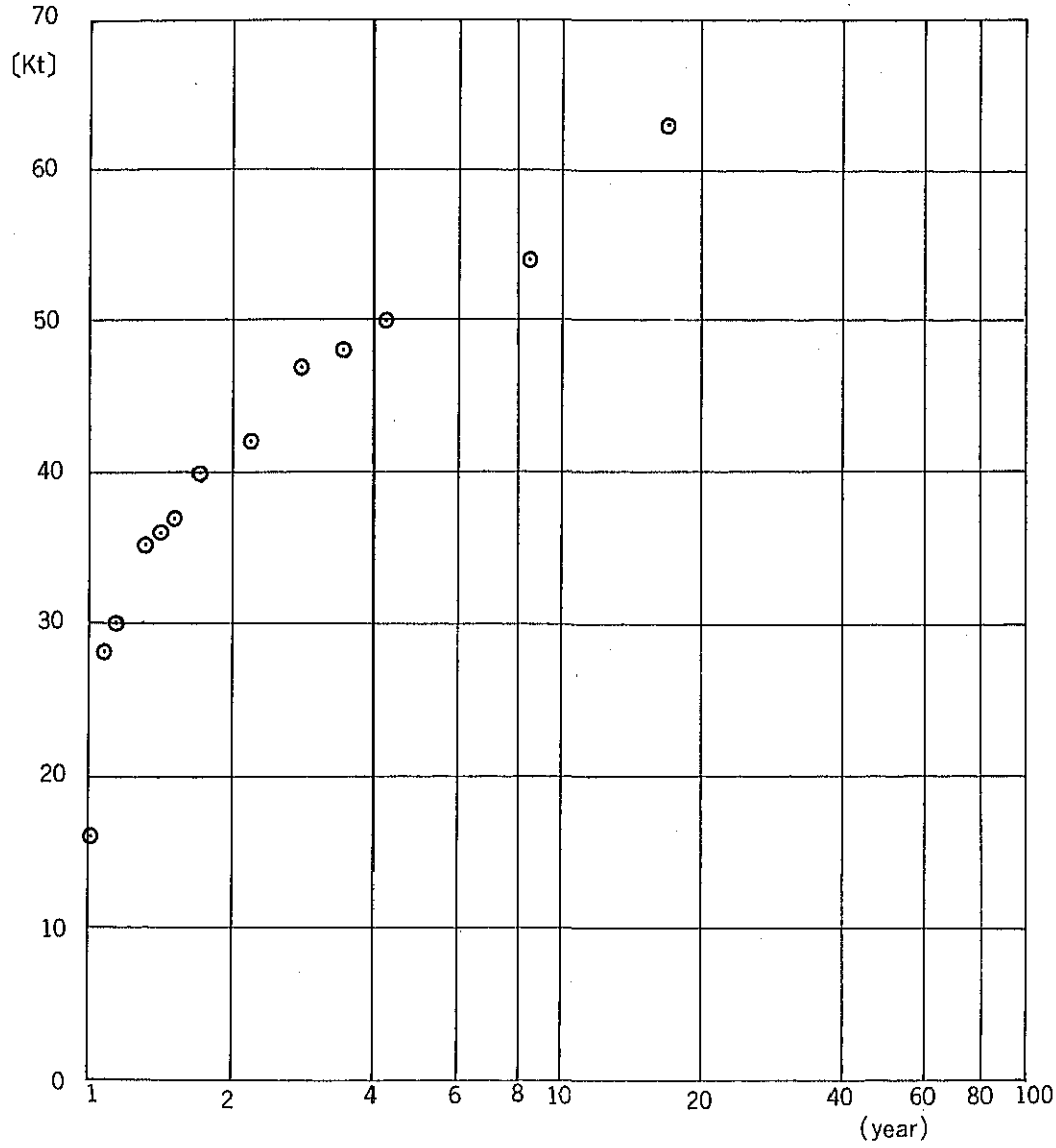
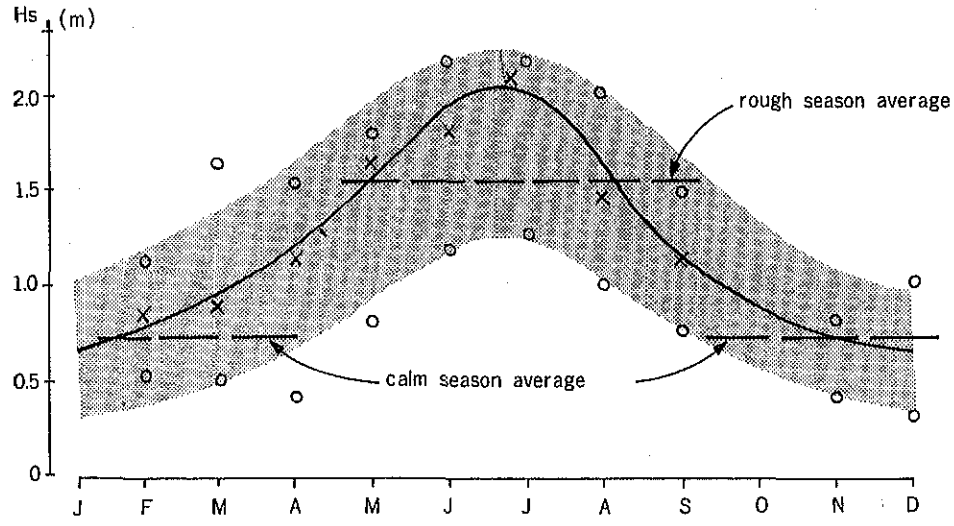
FIG. 2-3-5 MAXIMUM WIND VELOCITY AND RECCURENCE PERIOD



2-3-2. Maritime conditions

Monthly changes in average significant wave heights are indicated in Fig. 2-3-6, which were prepared from wave observation records for one year off the estuary of the Forcados. According to this figure, the wave conditions may be classified into two periods — the October-April period when the waves are relatively calm and the May-September period when the waves are rough.

FIG. 2-3-6 AVERAGE SIGNIFICANT WAVE HEIGHTS
(off Forcados)



The calm wave period coincides with the period when the low air pressure belt is situated near the coastline and the winds in the periphery of the coast are not strong. In this period, there are many swells in the SW to WSW direction. These swells are regular in shape. The period is long with about 11 sec, and the significant wave height is about 0.7 m. The waves, generated by localized strong winds, with a relatively short period of 5-7 sec are often combined with the swells.

The season in which high waves prevail coincides with the season in which the low air pressure belt is situated in the north and the southwesters are predominant. The waves in this season are generated by southwesterly and westerly winds and they may be wind waves that have crossed over a very long fetch. In the wave observation carried out for one year, the highest wave was 3.5 m with a period of 18 sec. Since the meteorological conditions in the coastal area of Nigeria are considerably stable and they are almost similar in any parts of the country. For this reason it is estimated that the results of wave observation stated in the above is well indicative of the characteristics of waves along the Nigerian coast.

The wave characteristics along the coast of Lagos remain unknown in detail

because no wave observation has ever been conducted. On the basis of the aforementioned observation, however, it is considered that they are practically the same as the wave characteristics of the sea off Forcados. In a field survey of the west mole of Lagos harbour, it was observed that the rubble stones situated about 50 metres from the head of the mole, had completely dispersed into the harbour side in a section of about 20 m. The armor stones in this area were considerably large and it appeared to us that each stone measured roughly 1 m^3 in volume. If it is assumed that this section was destroyed solely by wave force, it is calculated on the basis of the dimensions of the armor stones that this section was assaulted by waves measuring about 3.5 m in terms of significant wave height. Due to lack of information, however, no conclusion can be drawn as to whether the mole had been destroyed only by wave force or the damage had been accompanied by scouring action due to overtopping waves which attacked the bottom part of the harbour side of the mole. Therefore, it is likely that the aforementioned calculation of wave height represents an exaggerated estimate.

As waves attack the coast from the southwest throughout the year, it is conceivable that a longshore current flows from west to east along the Nigerian coast. The bottom sand which has been put into a floating state by wave breaking is carried away by longshore current, but the scouring of the sea bottom will not take place as long as sand is supplied to the full extent. If the supply is short, the scouring will take place. In sections where the longshore current gets weak, the sand that has been carried are deposited and the sandy beach spreads. The scouring of the sea bottom due to short supply of sand has taken place along the east coast of the east mole of the Lagos harbour, where the coastline has receded, while the depositing of sand has taken place along the west coast of the west mole of the harbour, where the coastline has advanced. It was told that in order to curtail the beach erosion near the east mole, about 1,600,000 m^3 of dredged spoil were being dumped into this section every year. This fact suggests that the annual amount of scourings is about 1,600,000 m^3 and the volume of littoral drift is practically the same as the scouring amount. One of the reasons why the littoral drift is intense is the fact that waves which assault the coast has a very

long period of about 12 sec. As the wave period is long the bottom slope near the coastline is very sharp with 1/5-1/10.

In a field survey on the west coast about 10 kilometres from the port of Lagos, it was observed that wave breaking took place at a point more than 100 m from the coastline and the point was very shallow. This suggests that a sand bar has been formed at this point. In an aerial observation, too, a similar sand bar was also observed on the east coast.

References:

1. W. A. Perkins and J. H. Stemberg: Nigeria, A Descriptive Geography, Third Edition, Oxford University Press, 1966
2. Nigerian Ports Authority: Warri Port Development -- Phase 2 Report -- Preliminary Studies and Design, vol. 2 -- Text, Section 2 to 8, 1976.

2-4. Economic conditions

2-4-1. Recent trend of gross domestic product

The growth rate of Nigeria's Gross Domestic Product (GDP) as against the preceding year stood at 8.5 per cent in 1974-75, 1.4 per cent in 1975-76 and 13.1 per cent in 1976-77, suggesting that Nigeria extricated itself from a slump in 1975-76. The GDP in 1976-77 was valued at 18,600 million Naira. With a national population of 80 million, the per capita GDP was registered at 233 Naira ($388 with $1 equal to 0.6 Naira).

By sector, the GDP in 1976-77 consisted of 5,260 million Naira in the mining sector, 4,570 million Naira in the agriculture, forestry, fishery and livestock sector, 1,670 million Naira in the manufacturing sector, and 1,420 million Naira in distribution sector (all in terms of 1974-75 factor cost), and they accounted for 32.2 per cent, 28 per cent, 10.2 per cent and 8.7 per cent, respectively, of the GDP valued at 16,300 million Naira. The earnings in the mining sector were derived mostly from the production of crude oil. A check of the growths in the

last three years (1974-1976) by sector indicates that the growth in the manufacturing sector was largest but that the mining sector has not yet restored to the 1974 level (see Table 2-4-1 and 2).

TABLE 2-4-1 SELECTED ECONOMIC INDICATOR COMPARISON OF PLAN FORECAST WITH CURRENT ESTIMATES

₦ MILLION

Sector	1974 - 75		1975 - 76		1976 - 77	
	Original third plan estimate	Current estimate	Plan forecast	Current estimate	Plan forecast	Current estimate
1. Gross domestic product (at 1974/75 factor cost)	14,410.7	14,254.3	15,447.8	14,448.8	16,755.7	16,346.2
2. Growth rate %	9.7	8.5	7.2	1.4	8.5	13.1
3. Capital formation	2,600.0	2,725.5	3,540.0	4,806.0	4,465.0	6,650.0
4. Traditional exports	304.3	418.2	346.8	351.3	355.6	421.2
5. Oil exports	6,458.1	5,365.7	7,120.3	4,563.1	7,913.0	6,321.3
6. Total exports	6,762.4	5,783.9	7,467.1	4,914.4	8,268.6	6,742.5
7. Imports	1,637.4	1,737.3	2,270.1	3,721.5	3,061.8	5,139.7
8. Current account balance	+3,615.6	+3,062.5	+3,681.4	+172.6	+3,634.5	-219.9
9. G.N.P. as % of G.D.P.	93.8	97.5	95.5	99.0	96.4	98.0

Source: Central Planning Office

TABLE 2-4-2 GROSS DOMESTIC PRODUCT AT CONSTANT 1974/75 FACTOR COST

₦ MILLION

Sector	Current estimate		
	1974-1975*	1975-1976	1976-1977
1. Agriculture, livestock, forestry and fishing	3,636.2	4,081.9	4,565.6
2. Mining and quarrying	5,859.7	4,781.3	5,261.9
3. Manufacturing and crafts	681.2	1,384.0	1,666.0
4. Electricity and water supply	56.6	65.0	81.4
5. Building and construction	837.8	759.8	896.6
6. Distribution	1,191.1	1,338.4	1,421.8
7. Transport and communication	366.8	411.0	541.9
8. General Government	901.8	883.3	1,056.2
9. Education	375.8	407.3	417.1
10. Health	132.0	115.1	185.4
11. Other services	215.3	221.7	252.3
TOTAL	14,254.3	14,448.8	16,346.2
Annual Growth Rate	8.5%	1.4%	13.1%

Source: Central Planning Office

* Federal Office of Statistics Provisional Figures adjusted by the Central Planning Office.

2-4-2. Federal budget and balance of trade and payments

The revenue budget of the Federal Government in 1977-78 is about 7,653 million Naira, up 12.5 per cent from the revised budget of the 1976-77. The greatest revenue source is the direct taxes, the receipt of which stands at 4,568 million Naira, and the direct taxes are followed by the mining revenue with 1,773 million Naira. Of the former category, the revenue of the petroleum profit tax stands at 4,286 million Naira. Of the latter, the receipt of royalty on oil and gas is 1,395 million Naira. These items in both categories account for about 74 per

cent of the total revenue, suggesting that the national budget of Nigeria is greatly reliant on receipts from oil.

Of the total national revenue, 1,800 million Naira is allocated to States, and the remaining 5,800 million Naira or so is spent by the Federal Government.

The current expenditure in 1977-78 is about 3,100 million Naira and the remaining 2,700 million Naira is incorporated into the Development Fund, enabling the Government to make investments in public projects. The total budget for investments is 7,232 million Naira, up 30 per cent from the actual outlays (estimated) of the previous year. In order to curb the inflation from growing at an annual rate of more than 20 per cent, it is understood that measures are taken so that the federal expenditure, including the current expenditure, will not exceed 8,600 million Naira.

A check of Nigeria's foreign trade balance sheet indicates that exports were valued at about 6,700 million Naira in 1976, marking a considerable improvement from about 4,900 million registered in 1975. The exports of crude oil registered a considerable drop in 1975 from the previous year, but these improvements were realized thanks to rises in the exports of crude oil and in their prices. Of the total export value, the share of crude oil stood at about 94 per cent. On the other hand, the total import value stood at 5,100 million Naira in 1976, registering an alarming rise of 38 per cent from the previous year. This represents a huge rise of three times from the 1,700 million Naira marked in 1974. This rise, as a matter of course, far exceeded the value predicted in the national development plan. When the export value is classified into consumer goods including passenger cars and capital goods, the ratio of both categories stood roughly at 1/3 to 2/3, and there have been no significant changes since 1974.

Such rises in the import value, as will be described later, has been related with the increase of import cargo at the port of Lagos, being responsible for a serious port congestion. A check of the trading pattern by country reveals that the main countries to which Nigeria's crude oil is diverted are the United States, U. K., West Germany, the Netherlands and France, and that a similar pattern

also prevails in the case of agricultural products. With respect to imports, the aforementioned five Western countries and Japan are Nigeria's trade partners. In trading with Japan, Nigeria's imports exceed its exports.

As regards the overall foreign payment balance in 1976, the black-ink balance was improved to some extent as against 1975. With the invisible trade payments totaling about 1,400 million Naira, however, a deficit of about 242 million Naira was registered as against the black-ink balance of 158 million Naira marked in 1975. It appears that the external assets of the nation as of the end of 1976 fiscal year dropped from the previous year and totaled about 3,500 million Naira (see Table 2-4-3, 4 and 5).

TABLE 2-4-3 EXPORT OF MAJOR COMMODITIES
1974/75 - 1976/77

₦ MILLION

Commodity description	Current estimate		
	1974 - 75	1975 - 76	1976 - 77
1. Groundnut	6.8	-	0.2
2. Groundnut oil	1.4	-	-
3. Groundnut cake	4.8	0.8	3.4
4. Cocoa beans	159.0	181.0	218.9
5. Palm kernels	43.7	18.5	27.0
6. Rubber	33.2	15.2	14.4
7. Hides and skins	10.6	6.8	6.8
8. Tin ore and metals	26.4	20.4	15.5
9. Crude petroleum	5,365.7	4,563.1	6,321.3
10. Timber, logs & plywood	14.0	4.8	1.4
11. Other commodities	108.3	109,6	133.6
Total	5,783.9	4,920.2	6,742.5

Source: Central Planning Office

TABLE 2-4-4 ANALYSIS OF IMPORTS BY END USE

(Value in ₦ million)

Item	1974 - 75	1975 - 76	1976 - 77
I. Consumer goods	(25.4)	(26.4)	(26.4)
(a) Non-durable goods			
i) Food	166.4	353.8	526.7
ii) Textiles	31.5	81.3	65.0
iii) Others	173.7	353.0	476.7
(b) Durable goods	67.0	191.7	282.0
Total	438.6	979.8	1,350.4
II. Capital goods	(69.0)	(67.7)	(68.5)
i) Capital equipment	500.6	1,135.9	1,515.5
ii) Transport equipment	116.8	371.1	729.6
iii) Raw materials	518.3	902.7	1,094.0
iv) Fuel	55.4	100.2	175.0
Total	1,191.1	2,509.9	3,514.1
Passenger cars	97.0 (5.6)	220.3 (5.9)	261.0 (5.1)
Grand total	1,726.7	3,710.0	5,125.5

Source: Central Planning Office

Note: Figures in brackets show percentage of total.

TABLE 2-4-5 IMPORTS AND EXPORTS BY COUNTRIES
1976/JAN. - JUNE

(Thousand ₦)

Area	Major countries	Imports C.I.F.	Export of domestic products F.O.B.
Africa		19,510	49,610
Europe		1,684,927	1,362,991
	Netherlands	100,810	299,631
	Fed. Rep. of Germany	367,158	239,655
	France	170,882	285,037
	United Kingdom	585,081	397,244
America		291,778	1,751,126
	U.S.A.	226,126	1,121,269
Asia		357,526	22,129
	Japan	234,278	21,380
Oceania		4,921	527
Total		2,360,583	3,186,383

Source: Nigeria Trade Summary (F.O. of Statistics)

2-4-3. Gross capital formation

The gross domestic fixed capital formation was estimated at 4,800 million Naira in 1975-76 and 6,600 million Naira in 1976-77 (in terms of current prices). It has been growing at a steady pace, far exceeding the pace predicted in the national development plan. The figure in 1976-77 represents 35 per cent of GDP. The building and construction sector occupies more than 50 per cent. A check of the fluctuations in 1974-75 through 1976-77 indicates, however, that the share of the aforementioned sector shows signs of a drop but that the rises in the sectors of transport and machinery were evident (see Table 2-4-6).

TABLE 2-4-6 GROSS CAPITAL FORMATION AT CURRENT PRICES

₦ MILLION

	Current estimate		
	1974 - 75	1975 - 76	1976 - 77
1. Building and construction	1,809.0	2,917.4	3,512.3
2. Transport equipment	184.8	705.8	1,063.7
3. Machinery	666.5	1,160.8	2,043,9
4. Land improvement	64.2	22.1	30.1
Total	2,725.5	4,806.1	6,650.0

Source: Central Planning Office

Even if the inflationary tendency of the national economy is taken into consideration, such rises in the capital formation is worthy of special note.

2-4-4. Price movements

Only urban areas are taken up for the computation of an overall consumer price index in Nigeria, and the number of items covered in this computation is insufficient. For this reason the index is not necessarily a convincing yardstick to realize changes in the inflation. When the index is taken up as a general yardstick, the rise was registered at 12.6 per cent in 1974, 34.1 per cent in 1975 and 24.7 per cent in 1976, and it is pointed out that the index in 1977 may have surpassed the 1976 level. High rises were marked by foods and fuels, the index of which began to rise at a high pace in 1975.

