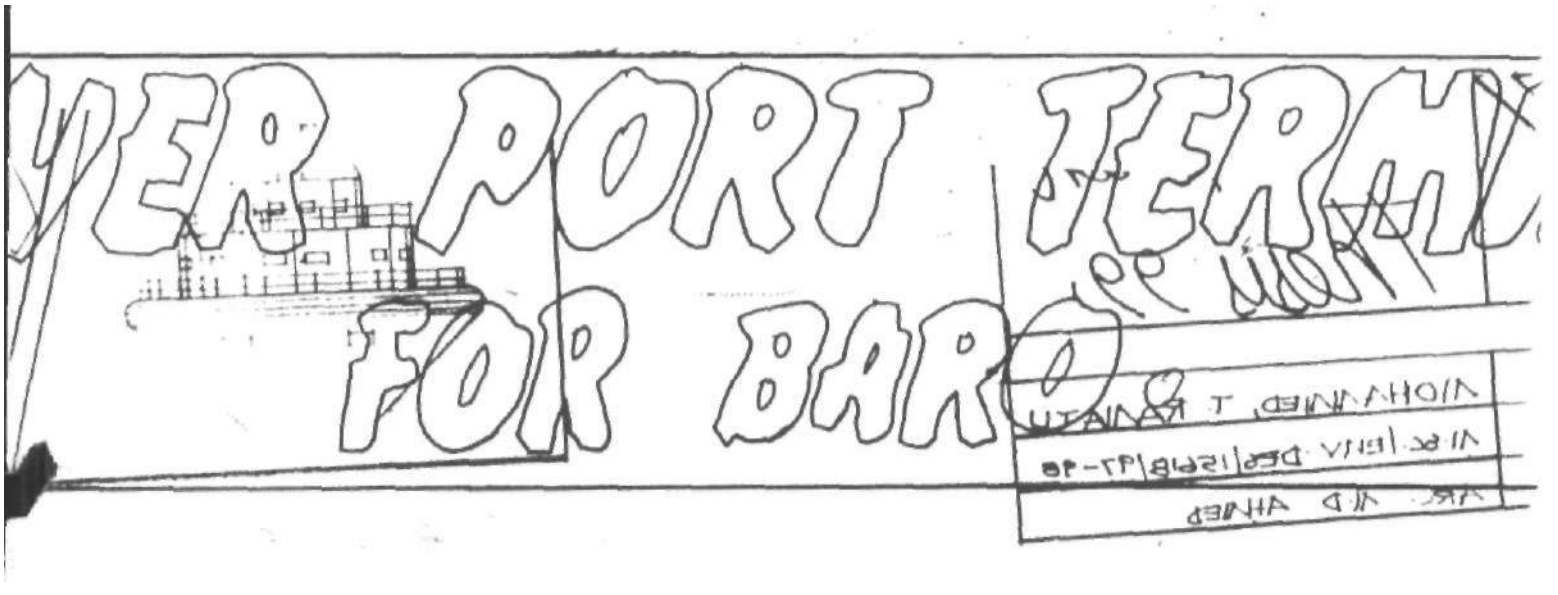
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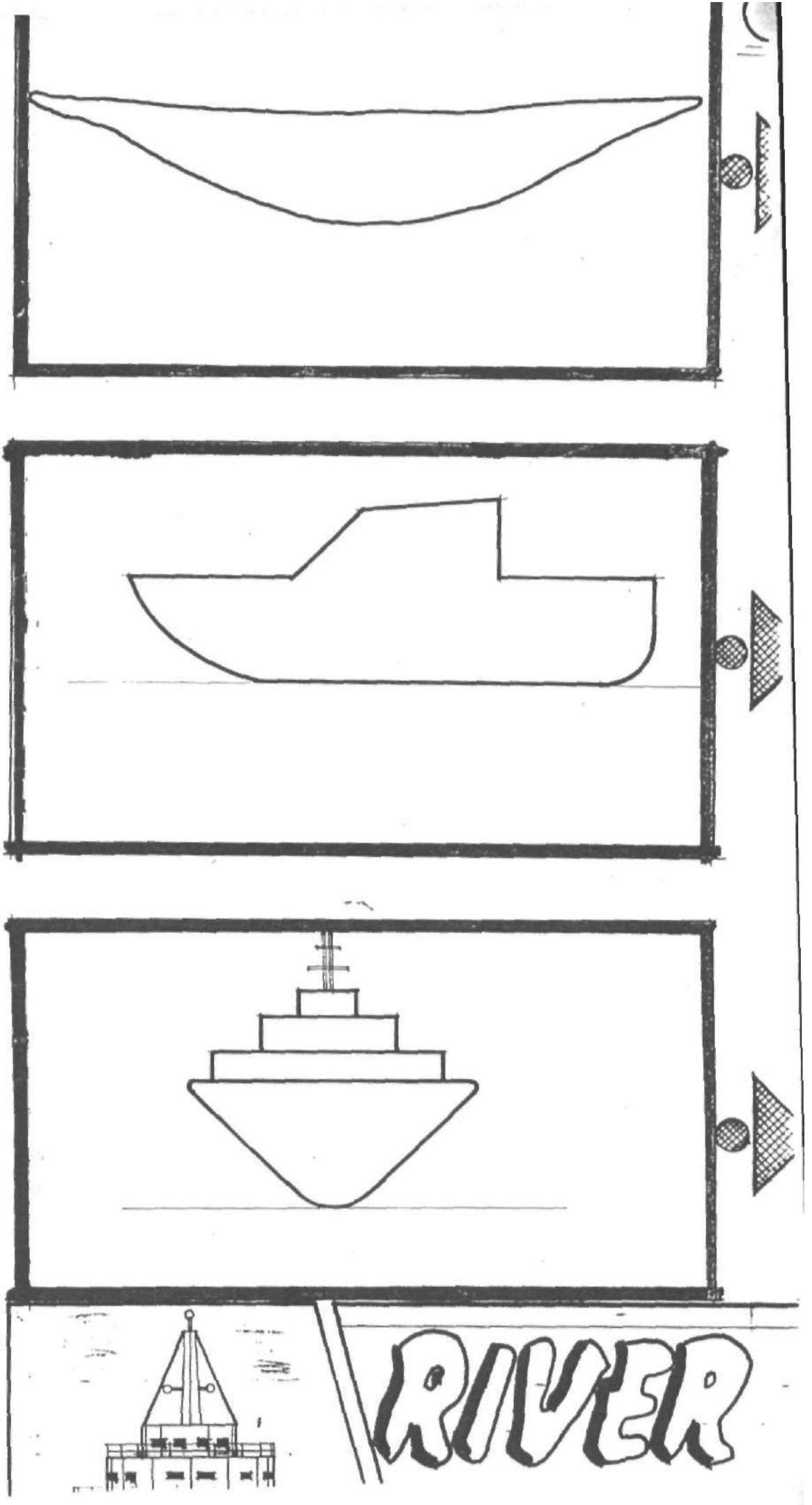