2-4-5. Present condition of Nigerian industries

(1) Features of industries in Nigeria

The industries in the Federal Republic of Nigeria made a rapid progress and marked an annual growth of 12.2 per cent in terms of the value added during the past ten years of from 1962/63 to 1972/73. Notwithstanding such a high rate

TABLE 2-4-7 STRUCTURE OF MANUFACTURING BY VALUE ADDED AND EMPLOYMENT PERCENTAGE DISTRIBUTION

Industry group	1965		1971		1972	
	Value added	Employment	Value added	Employment	Value added	Employment
Meat products	0.9	1.5	1.6	1.1	1.4	1.6
Dairy products	0.3	0.4	0.4	0.2	0.4	0.3
Fruit canning and preserving	-	0.7	-	0.2	-	0.2
Vegetable oil milling	5.4	6.3	3.1	4.1	2.6	6.0
Grain mill products	3.3	0.8	2.4	1.0	1.7	1.0
Bakery products	1.4	2.5	1.3	3.3	1.0	3.0
Sugar and sugar confectionery	1.7	5.4	1.8	3.6	3.1	3.2
Miscellaneous food preparations and animal feeds	13.9	3.0	0.8	0.5	0.3	0.4
Spirits, distillery and beer	14.6	3.0	14.7	2.5	12.7	2.5
Soft drinks	1.3	1.0	1.3	0.5	2.4	0.8
Tobacco	-	-	9.7	2.9	8.7	2.5
Textiles	10.9	15.0	17.5	22.4	12.6	22.1
Made-up textile goods (Except wearing apparel)	1.0	2.1	1.1	2.7	1.1	2.1
Knitted goods and woven carpet	-	-	0.4	1.3	1.8	2.6
Wearing apparel	0.4	0.6	0.3	1.1	1.5	1.2
Tanning	0.8	0.7	0.4	0.6	0.5	0.6
Travel goods	0.2	0.4	-	0.5	-	0.4
Footwear	1.3	1.9	1.1	2.0	0.3	1.4
Sawmilling	1.4	5.8	2.1	6.7	2.3	5.4
Wooden furniture and fixtures and other wood products	2.4	4.8	0.6	3.7	1.0	3.5
Containers, boxes of paper and paper board	-	-	0.7	1.0	1.0	1.0
Paper products	1.0	1.0	0.7	1.0	1.0	0.9
Printing	2.8	6.5	3.0	5.4	2.6	6.0
Basic ind. chemicals fertilisers and pesticides	0.6	0.3	1.1	0.4	0.4	0.2
Paints	1.0	0.4	0.9	0.5	1.1	0.5
Drugs of medicines	-	-	0.4	0.6	0.8	0.8
Soaps, perfumes, cosmetics and other cleaning preparations	-	-	5.2	2.7	5.4	3.1
Other chemical products	6.4	4.0	0.9	0.9	0.9	0.9
Products of petroleum and coal	-	-	8.3	0.3	9.4	0.3
Tyres and tubes	2.3	1.8	2.3	1.2	2.4	1.8
Other rubber products	-	-	0.5	2.9	1.0	2.8
Plastic products	-	-	1.8	2.0	1.3	2.4

TABLE 2-4-7 (Continued)

Industry group	1965		1971		1972	
	Value added	Employment	Value added	Employment	Value added	Employment
Pottery and glass products	0.3	0.6	0.5	1.1	0.3	0.9
Bricks and tiles	-	-	0.1	0.2	0.1	0.4
Cement	4.7	3.6	2.2	2.1	2.6	1.9
Concrete products	-	-	0.7	1.5	1.6	1.7
Basic metal, cutlery, handtools and general hardware	7.0	8.3	0.9	1.6	0.5	0.4
Metal furniture and fixtures	-	-	1.2	2.2	1.4	2.9
Structural metal products	-	-	2.0	2.7	2.3	3.1
Fabricated metal products	-	-	3.5	5.2	7.0	4.6
Manufacture of agricultural and special ind. machinery	-	-	0.1	0.2	0.2	0.2
Machinery and equipment except electrical	-	0.2	-	0.2	-	0.1
Manufacture of radio and TV and communication equipment	-	-	0.7	0.5	0.8	0.6
Manufacture of household electrical apparatus and supplies	1.0	0.9	0.3	0.6	0.4	0.7
Transport equipment, motor-body and ship-building and repairs	9.7	14.3	0.3	0.6	-	0.3
Manufacture of watches and clocks and jewelleries	-	-	0.1	0.2	-	-
Manufacturing industry not yet classified	1.9	1.8	0.6	1.3	0.5	1.2
Total percentage	100	100	100	100	100	100
Total absolute	N 1/ 129,012	66,466	221,223	145,445	494,855	167,626

Source : Third National Development Plan, 1975-80
(Federal Ministry of Economic Development)

Note : 1/ Unit in 1,000 Naira

of growth, the proportion in the gross domestic product noted little increase at 5.6 per cent in 1962/63 and 6.5 per cent in 1972/73. This may be explained by the sharply increasing share of the mining sector (mainly, production of crude oil) in GDP caused relatively little increase in the share of the manufacturing. Generally speaking, however, the manufacturing industries in Nigeria is at a low level.

Table 2-4-7 shows the percentage distribution by value added of the manufacturing sector or the structure of manufacturing.

According to the table, the structure of manufacturing is characterized in the following.

a) The manufacturing is comprised largely of light industries requiring no high level technique. For example, in 1972, the foods, drinkings and tobacco constituted 34.3 per cent and textiles and clothings 17.8 per cent of the total value added, such light industries thus constituting 51 per cent.

b) The metal processing industry constitutes 12.6 per cent of the whole and is at a relatively high level as a developing country. But, looking into the structure more specifically, such industries as metal assembly, metal furniture and construction metals occupy a greater part, while the industries requiring a high level of technique such as, for example, general, electric, transport and precision machines and instruments are not yet developed barely at 1.9 per cent of the total value added.

c) In the division of chemical industry, a trend of relative weakness in the group of intermediate products is noted, with fundamental chemical products and fertilizers only at 0.4 per cent. On the other hand, the group of chemical products directed for consumers such as cosmetics and detergents for domestic use are of 5.4 per cent of the value added, largest in the divisions of chemical industry except the division of oil industry.

The oil division occupies 9.4 per cent of the total value added. This value is the largest next to those of the drinkings, and textiles and clothings, showing a feature of the manufacturing in Nigeria.

(2) Scale and location of manufacturing industries

According to the 1974 survey, the manufacturing industries in Nigeria comprise about 3,000 enterprises in operation, but their scale of operation is very small, enterprises with employees less than 50 persons constituting 97.5 per cent. The types of industries with a relatively large scale among the manufacturing industries are those of lumbering, wooden product manufacturing, oil product manufacturing and rubber product manufacturing, but the enterprises with more than 500 employees number only seven companies. Table 2-4-8 shows the enterprises by type and employment scale.

TABLE 2-4-8 NUMBER OF ENTERPRISES BY TYPE AND EMPLOYMENT SCALE

No.[1)]	Type of industries	Employment scale				
		less than 50	50-99	100-499	more than 500	Total
2200	Production of petroleum and natural gas	-	5	5	2	12
3117	Manufacture of bakery products	113	-	-	-	113
3220	Manufacture of wearing apparels	1,667	-	-	-	1,667
3233	Man. of products of leather substitutes except footwear and wearing apparels	20	-	-	-	20
3240	Manufacture and repairs of footwear	135	-	-	-	135
3311	Sawmilling and manufacture of cork	25	12	-	2	39
3320	Carpentry and wool work	360	1	-	-	361
3420	Printing, publishing and allied industry	87	1	2		90
3559	Rubber production	1	15	9	2	27

TABLE 2-4-8 (Continued)

3699	Man. of non-metallic mineral products	30	3	-	-	33
3811	Welding and iron works	235	5	-	1	241
3831	Electrical industrial machinery and apparatus	181	5	2	-	
	Other industries	58	8	5	-	71
	Total (Number)	2,912	55	23	7	2,997
	(percentage)	(97.0)	(2.0)	(0.8)	(0.2)	(100.0)

Source: Industrial Directory, 1974 (Federal Ministry of Economic Development)

Note: 1) ISIC code number

Reportedly, more than half of these enterprises are located in the Lagos area. Table 2-4-9 shows the industrial outputs in terms of the value added by States. As seen, at the top is the Lagos State at 59.5 per cent of the whole, followed by Western State at 11.5 per cent, East-Central State at 9.4 per cent, and North-Central and Kano States at 6 per cent respectively. Particularly, by two States of Lagos and Western is occupied 71 per cent of the whole enterprises.[Note)] As the recent data are not available, it is difficult to say with certainty, but there is apparently further progress in the concentration into the Lagos area, and the Nigerian Government is encouraging the industrial dispersal.

Note: The names of States given here are those when there were twelve States.

TABLE 2-4-9 INDUSTRIAL OUTPUTS BY STATE

States	Value added		Remarks
	Amount	%	
Benue Plateau	3,076	0.5	
East-Central	54,662	9.4	
Kano	32,589	5.6	
Kwara	14,653	2.5	
Lagos	345,099	59.5	
Mid. West	17,607	3.0	
North-Central	32,817	5.7	
North-East	1,670	0.3	
North-West	932	0.2	
Rivers	6,888	1.2	
Southeastern	3,254	0.6	
West	66,734	11.5	
Total	579,985	100.0	

Source: Annual Abstract of Statistics, 1974
(Federal Office of Statistics)

(3) Progress of the major industrial development projects

Nigeria is proud of the output of crude oil ranking the eighth in the OPEC countries and is tackling the national development intentionally with the revenue from the export of crude oil in the background. What forms the core of such national development is the industrial development. But, on account of the shortage in fund due to sluggishness in the export of crude oil from the recent world-wide recession and also shortage in the engineering faculty and materials as well as skilled labour and management stratum, delay is noted in the projects not only in the division of industrial development but in the area of social overhead capital and many other fields.

In the following are given briefly the conditions of progress of the major industrial development projects.

a) Iron and steel

The Ajaokuta Steel Mill is still in the stage of the location being determined and only the road work commenced, and the plant construction is not yet started. It is a steel mill of a production scale of about 1,500,000 tons a year and is said to start the operation from the onset of the year 1981. Apart from the above, there are two direct reduction iron and steel mill construction projects, but the construction of Port Harcourt mill is postponed for the time being, while Warri mill is still in the stage of preparatory works. They are respectively of a scale of annual output of one million tons.

b) Oil refining

The Warri oil refinery (with a daily output of 100,000 barrels) is in good progress of the work and is said to be completed in 1978. For the Kaduna oil refinery (with a daily output of 70,000 barrels), a Japanese contractor has already entered the site and is starting the work. The project of expanding the existing oil refinery at Port Harcourt to a capacity of 75,000 barrels and the other two projects of export oil refineries of 300,000 barrels respectively are not in progress.

c) Pulp and paper

Both of the plants of Iwopin in Ogun State and Calabar in Cross River State are under construction. The former is located close to the proposed site of New Ocean Terminal stated later, and the construction materials are reportedly being transported via Lekki Lagoon.

d) Cement

It is expected to provide a tentative self supply system through expansion of the existing Calabar and two other plants and new installations at Shagamu and another place. Expansion of the Calabar and construction of the Shagamu and one other plants are in progress presently.

e) Petrochemicals and nitrogen fertilizer

There is a plan of constructing plants close to the direct reduction iron and steel mills in Bendel and Rivers States, but they are still in the stage of feasibility study.

2-4-6. Bottlenecks to the economic development

The Nigerian economy is heavily dependent upon the exports of crude oil, and fluctuations in its export price and quantity produce a variety of influences, directly and indirectly, on the management of the economy. When the global recession continues as witnessed recently, the exports of crude oil level off and such a high economic growth as experienced today may no longer be anticipated. A lack of funds required for the implementation of various projects is becoming evident and it appears that there are signs of a rise in the degree of reliance on external loans.

Officials in charge of economic development explained that there were other questions beside these financial restrictions. Due to lack of technical knowhow — particularly, lack of engineers in the construction sector — and also to lack of materials and equipment as well as the progress of inflation, the Third National Development Plan (1975-79) which is under way at present may be considerably behind schedule and is likely to slip into the next plan period.

Nigeria's national population of 80 million is largest in Africa and, moreover, increasing at an annual rate of about 2.5 per cent. For this reason the Western countries are counting Nigeria as an enormous potential market and the Nigerian Government is also stepping up a variety of industrial development projects under its policy of Nigerianization. However, the largest bottleneck lies in the lack of skilled workers equipped with technology and management capabilities. It takes time to educate people.

In the existing National Development Plan, emphasis is placed on the deve lopment of infrastructures — particularly, that of the transport section. It was told that the next five-year plan, an emphasis would be put on agriculture and industry. For the development of these sectors, a well balanced development of social overhead capital is inevitable. Judging from the present situation of

railways, ports and harbours as well as roads, there seems to be a need to give priority to continued investments in these sectors.

2-5. Transportation network

2-5-1. Roads

Among the various modes of transportation the road transportation has been playing the most important role in Nigeria. The construction of trunk road A is under the responsibility of the Federal Ministry of Works, while the State governments are in charge of other trunk roads. Road improvement works are extensively being carried out in the various parts of the country, including the Lagos Ring Road which is vital for the remedy of traffic congestions in the Lagos Island and its vicinity.

According to the information obtained at the Federal Ministry of Works an emphasis has been placed on the construction and improvement of the following roads.

- Lagos - Ojota - Ibadan - Ilorin - Kaduna - Kano - Sandamu, and the A-1 route which branches near Bokani: As a part of this route a dual carriage way linking Lagos with Ibadan is near completion and its extension to Ilorin has been planned.
- Warri - Kaduna,
- Calabar - Wukari - Numan - Maiduguri,
- Port Harcourt - Enugu, This route is, at present, very poor in its quality.
- The Trans African Highway linking Badagri and the A-4 route via Lagos, Benin, Onitsha and Enugu,
- Badagri - Abeokuta - New Bussa - Bin Yauri - (A-1 route)

These routes are shown in Fig. 2-5-1.

In compliance with the addition of the Tin Can Island Port to the Lagos Ports Complex a new road was built, passing through the western part of the metropolitan area, to link the new port with the Ojota junction. There is another plan to link the Lagos Outer Ring Road with the same junction, crossing the

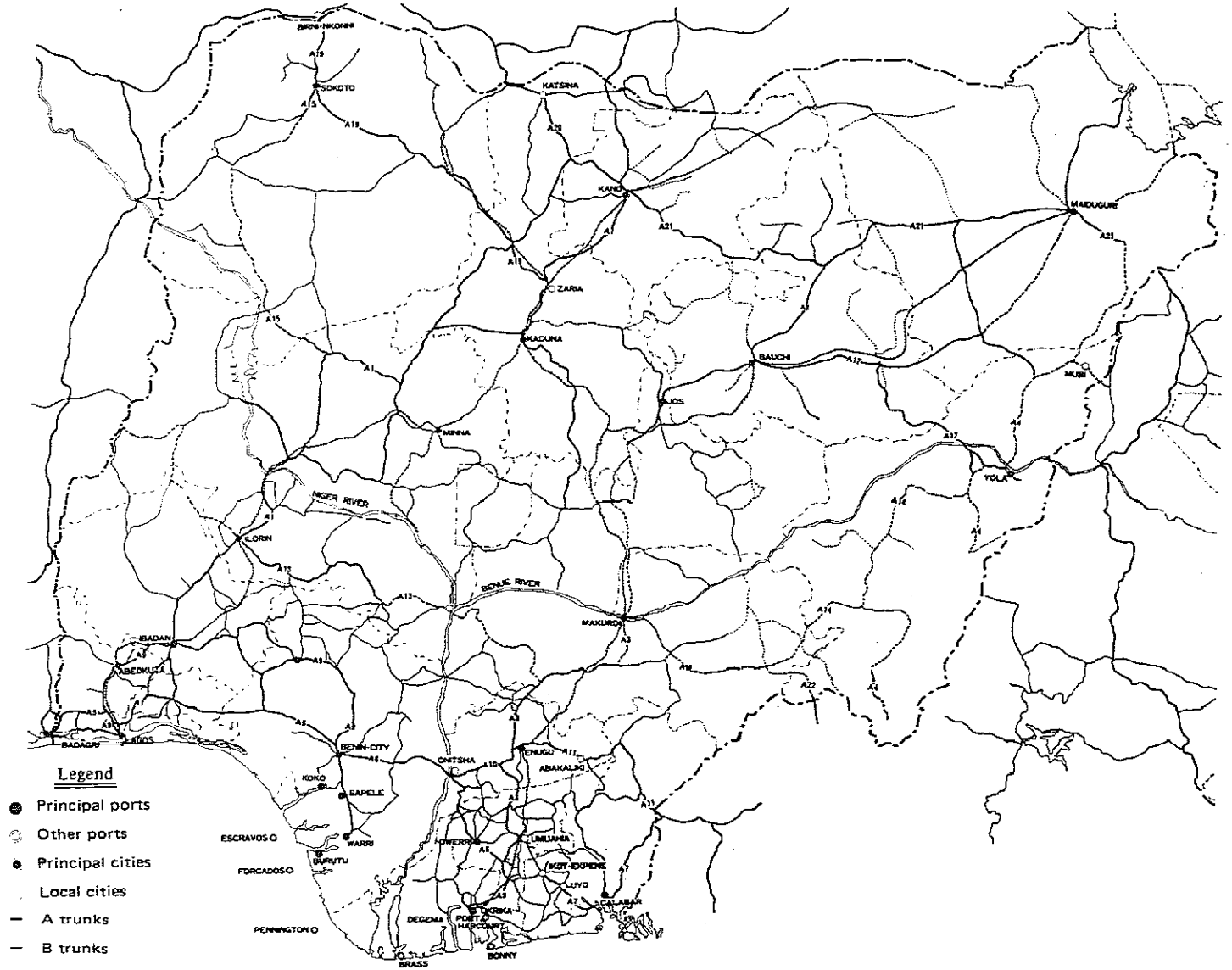


FIG. 2-5-1 TRANSPORT NETWORK IN NIGERIA

Lagos Lagoon at the east of Carter Bridge.

2-5-2. Railways

Railways in Nigeria, now under the jurisdiction of the Nigerian Railway Corporation, were originally developed to transport for export agricultural products in the northern regions to ports which were at that time under the management of railways. For this reason the railway network is indeed insufficient to meet the present day requirement and due to various reasons the railway transport has lost its competitive power to the road transportation except a few types of goods. Most of the port traffic is at present carried inland by road.

The construction of new railways has been limited to those related to the Ajaokuta Steel Mill project and we were informed that there was not any plan to link Lagos directly with the Delta and Rivers ports complexes by rail. The existing railway lines are also shown in Fig. 2-5-1.

2-5-3. Inland waterways and coastal shipping

Although main channels for inland navigation of barges are the Niger and the Benue the inland water transportation has been playing only a limitted role due to the development of road transportation network and the instability of navigable channels and rivers. The inland water transportation is under the control of the Federal Ministry of Transport. Nigerian coastal shipping is at present specialized in the transport of refined oil from the Delta ports to Lagos.

2-5-4. Ports

(1) Port administration and management

According to the information obtained at the Nigerian Ports Authority, the Nigerian Ports Authority (N.P.A.) is an autonomous public corporation created by the "Ports Act (Cap. 155) of the Laws of the Federation of Nigeria and Lagos" and the statutory duties and its activities are as follows:

The Authority has the duty to maintain, improve and regulate the harbours and approaches thereto in all ports of Nigeria and to make provisions for and

operate such shorehandling and quay facilities as may appear to it best serve the public interest. In addition, the Authority is responsible for pilotage services and the provision of lights, marks and other navigational aids in all ports, port approaches and the territorial waters of Nigeria.

The Authority commenced operating on April 1, 1955.

Policies are formulated by a Board, appointed by the Federal Military Government, the membership of which include varied interests, and the general manager who is the chief executive of the organization. Each port complex is administered by a port manager who is the local chief executive responsible for the day-to-day running of the business in his area of jurisdiction.

The Authority is committed to discharge its obligations to the port users through planning and execution of projects relating to port improvement, mechanization and development.

It appears to us that although the Authority was intended to be financially self-supporting various expansion projects are being financed by the Federal Government.

(2) Major ports of Nigeria

Among the major ports of Nigeria the port of Lagos has been playing a vital role, occupying 70 per cent of the total general cargo traffic of the country in 1976/77, followed by 19 per cent of the port of Port Harcourt (Table 2-5-1, Table 2-5-2). In addition to these, several oil terminals, situated mostly in the delta area, have been playing an important role to export crude petroleum which is at present an exclusive foreign currency earner in Nigeria.

Lagos Ports Complex consists mainly of Apapa Quays, newly built Tin Can Island Port and two lighterage terminals, while the Rivers Ports Complex includes, in addition to Port Harcourt which is the second largest port in the nation and situated on the left bank of the Bonny River, 66 Km from the sea, Okrika Terminal for the shipment of refined petroleum oil, Bonny and Brass terminals for crude petroleum and Degema.

The Delta Ports Complex comprises the river ports of Warri, Sapele, Koko

and Burutu. Also included are Escravos, Forcados and Pennington terminals for the shipment of crude petroleum. The ports of Warri, Koko and Burutu are operated by the Authority for the handling of cargoes. The approaches to all delta ports are controlled by the depth of water at Escravos Bar which is at present 4.88 metres from the chart datum. However the Authority has plans to dredge the bar to 6.40 metres in the near future.

Calabar Port lies some 40 N.M. from the Fairway Buoy and 5 N.M. from the main entrance channel of the Cross River. The maximum recommended draft for vessels using the port is, according to the Handbook of the Nigerian Ports Authority, 5.94 metres.

As stated in the above most ports of Nigeria, except for crude oil terminals for large tankers, are located in rivers, while the largest port in the country, Lagos lies at the tidal estuary of the Lagos Lagoon. For this reason it is difficult to remodel or expand these ports to a modern ocean terminal which can accommodate large container ships and bulk carriers, although various expansion projects are under progress as shown in Table 2-5-3.

TABLE 2-5-1 GENERAL CARGO [1] HANDLED FROM 1955-56 TO 1976-77

ALL PORTS

(Metric Tonne)

Year	Lagos Ports Complex			Rivers Ports Complex			Delta Ports Complex			Calabar Port			All Ports Complexes Combined		
	Inward	Outward	Total	Inward	Outward	Total	Inward	Outward	Total	Inward	Outward	Total	Inward	Outward	Total
1955-56	799,862	544,982	1,344,843	277,544	235,221	513,162	-	-	-	-	-	-	1,077,803	780,202	1,858,005
1956-57	900,275	651,960	1,552,235	336,928	255,507	592,435	-	-	-	-	-	-	1,237,203	907,467	2,144,670
1957-58	855,927	559,870	1,415,797	360,142	228,105	588,247	-	-	-	-	-	-	1,216,069	787,975	2,004,044
1958-59	901,477	749,977	1,651,454	368,393	320,510	688,903	-	-	-	-	-	-	1,269,870	1,070,487	2,340,357
1959-60	1,043,103	684,655	1,727,758	421,482	282,729	704,211	-	-	-	-	-	-	1,464,585	967,384	2,431,969
1960-61	1,107,029	615,524	1,722,553	445,160	298,689	743,849	-	-	-	-	-	-	1,552,189	914,213	2,466,402
1961-62	1,029,081	821,185	1,850,266	444,013	400,301	844,314	-	-	-	-	-	-	1,473,094	1,221,486	2,694,580
1962-63	909,167	762,072	1,671,239	498,871	391,234	890,105	-	-	-	-	-	-	1,408,038	1,153,306	2,561,344
1963-64	964,447	920,560	1,885,007	484,980	450,135	935,115	-	-	-	-	-	-	1,449,427	1,370,695	2,820,122
1964-65	967,139	1,038,944	2,006,083	447,370	380,779	828,149	-	-	-	-	-	-	1,414,509	1,419,723	2,834,232
1965-66	1,038,292	1,130,504	2,168,796	477,679	409,800	887,479	13,866	131	13,997	-	-	-	1,529,837	1,540,435	3,070,272
1966-67	997,031	1,094,723	2,091,754	483,815	292,060	775,875	2,990	546	3,536	-	-	-	1,483,836	1,387,329	2,871,165
1967-68	1,137,254	1,436,676	2,573,930	-	-	-	777	106	883	-	-	-	1,138,031	1,436,782	2,574,813
1968-69	1,052,180	1,496,208	2,548,388	-	-	-	6,813	-	6,813	-	-	-	1,058,993	1,496,208	2,555,201
1969-70	1,349,981	1,290,713	2,640,694	79,829	23,545	103,374	35,597	3,273	38,870	44,026	25,947	69,973	1,509,433	1,343,478	2,852,911
1970-71	2,168,132	1,135,439	3,303,571	326,202	54,178	380,380	284,701	78,126	362,827	34,262	57,579	91,841	2,813,297	1,325,322	4,138,619
1971-72	2,578,780	813,178	3,391,958	617,032	110,075	727,107	372,053	27,309	399,362	20,188	60,528	80,715	3,588,053	1,011,090	4,599,143
1972-73	2,202,363	734,283	2,936,646	478,390	172,174	650,564	204,376	27,165	231,541	15,220	41,290	56,510	2,900,349	974,912	3,875,261
1973-74	2,303,559	814,164	3,117,723	593,241	136,652	729,893	186,453	32,509	218,962	10,075	33,584	43,659	3,093,328	1,016,909	4,110,237
1974-75	2,595,827	390,930	2,986,757	741,708	105,102	846,810	333,279	30,200	363,479	19,122	41,655	60,777	3,689,936	567,887	4,257,823
1975-76	3,696,733	385,356	4,082,089	1,154,861	117,820	1,272,681	627,793	16,668	644,461	75,842	35,176	111,018	5,555,229	555,020	6,110,249
1976-77 [2]	4,859,713	424,072	5,283,785	1,327,324	128,351	1,455,681	702,642	11,595	714,237	100,251	37,599	137,850	6,989,930	601,623	7,591,553

1) General Cargo Figures include Container Traffic but exclude Tonnages of Fish, Dry Bulk Cargo, Wheat Grain/Offal and Crude Petroleum Oil.

2) Provisional.

Source : NPA.

TABLE 2-5-2 NUMBER OF VESSELS ENTERED AND THEIR NET REGISTERED TONNAGES: 1955-56 TO 1976-77 (EXCLUSIVE OF FISHING AND NAVAL VESSELS)

ALL PORTS

Year	Lagos		P/Harcourt		Bonny		Okrika		Degema		Brass		Warri		Sapele		Burutu		Koko		Escravos		Forcados		Pennington		Calabar		All Ports	
	No. of V.	Total N.R.T.	No. of V.	Total N.R.T.	No. of V.	Total N.R.T.	No. of V.	Total N.R.T.	No. of V.	Total N.R.T.	No. of V.	Total N.R.T.	No. of V.	Total N.R.T.	No. of V.	Total N.R.T.	No. of V.	Total N.R.T.	No. of V.	Total N.R.T.	No. of V.	Total N.R.T.	No. of V.	Total N.R.T.	No. of V.	Total N.R.T.	No. of V.	Total N.R.T.	No. of V.	Total N.R.T.
1955-56	1351	3,397,868	467	1,075,357	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1818	4,473,225
1956-57	1437	3,436,361	487	1,089,171	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1924	4,525,532
1957-58	1522	3,783,967	556	1,277,847	-	-	-	-	91	250,476	-	-	171	302,675	354	544,728	238	402,348	-	-	-	-	-	-	-	-	208	417,414	3140	7,890,725
1958-59	2027	4,595,506	695	1,799,631	-	-	-	-	65	202,987	-	-	131	305,103	231	597,549	228	461,147	-	-	-	-	-	-	-	-	215	438,599	3592	9,114,427
1959-60	2213	5,010,297	722	1,909,914	-	-	-	-	94	245,745	-	-	190	451,843	288	655,407	241	528,550	-	-	-	-	-	-	-	-	248	446,205	3996	10,036,838
1960-61	2126	5,109,271	886	2,545,311	-	-	-	-	80	224,717	-	-	189	449,588	296	799,142	276	558,368	-	-	-	-	-	-	-	-	223	414,300	4076	10,965,748
1961-62	2233	5,568,732	847	2,321,725	176	1,181,873	-	-	62	142,696	-	-	172	410,427	276	689,598	246	503,064	-	-	-	-	-	-	-	-	205	473,479	4217	11,291,594
1962-63	2174	5,548,776	939	2,639,451	198	1,355,870	-	-	75	219,944	-	-	187	439,575	335	774,369	159	372,758	-	-	-	-	-	-	-	-	178	402,300	4245	11,752,043
1963-64	2063	5,912,723	1084	2,855,597	225	3,897,101	-	-	40	108,982	-	-	161	424,929	345	865,411	190	426,622	2	5,456	-	-	-	-	-	-	173	419,732	4283	14,916,553
1964-65	1965	5,758,064	987	2,720,412	324	2,987,269	-	-	33	78,614	-	-	150	402,413	281	750,677	198	454,816	5	17,594	-	-	-	-	-	-	169	369,491	4112	13,539,350
1965-66	1954	5,684,494	1084	3,037,521	405	5,011,457	-	-	32	87,789	-	-	198	484,163	287	758,276	208	545,057	20	48,147	-	-	-	-	-	-	186	368,029	4374	16,023,023
1966-67	1907	5,586,772	1230	3,237,615	520	7,569,606	-	-	25	71,978	-	-	229	570,603	327	905,898	189	330,615	14	14,763	-	-	-	-	-	-	191	357,495	4632	18,645,345
1967-68	1748	5,091,694	..				-	-	..	..	-	-	124	234,259	218	501,165	82	86,832	7	2,187	-	-	-	-	-	-	..	..	2179	5,916,137
1968-69	1659	4,769,203	..	..	174	2,621,442	-	-	..	..	-	-	203	464,487	264	556,651	43	40,001	12	7,773	-	-	-	-	-	-	72	73,395	2427	8,532,952
1969-70	2070	4,719,927	77	170,962	567	7,538,664	-	-	-	-	-	-	195	428,707	243	529,276	39	77,394	21	14,850	-	-	-	-	-	-	110	115,916	3322	13,595,696
1970-71	1507	4,340,612	264	608,545	540	8,661,447	-	-	-	-	-	-	260		246	501,381	26	41,894	22	41,174	-	-	-	-	-	-	120	173,136	2985	14,368,188
1971-72	1669	5,339,478	502	1,496,030	755	10,840,782	157	814,575	-	-	-	-	203	561,058	177	490,997	3	7,484	17	38,943	264	5,750,242	388	11,099,288	19	252,483	59	155,038	4213	36,846,398
1972-73	1649	5,532,545	551	1,629,459	756	10,556,136	300	988,529	-	-	-	-	172	453,011	173	486,674	11	28,589	9	3,594	287	6,844,410	413	12,165,884	20	303,556	113	155,979	4454	39,148,366
1973-74	1576	5,630,676	382	1,278,984	558	9,922,174	477	1,188,017	--	-	-	-	225	493,284	262	646,555	3	8,451	14	53,883	278	8,161,401	408	14,605,183	12	165,656	100	132,206	4295	42,286,470
1974-75	1426	5,482,146	497	1,539,720	579	18,968,415	425	1,013,365	-	-	126	3,571,402	313	620,702	276	385,761	1	1,555	26	46,062	238	7,097,791	367	17,059,234	-	-	114	184,743	4388	55,970,896
1975-76	1969	6,967,127	489	1,304,931	441	15,292,860	424	987,244	-	-	77	4,806,678	329	626,710	344	457,188	2	1,737	74	196,322	166	5,595,228	310	16,269,605	20	551,693	183	323,179	4828	53,380,502
1976-77 1)	2131	6,857,421	586	1,439,720	448	16,719,169	412	948,990	-	-	113	6,811,182	349	596,963	463	530,206	11	18,424	60	185,163	205	8,756,244	323	20,908,194	53	3,089,652	227	441,735	5381	67,303,113

.. = Not Available V. = Vessels.

1) : Provisional Source : NPA

TABLE 2-5-3 BERTHING FACILITIES (HARD QUAY) PRESENTLY AVAILABLE AND CONTEMPLATED DURING 1975-80 PLAN PERIOD

Lagos Ports Complex		Rivers Ports Complex		Delta Ports Complex		Calabar Port Complex	
Facilities Available	Facilities Contemplated	Facilities Available	Facilities Contemplated	Facilities Available	Facilities Contemplated	Facilities Available	Facilities Contemplated
I. APARA QUAYS: (i) 2393 metre long quay consisting of 15 general cargo berths, included is a 220 metre long temporary container berth; (ii) Fish Wharf 85 metre long; (iii) Ijora Wharf for dry bulk 122 metre long and (iv) Petroleum Wharf for the discharge of refined petroleum oil 425 metre long. II. TIN CAN ISLAND PORT: 2500 metre long wharf consisting of 10 berths-Two for RO/RO; One for Bulk, Five for general cargo; and Two for service vessels III. LIGHTER TERMINALS : (i) Kiri Kiri Lighter Terminal - 1560 metre long wharf; (ii) Ikorodu Lighter Terminal - 1140 metre long wharf.	I. Third Apapa Wharf Extension Project 6 berths, 1500 metre long quay (1000 metre for an ultra modern container terminal); construction work is likely to be completed by end of 1978 or latest early 1979. II. New Ocean Terminal, Lagos 1st phase - 8 to 15 berths, hydraulic investigations are in progress. III. Atlas Cove Petroleum Jetty Contract for construction will soon be awarded, when completed will facilitate berthing for two ocean going and two coastal tankers simultaneously.	PORT HARCOURT (i) 980 metre long consisting of 7 general cargo berths; one berth for coal and other dry bulk - 137 metre long; 143 metre long jetty for vegetable oil.	I. PORT HARCOURT PORT DEVELOPMENT 1st phase, 6 berths at a new location to be developed. II. ONNE LIGHTER TERMINAL Construction work is in progress and is expected to be completed by end of 1978. III. PORT-A-BARGE LIGHTER TERMINAL to be installed on a pre-fabricated steel pontoons for the discharge of barges. IV. OKRIKA OIL JETTY to facilitate the berthing of one MRX tanker and one coaster of up to 5000 DWT simultaneously. Contract for construction will soon be awarded.	WARRI (i) 3 berths - 482 metre long quay. (ii) KOKO 1 berth - 137 metre long quay. (iii) BURUTU One, 229 metre long berth.	WARRI 1950 metre long quay consisting of 8 berths - six general cargo, one RO/RO, and one service berth. Construction will soon commence and is likely to be completed by mid 1979. II. SAPELE Contract for the construction of four new berths, 980 metre long wharf is already awarded. III. OGUNNU Proposals are being appraised to construct a wharf which will handle the materials for Ajaokuta Steel Complex. IV. KOKO This project includes the development of a shrimps and fishing terminal as well as some lighter berths. Project is suspended for the time being.	One Berth	Four berths, a total of 860 metre long wharf at a new site is under construction and is likely to be completed by end of 1979.

Source: NPA

3. Present situation of the Lagos Ports Complex

3. Present situation of the Lagos Ports Complex

3-1. Introduction

(1) According to the statistics given by the Central Planning Office and the Nigerian Ports Authority, the total export cargo traffic of Nigeria reached 82 million metric tons in 1975/76 and of this total crude oil export from the Rivers and Delta Ports Complexes occupies about 99 per cent, while the total import cargo of Nigeria reached 8.6 million metric tons in 1975/76. Approximately 65 per cent of the import traffic is general cargoes including containerized cargoes.

(2) In 1975/76 the Lagos Ports Complex, the largest general cargo port in Nigeria, handled 7 million tons of cargo or some 75 per cent of the country's sea-borne trade, excluding crude petroleum oil. The 92 per cent of this traffic is import cargoes, while the export cargo occupies only 8 per cent.

(3) The Lagos Ports Complex consists mainly of Apapa Quay and Tin Can Island Port. The 3rd Apapa Wharf which is now under construction will soon be put into operation. In addition to these the port has many mid-stream berths and two lighterage terminals.

(4) The port of Lagos has encountered with, at least, the following problems as far as the operation of the Apapa Quay is concerned.

a) The amount of general cargo handled at the Apapa Quay has far exceeded its handling capacity due to serious congestions caused by increased shipping traffic.

b) Most of the import cargo sheds at Apapa has been occupied by overtime cargoes. It appears to us that a quick dispatch of ship has been hindered due to such inefficient operation of transit sheds. We were told, however, that the Nigerian Ports Authority had started to clear such cargoes from sheds.

c) Quay aprons and roads of the Apapa Quay are full of vacant lorries awaiting cargoes. For this reason the traffic flow inside the port area has been put into extreme confusion and stevedoring operations have been often suspended.

d) Since the urbanization of Lagos City has embraced the Apapa Quay the traffic congestion in the city area has caused slow evacuation of port cargoes.

3-2. Cargo traffic

The cargo traffic with commodity breakdowns of the port of Lagos is shown in Table 3-2-1. As the table indicates general cargo including containerized cargo and petroleum oil occupy 92 per cent of the total traffic. The trend of cargo traffic in the past eleven years is shown in Table 3-2-2. Table 3-2-3 shows the past trend of cargo traffic with commodity breakdowns.

TABLE 3-2-1 CARGO TRAFFIC WITH COMMODITY BREAKDOWNS (1975/76)

(Unit: metric ton)

Type of cargo	Quantity	Percentage
General Cargo	3,840,623	54.53
Containerized Cargo	241,466	3.43
Wheat Grains/Offal	461,296	6.55
Fish	53,284	0.57
Dry Bulk	16,819	0.24
Vegetable Oil	25,820	0.37
Petroleum Oil	2,403,569	34.13
Total	7,042,877	100.00

Source: NPA

Note: Bagged cement and vehicles are included in general cargo.

TABLE 3-2-2 CARGO TRAFFIC IN THE PAST 11 YEARS

(Unit: thousand metric tons)

Year	Inward	Outward	Total
1966/67	1,908	1,262	3,170
67/68	2,272	1,563	3,835
68/69	2,171	1,662	3,832
69/70	2,529	1,422	3,952
70/71	3,784	1,328	5,113
71/72	4,196	976	5,174
72/73	3,681	939	4,620
73/74	4,320	1,053	5,373
74/75	4,660	566	5,225
75/76	6,460	582	7,043
76/77[1)]	8,256	730	8,986

Source : NPA

Note : 1) provisional

3-3. Channels and anchorages

Ships can navigate to the Lagos Ports Complex without any assistance of tugboats through the entrance channel protected with two moles and then they have to turn sharply to the left to reach the 3rd Apapa Wharf and the Tin Can Island Port. Such a sharp bend of the channel must be rectified to accommodate large-sized vessels to those facilities.

The entrance channel is 250 metre wide and 11 metre deep except some parts near the Tin Can Island Port. For this reason, at present, vessels that draw less than 8 metres are permitted to use the Tin Can Island Port. The deepening to 11 metres was recently carried out and almost completed except some parts of the channel. We gained the impression that a large amount of maintenance dredgings will become inevitable due to such deepening works, although we were informed that the maintenance dredging around the entrance was

TABLE 3-2-3 CARGO THROUGHPUT LAGOS PORTS COMPLEX

(METRIC TONS)

Year	General Cargo			Container			Wheat Grains/Offal			Fish			Dry Bulk[1]			Vegetable Oil			Petroleum Oil			Total	Total	Total
	Inward	Outward	Total	Inward	Outward	Total	Inward	Outward	Total	Inward	Outward	Total	Inward	Outward	Total	Inward	Outward	Total	Inward	Outward[3]	Total	Inward	Outward	Throughput
1966/67	997,031	1,094,722	2,091,753	-	-	-	-	-	-	-	-	-	-	-	-	-	133,876	133,876	910,887	33,383	944,270	1,907,918	1,261,981	3,169,899
1967/68	1,157,253	1,436,676	2,573,929	-	-	-	-	-	-	-	-	-	-	-	-	-	122,343	122,343	1,134,653	3,760	1,138,413	2,271,906	1,562,779	3,834,685
1968/69	1,051,100	1,496,207	2,547,307	1,079	-	1,079	-	-	-	-	-	-	-	-	-	-	151,456	151,456	1,118,620	13,854	1,132,474	2,170,799	1,661,517	3,832,316
1969/70	1,346,519	1,290,713	2,637,232	3,462	-	3,462	-	-	-	-	-	-	-	-	-	-	117,836	117,836	1,179,282	13,844	1,193,126	2,529,263	1,422,393	5,951,656
1970/71	2,160,170	1,135,439	3,295,609	7,962	-	7,962	270,348	51,626	321,974	19,903	-	19,903	138,204		138,204		117,082	117,082	1,187,589	24,177	1,211,766	3,784,176	1,328,324	5,112,500
1971/72	2,562,821	813,179	3,376,000	15,959	-	15,959	375,778	72,384	448,162	14,189	-	14,189	14,467		14,467	-	54,166	54,166	1,213,223	37,810	1,251,033	4,196,437	977,539	5,173,975
1972/73	2,173,736	734,273	2,908,009	28,625	-	28,625	253,370	76,951	330,321	12,371	-	12,371	50	-	50	-	86,816	86,816	1,212,705	41,132	1,253,837	3,680,857	939,172	4,620,029
1973/74	2,242,741	814,164	3,056,905	60,818	30	60,848	136,152	80,743	216,895	61,186	-	61,186	51,280	-	51,280	-	107,037	107,037	1,767,894	50,729	1,818,623	4,320,071	1,052,703	5,372,774
1974/75	2,472,236	390,930	2,863,166	123,591	-	123,591	306,930	53,703	360,633	60,833	-	60,833	16,993	-	16,993	-	58,292	58,292	1,679,069	62,859	1,741,028	4,659,652	565,784	5,225,436
1975/76	3,455,267	385,356	3,840,623	241,466	-	241,466	380,278	81,018	461,296	53,284	-	53,284	16,819	-	16,819	-	25,820	25,820	2,313,201	90,368	2,403,569	6,460,315	582,562	7,042,877
1976/77[2]	4,319,751	457,427	4,777,178	298,740	18,134	316,874	592,348	147,779	740,127	97,920	-	97,920	153,828	-	153,828	-	31,166	31,166	2,793,250	75,445	2,868,696	8,255,837	729,951	8,985,788

Source: NPA

Note: 1) Includes Cement Clinker/Gypsum and Coal only.
2) Provisional
3) Bunkerings.

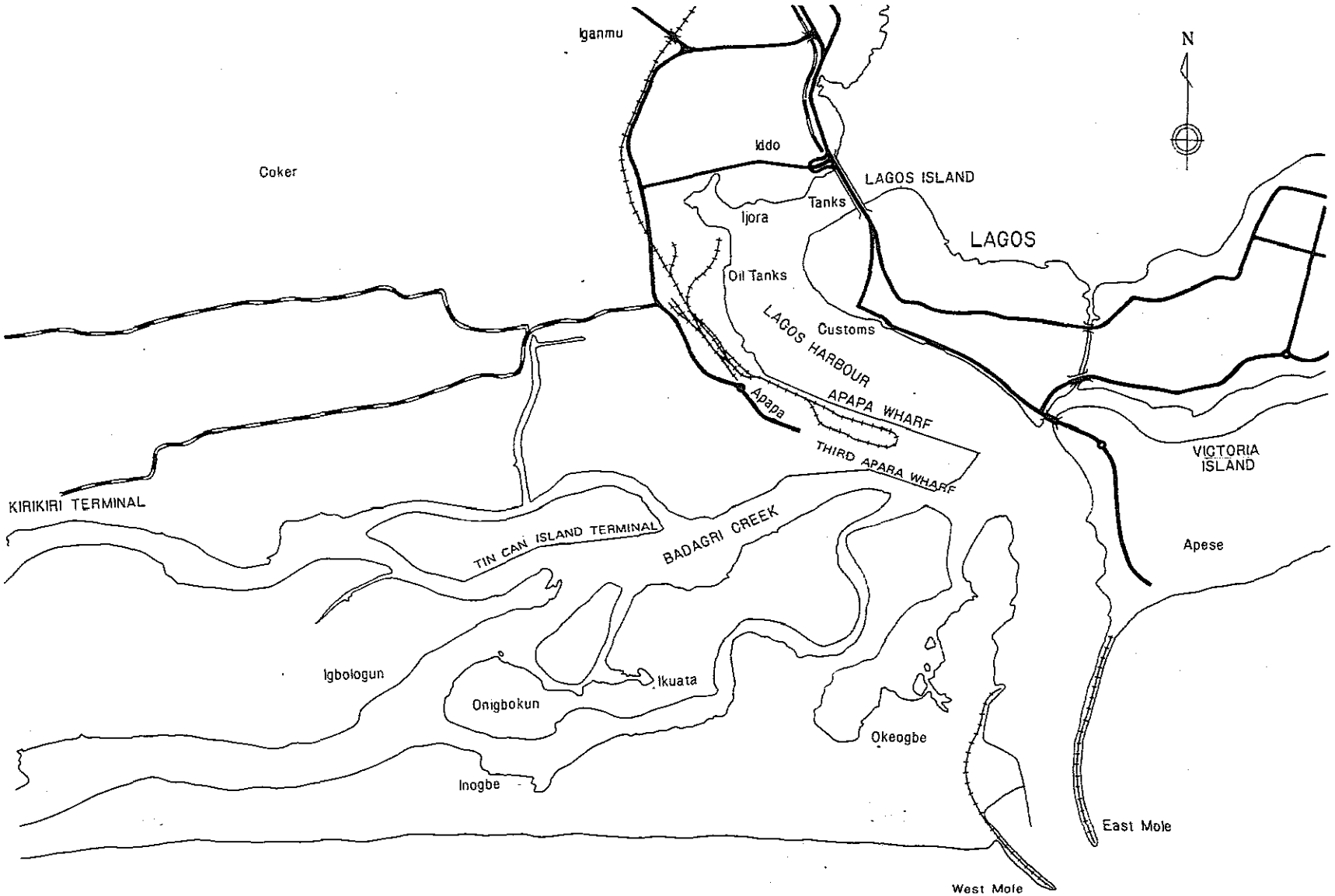
negligible.