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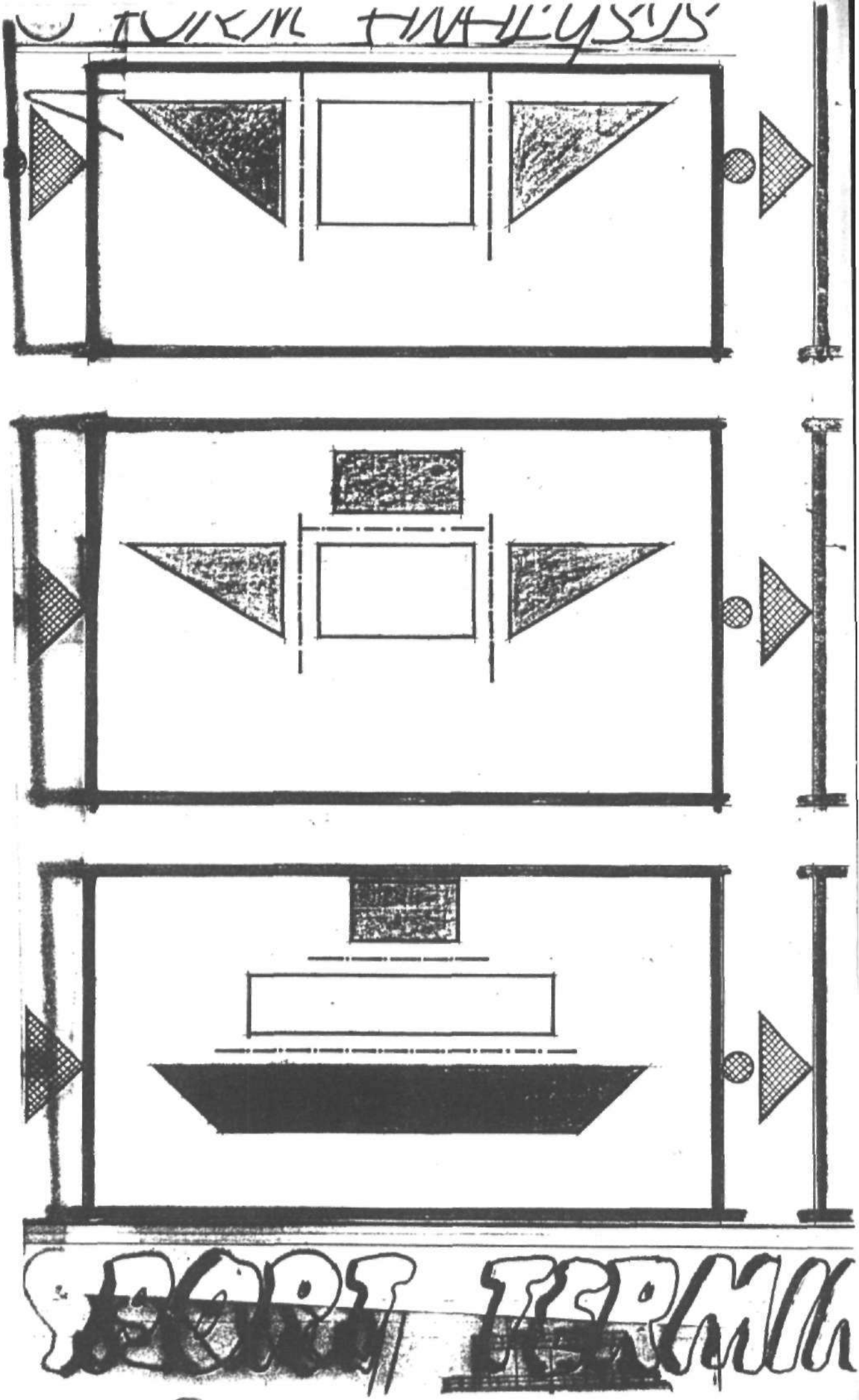