We were told that the current velocity of the main channel ranged between 2 and 5 knots.

At present, incoming and outgoing vessels to and from the port of Lagos number only 12 on a daily average. Even after the Tin Can Island Port and the new Apapa Wharf are fully put into operation the present harbour entrance will be sufficient to meet the increasing traffic under normal conditions that pilots and tugboats are always available. Fig. 3-3-1 shows the location of various facilities in the Lagos Ports Complex.

Approximately 25 vessels can anchor inside the harbour entrance, but it appears to us that some of the vessels are at anchor very close to the navigation channel. Such an anchoring must be avoided as the shipping traffic increases.

FIG. 3-3-1 LOCATION OF FACILITIES IN THE LAGOS PORTS COMPLEX



3-4. Mooring berths, transit sheds and warehouses

(1) Apapa Quay

a) 2,393 metre long Apapa Quay with the water depth of 8.23 metres consists of 15 general cargo berths including a 220 metre long temporary container berth (berth No.14). We were told, however, that the berth No.1 was mainly used for the discharge of bulk cement and wheat, while the berth 7A was mainly used by government vessels.

There are 13 transit sheds and their total space is approximately 80,000 sq. metres, while 44,520 sq. metres of warehouses and 131,000 sq. metres of open stacking area are available.

b) Ijora Wharf (length: 122 m, water depth: 5.79 m) is owned by the Nigerian Railway Corporation. It was primarily intended for discharging of coal for railway use, but at present the wharf is mostly used by the Nigerian Ports Authority as a dry bulk cargo berth.

c) Vegetable oil wharf (length: 122 m, water depth: 7.62 m) is partly used for the discharge of imported vegetable oil and mostly used to unload petroleum oil. Due to the increased refined petroleum oil traffic to Lagos 2 or 3 tankers are, we were told, always discharging oil between the vegetable oil wharf and petroleum wharf (length: 425 m, water depth: 4.88 to 7.62 m).

(2) Tin Can Island Port

The Tin Can Island Port, completed in October 1977, is 2,500 metre long and structurally 13.5 metre deep. It consists of 10 berths - two for RO/RO vessels, one for dry bulk cargoes and others for general cargoes. Since the channel dredging has not been completed the port has been used as about 15 berths by relatively smaller and shallower vessels. When we visited the Tin Can Island Port 17 ships had been moored at the quay.

The Tin Can Island Port is a most modern terminal in the Lagos Ports Complex and in Nigeria as well. The quay apron is 40 metre wide and there is

an ample space for open stacking areas. Behind the quay are 5 transit sheds and 3 warehouses. The port has its own water and power supply system and for this reason, irrespective of frequent failure of commercial power supply quay cranes are operative at any time. The entire port area is not served by rail.

(3) Lighterage terminals

There are two lighterage terminals in the port of Lagos. Kirikiri terminal is 1,560 metre long, while Ikorodu terminal in the Lagos Lagoon is 1,140 metre long.

(4) The third Apapa Wharf extension project

This project consists of the construction of 1,500 metre long quay with 4 berths of modern container terminal and 2 general cargo (RO/RO) berths. The water depth of the quay is structurally 13.5 metres, but for the time being the quay is dredged to 11.5 metres from the datum level. The project is near completion and one of the container berths was put into operation during our stay in Lagos. Three gantry cranes are to be installed on the container berths.

(5) Others

There are 25 mid-stream berths in the Lagos Ports Complex

There is a container depot called Lily Pond outside the Apapa Quay, which is operated by Container Terminal Company (Nigeria) Ltd., and has been designated as customs area.

The Customs Quay in the centre of the city was demolished in 1977.

3-5. Transportation of cargoes to and from the hinterland

Although the Apapa Quay is rail-served most of the cargoes is carried by road. Cargoes handled at Apapa Quay pass through two main gates. Owing to the traffic congestions in the city area a quick flow of port traffic is often jeopardized except at midnight.

Tin Can Island Port has better road access to Ikeja, northern part of the Lagos metropolis.

3-6 Port operations

(1) The port of Lagos is run 24 hours a day. Stevedoring works are carried out by five companies designated by the Nigerian Ports Authority.

Table 3-6-1 shows the labour productivity at Apapa Quay, in which TNGH shows the actual labour productivity. It is felt that the productivity is not bad as far as TNGH is concerned.

TABLE 3-6-1 LABOUR PRODUCTIVITY AT THE PORT OF LAGOS (AT APAPA QUAY)

	1975/76		1976/77
	Imports	Exports	Imports
No. of ships	1,225	439	1,225
Total cargo tonnage (ton)	2,963,496	393,661	3,347,042
TGGH	7.9	6.4	9.7
TNGH	9.3	10.2	13.1
TGHH	5.0	4.4	6.6
TNHH	7.3	8.5	9.6

Source: NPA

Note: TGGH = Ton per gross gang hour
TNGH = Ton per net[1)] gang hour
TGHH = Ton per gross hook hour
TNHH = Ton per net hook hour
1) gross gang hours minus lost time due to various reasons

At Apapa Quay, excluding berths Nos. 1 to 4, 7A and the temporary container berth, the berths have been allocated to various conference lines, while some of the mid-stream berths combined with Kirikiri lighterage terminal have also been assigned to conference lines. It has been told that, different from Apapa, Tin Can Island Port is operated on a "first come, first served" system and is mainly used by tramp vessels. It was also reported that the completion of the Tin Can Island Port had resulted in a substantial decrease of waiting times by tramp vessels.

(2) It appears to us that ship's turn-around time in port will be further improved if the control over overtime cargoes and movements of lorries in the port area of Apapa is strictly exercised. To reduce overtime cargoes it may be necessary for the Ports Authority or the Government to encourage private warehousing business.

(3) Pilotage is compulsory. There is not any regulation on the night arrival and departure of ships, but we were told that there were few ships which enter or leave the port during night time.

(4) Coupled with the improved operations of the Apapa Quay the inauguration of the 3rd Apapa Wharf and the full operation of the Tin Can Island Port will remarkably reduce the port congestion of Lagos. Particularly, in view of the increasing trend of containerization the four container berths at the 3rd Apapa Wharf will increase the port's capacity to a large extent.

3-7. Port planning aspects

(1) With the completion of the Tin Can Island Port and the 3rd Apapa Wharf extension there is no room for expansion of port facilities except the area in the vicinity of the Tin Can Island Port. In the planning of port facilities in this area, however, two subjects must be studied. One is a road access to the site, while another is the dredging of a channel and its maintenance. If a facility is planned for large vessels requiring a channel depth of more than 11 metres the volume of capital and maintenance dredgings will reach a tremendous amount. For this reason the port development in this area will be confined to facilities for vessels of a limitted scale.

(2) A coordination must be strengthened between the port expansion and the land use plan of the Lagos metropolitan area because the urbanization is progressing westward along the Badagri road.

4. Concept of the New Ocean Terminal and its functions

4. Concept of the New Ocean Terminal and its functions

4-1. Basic concept

(1) The New Ocean Terminal that the Nigerian Ports Authority is contemplating to build in the Lagos area is a port for large vessels such as third generation container ships and very large bulk cargo carriers which are unable to enter the present ports of Nigeria due to their physical limitations. As stated in Chapter 2 of this report none of the ports in Nigeria faces the sea directly, except crude petroleum oil terminals. Except Lagos, commercial ports under the Ports Authority are situated on river banks and ships have to navigate river channels across their estuary bars. These ports are not suitable for large scale development, while the difficulties also exist in the further expansion of the Lagos Ports Complex as shown in Chapter 3.

(2) Due to the reasons stated in the above the New Ocean Terminal must be built at a new site and have an easy access to the sea. It is natural for the Ports Authority to have contemplated to build the New Ocean Terminal first in the Lagos metropolitan area because the metropolitan Lagos is the largest consuming market and also the largest industrial area in the country.

(3) The New Ocean Terminal should also play an important role as a basis of industrial development, because the most modern maritime transportation means is one of the essential tools to attract various types of manufacturing industries. For this reason, when the construction of a new ocean terminal is contemplated the planning of the terminal should be made so that it is able to serve the industries which will be located in and around the project area. Such an addition of industrial functions to the New Ocean Terminal will certainly increase the economic viability of the project.

4-2. Functions of the New Ocean Terminal

When a planning is made on the New Ocean Terminal the present condition

of the Lagos metropolitan area and the economy of Nigeria, in addition to the changing pattern of maritime transportation must be taken into consideration.

4-2-1. Most modern marine terminal

It is no need to mention that the worldwide tendency of the maritime transportation industry is a rationalization by introducing larger vessels both in bulk and container transportation. Typical examples are, on one hand, the introduction of ULCC to crude oil transportation and, on the other hand, the emergence of 3rd generation container ships in the transport of general cargoes. Major ports in the world have adapted themselves to this trend, and in some cases an entirely new port has been built to meet the transportation revolution.

The accelerated containerization of import general cargoes to Nigeria, for example, is an urgent requirement since the ports of origin are ready for the most modern container transportation, while another example is the import of wheat grains to feed the nation by large grain carriers, resulting in a considerable reduction of freight rates.

In this regard the Lagos Ports Complex is in a difficult position because the channel is shallow and its deepening will impose a heavy burden of dredgings and the channel leading to Tin Can Island Port has sharp bends at some parts.

If the New Ocean Terminal with the most modern and deep-water port facilities is built in order to meet these requirements it will also be able to serve as a transhipment port to neighboring West African countries, in addition to its role as the 3rd Lagos Port next to Tin Can Island Port. A transhipment of containers by feeder service vessels and of wheat grains, etc., has become common in some parts of the world.

4-2-2. Centre of light and heavy industries

(1) Problems in the urbanization and industrialization in the Lagos area

Although the Government has placed an emphasis on a rural development policy to curb the migration from rural to urban areas the population increase in urban areas is progressing at a high rate. The Master Plan Project Unit of

the Lagos State Ministry of Works and Planning has estimated that the population of the metropolitan Lagos will increase at an annual rate of 6.5 per cent between 1976 and 1980 including the natural growth and migration, and reach 4.5 million before the end of 1980.

The Unit mentioned in its Report that we referred to in Chapter 2 as follows: "In Lagos almost two thirds of its inhabitants are relatively new comers, within a decade or two from different and various rural backgrounds."

The migration from rural to urban areas has brought various socio-economic impacts to the environment of both areas, particularly of urban areas. An over-concentration of population in urban areas may often bring about a certain degree of social disorder. A terrible traffic congestion in streets and highways in the Lagos metropolitan area is one of the examples of such impacts and has become one of the reasons for the slow evacuation of port cargoes.

In addition to the development of agriculture an industrization has become one of the most important policies of the Federal Government.

The industrialization in Nigeria is gradually progressing, but the growth rates in recent years are relatively high. According to the information obtained at the Master Plan Project Unit, the manufacturing industry in Lagos in 1973 has 28.5 per cent of the establishments, 47.6 per cent of employment, 58.1 per cent of wages and salaries, 59.5 per cent of value added and 72.7 per cent of net capital expenditure of total in the country. And there is a trend of concentration when the value added is compared to that in 1965.

The manufacturing industries situated in and around the Lagos area is medium and small in scale and most of them are light industries. It appears to us that large scale industrial development projects, particularly those of basic industries such as iron and steel works and crude oil refineries, etc., are implemented at various places far from Lagos.

The Master Plan Project Unit of the Lagos State Ministry of Works and Planning has recognized that the growth of manufacturing industry in Lagos has already reached such a momentum that it has to be well controlled and sub-

ordinated to appropriately defined policies.[1)]

The Master Plan Project Unit is of the opinion that these policies should provide for the growth of only selected branches of manufacturing industry with preferences given to:[1)]

a) industry producing consumer goods evidently directed to satisfy the local market created by the metropolis, for example the food industry producing perishable goods,

b) industry strongly depending on raw material or bulky semiproducts imported by sea through Lagos harbour,

c) industry producing constructional materials, as its growth may help the solution of Lagos rapidly aggravating housing problem,

d) industry, which directly serves Lagos special functions, as for example printing industry related to the Lagos role of scientific and information centre,

e) industry, which due to the high level of technology it employs must be located in the country's most advanced industrial centre possessing the highly qualified labour force.

According to the Unit's view, the location of new industrial estates has to aim at the improvement of the metropolis, first of all promoting a more balanced urbanization pattern within Lagos metropolitan area.

(2) Necessity of an industrial centre

We generally support the opinions of the Master Plan Project Unit, but we would like to emphasize the importance of industrialization in the vicinity of the Lagos metropolitan area.

Although the dispersal of industry has been an important element of government policy and an industrialization in a large city area may often cause further migration and therefore adversely affect the curtailment of an over-concentration of people, it is considered that an industrialization in the vicinity of the Lagos

1) "Development of Manufacturing Industry in Lagos 1976", December 1976, Master Plan Project Unit, LSMWP and UNOTC

metropolitan area should be promoted in order to increase employment opportunities because most of the people who once migrated to urban areas seldom return to rural areas and it is expected that the migration to the Lagos area will last for some years to come.

If the industrialization is carried out in the vicinity of the Lagos area it is easy to obtain a large number of labourers and to transport various products to the biggest consuming area in Nigeria. In addition, if an industrial site has an access to maritime transportation means transport of raw materials from domestic and overseas origins becomes quite easy, and import- and export-oriented industries can also be located.

It is no need to mention that an industrial site near large consuming market is attractive to business circles. Although the industrial development in Nigeria is, as a whole, at an infant stage such a seaboard industrial area will greatly contribute to the economic development of Nigeria on a long term basis.

Due to the reasons stated in the above the New Ocean Terminal must function as an industrial centre for Nigeria in general and for the Lagos metropolitan area in particular.

(3) Selection of industries

In selecting the industries to be located in the New Ocean Terminal site a priority should be given to:

a) industry which needs to have its own water-front,

b) industry which heavily depends on maritime transportation means,

c) industry which produces various commodities directed to the Lagos metropolitan area, e.g. the biggest consuming market in Nigeria, and

d) industry which needs the high level of technology and managerial skill, and highly qualified labour force.

It is considered that the following industries will be appropriate to the New Ocean Terminal site.

- Shipbuilding and repair yard
- Iron and steel mill

- Petroleum oil refining and petro-chemical industry
- Flour mill
- Automobile assembling factory
- Fertilizer manufacturing plant

4-3. Conclusions

(1) As explained in the above, the New Ocean Terminal must be planned not only as a commercial port but also as an industrial port with a spacious industrial area in view of the present and future situation of Nigeria and the Lagos metropolitan area.

(2) For this reason this project will become very large in its scale and has to be accompanied by related infrastructure projects such as housing, highways, water and power supply, etc. Such a combined planning of various projects means that the New Ocean Terminal project is a comprehensive regional development project.

(3) It should be understood, therefore, that the implementation of the New Ocean Terminal project is the construction of a coastal satellite city with a port as its nucleus. The new city must be located near to the city of Lagos, within a radius of 50 - 60km, to realize an easy shift of population from the Lagos metropolitan area and function as the New Ocean Terminal which serves to the hinterland of present Lagos Ports Complex. The characteristics of the coastal satellite city are as follows:

a) The city must have, as its nucleus, a modern port which can accommodate large container ships and bulk carriers, and serves not only as a general cargo port but also as an industrial port.

b) The city must be aimed at reducing the over-concentration of people in the Lagos metropolitan area. In order to attain this aim various types of industries are attracted to the city and a large amount of employment opportunities is created.

(4) The functions expected to the New Ocean Terminal are:-

a) to serve as a distribution centre of various types of commodities which are carried by large-sized container ships, bulk carriers and special purpose ships,

b) to serve as a transhipment port to neighboring countries,

c) to serve various kind of industries which need to have their own water-front, and thus

d) to contribute to the regional development.

(5) The implementation of the New Ocean Terminal project as specified in the above may not be carried out by NPA alone because the project is big in its scale, multiple in its nature and consists of several sub-projects. It is believed, therefore, that a close consultation and liaison with various government organizations concerned are extremely important from an early stage of the project planning.

5. Traffic forecasts and development scale of the New Ocean Terminal

5. Traffic forecasts and development scale of the New Ocean Terminal

5-1. Traffic forecasts

5-1-1. Principles of forecast

(1) Economic frame

In forecasting the future volume of cargoes, the development trend of the Nigerian economy in the future must be taken into consideration as a premise, and it is assumed that the Nigerian economy will develop, as a rule, in conformity with the basic target intended by the Third National Development Plan. On the other hand, there are some problems which the Nigerian economy is experiencing recently. They are, for example, delay in various development projects and tardiness in growth of the mining sector which is dependent on export of crude oil. Then, required modifications arising out of such problems will be made upon a long-range point of view.

(2) Target year

Since the present study is intended for formulation of the development plan of a modern port upon a long ranging point of view subsequent to completion of the two big projects, Tin Can Island Port and Third Apapa Wharf, the target year of the project will be set to 1999-2000 A.D. Further, as the intermediate points to the target year of the project, the years of 1984/85 and 1989/90 scheduled as the target years of the forthcoming Fourth and Fifth National Development Plans will be taken for forecast of the traffic, etc.

(3) Method of forecasting

In forecasting the port cargo traffic there is a method where the volume of marine transport by kind of cargoes is estimated based on the relationship between production and demand in the hinterland, while another method is a macroscopic procedure where a correlation between a macro economic index expressing the change in the demand for marine transport in the past and cargo traffic is first found, then the future traffic is calculated utilizing such a

correlation formula.

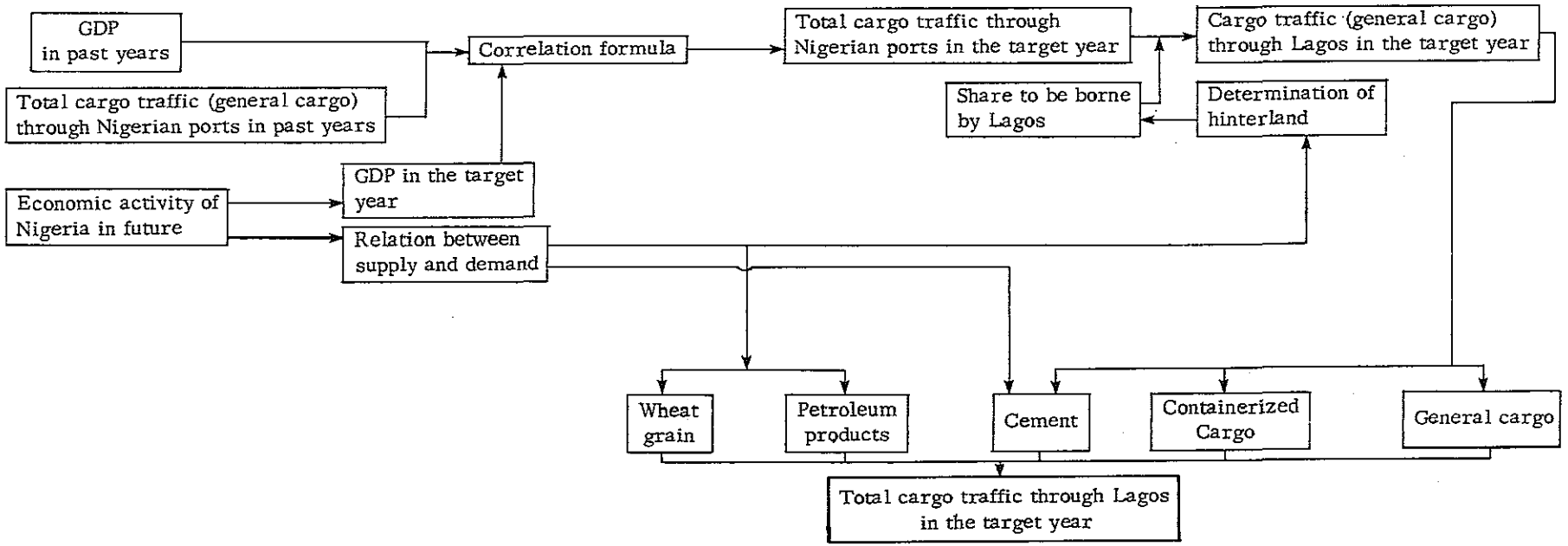
In the present survey, the macroscopic procedure was mainly employed, but for some special cargoes, individual forecasting was made. Specifically, for general cargoes, it should be noted that there is a fairly good relationship between cargo traffic and domestic economic activities. For this reason, by formulating this relationship from the past records, the cargo traffic through all Nigerian ports was forecasted. The share of the port of Lagos (including the New Ocean Terminal) was determined in consideration of the actual traffic of the present port of Lagos and the characteristics of the projected hinterland of the Lagos Port.

On the other hand, as the special cargoes, petroleum products and wheat grains were forecasted individually upon analysis of the relationship between production and demand.

Due to the reasons that the handling method of and facilities for cement and containerized cargo, which were included in general cargoes and thus forecasted macroscopically, are different from those of ordinary general cargoes estimates were made on the share of their respective volumes in the whole general cargo.

Fig. 5-1-1 shows the procedure of forecasting of the cargo traffic employed in the present study.

FIG. 5-1-1 PROCEDURES FOR THE ESTIMATE OF CARGO TRAFFIC



5-1-2. Hinterland

(1) Setting of the hinterland

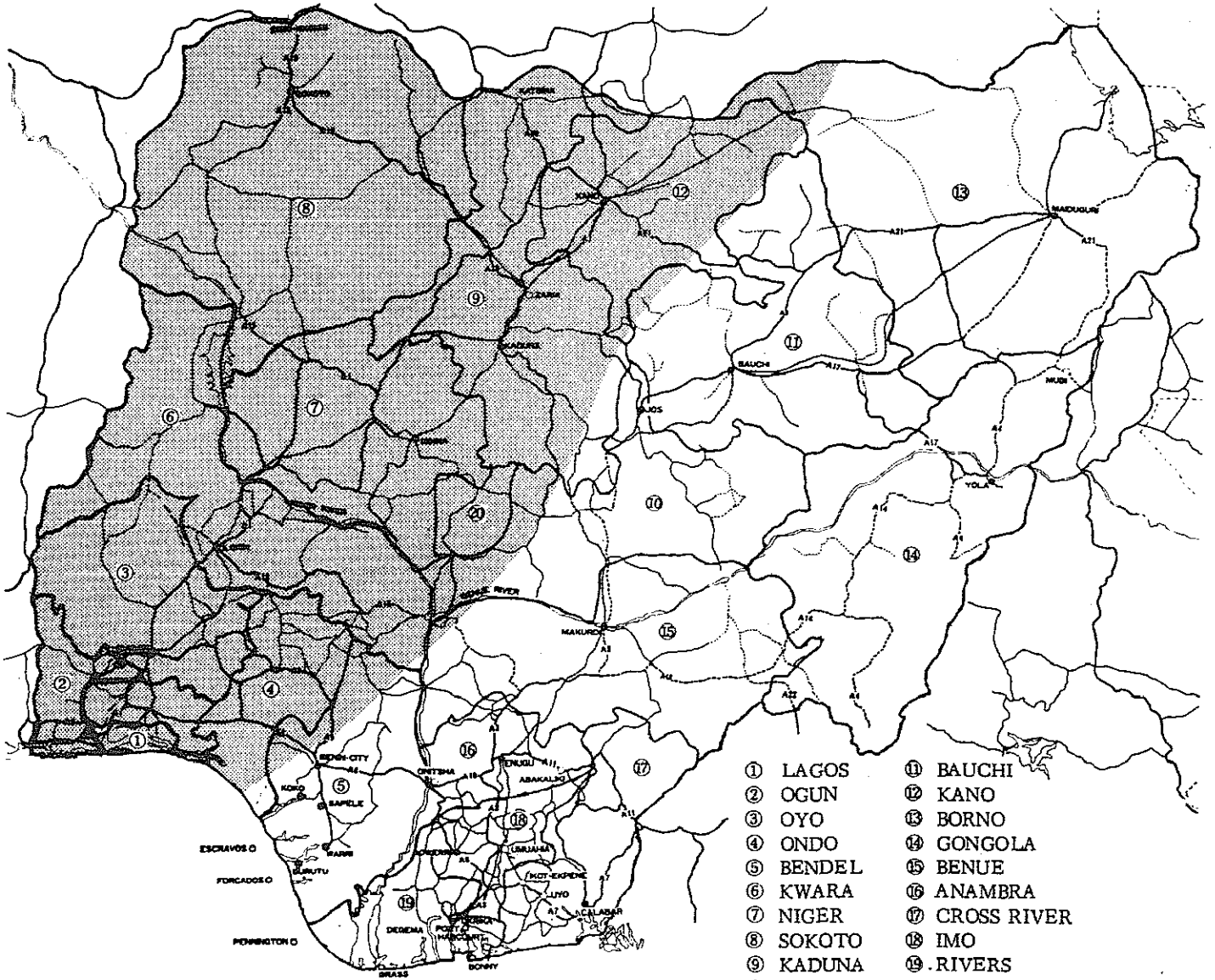
By the hinterland is referred to an area of origin and destination of the greater part of the cargoes handled at the port concerned. In such area, use of the port reduces the cost of land transport of the cargoes to minimum.

The hinterland of the port of Lagos including the New Ocean Terminal covers, if the transport network of roads, railways, etc., is taken into account, the following nine States :

Lagos, Niger, Ogun, Sokoto, Ondo, Kaduna, Oyo, Kano and Kwara.

In Fig. 5-1-2 is illustrated the range of the hinterland of the port of Lagos.

FIG. 5-1-2 HINTERLAND OF THE PORT OF LAGOS



(2) Population and area within the hinterland

The area within the hinterland of the port of Lagos is 435,000 km^2 or 47.1 per cent of the whole land area of the country. The population is 29 million or 52 per cent of the total population according to the 1963 census. The population density is 60 persons/km^2 in the national average, but in Lagos State, it is 403 persons/km^2, much higher than those in the other States.

While there is no official publication of the censuses after 1963, a rate of increase of average 2.5 per cent a year is used for planning purposes. Particularly, in the Lagos metropolitan area, the population is increasing reportedly at a rate of about 8 per cent a year. While the population concentration in the Lagos metropolitan area is remarkable presently, there will be not much change in the percentage of the population in the whole hinterland of the port of Lagos to the total population from that at the time of the 1963 census.

Table 5-1-1 shows the area within the hinterland of the port of Lagos and the result of the 1963 census.

TABLE 5-1-1 AREA AND POPULATION OF THE HINTERLAND OF THE PORT BY STATE

State	Area (sq. km)	Population (1,000)	Population density (per sq. km)	Remarks
Lagos	3,756	1,444	403	
Western	75,368	9,488	126	
Kwara	74,260	2,399	32	
North-Western	168,719	5,734	34	
North-Central	70,209	4,098	58	
Kano	43,071	5,775	134	
Sub total	435,206	28,938	66	
National total	923,769	55,938	60	
Per cent in the national total	47.1%	52.0%	-	

Source : Annual Abstract of Statistics, 1974

Note : Names of States are shown by those before reorganization.

5-1-3. Traffic forecasts

(1) General cargoes

1) Setting of model formula

It is known that the cargo traffic is correlated with the gross national product or gross domestic product generally. However, in the case of Nigeria, the recent trend indicates that the growth of gross domestic product is dull against that of cargo traffic, and no correlation is noted between these two. This is because of a great weight of the crude oil production in the gross domestic product on one hand and an increase in the cargo traffic although the production of crude oil has slowed down since 1974.

Then, when the cargo traffic is taken against the gross domestic product excluding mining sector, a strong correlation is observed. This is considered to be based on the reason that the stagnancy of the crude oil production has so far affected the other industrial activities only on a limited scale. It is thus expected that the transport activity in Nigeria has a closer correlation with the gross domestic product excluding mining sector to permit application of this correlation to the forecasting of cargo traffic.

Table 5-1-2 shows the general cargo traffic through the Nigerian ports and the gross domestic product (except the mining) during the last seven years, and these numerical values are used for regressive analysis.

If the general cargo traffic and the gross domestic product (except the mining) in the i-th year are represented by Yi and Xi respectively, the regression formula is expressed as

$$Yi = aXi + b.$$

Then, obtaining the values of a and b by applying the theory of least square,

$$Yi = 0.615Xi + 58.0 \qquad (5\text{-}1\text{-}1)$$

where Yi : 1,000 tons; and

Xi : 1,000,000 Naira.

Further, the correlation coefficient r is

$$r = 0.924$$

TABLE 5-1-2 CARGO TRAFFIC (NIGERIAN PORTS) AND GROSS DOMESTIC PRODUCT

Year	Gross domestic product[1]		Gross domestic product excluding mining sector [1]		Cargo traffic[2] (general cargo)		Remarks
	Amount (₦ million)	Percentage increase over the previous year	Amount (₦ million)	Percentage increase over the previous year	Cargo traffic (thousand metric tons)	Percentage increase over the previous year	
1970-71	9,442.1	-	6,314.2	-	4,139	-	
1971-72	11,177.9	18.4	6,785.2	7.5	4,559	10.1	
1972-73	11,993.1	7.3	6,790.2	0	3,875	-17.7	
1973-74	13,135.5	9.5	7,207.9	6.2	4,110	6.1	
1974-75	14,254.3	8.5	8,394.6	16.5	4,258	3.6	
1975-76	14,448.8	1.4	9,667.5	15.2	6,110	43.5	
1976-77	16,346.2	13.1	11,084.3	14.7	7,597	24.3	

Source: 1) Third National Development Plan 1975-80, Central Planning Office

2) Nigerian Ports Authority

Notes: 1. General cargo means all cargoes except wheat grains, fish, dry bulk, vegetable oil and petroleum oil.

2. Cargo traffic comprises the traffic through the ports of Lagos, Port Harcourt, Warri, Calabar and Koko.

which shows that it is reasonable to forecast the cargo traffic by the formula shown here.

2) Forecasting of the cargo traffic through Nigerian ports.

The forecast of the general cargo traffic in the future is calculated by putting into the formula 5-1-1 the forecasted value of the gross domestic product (except the mining) in the respective target years. Forecasting of the gross domestic product is very difficult, but here it is set with reference to the growth rates projected in the Third National Development Plan

and in the past years.

Table 5-1-3 shows the targets of the Third National Development Plan. According to the table, the average rate of growth during the plan period is set at 9.5 per cent, and the growth rate except the mining sector at 12.6 per cent. On the other hand, according to the records of the past six years, the average growth rate is approximately equal to the target value of the Third Plan, but the growth rate of the respective years is undergoing the influence of crude oil production. Further, the annual average growth rate of the gross domestic product except the mining (mainly crude oil production) in the past six years is 9.8 per cent which is considerably lower than the target value of the Second Plan, but is growing steadily regardless of the size of crude oil production. Particularly, for the three years of from 1974 to 1977, the growth rate is as high as 15 per cent.

TABLE 5-1-3 ACTUAL AND PROJECTED GROWTH RATES OF GDP

Unit: per cent

Projected growth rates in the 3rd National Development Plan				Actual growth rate of GDP			
Year	GDP	GDP excluding mining sector	Mining sector	Year	GDP	GDP excluding mining sector	Mining sector
1975-76	7.2	9.0	5.1	1971-72	18.4	7.5	40.4
1976-77	8.5	11.1	5.2	1972-73	7.3	0.0	18.4
1977-78	9.8	13.1	5.4	1973-74	9.5	6.2	13.9
1978-79	10.6	14.3	5.5	1974-75	8.5	16.5	10.5
1979-80	11.5	15.4	5.6	1975-76	1.4	15.2	-37.7
				1976-77	13.1	14.7	10.1
Annual average growth rate	9.5	12.6	5.3		9.6	9.8	9.1

Source: Central Planning Office

It is not expectable that the scale of crude oil production will increase greatly in a short period hereafter, so that it is hardly conceivable that the GDP excluding the mining sector will continue to maintain a high growth seen in these three years over a long period. Thus, employing the growth rate of average 9.8 per cent a year which is the actual value during the past six years, the general cargo traffic is forecasted.

The Nigerian Government has a target of developing the per capita GDP from the current level of 200 Naira to the level of 700 Naira in twenty years. From this, it seems reasonable to estimate the growth rate of the gross domestic product except the mining at 9.8 per cent.

Now, using this value, the general cargo traffic in the respective target years is calculated according to formula 5-1-1, as shown in Table 5-1-4.

TABLE 5-1-4 FORECASTS OF GENERAL CARGO TRAFFIC THROUGH NIGERIAN PORTS

Year	Cargo traffic (thousand metric tons)	Rate of increase over 1975-76 traffic	Average annual growth rate (per cent)
1975-76	6,110	100	
1984-85	13,800	226	9.6%
1989-90	22,000	360	
1999-2000	56,000	917	

3) Cargo traffic through the port of Lagos

The share of the port of Lagos in the general cargo traffic in Nigeria is in a decreasing trend, although gradually, during the past five years since 1973/74, as shown in Table 5-1-5, but still represents a percentage of 72 in average.

TABLE 5-1-5 SHARE OF THE PORT OF LAGOS IN GENERAL CARGO TRAFFIC

(Unit: thousand metric tons)

Year	All ports	Lagos Ports Complex	Percentage to national total
1972-73	3,875	2,937	
1973-74	4,110	3,117	75.8
1974-75	4,258	2,986	70.1
1975-76	6,110	4,082	66.8
1976-77	7,597	5,284	69.6
Average share			71.58

Source: Nigerian Ports Authority

On the other hand, as stated in paragraph 5-1-2, the population and area of the hinterland of the port of Lagos represent 52 per cent and 47 per cent of those of the whole country respectively. Against such values, the cargo traffic through the present port of Lagos is of very great weight. However, it is not considered that such situation will continue hereafter over a long period of time, and the share of Lagos is expected to decrease with progress of development and improvement of the other ports. Then, in estimating the future share of the port of Lagos, it is assumed that the share after about twenty years or in 1999/2000 will approximate to 50 per cent which is nearly close to the percentage of population or area in the hinterland. The shares in the intermediate years will be set with the share as of 1975/76 assumed to be 72 per cent or average of the past five years and this value assumed to decrease linearly to 50 per cent in the target year of 1999/2000.

Further, with respect to the cargo traffic by inward and outward, it is expected that there will be no great change occurring macroscopically. Thus, it is assumed that the present ratio of inward and outward cargoes through the port of Lagos will be maintained in the future. Specifically, classification of the inward and outward cargoes is made in use of the pro-

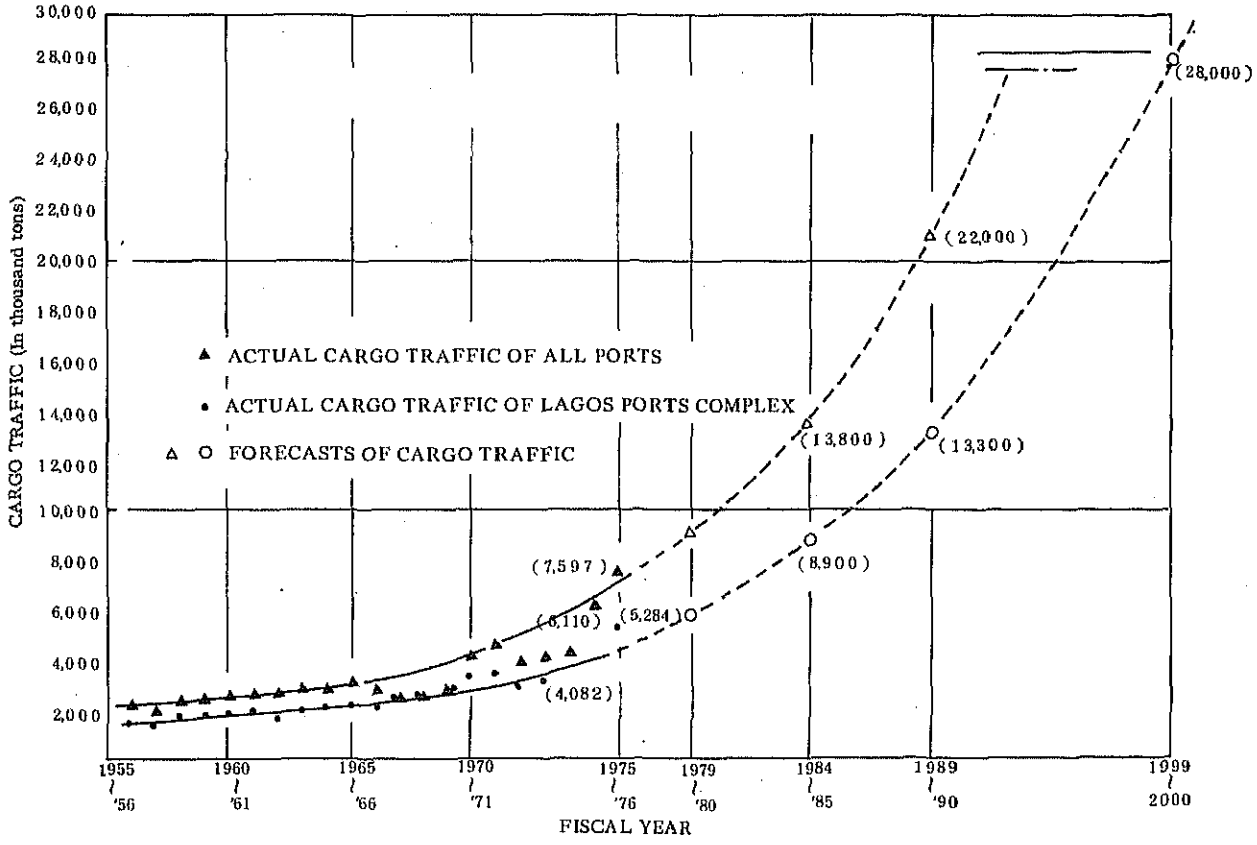
portion of the outward cargoes (about 11 per cent average) in the total general cargo traffic during three years of from 1974/75 to 1976/77.

Based on the foregoing share and proportion of the outward cargoes to the total traffic, the future general cargo traffic through the port of Lagos is calculated as shown in Table 5-1-6. Also in Fig. 5-1-3 is illustrated the result of forecast of the general cargo traffic against the past records of traffic through the port of Lagos.

TABLE 5-1-6 FORECAST OF GENERAL CARGO TRAFFIC THROUGH THE PORT OF LAGOS

Year	General cargo traffic (thousand metric tons)			Rate of increase over 1975-76 traffic	Average annual growth rate	Remarks
	Outward	Inward	Total			
1975-76	385	3,697	4,082	100	-	Average share (five years) borne by Lagos 72%
1984-85	979	7,921	8,900	218	9.10	Share borne by Lagos 64.5%
1989-90	1,463	11,837	13,300	326	8.63	" 60.5%
1999-2000	3,080	24,920	28,000	660	7.99	" 50%

FIG. 5-1-3 FORECASTS OF GENERAL CARGO TRAFFIC



4) Special cargoes included in general cargoes

The general cargo traffic through the port of Lagos was forecasted macroscopically in the foregoing. But, in such general cargoes are included the cargoes having a possibility of the cargo handling method being changed in the future. Specifically, they are cement and containerized cargoes, and here forecasting is made of the volumes of cement and containerized cargoes included in general cargoes forecasted in the preceding paragraph.

a) Cement

Domestic demand for cement in Nigeria is increasing rapidly

year after year owing to rapid progress of the investment in roads, buildings and other construction works. On the other hand, it is intended to increase the domestic production of cement along the Third Development Plan, but the production is presently unable to overtake the increasing demand. It has been alleged that the self-supply system will be realized in the final year (1984/85) of the Fourth National Development Plan, but it will be difficult actually, and here it is assumed that the balance of supply and demand will not be realized before the final target year of this project or 1999-2000.

Table 5-1-7 shows the imports of cement through the whole ports of Nigeria and those of the port of Lagos during the recent four years. It shows that when the whole ports are taken, the import is increasing at a rate of about 57 per cent a year average.

TABLE 5-1-7 TREND OF THE IMPORTS OF CEMENT

(Unit: thousand metric tons)

Year	All ports	Lagos Port	Share borne by Lagos (%)
1972-73	493	336	68.2
1973-74	470	278	59.2
1974-75	1,094	753	68.8
1975-76	1,894	1,140	60.2
Total	3,951	2,570	63.5

Source: Nigerian Ports Authority

It is not conceivable that such a high growth cement imports will be maintained hereafter, but it may be assumed that the demand will increase at least at a rate approximating the growth rate of GDP (except the mining) in a long range view.

The import in 1975/76 is 1,894,000 tons to which some domestic production is added to meet the demand in 1975/76. With this taken

as a base and extended at a growth rate of 9.8 per cent average a year, the demand in 1999/2000 is estimated at least to be 16,700,000 tons. This means that the annual average growth rate of the domestic production of cement in order for the self supply to be achieved by 1999/2000 must be about 13 to 14 per cent. At the intermediate points up to the self supply established in 1999-2000, the difference between the demand growing at this rate and the supply must rely on import.

Table 5-1-8 shows the demand, production and import at the respective intermediate points, and for the handling at the port of Lagos, the cement traffic forecasted upon the actual share during the past four years is indicated.

TABLE 5-1-8 FORECAST OF CEMENT IMPORT

(Unit: thousand metric tons)

Year	Demand	Domestic production	Import	
			All ports	Lagos
1975-76	1,894	-	1,894	1,140
1984-85	4,287	2,391	1,896	1,203
1989-90	6,748	4,572	2,176	1,381
1999-2000	16,723	16,723	0	0

b) Containerized cargo

At the port of Lagos, the containerized cargo has been increasing, but its share in the total traffic is very small, as seen in Table 5-1-9. This is accountable mainly by delay in containerization in the West African trade route and absence of genuine container wharves. However, since the Apapa container wharf is soon completed and the containerization has been positively promoted in the West African trade the containerized cargo will increase sharply

TABLE 5-1-9 RECENT TREND OF CONTAINERIZED CARGO THROUGH LAGOS PORTS COMPLEX

(Unit: thousand metric tons)

Year	General cargo			Containerized cargo					
				Inward		Outward		Total	
	Inward	Outward	Total	Tonnage	Rate of containerized cargo %	Tonnage	Rate of containerized cargo %	Tonnage	Rate of containerized cargo %
1972-73	2,203	734	2,937	29	1.3	-		29	1.0
1973-74	2,304	814	3,118	61	2.6	-		61	2.0
1974-75	2,596	391	2,987	124	4.8	-		124	4.2
1975-76	3,697	385	4,082	241	6.5	-		241	5.9
1976-77	4,619	475	5,094	299	6.5	18	3.7	317	6.2

Source: Nigerian Ports Authority

hereafter. Here, examining the cargoes handled at the Apapa wharf during the past two years, it was found that about 45 to 50 per cent of the general cargoes except cement would be containerizable, as shown in Table 5-1-10.

TABLE 5-1-10 ESTIMATE OF CONTAINERIZABLE IMPORT CARGOES THROUGH APAPA QUAY

(Unit: thousand metric tons)

Year	1973-74	1974-75
General cargo (A)	2,456	2,091
Cement (B)	764	267
Containerizable cargo (C)	762	918
Ratio of containerizable cargo C/(A-B)	45.3%	50.3%

Note: The estimate was made based on the information given by NPA.

Then, if the containerizable percentage of general cargoes except cement in 1975/76 is assumed to be 50 per cent, the rate of containerization (proportion of actually containerized cargoes to containerizable cargoes) at the port of Lagos is given as 18.9 per cent.

Upon the foregoing result of examination, forecasts of the containerized cargo in the future are made according to the following preconditions.