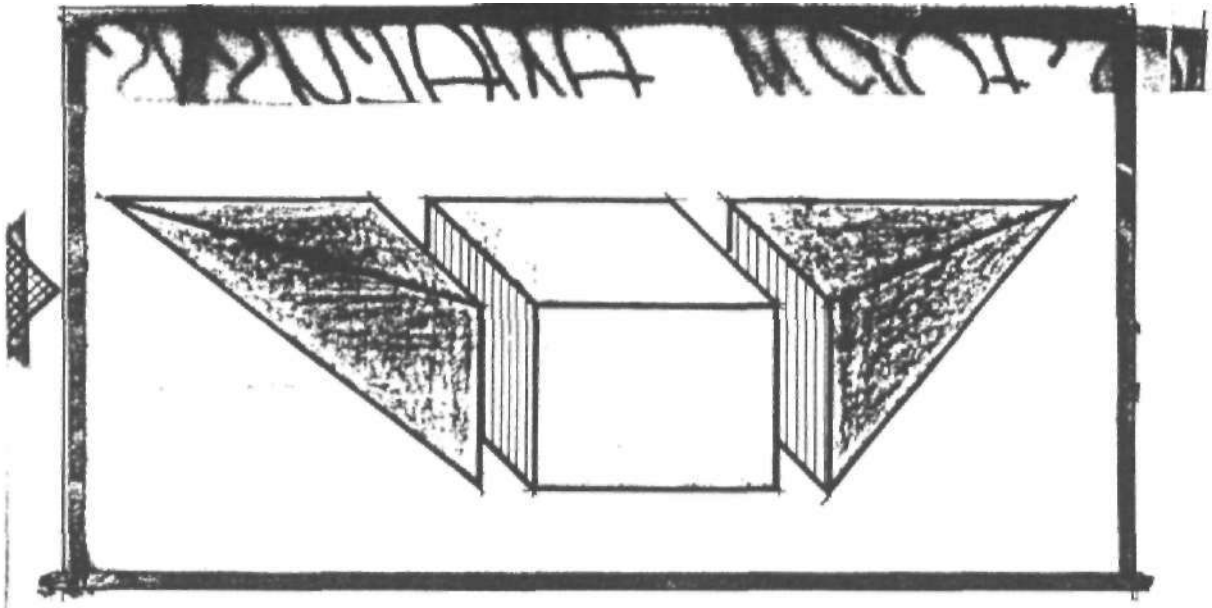

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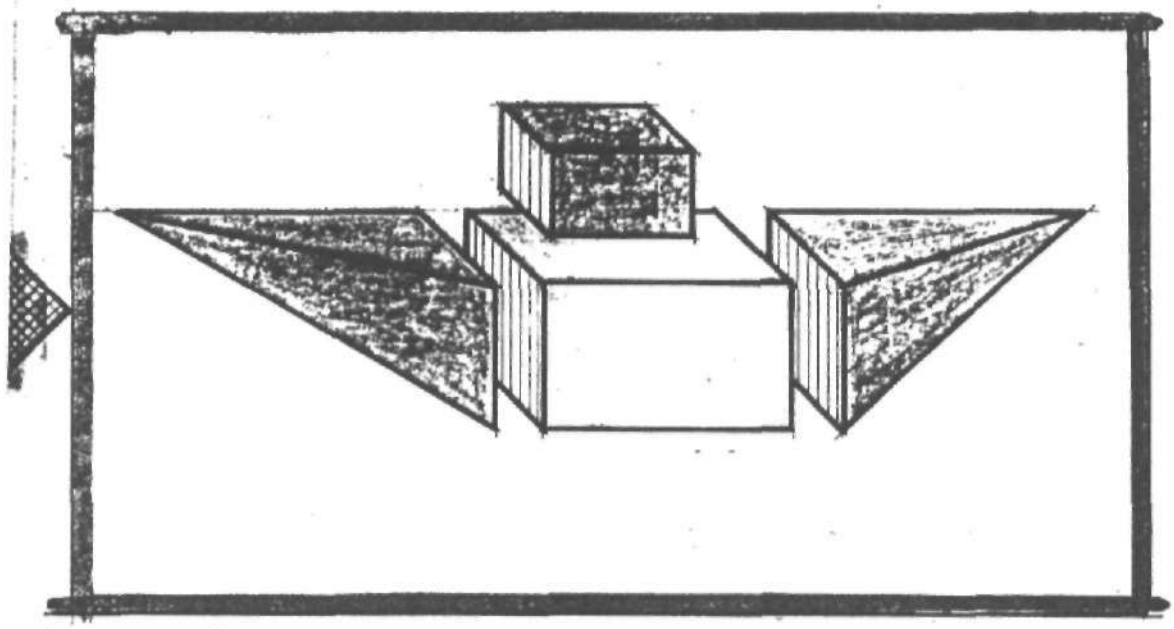


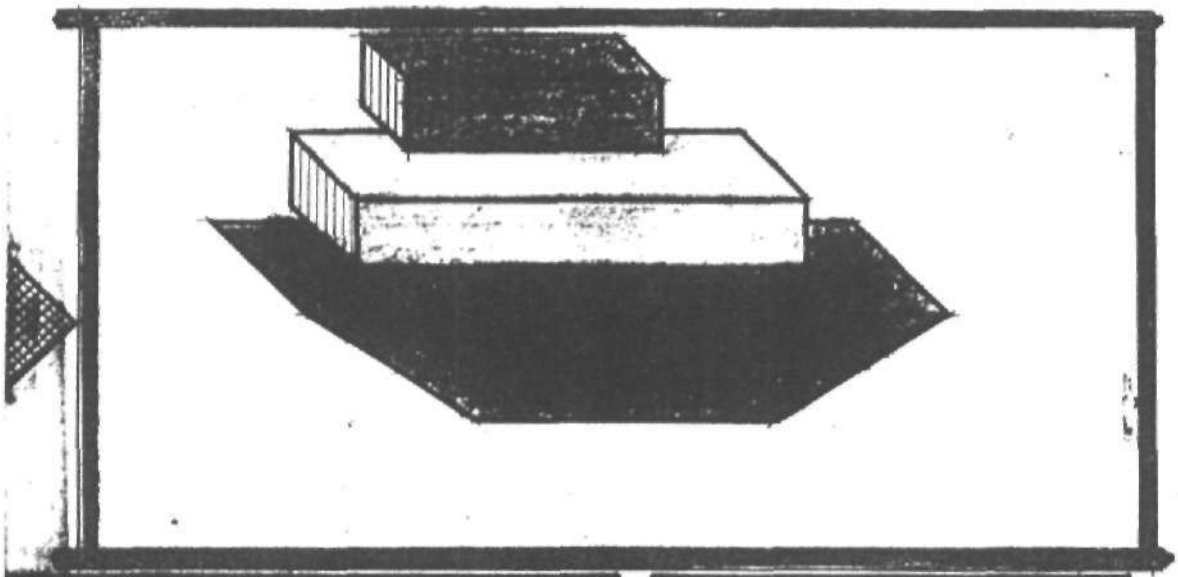

FOR BARO


RIVER









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thesis

Proposed Terminal for Bhopal.