(Import)

i) Containerizable cargo rate of general cargoes except cement: 50 per cent.

ii) Rates of containerization are:

1975-76	about 20 per cent,
1984-85	about 80 per cent, and
1999-2000	about 100 per cent.

iii) The rate of containerization in 1989-90 is determined under the assumption that the rate increases linearly from 1984-85 to 1999-2000.

(Export)

Export cargoes consist mainly of agricultural products and are scarcely containerized, and it is difficult to clearly set forth the cargoes of which containerization is expectable in the future. However, in the trade route having the import cargoes containerized, the export cargoes are likely to be containerized positively. Thus, for containerization of the export cargoes, it is assumed that the containerization within the range of 20 per cent of the export cargoes is realized. Table 5-1-11 shows the result of forecasting under the foregoing conditions of the containerized cargoes in the respective target years.

TABLE 5-1-11 FORECASTS OF CONTAINERIZED CARGO

(Unit: thousand metric tons)

Year	General cargo			Containerized cargo			Remarks
	Outward	Inward	Total	Outward	Inward	Total	
1975-76	385	2,557 (1,140)	2,742 (1,140)	-	241	241	Rate of containerizable cargo about 50%
1984-85	979	6,718 (1,203)	7,697 (1,203)	195	2,690	2,885	Rate of containerization 80%
1989-90	1,463	10,456 (1,381)	11,915 (1,381)	293	4,550	4,843	" 87%
1999-2000	3,080	24,920	28,000	616	12,460	13,076	" 100%

Note: Figures in brakets show the volume of imported cement and are not included in general cargo.

(2) Wheat

Per capita calorie intake in Nigeria in 1974-75 is 2,023 calories, but in the Third National Development Plan, it is intended to enhance, as a target of the calorie intake, to the level of 2,200 calories in the final year of the plan or 1979-80. Thereafter, details are not known, but it is assumed here that the level will be improved to 3,000 calories in 1999-2000. This level is equivalent to that of the average calorie intake per capita in eight western countries in 1968 and is considered to be a reasonable value for this country aiming to improve the gross domestic product in 1999-2000 to the level of advanced countries.

On the other hand, for such calorie intake, five kinds of foodstuff are short-coming presently. They are wheat, milk, meat, offal and fish and are dependent on import. Table 5-1-12 shows the actual calorie intakes from these five items of foodstuff and also the projected and forecasted values. The forecasted values are those of extrapolation of the annual average rate of growth during the period of the Third Development Plan. The calorie intake in future is dependent greatly on the carbohydrates (wheat) and proteins (fish).

TABLE 5-1-12 CALORIES INTAKE FROM FIVE IMPORTED FOOD ITEMS

(Unit: Calorie/cap/day)

Commodity / Year	Wheat	Milk	Beef	Offal	Fish	Remarks
1974-75*1)	46	15	14	3	21	*1) Actual value
1979-80*2)	65	16	14	3	31	*2) Target value of 3rd National Development Plan
1984-85	71	18	15	3	34	Projected target value
1989-1990	77	19	17	3	37	
1999-2000	89	22	19	3	42	

Upon these numerical values, the annual demand for the five items was calculated for the respective target years. The result is shown in Table 5-1-13.

TABLE 5-1-13 ESTIMATE OF DEMAND FOR FIVE IMPORTED FOOD ITEMS

(Unit: thousand metric tons)

Commodity / Year	Wheat	Milk	Beef	Offal	Fish	Population (thousand persons)
1974-1975	480	540	161	54	890	73,000
1979-1980	775	650	187	61	1,465	82,600
1984-1985	984	829	220	69	1,845	93,700
1989-1990	1,164	990	283	104	2,271	105,000
1999-2000	1,722	1,468	405	134	3,300	136,000

In this case, the growth rate of population was taken as 2.5 per cent a year. The values for 1974-75 and 1979-80 are of the actual records and those shown in the Third National Development Plan.

In Table 5-1-14 are shown the domestic productions and targets of production under the Third Plan of these five items, and the government is going to exert efforts toward self supply of these foods. Particularly, for the wheat, the govern-

ment is expecting a very high rate of increase of the production at 160 per cent a year average during the plan period. For the other items, the plan of increasing the production is considered to be reasonable, but for the wheat, it is hardly conceivable that a high rate of growth will be maintained over a long period after 1980. Thus, here, the rate of increase in the yield of wheat after 1980 was assumed to be about 6.0 per cent which was the annual average of the past five years. With this rate taken, the domestic production in the respective target years was calculated. The result is shown in Table 5-1-14.

TABLE 5-1-14 PRODUCTION PLAN OF FIVE FOOD ITEMS

(Unit: thousand metric tons)

	Wheat	Milk	Beef	Offal	Fish	Remarks
Production in 1974-75	20	320	112	44	700	Actual result
Planned production in 1979-80 (3rd National Development Plan)	200	360	143	52	1,085	Plan
Average annual growth rate during the plan period (per cent)	1.60	2.4	5	3.5	10	

Source: Third National Development Plan 1975-80.

The difference between the demand and the production stated above represents the import. For the wheat, it is assumed that the landing is made at the port of Lagos which includes the Lagos area of great consumption in the hinterland. Table 5-1-15 shows the import of wheat in the respective target years.

TABLE 5-1-15 FORECAST OF WHEAT IMPORT

(Unit: thousand metric tons)

	Demand	Domestic production	Import	Remarks
1974-75	480	20	460	Actual result
1979-1980	775	200	575	Target of the 3rd National Development Plan
1984-1985	984	284	664	Projected value
1989-1990	1,164	380	784	
1999-2000	1,722	680	1,042	

(3) Petroleum products

According to the 1976 edition of Nigeria Year Book, the consumption of petroleum products in 1974 and 1975 is growing steadily as shown in Table 5-1-16.

TABLE 5-1-16 COMSUMPTION OF PETROLEUM PRODUCTS

Products	First Quarter 1974 (1)	Fourth Quarter 1974 (2)	First Quarter 1975 (3)	Percentage change between	
				(1) & (3)	(2) & (3)
Liquified petroleum gases	3,837	4,941	4,754	+ 23.9	- 3.8
Aviation spirit	100	1,357	2,576	+ 2,576.0	+ 89.8
Motor spirit	197,389	233,739	230,517	+ 16.8	- 1.4
Kerosene	96,105	109,616	101,227	+ 5.3	- 7.6
Automotive gas oil	166,199	161,751	169,560	+ 2.0	+ 4.8
Fuel oil	81,312	103,122	98,324	+ 20.9	- 4.6
Lubricants	17,600	15,132	15,339	- 12.8	- 11.4
Greases	978	1,135	910	- 6.9	- 19.8
Petroleum jelly, waxes, etc.	10,637	3,162	9,017	- 15.2	+ 85.2
Bitumen and asphalt	28,978	26,128	31,256	+ 7.9	+ 19.6
TOTAL	603,135	660,083	663,480	+ 10.0	+ 0.5

Source: Nigeria Year Book, 1976

From the consumption in the first quarter of 1974 and that in the fourth quarter shown in the table, the consumptions in the second and third quarters are estimated at 622,000 tons and 641,000 tons respectively. With such values, the annual consumption of petroleum products in 1974-75 is estimated to be approximately 2,587,000 tons. The oils constitute 91 per cent of the whole petroleum products at 2,357,000 tons.

Further, the import of oil products of the port of Lagos (including the domestic import from the delta area) is growing at a rate of 11.85 per cent average a year during the past 10 years as shown in Table 5-1-17. Particularly, during the four years of from 1972/73 to 1976/77, it is increasing at a rate as high as 23.18 per cent. If it is assumed that the domestic consumption of oils has increased at the same growth rate (23.18 per cent), the national oil consumption in 1975/76 and that in 1976/77 are given as 2,903,000 tons and 3,576,000 tons respectively.

TABLE 5-1-17 PETROLEUM OIL HANDLED AT LAGOS PORTS COMPLEX

Year	Outward	Inward	Total
1966 – 67	33	911	944
1967 – 68	4	1,135	1,139
1968 – 69	14	1,119	1,133
1969 – 70	14	1,179	1,193
1970 – 71	24	1,188	1,212
1971 – 72	38	1,213	1,251
1972 – 73	41	1,213	1,254
1973 – 74	51	1,786	1,837
1974 – 75	63	1,679	1,742
1975 – 76	90	2,313	2,403
1976 – 77	75	2,793	2,868

Source: Nigerian Ports Authority

Note: Average annual growth rate: 11.85 per cent.
The outward cargo is mostly oil for bunkers.

While it is difficult to forecast future consumption of oils in Nigeria, here it is assumed that the growth rate of the import of oils at the port of Lagos represents that of the national consumption and that such rate of growth of the consumption is expectable hereafter.

On the other hand, there is only one oil refinery in Nigeria presently. It is the Oil Refinery in Port Harcourt City which has a capacity of 60,000 barrels a day. In order to establish a self supply system, the Nigerian Government is planning, in its Third National Development Plan, to expand the capacity of the said refinery to 75,000 barrels/day and, at the same time, construct a Kaduna Refinery (70,000 barrels/day) and a Warri Refinery (100,000 barrels/day) and also two refineries, each with a capacity of 300,000 barrels/day, for export. These projects total to 845,000 barrels/day or an annual output of 49 million tons. Nigeria will soon have no import of oils but turn into an exporting country.

Thus, when the location of the export refineries is far from Lagos, the port of Lagos must function as a distribution centre of oils to the large consumption area which the port of Lagos has in its hinterland.

Table 5-1-18 shows the consumption of petroleum products in each of the States of Nigeria in the first quarter of 1975.

TABLE 5-1-18 CONSUMPTION OF PETROLEUM PRODUCTS BY STATES

(Tonnes)

Products	Lagos State	North Western State	North Central State	Kano State	North Eastern State	Benue Plateau State	Kwara State	Western State	Mid-Western State	East Central State	South Eastern State	Rivers State	First Quarter 1975
Motor spirit	60,909	6,281	11,979	82,152	6,915	9,851	6,038	50,826	19,619	28,717	6,794	10,436	230,517
Kerosene	44,747	2,855	2,501	10,987	1,398	3,944	1,203	8,523	5,520	8,778	3,301	7,465	101,227
Automotive gas oil	47,829	5,066	9,549	11,948	7,507	6,797	5,438	11,015	21,750	14,216	8,723	19,722	169,560
Fuel	72,042	2,269	9,532	2,060	406	404	2,421	1,919	1,761	2,592	2,379	539	98,324
TOTAL	225,527	16,471	33,561	37,147	16,226	20,996	15,105	72,283	48,650	54,303	21,197	38,162	599,628

Source: Nigeria year book, 1974

Note : Names of States are those before reorganization.

According to the table, about 50 per cent of the petroleum products are consumed in the Lagos and Western States, followed by the States of East-Central, Mid-Western and Kano.

This consumption is covered by the import through the port of Lagos (about 420,000 tons/quarter) and the production at the Port Harcourt Refinery. The import through the port of Lagos is nearly equal to the consumption in the six western States which constitute the hinterland of the port of Lagos as established in this chapter.

However, upon completion of the oil refinery project in a scale scheduled in the Third National Development Plan, the production will exceed the level of domestic consumption, so that the oil distribution function to be shared by the port of Lagos in the future will be reduced to about two States of Lagos and West subject, of course, to the location of the oil refineries. On the other hand, the consumption in the said two States will be about 20 per cent of the national total, equivalent to the populational share of the two States due to extension of the motorization, etc., in 1999-2000.

Table 5-1-19 shows forecasts of the domestic consumption of oils and the quantity of oils supplied via the port of Lagos.

TABLE 5-1-19 FORECASTS OF DEMESTIC COMSUMPTION OF OILS AND OF THE TRAFFIC THROUGH LAGOS PORTS COMPLEX

Unit: thousand metrictons

	Domestic consumption	Traffic through Lagos	Share borne by Lagos (per cent)
1975—76	2,912	2,313	79.7
1984—85	8,800	4,400	50.0
1989—90	15,300	6,100	40.0
1999—2000	47,000	9,400	20.0

(4) Summary of the estimates of the cargo traffic through the port of Lagos

Results of forecasting of all the cargo traffic through the port of Lagos are represented in Table 5-1-20.

TABLE 5-1-20 FORECASTS OF THE TOTAL CARGO TRAFFIC THROUGH LAGOS PORTS COMPLEX

Unit: thousand metric tons

Year	By outward and inward	General cargo				Wheat	Petroleun oil	Others	Total throughput
		Break bulk	Containerized	Cement	Sub total				
1975-76	Outward	385	-	-	385	81	90	26	582
	Inward	2,310	241	1,140	3,687	380	2,313	70	6,460
	Total	2,701	241	1,140	4,082	461	96	96	7,042
1984-85	Outward	784	195	-	979	-	-	-	979
	Inward	4,028	2,690	1,203	7,921	664	4,400	-	12,984
	Total	4,812	2,885	1,203	8,900	664	-	-	13,964
1989-90	Outward	1,170	293	-	1,463	-	-	-	1,463
	Inward	5,907	4,550	1,380	11,837	784	6,100	-	18,721
	Total	7,077	4,843	1,380	13,300	784	6,100	-	20,184
1999-2000	Outward	2,464	616	-	3,080	-	-	-	3,080
	Inward	12,460	12,460	-	24,920	1,042	9,400	-	35,362
	Total	14,924	13,076	-	28,000	1,042	9,400	-	38,442

Notes : 1. Figures in 1975-76 show actual results.
2. Wheat includes offal.
3. Others mean dry bulk cargoes.

5-2. Proposition on the development scale of the New Ocean Terminal

5-2-1. Cargo handling capacities of current facilities

The handling capacity of a facility is, in other words, the optimum capacity of a wharf. Theoretically, it is defined as the volume of cargoes at which the total expense per unit cargo passing the wharf in a unit time is reduced to minimum.

The expenses consumed at a port include those relating to vessels, facilities, loading and unloading, storage and other miscellaneous port expenses and the capacity is generally expressed, in many instances, upon the amount of cargoes handled in one year taken as the unit time.

According to the foregoing definition, in considering the optimum handling capacity of a wharf, the expense relative to vessels may be reduced if it is arranged that there is no waiting time, but, at the same time, the volume of cargoes handled at the wharf is also reduced to increase the facility expense per unit cargo. Therefore, it is not advantageous usually to avoid the phenomenon of berth waiting completely.

The ship expense is comprised basically of the ship value (depreciation), allowance to crew, fuel cost (while in port), insurance premium, etc., and is the total of the lost expense while in waiting from entry to berthing and that while in berthing. This is more or less related to the number of berths, loading and unloading capacity (loading and unloading speed), arrival pattern of ships and loading and unloading volume of cargoes per ship, depending of course on the characteristics of the respective ports.

Anyway, it is very difficult to calculate the optimum capacity of a wharf theoretically. Thus, here, an optimum capacity for various types of wharves is determined from the experience in the past for examination of the capacities of the current facilities.

(1) Handling capacity by type of berthing facility

a) General cargo wharf

The annual cargo traffic through a deep-water wharf (with a water depth of -9 metres or more) handling general cargoes in Japan is generally

150,000 to 200,000 tons per berth. The former value represents the actual results of the ports loading and unloading about 1,000 tons of cargo per port per ship, while the latter value represents those of about 2,000 tons. In both cases, the berth occupancy rate is 50 to 60 per cent, and the loading and unloading efficiency is average 15 to 20 tons/gang per hour. The efficiency of stevedoring is not much different if a wharf crane is used in place of the ship's gear unless the cargo is of a special form. Thus, in Japan, except the wharves handling heavy and other special cargoes, it is rare to install wharf cranes on general cargo wharves. In general, the efficiency of cargo handling at a wharf is dependent on how fast the cargoes placed on the apron are cleared. In other words, the cargo handling efficiency is governed by how effectively the forklift and other transportation equipment are used on the apron.

In planning a deep-water general cargo wharf, satisfaction of the foregoing conditions is taken as a premise, and handling of 150,000 to 200,000 tons of cargoes a year per berth is considered to be an economically adequate capacity.

In Table 5-2-1 are shown the actual results of cargo handling at the Apapa Quay, Lagos. Upon conversion per metre of berth, the handling is 1,000 to 1,100 tons/year which is not much different from the cases in Japan. But, in the case of Apapa Quay, the berth occupancy rate is high at 80 to 90 per cent, so that it is doubtful if the wharf is operated at an economic and adequate capacity or not. As stated in Chapter 3, such a high rate is considered to be the result of the cargoes on the apron being cleared very inefficiently.

TABLE 5-2-1 CARGO TRAFFIC THROUGH APAPA QUAY

Period	1. 4. 73 - 31. 3. 74				1. 4. 74 - 31. 3. 75			
Facilities	Lighter Berth		Main Berth		Lighter Berth		Main Berth	
	113M		2438M		113M		2438M	
Cargo Traffic	Tonne	Tonne per Metre	Tonne	Tonne per Metre	Tonne	Tonne per Metre	Tonne	Tonne per Metre
April — June	10,614	93.9	550,419	225.8	6,380	56.5	615,386	252.4
July — Sept.	10,100	89.4	725,429	297.5	11,779	104.2	699,329	286.0
Oct. — Dec.	5,967	52.8	711,854	292.0	16,994	150.3	802,199	329.0
Jan. — March	7,560	66.9	578,383	237.2	12,859	113.8	630,310	258.5
TOTAL	34,241	303.0	2,566,085	1,052.5	48,012	424.8	2,747,224	1,126.8

Source: Nigerian Ports Authority

Anyway, it is considered to be appropriate to examine the facility plan with the adequate capacity per berth of a deep-water general cargo wharf taken as 150,000 to 200,000 tons/year (or nearly 1,000 tons/metre/year) on condition that the clearance of cargoes on the apron is improved.

Upon such consideration, the adequate handling capacity per berth of the respective wharves are shown specifically in the following.

Apapa Quay 150,000 tons/year (average berth length: 160 m/B)

Tin Can Island 200,000 tons/year (average berth length: 250 m/B)

For the lighterage terminals, the annual handling volume per unit berth length was assumed to be 400 tons/m.

The plan of the general cargo wharf at the New Ocean Terminal will be made with the handling capacity per berth assumed to be 200,000 tons/year.

b) Container wharf

The optimum capacity of a container wharf is expressed in terms of annual cargo traffic calculated based on the number of containers at which the total cost of handling per container is reduced to minimum.

In general, container ships are 4 to 5 times higher in ship value than conventional ships, so that the loss occurring in the ship expense due to berth waiting affects the total cost greatly.

An example of the optimum capacity of a berth is as shown in Table 5-2-2. In the Table are shown the adequate number of containers handled annually at a wharf which is planned for container ships with a loading capacity of 1,000 containers and the berth occupation rate.

TABLE 5-2-2 OPTIMUM ANNUAL CAPACITY OF CONTAINER WHARF

Facilities	No. of containers handled	Berth occupation rate	No. of ships (per week)	Average waiting time for berth (day)
Quay length 250 m Wharf area 75,000 m^2 Two gantry cranes	60,000	35%	1.7	0.3

Source: Keihin (Tokyo Bay) Port Development Authority

As seen from Table 5-2-2, the berth waiting is 0.3 day/vessel average so that there is very little opportunity for the incoming vessels waiting for berth. On the other hand, if such situation is seen from the facility side, the efficiency is by no means good with the berth occupation rate at only 35 per cent.

Table 5-2-3 shows the actual handling of containers at the container terminals now in operation in the Tokyo bay ports.

TABLE 5-2-3 NUMBER OF CONTAINERS HANDLED IN 1977

Facilities	No. of berths	Total number of containers			Average No. of containers per berth
		Export	Import	Total	
Quay length 250~300m Wharf area 75000~90000m^2 Two gantry cranes per berth	12	394,327	377,733	722,060	64,338

Source: Keihin (Tokyo Bay) Port Development Authority

As seen, the actual result is not much different from the calculated value above. For reference, the rate of loaded containers by trade route (percentage of the loaded containers to the total number of containers handled) handled at the twelve container terminals in the ports of Tokyo Bay is shown below.

TABLE 5-2-4 RATE OF LOADED CONTAINERS (1972)

Trade route	Export	Import	Total
Pacific Northwest	0.95	0.70	0.82
Pacific Southwest	0.95	0.60	0.78
Australia	0.90	0.90	0.88
Europe	0.97	0.80	0.90
New York	0.97	0.80	0.90
Average	0.95	0.74	0.85

Source: Keihin (Tokyo Bay) Port Development Authority

The container handling works are fully mechanized. Thus, if the scale and quality of the terminal facilities are the same, the adequate container handling capacities are not much affected by the difference in the condition of respective countries but are reasonably regarded to be approximately equal in any countries (provided, if the capacity is expressed in terms of cargo volume, it will of course differ from country to country depending on the loaded rate).

Accordingly, in the planning of the New Ocean Terminal, a study will be made with the adequate capacity of a container wharf taken, as a rule, as handling standard 60,000 20' containers a year. For the Apapa Container Wharf now being constructed, the marshalling area is small, while it will be used largely by relatively small container ships, so that handling of 50,000 containers a year is taken as the adequate capacity.

Converting the above number of containers to cargo volumes,

Apapa Container Wharf (Third Apapa Extension)

Import:	Loaded rate (100%) x 25,000 containers x loaded cargo volume per container (15 FT/container*) = 375,000 FT
Export	Loaded rate (10%) x 25,000 containers x loaded cargo volume (15 FT/container) = 37,500 FT
Total	410,000 FT ≒ 400,000 FT

* Average loaded volume per container.

Container wharf at the New Ocean Terminal,

Import	100% x 30,000 containers x 15 FT/container = 450,000 FT
Export	10% x 30,000 containers x 15 FT/container = 45,000 FT
Total	495,000 FT ≒ 500,000 tons

For the ro/ro berth of the Tin Can Island Port, it has a vast yard and is thus considered to be of the same handling capacity with that of the container wharf of the New Ocean Terminal.

c) Bulk cargo wharf

The handling capacity of a bulk cargo wharf varies greatly with the capacity of unloaders installed on the wharf. The capacity of unloaders is determined generally upon the ship size and projected annual handling volume.