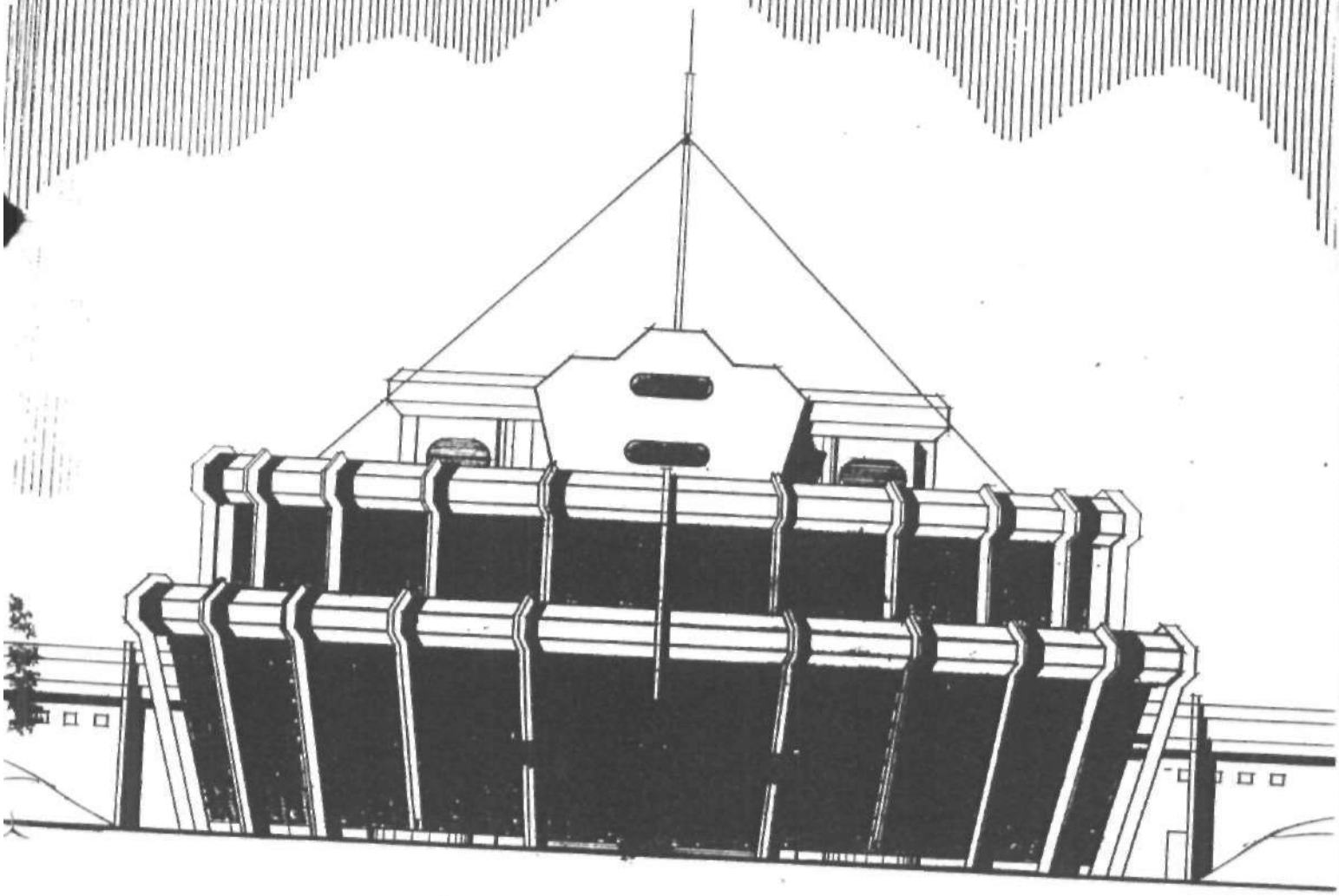
SECTION X-X

SECTION 2-2

NOTES:

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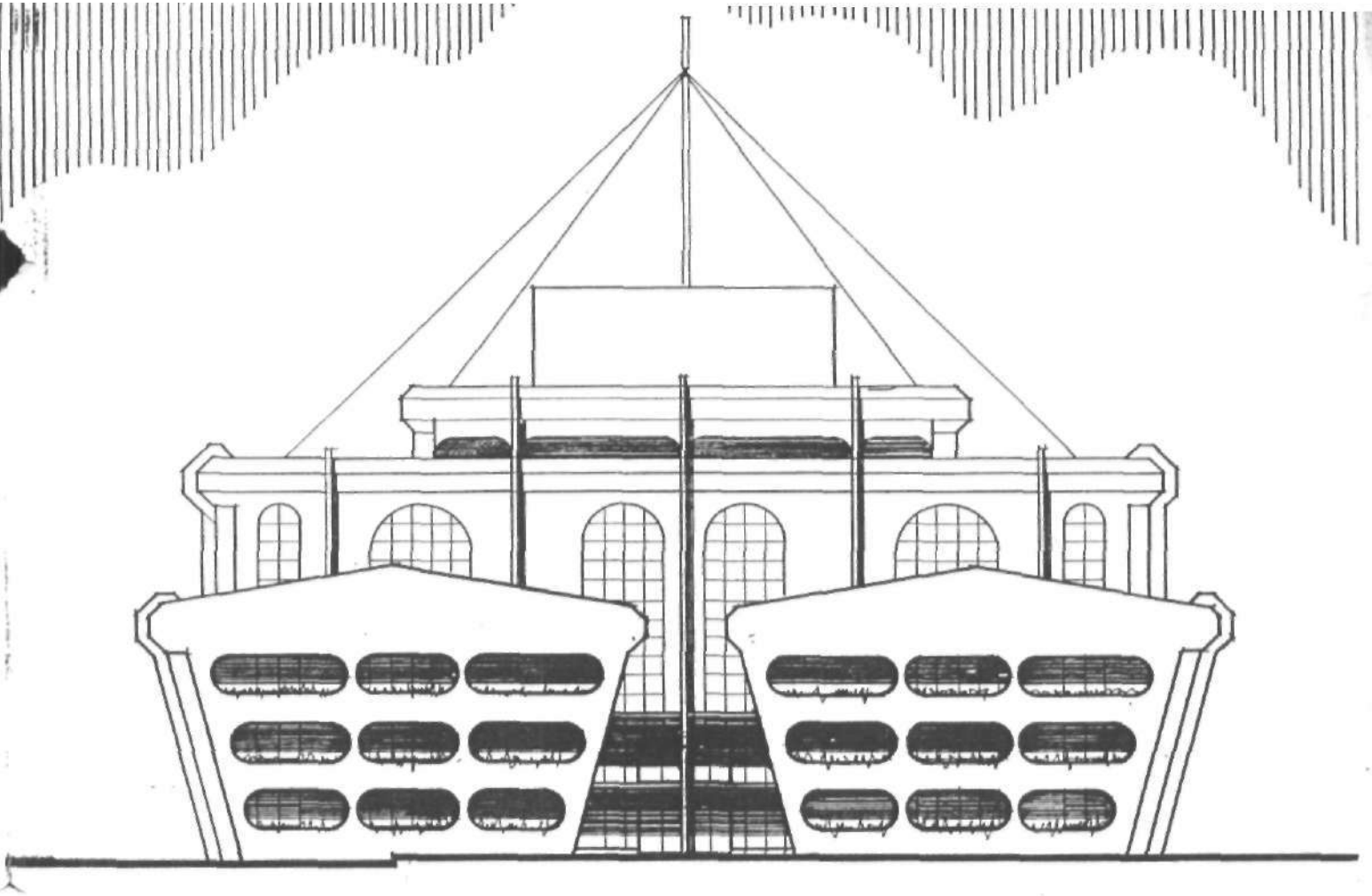
Section



north east

SR PORT TERMIN

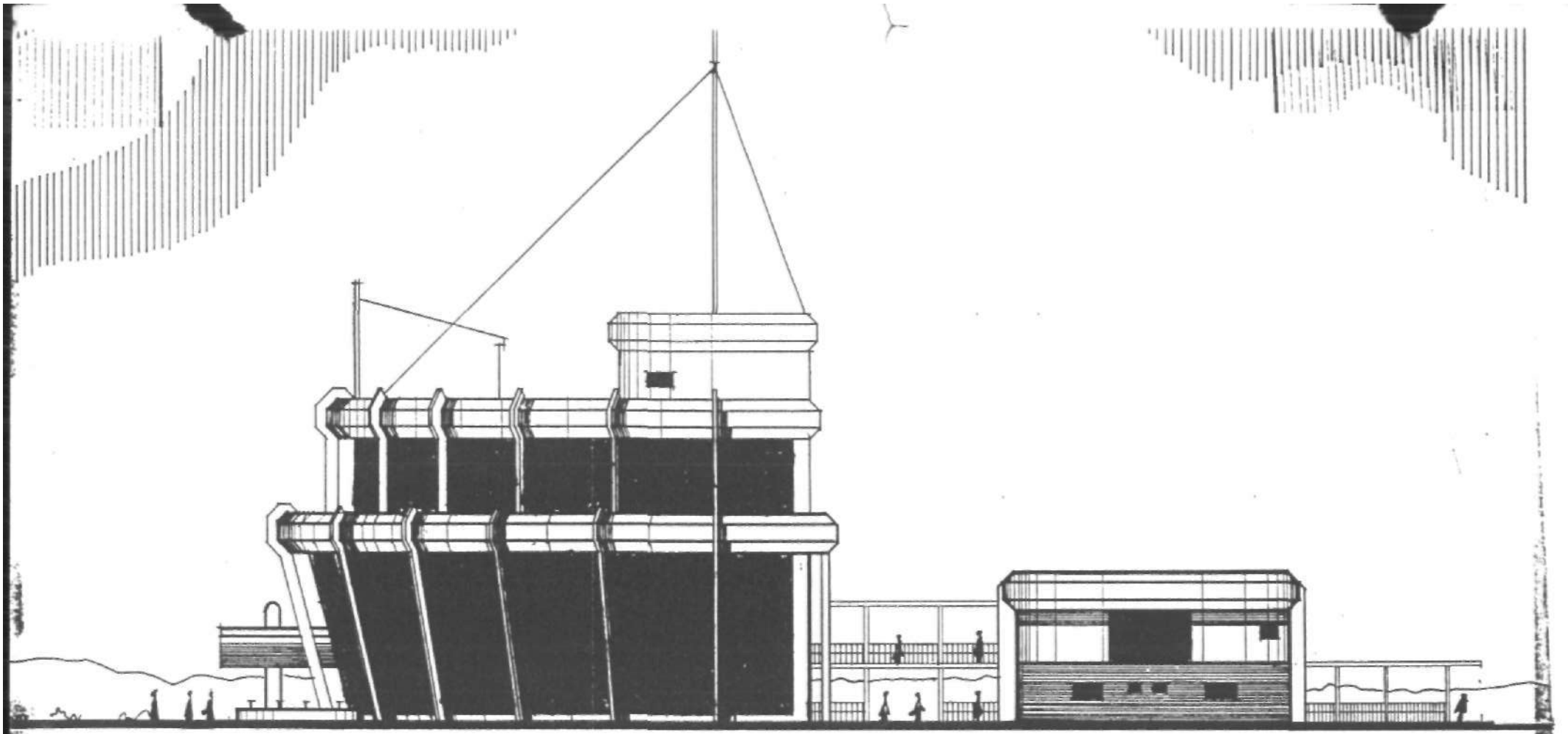
FOR BARO.



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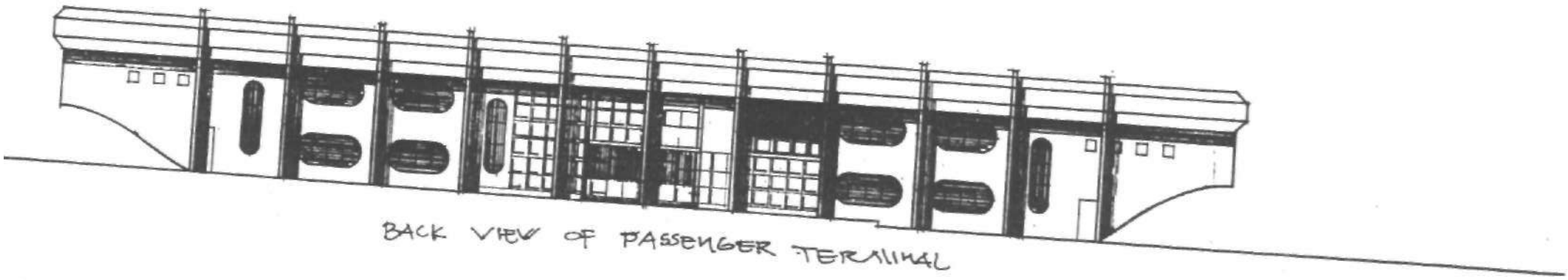
FOR BARO.