・Cereal wharf (for wheat grains)

Generally on a cereal wharf is most effectively installed pneumatic or any other unloaders. In Table 5-2-5 are shown the pneumatic unloaders installed and in operation on the public wharves in Japan. These unloaders are of the per hour capacity of minimum 100 tons and maximum 400 tons. The deep-water quay built recently in Japan exclusively for grains is provided with unloaders with a total handling capacity of 400 to 600 tons an hour and is handling one million to two million tons of grains per berth a year.

berth a year.

TABLE 5-2-5 PNEUMATIC UNLOADERS ON PUBLIC WHARVES (EXAMPLES IN JAPAN)

Port	Water depth of berth (m)	Rated capacity (t/h)	Volume handled (1000 tons/ year)	Working days/year	Working hours/year
Shimizu	-11	300	176	226	1,383
"	-11	300	134		
Nagoya	-10	150	64	94	464
"	-10	100	21	44	250
Yokkaichi	-10	300	518	255	2,872
"	-10	300			
Osaka	-11	150	1	2	16
"	-11	150	16	28	216
"	-11	400	175	150	1,250
Kobe	-12	150	493	250	1,884
"	-12	400			1,708
Tomakomai	-12	n.a.	255	198	1,508
Otaru	-12	300	27	32	360
Hakata	-11	400	322	252	2,293
"	-11	400	194	205	1,386
"	-11	210	133	170	902
"	-11	210	130	179	907

Note: n.a. - not available

On the other hand, grain carriers include those as large as 65,000 DWT in service, yet there are still many carriers of 10,000 DWT class used presently.

The New Ocean Terminal is designed for very large vessels, so that there will be installed two units of 400 tons/hour unloaders per berth. The annual handling capacity of the grain wharf will be:

Annual handling capacity = (Unloading capacity) x (Machine efficiency) x (Number of machines) x (Number of working days a year) x (Working hours a day) = 400 tons/hour x 0.6 x 2 x 200 days x 15 hours/day = 1,440,000 tons.

However, in the case of a quay such as Apapa No.1 Berth, vessels of the 10,000 DWT class at the largest are intended for. Therefore, it will be enough to consider a capacity commensurate with one unit of 400 tons/hour unloader or two units of 200 tons/hour unloader. Then, the annual handling capacity per berth will be:

Annual handling capacity = 400 tons/hour x 0.6 x 200 days x 15 hours/day = 720,000 tons.

The bulk cargo berth of the Tin Can Island Port will be of the same handling capacity with Apapa.

· Oil terminal

The capacity of an oil terminal will be examined similarly to the grain wharf, but the petroleum products will be shipped from Warri and Port Harcourt. In such case, 10,000 DWT class tankers will have to be used from the restriction of channel depth in both ports which are located up river respectively.

With the pump capacity, etc., chosen appropriately in consideration of the foregoing conditions, the annual handling capacity per berth of the oil terminal will be:

Annual handling capacity = (Pump up capacity) x (Machine efficiency) x (Working days a year) x (Working hours a day)

= 1,000 tons/hour x 0.6 x 220 days x 15 hours/day = 1,980,000 tons.

(2) Total handling capacity of current facilities

The loading and discharging capacity of the port of Lagos will be largely increased with the completion of the Tin Can Island Port and the third Apapa Wharf which will soon be put into operation.

The capacity of the Lagos Ports Complex is calculated based on the analyses made by type of cargo and its handling method as stated in the above. As a result the estimated annual capacity of the Lagos Ports Complex, including the Third Apapa Wharf is as follows.

(Unit: thousand metric tons per year)

a)	Conventional general cargo berths		
	Apapa Quay	(14 berths)	2,100
	Tin Can Island	(7 berths)	1,400
	Two lighterage terminals	(2,700m)	1,080
	Total		4,580
b)	Container/roro berths		
	The third Apapa Wharf	(6 berths)	2,400
	Tin Can Island	(2 berths)	1,000
	Total		3,400
c)	Dry bulk cargo berths		
	Apapa Quay	(1 berth)	720
	Tin Can Island	(1 berth)	720
	Total		1,440
	Grand Total *1/		9,420

Note: *1/excluding vegetable oil and petroleum wharves and Ijora Wharf

In Table 3-2-1 is shown the cargo traffic through the port of Lagos in 1975/76. It is noted that by only the general cargoes and containerized cargoes, 4 million tons were exceeded. The cargo traffic thus exceeding the said adequate capacity greatly is the result of chronic port congestion.

5-2-2. Development scale of the New Ocean Terminal

As already stated, it is considered that the general cargo traffic in the year 2000 will reach approximately 28 million tons including containerized and roro cargoes, which far exceed the present capacity (8 million tons) of the Lagos Ports Complex. An outstanding feature in the changing pattern of transportation is containerization which has been reflected in the traffic forecasts. Containerized cargoes (including roro cargoes) will occupy 13 million tons in 2000 while the amount of conventional general cargo will become 15 million tons. For this reason, following number of berths must be built at the New Ocean Terminal:

Container/roro berths: 19

Conventional general cargo berths: 50

Table 5-2-6 shows the projected scale including the berths handling bulk cargoes and oils of the New Ocean Terminal. For the oils, the current berths are calculated as two berths.

TABLE 5-2-6 DEVELOPMENT SCALE OF THE NEW OCEAN TERMINAL

Unit: berth

Facilities	Existing berths	Number of berths to be built at the new terminal			Remarks
		1984–85	1989–90	1999–2000	
General cargo wharf	21	-	13	50	1) No.1 berth at Apapa and No.1 berth at Tin Can Island Port (to be converted to general cargo berths in 1999/2000)
Container/roro wharf	8	-	3	19	
Special wharf for wheat grains	0	1	1	1	
Wharf for dry bulk (cement) cargo	2 1)	-	-	-	
Petroleum wharf	2	1	1	3	
Total	33	2	18	73	

5-3. Study on industrial development

5-3-1. Purpose of study

As described in Chapter 4, the New Ocean Terminal plays a very useful role as an infrastructure for location of seaboard industries. Further, by planning the location of industries, the development effect of the New Ocean Terminal is highly elevated. Here, it is intended to examine the overall scale of the regional development including the New Ocean Terminal by choosing industries to be located appropriately in the New Ocean Terminal and setting their approximate scales.

5-3-2. Kinds and scales of industries to be located

The industries in Nigeria are, as stated in Chapter 2, generally at a low level. Particularly, the fundamental industries producing intermediate materials and machineries requiring a high level of technology are scarcely present. As the result, the proportion of the import of raw materials is very high except some manufacturing industries.

In view of such situation, the Nigerian Government makes it a great target of the industrial development hereafter to promote the following industries.

(1) Major export industries: More than 40 per cent of the production is intended for export.

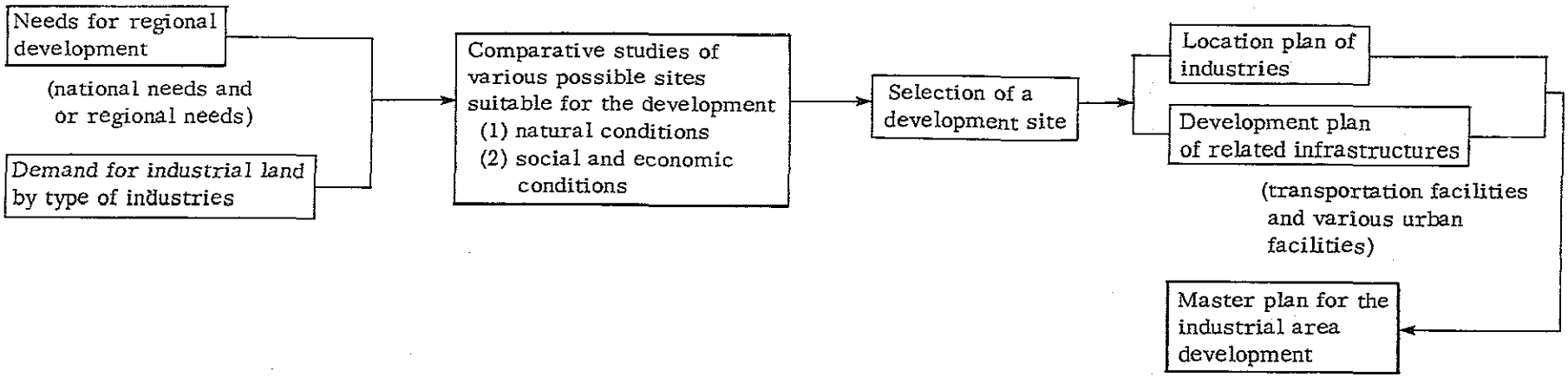
(2) Engineering industries: Agricultural machines and instruments, metal and wood working machines, construction machines, electrical machines and equipment and conveyance machines.

(3) Fundamental industries and chemical products

The industries listed as appropriate for location in Chapter 4 may be said to be complying with such target of the Government and be located most advantageously with a modern port as a nucleus.

Fig. 5-3-1 shows the study procedure of the location of industries.

FIG. 5-3-1 PROCEDURES FOR THE STUDY OF INDUSTRIAL AREA DEVELOPMENT



The industries selected for location in Chapter 4 are of the following scale respectively.

a) Iron and steel industry

Present domestic consumption of iron and steel is rather small against the economic level. In general, the iron and steel consumption per capita is closely related to the national income per capita, and the potential demands for iron and steel in 1979/80 and 1984/85 based on such national income are expected to exceed 3,500,000 and 4,500,000 tons respectively.

On the other hand, the Nigerian Government has a plan of iron and steel manufacturing of annual 2,500,000 tons including steel produced by the direct reduction method during the period of the Third National Development Plan, but about 3 million tons must be added until 1984/85.

Accordingly, in this project, a new iron and steel mill having an annual capacity of 3 million tons is planned as the first phase of the project.

b) Oil refining and petrochemical industries

For export, an oil refinery with a daily output of 300,000 barrels is planned. The daily output of 300,000 barrels is an adequate scale of operation as that in the initial stage of operation.

The petrochemical industry will have naphtha supplied from the oil refinery to produce all sorts of derivatives of the ethylene, propylene and butane-butylene systems. The scale of production will be 400,000 tons/year as converted to ethylene.

It is a prerequisite for the oil refinery for export that it is located adjacent to a deep-water port.

c) Shipbuilding and repair

Aiming at a scale capable of repairing large vessels for a modern port, a shipbuilding yard of 200,000 gross tons a year is planned.

d) Automobile assembly

The operation will be started mainly with assembling for the time being,

but the domestic production will be aimed at in a long run. In the stage of assembly, a large amount of parts will be introduced, so that it is advantageous that the plant is located along the seashore.

The scale of production will be one shift 100,000 vehicles/year in consideration of the current trend of domestic demand.

e) Flour milling

The wheat will not be self-sufficient for the time being but be dependent on the import for a considerable time to come, so that it is desirable that the milling industry is located at a port allowing large grain carriers to enter. As the annual import of wheat is expected to exceed one million tons, a flour mill with a scale of an annual output of 500,000 tons is planned.

f) Chemical fertilizers

Where natural gas and coal are used as the starting materials, the location is dependent on the resources. However, where naphtha is used as the starting material, the plant is to be located close to an oil refinery. While its scale is governed by the oil refining capacity, a scale as large as 500,000 tons is planned.

g) Thermal power generation

For the time being, the power generation will be of a scale capable of supplying power to the foregoing industries and covering part of the demand in the Lagos metropolitan area. The capacity will then be one million KW, but it is important to give consideration for additional installations in the future.

5-3-3. Industrial land area, port facilities, etc., required for industrial location

(1) Industrial land area

Examining the totally required industrial land area in reference to the unit land per unit production of the respective industries and also the examples in Japan, it is given as 17 million square metres including the land for related industries.

When roads, railways and other public sites are added, the industrial area will be 22 million square metres. In this industrial area is included the space for future expansion of the iron and steel manufacturing, oil refining and electric power.

(2) Employment effect

While the employment capacity of the respective industries varies with the quality of labour force, if it is assumed that a standard quality of labour is obtainable, there will be about 20,000 of labour force absorbed. The industries particularly great in the employment effect are the iron and steel manufacturing, automobile assembly and shipbuilding.

When 20,000 labourers are gathering, there settle about 100,000 persons including their families. With commerce and other services added to this, it is expected that there will be formed a city of a scale of about 150,000 persons.

Accordingly, in the project, it is important to give consideration not only to the port and industrial development but to settlement of the workers.

(3) Major port facilities

Planning of the port facilities varies greatly depending on the means of transport of raw materials required by the located enterprises and of the products. In this project, it is contemplated that the principal raw materials are introduced mainly by sea and that the products are shipped by sea if they are export products (oil products) or by land if they are products for domestic use. What matters particularly in planning the port facilities is the means of transport of iron ore and coal, which are the raw materials of iron and steel manufacturing, and crude oil for refining. Any of these materials has no possibility of production in the periphery of the development area and is likely to be furnished from the Rivers State, etc., which are at least 400 to 500 km apart from the site. Of the crude oil among these materials, it is considered to be economical to transport it from the offshore oil terminal off the Rivers State to the project area with medium sized tankers (60,000 DWT - 100,000 DWT) shuttling there between. For the iron ore and coal, development of the inland areas is expected, but for the iron and steel mill located in the New Ocean Terminal, they will be imported from Brazil and other foreign countries by means of large carriers (200,000 DWT class).

With the foregoing transport plan taken as a premise, there will be required an access channel and anchorage basins allowing the 200,000 DWT class carriers to enter and various types of mooring facilities for the principal raw materials. For the mooring facilities, it will be required to secure a waterfront of an extension of 6,000 m.

5-3-4. Problems in industrial development

Physical scales of development of the land and port facilities required for the industrial development are arranged orderly in Table 5-3-1.

TABLE 5-3-1 DEVELOPMENT SCALE OF WATERFRONT INDUSTRIES

Type of Industries	Production seale	Plant area (1,000 m^2)	Employment (persons)	Water depth and length of main quays (m)		Raw materials through port (1,000 tons/year)		Remarks
				Depth	Length			
Iron and steel	Crude steel 3 million tons/year	7,000 1/	4,000	(-16--18) (--10)	1,500 1,000	Iron ore Coal	5,000 2,000	1/ Expansion site is taken into account
Petroleum refining	300 thousand barrels/ day	3,000 1/	1,000	(-10--14) (-14-)	1,000 500	Crude oil	15,000	"
Petrochemicals	400,000 tons/year (ethylene basis)	1,000	1,200	(-7.5-)	500			
Chemical fertilizer	500 thousand tons/year	500	1,000	(-14)	300	Phosphate rock or naphtha		
Shipbuilding and repair	200 thousand tons/year	100	2,700	(-10)	600	Steel plate, etc.	300	
Automobile assembly	One shift 100 thousand/year	1,200	4,000	(-10)	500	Parts 2/	600	2/ For two shift production
Flour mill and related food processing	500 thousand tons/year	500	250	(-14)	300	Wheat grains	500	
Power station	One million kilowatt	300 1/	250		300			
Sub total		13,200	14,400	-		-		
Other related industries	-	3,800	5,600	-		-		
Public space including roads and railways, etc.	-	5,000	-	-		-		
Total		22,000	20,000	-		-		

With the introduction of industries to the New Ocean Terminal the scale of development will far exceed the port's own needs. It is, however, very important to formulate the master plan so that various functions expected to the New Ocean Terminal will be comprehensively and efficiently maintained.

For materialization of the project, it is required to accumulate investigations and researches. Particularly for the industrial development project, it is required to give consideration to the following matters.

(1) The time of realization of the industrial development project must be determined in coordination of the development projects of the other areas in the country. Thus, the time of realization may differ from industry to industry. But, the development of infrastructural facilities for industrial location (land, breakwaters, entrance channel, etc.) must be carried out according to the master plan.

(2) Relative to the time of realization of the industrial development plan, it is required to adjust partly the commercial port plan. With respect to the wharf designed exclusively for the imported wheat and oil products, if the time of operation of the oil refining and flour milling industries is accelerated, it is required to reexamine the scale and layout of the commercial facilities, studied in 5-2-1 (1).

(3) Further, studies should be made on industrial water, foundation soil and transportation of the raw materials before the industries are attracted to the project area.

6. Location of the New Ocean Terminal

6. Location of the New Ocean Terminal

6-1. Conditions for the site selection

(1) The site for the New Ocean Terminal which must function as explained in Chapter 4 and has the development scale stated in Chapter 5 of this report must be sought outside the built-up area of the Lagos metropolis.

(2) It is no need to mention that the site must face the sea.

(3) Various comparisons are made on the two possible sites as shown in Fig. 6-1-1.

One is a place located south of Kirikiri lighterage terminal as proposed by Pacific Consultants International of Japan in its report "Development of the Lagos Ports Complex" published in July 1977 and submitted to the Nigerian Ports Authority (this place is hereinafter called "site-A"), while another is situated, facing the sea, approximately 50 KM east of Lagos and about 25 KM southwest of Epe town (this place is hereinafter called "site-B"). The site-B includes tiny villages of Igando and Iberekodo. The site-A is a low land and partly consists of marsh.

According to our aerial observation the vast undeveloped area including the site-B, bordered by Lagos and Lekki Lagoons and the sea with a straight coast-line, has no sizable undulation and is covered with scrub.

(4) The further west of the site-A was excluded from among the alternative sites because of its geographical location that the area is situated at the south-western tip of the Federal Republic, while the coastal area between the Victoria Island of Lagos and the site-B was also disqualified due mainly to the difficulties in road access to the area which has to bypass the Lagos metropolitan area and the possible expansion of built-up areas to the east of Victoria Island.

(5) There will be an alternative site; namely the south of Lekki Lagoon where a narrow land strip exists between the sea and the lagoon. If this site is selected a considerable amount of dredging and excavation will be saved since the

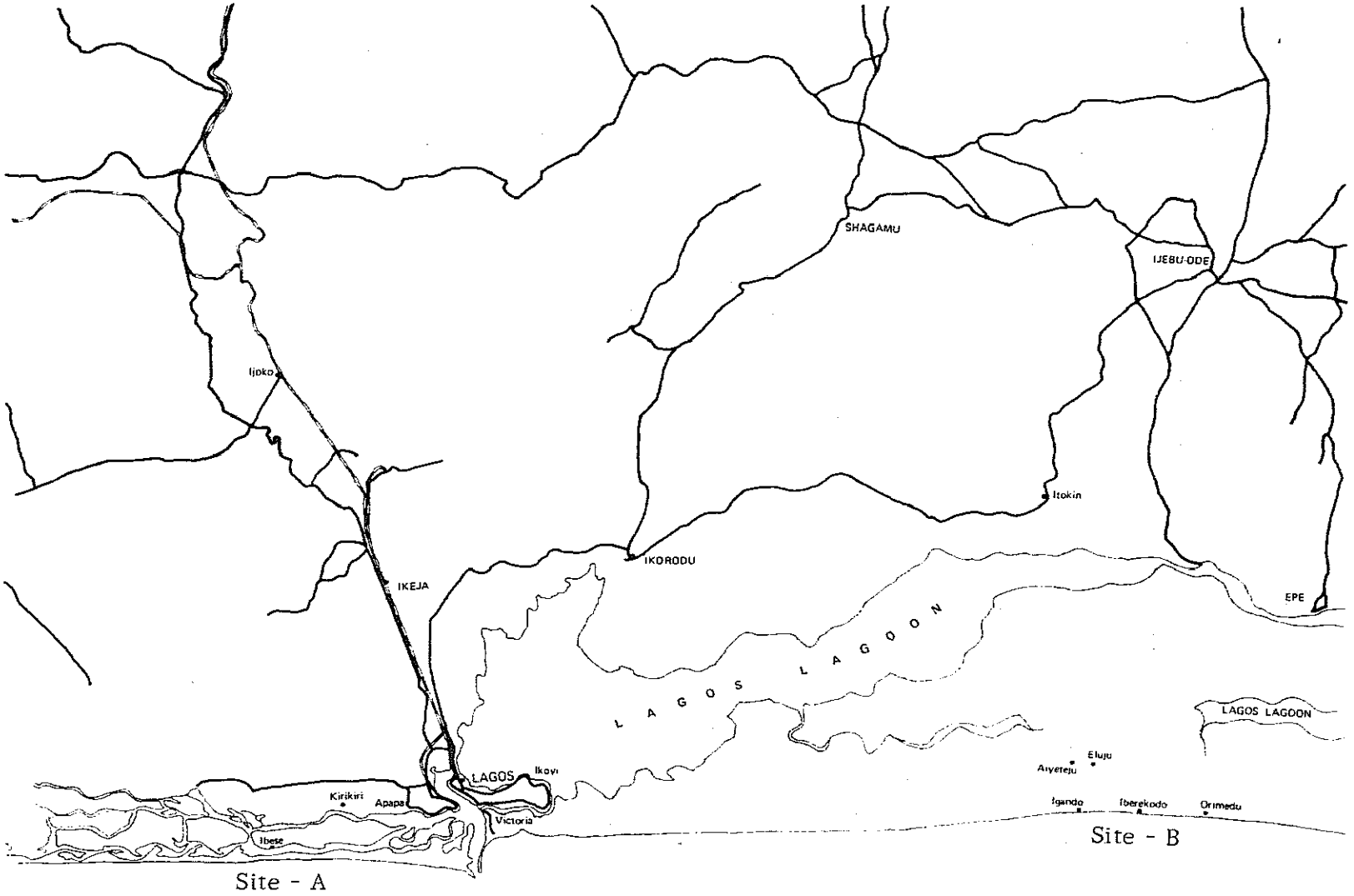


FIG. 6-1-1 POSSIBLE SITES FOR THE NEW OCEAN TERMINAL

lagoon can be usable as anchorages. It will not be advisable, however, to use the lagoon as a harbour because it is considered that most part of the lagoon may be non-saline and may be used as an important water resource for the people of the Lagos metropolitan area and for industrial purposes.