SOUTH EAST

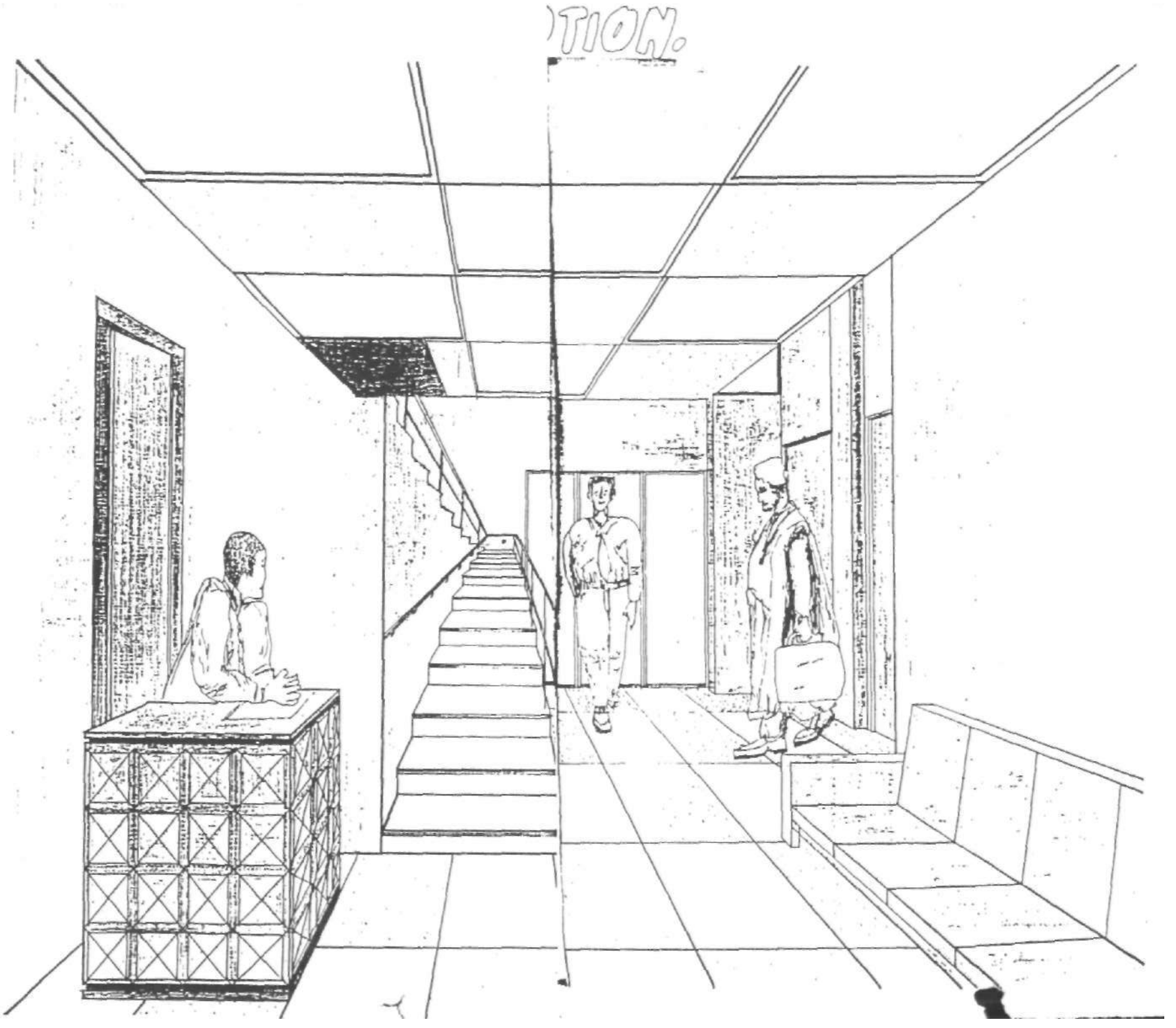


NORTH WEST

RIVER PORT TERMINAL



BACK VIEW OF PASSENGER TERMINAL


TION.