6-2. Comparisons from the port planning and urbanization point of view

6-2-1. Site-A

(1) Advantages

a) A gradual expansion of port facilities is possible at the site-A by utilizing the present channel leading to the Tin Can Island Port to meet the increasing demand for traffic in the immediate future. For this reason an initial investment in the port construction is much less at the site-A than at the site-B. In this case, however, the size of ships are limitted due to the limitted water depth of the channel (11-11.5 metres) and its alignment. Such a water depth is, however, insufficient to satisfy the functions of the New Ocean Terminal.

b) The extension of the present road network to the site is easier and less costly than that of the site-B, although such an extension will naturally accelerate the congestion of the existing road network in the Lagos metropolitan area.

c) It appears to us that the development of the site-A will result in a considerable amount of savings to the total investment in the project, compared to the project cost at the site-B, because various types of infrastructures already exist in the vicinity of the site being so close to the centre of the Lagos metropolis.

d) The construction of the New Ocean Terminal brings an additional entrance to the entire Lagos Ports Complex. The two entrance system certainly avoids the total closure of the port when an accident due to ships collision, etc., occurs at one of the entrances.

(2) Disadvantages

a) The site-A is too close to the congested Lagos city area. Although the site-A area has been reserved as a port complex in the interim land use plan 1977-1982, Master Plan for Metropolitan Lagos made by the Master Plan Project Unit of the Lagos State Ministry of Works and Planning the development of the area as a multi-purpose port cum industrial area mentioned in Chapter 4 will bring various adverse effect to the healthy development of the Lagos metropolitan area, particularly in view of the fact that the urbanization of the area is progressing toward west.

b) From geographical point of view the Lagos metropolitan area is situated at the southwestern tip of the Federal Republic and for this reason a further development of port and industrial area in the western part of the metropolis is not a right policy and rather against the Federal Government's policy of industrial dispersal.

6-2-2. Site-B

(1) Advantages

a) The site-B is an entirely undeveloped area with virtually no inhabitants except those in a few tiny villages. For this reason a large scale development which satisfies the new concept stated in Chapter 4 is possible without any adverse effect to the environment.

b) Since the site is situated 50 KM apart from the city of Lagos the development of the area becomes possible without any adverse effect to the Lagos metropolitan area.

c) The site-B is a virgin land for physical development and has not any sizable topographic limitations. For this reason a diversification of planning works can be obtained.

d) The development of the site-B as an industrial area will coincide with the Federal Government's policy of industrial dispersal.

(2) Disadvantages

a) At the site-B the development means a creation of a new city on a virgin land. For this reason the development of the site-B will cost much money.

b) The road from Lagos to Epe via Ikorodu and Itokin is at present a single carriage way except some parts in the Lagos metropolitan area, while it appears to us that the road between Ejirin and Ijebu-Ode is sub-standard in its quality. When the site-B is developed the improvement of these roads to dual carriage ways is required.

c) In view of the characteristics of the New Ocean Terminal a railway access is necessary wherever the site is selected. Since the site-B is far from the existing railway network the construction cost of a railway will become high. The new railway will probably be connected with an existing line at Ibadan.

6-3. Comparisons from the engineering point of view

6-3-1. Site-A

(1) Advantages

The amount of capital dredgings will be less at the site-A than at the site-B, because creeks can be used as a part of channels and anchorages. It may be, however, necessary to obtain the soil for land reclamation by additional dredgings of the area when the amount of reclamation soil is insufficient due to short supply of dredged soil.

(2) Disadvantages

a) The creation of the new harbour entrance excavating the sandy beach into a creek will change the hydraulic characteristics of the existing entrance channel because the current velocity at the latter may become less due to the new opening, resulting in weaker tidal flush and increased maintenance dredging works at the present channel.

b) Since there is a water resource to a part of the Lagos metropolitan area in the vicinity of the proposed site the opening of the new harbour entrance may adversely affect the water supply due to the increased intrusion of salt water to related creeks. In view of the extreme short supply of tap water in dry season in the Lagos metropolitan area the conservation of a water resource should be strictly enforced.

We are of the opinion that the two disadvantages described in the above are decisive factors to judge the viability of this project at the site-A. For this reason, a thorough investigation must be carried out when the site-A is selected for development.

c) The construction of the new entrance protected with long breakwaters projected from shore will cause an erosion to the beach between the new and existing entrances. Changes in littoral drift due to such erosion may again adversely affect the maintenance of the existing entrance.

6-3-2. Site-B

(1) Advantages

It appears to us that there is not much difference between the site-A and the site-B in the characteristics on coastal engineering phenomena such as waves and current, etc. For this reason difficulties in the construction of a new harbour entrance will be more or less the same at both sites.

However, the impact of a beach erosion to the east coast of the harbour entrance at the site-B is less important than at the site-A because the area around the site-B is entirely undeveloped.

(2) Disadvantages

The amount of capital dredging will be larger at the site-B than at the site-A because there is no water surface available for anchorages behind the shore.

6-4. Conclusions

The comparisons of both sites as shown in the above are not always based on theoretical analyses or on quantitative calculations. But we believe that al-

though the creation of the New Ocean Terminal at the site-B will cost more than at the site-A, the development of the site-B will be extremely contribute as a whole to the long-term (probably twenty years or more) development of the Lagos metropolitan area.

7. Studies to be made within one or two years

7. Studies to be made within one or two years

7-1. General studies on natural conditions

(1) Once a site for the New Ocean Terminal is selected a master plan for the project must be formulated and the technical and economic feasibility must be confirmed. It is important for planners to be familiar with natural conditions surrounding the site before the master plan is formulated.

Studies on natural conditions include: -

a) topographic condition (land and sea),

b) geological condition (land and sea),

c) wind, and

d) maritime condition.

The studies on maritime condition include: -

a) wave condition,

b) longshore current and littoral drift, and

c) tide.

(2) The various types of studies mentioned in the above are very important in the formulation of the master plan of the project. But it can not be asserted that the master plan should be formulated based on the whole results of these observations. Since the observations, especially of wave and wind need a few years the master plan formulation is often carried out in parallel with those observations. If necessary the master plan may be partly amended and improved before its implementation based on the information additionally obtained through those observations.

(3) The observation of wind and wave is usually carried out in order to investigate the relation between wind and wave. The property of waves affects the littoral drift of sand, the determination of breakwater layout and structural designs, and the calmness of the harbour basin. It is recommended however that the observation of wind and wave is carried out after the decision was made by the Federal Government on the implementation of the New Ocean Terminal project because the continuous observation of waves by sophisticated equipment is rather costly. For this reason the

observation of wind and wave is excluded from among the study items, but the wave observation is carried out by a simple method only when the observation of long-shore current is made.

7-2. Contents of each study item

It is hoped that the following studies are carried out before the master plan for the port development is formulated. It is recommended however that the studies on topographic and geological conditions are made in the fiscal year 1978.

7-2-1. Topographic condition (Fig. 7-2-1)

Detailed topographic maps in and around the proposed site are essential tools to formulate the master plan for the New Ocean Terminal and to calculate the amount of earth moving works and dredgings.

(1) Land area

- aerial photographic survey and mapping
- area: 5 km (north and south direction) x 20 km (along the coast-line)
- mapping: 1/10,000 for the whole area
  1/5,000 for the central part of the area (5 km x 10 km)

(2) Sea area

- depth sounding and mapping
- area: 3 km (north and south direction) x 10 km (along the coast-line)
- interval of sounding lines: 200 metres
- mapping: 1/5,000

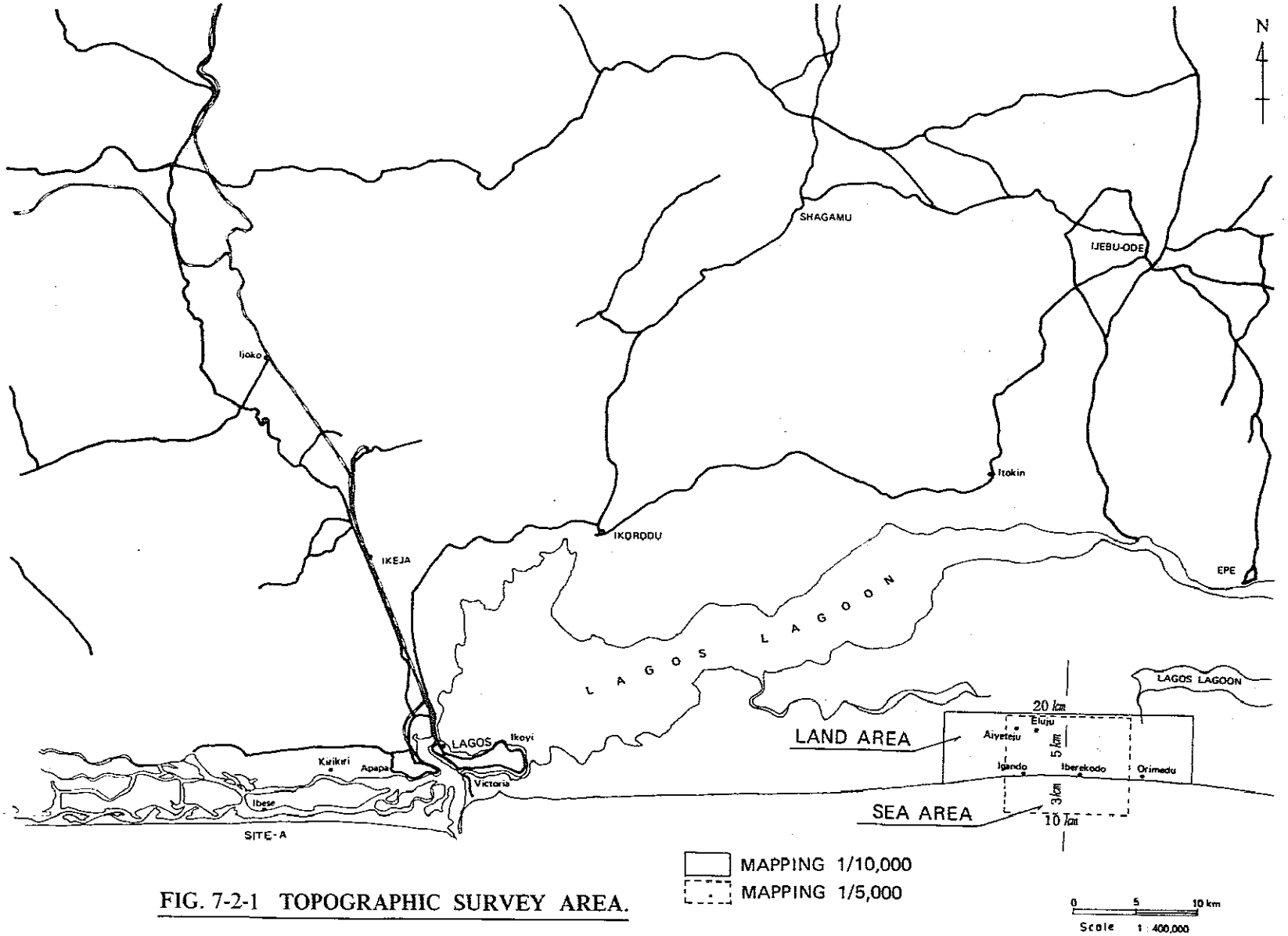


FIG. 7-2-1 TOPOGRAPHIC SURVEY AREA.

7-2-2. Geological condition (Fig. 7-2-2)

Geological condition must be studied to examine the bearing capacity of the foundation strata.

(1) Soil borings and tests

- borings

  land area: four holes - depth 30 metres

- soil tests

  in-situ standard penetration test, collection of disturbed soil samples, specific gravity and size distribution of particles.

(2) Sonic prospecter survey for the sea area

- area : 3 km (north and south direction) x 10 km (along the coast-line)
- depth of exploration : 60 metres

This survey is carried out simultaneously with the depth sounding stated in the above.

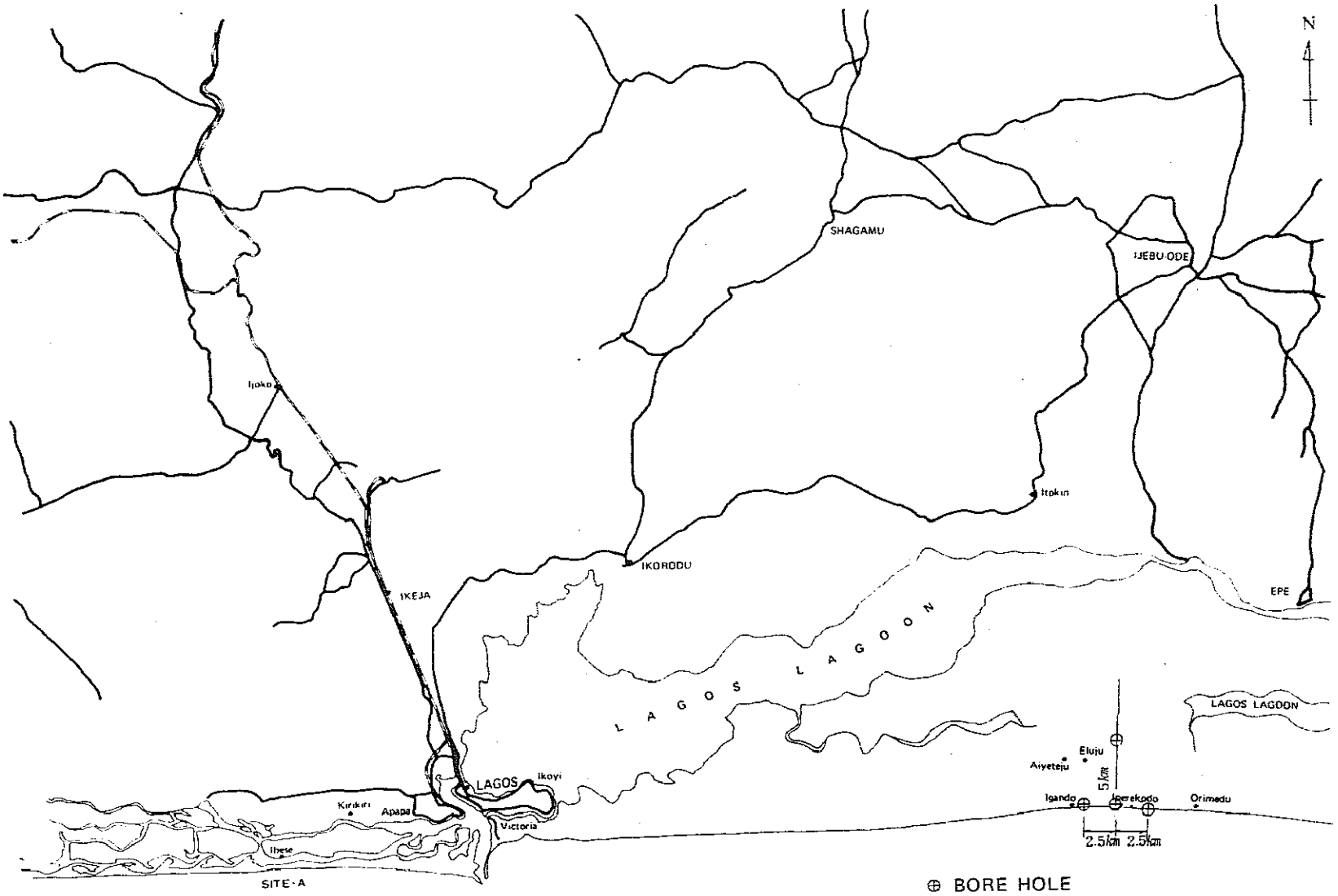


FIG. 7-2-2 LOCATION OF BORE HOLES.

7-2-3. Maritime condition

(1) Survey on the seasonal changes of the bottom topography

It appears to us that a sand bar has been formed at the sea bottom more than 100 metres offshore. The bar changes its shape and location according to the characteristics of waves, particularly along the Nigerian coast where strong waves wash the shore in rainy season and the sea is relatively calm in dry season. The seasonal changes of a sand bar is one of the important factors in determining the layout of breakwaters, including the water depth at the breakwater head. Frequent soundings of the sea depth are powerful tools to know the characteristics of a sand bar in details.

- area: 500 metres (along the coast-line) x (up to -15 metres from the chart datum)
- frequency: two times (one is September and the other in February)

The depth sounding in February is carried out as a part of the topographic survey stated in (2) of 7-2-1.

- interval of sounding lines: 100 metres

(2) Observation of longshore current

A longshore current is deeply related to sand movements. The stronger the current becomes, the more sand moves. Since the current velocity depends on wave conditions such as wave heights, periods and approach angles the velocities of the current must be measured under various wave conditions. The characteristics of waves during the current observation must therefore be confirmed.

- frequency: two times each in rainy and dry seasons
- wave condition (wave height): more than two metres, 1.5 - 2.0 metres, 1.0 - 1.5 metres and less than 1.0 metres

(3) Investigation of the seabed material

As a sand particle becomes smaller it is easily disturbed by waves and carried away by long-shore current. The properties of sand particles at the sea bottom are different from place to place and vary according to wave conditions. It is therefore necessary to carry out the investigation in different seasons.

a) Foreshore and backshore

- frequency: two times (one in September and the other in February)
- area: 4 km along the coast-line at every 200 metres, about 40 points

b) Seabed

- frequency: once in January
- area : 4 km (along the coast-line) x (up to -15 metres from the chart datum),
- interval of sampling: two metres for water depth and 400 metres along the coast-line, about 80 points

7-3. Cooperation and undertakings of the Federal Government of Nigeria and the Nigerian Ports Authority

Since the scope of studies stated in the above is rather extensive and the site is not easily accessible and isolated from the built-up area of Lagos it is earnestly hoped that various types of cooperation are extended to the Japanese study team by the Federal Government and the Nigerian Ports Authority so that the studies are carried out without serious troubles. We are of the opinion that the Nigerian authorities concerned should undertake the following arrangements before the site survey is started.

a) Security measures are assured to the study staffs and equipment, and emergency communications system is maintained.

b) Permissions or approvals, etc., required by the Federal or State regulations are promptly given when applied; e.g. landing and takeoff of helicopters at the study site and the use of transceivers, etc.

c) Assignment of two or three counterpart officials.

d) Issue of work permits to Japanese consulting firms that will be engaged in study works.

e) The purpose of the study is explained to residents in and around the site and an advance notice is given to them so that the trespassing to private land by study staffs is permitted.

f) The following facilities are provided free of charge by the Nigerian Ports Authority.

- a survey boat
- accommodations for local labourers

It is believed in view of the wide varieties of study subjects, particularly in coastal engineering aspects that any participation in the study works of research staffs of the hydraulic laboratory of the University of Lagos and of the engineers of the Ports Authority will no doubt contribute to the upgrading of Nigerian engineering techniques in this field.

APPENDICES

1. SCOPE OF WORK

FOR

THE STUDY ON THE CONSTRUCTION PROJECT OF

THE NEW LAGOS PORT

OCTOBER, 1977

JAPAN INTERNATIONAL COOPERATION AGENCY

1. INTRODUCTION

With the concurrence of the Government of the Federal Republic of Nigeria, the Government of Japan has decided to conduct a study on the construction project of the new Ocean Terminal in accordance with laws and regulations in force in Japan, and the Japan International Cooperation Agency (JICA), the official agency responsible for the implementation of the Technical Cooperation Programmes of the Government of Japan, will carry out the study in close cooperation of the Government of the Federal Republic of Nigeria and the authorities concerned.

2. OUTLINE OF THE STUDY

The objective of the study is to select the most suitable location of a new port in the Lagos metropolitan area and to propose the scale of the port development with a long-term prospect.

3. SCOPE OF WORK

(1) Main subjects of the study

a) Natural conditions

- Collection and analysis of the meteorological, hydraulic and geological data, etc.
- Reconnaissance of proposed or possible construction sites.
  A certain amount of field observations may be conducted.

b) Social and economic conditions

- Review of the Third National Development Plan, etc.
- Collection and analysis of statistical data on social and economic conditions.

c) Study on the port of Lagos

- Traffic flow and inland transportation of seaborne trade.
- Port management and operation.
- Capacity of the existing port facilities.

d) Selection of a new port construction site

e) Scale of a long-term port development

f) Items of further studies to be made

4. TIME SCHEDULE AND REPORT

(1) The study shall commence within about 3 months after the "SCOPE OF WORK" is agreed by both countries.

(2) A provisional observation report will be submitted to the Government of Nigeria by the study team during its stay in Nigeria.

5. UNDERTAKING OF THE GOVERNMENT OF NIGERIA

(1) The Government of Nigeria and the authorities concerned will provide the study team with necessary and available information and data.

(2) The Government will make arrangement for visiting the authorities concerned.

(3) The Government will assign counterparts to cooperate with the study team.

(4) The Government will provide the study team with transportation facilities such as boats for the field survey.

(5) The Government will exempt the study team from taxes and duties for the equipment and materials to be brought into Nigeria by the study team.

6. EXPERTS OF STUDY TEAM

The study team consists of experts of different fields as listed below.

- Team leader
- Port planning
- Transport planning
- Hydraulic and coastal engineering (two)
- Soil exploration and structural design

The above-mentioned fields of expertise will, however, be subject to change.

2. Formation of the study team

Head : Mr. Susumu MAEDA
General Manager, The Overseas Coastal Area Development Institute of Japan (OCDI)

Deputy Head : Mr. Tomoo ISHIWATA, (Port planning)
Deputy Director,
Planning Dept., OCDI

Members : Dr. Hajime INAMURA, (Transport planning)
Chief, Port Planning Laboratory,
The Port and Harbour Research Institute, Ministry of Transport

Mr. Tomotsuka TAKAYAMA, (Hydraulic and coastal engineering)
Chief, Storm-Tide and Tsunami Laboratory,
The Port and Harbour Research Institute,
Ministry of Transport

Mr. Toru YOKOTA, (Soil exploration and structural design)
Civil Engineer, OCDI

Mr. Yukio KOMORI, (Hydraulic and coastal engineering)
Civil Engineer, OCDI