PAKISTAN
REPORT OF PHITTI CREEK PORT CONSTRUCTION PROJECT

APPENDIX

FEBRUARY 1973

OVERSEAS TECHNICAL COOPERATION AGENCY
GOVERNMENT OF JAPAN

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1-1 General

1) General Description of Pakistan

Pakistan is divided into West Pakistan and East Pakistan and they are geographically separated from each other at a distance of over 1,000 miles with the Indian sub-continent sandwiched between the two. Pakistan has a total land area of 365,403 sq. miles, of which West Pakistan accounts for 85% or 310,403 sq. miles and East Pakistan accounts for the remaining 15% or 55,126 sq. miles.

The climate in Pakistan diversifies ranging from the wet tropical climate to the most dried climate. In West Pakistan the dry continental climate prevails and there is very little rain. In East Pakistan, meanwhile, the wet tropical climate is prevalent featured by much rain.

The population, according to the latest census (1961), was 94 million and that for the year 1969/70 is estimated at 132 million. This figure consists of 60 million in West Pakistan and 72 million in East Pakistan, presenting an extraordinary phenomenon that the population in East Pakistan with an area equivalent to 1/6 of the area of West Pakistan exceeds the population in the latter.

The GNP in Pakistan for the year 1969/70 was 7,500 Crore Rs (1,570 crore) and its average annual growth rate for the past 10 years is 5.1%.

Per capita GNP for the year 1969/70 was 570 Rs ($119), ranking in the considerably low class compared with other countries.

Table 1. Gross National Product

(In crore rupees)

	1959-60	1960-61	1961-62	1962-63	1963-64	1964-65	1965-66	1966-67	1967-68	1968-69	1969-70
Primary Industry	1,682.3	1,736.7	1,827.1	1,837.2	1,952.8	1,989.2	2,021.2	2,043.7	2,264.9	2,333.9	2,475.1
Agriculture	1,675.3	1,728.5	1,818.3	1,827.2	1,941.1	1,976.1	2,007.5	2,029.6	2,250.4	2,318.8	2,459.3
Mining & quarrying	7.0	8.2	8.8	10.0	11.7	13.1	13.7	14.1	14.5	15.1	15.8
Secondary Industry	358.1	405.8	461.2	505.9	604.5	663.2	677.4	739.8	793.3	895.8	925.8
Manufacturing	293.0	326.2	363.0	397.3	435.1	471.1	494.9	534.6	567.6	615.3	653.0
Construction	65.1	79.6	98.2	108.6	169.4	192.1	182.5	205.2	225.7	280.5	272.8
Tertiary Industry	1,096.1	1,157.2	1,207.1	1,275.6	1,359.3	1,424.1	1,564.7	1,694.6	1,754.6	1,856.0	1,979.3
Electricity, gas, water and sanitary services	10.7	12.0	12.5	17.3	23.3	28.3	32.5	34.2	37.3	42.0	46.4
Total (Gross Domestic Product)	3,147.2	3,311.7	3,507.9	3,636.0	3,939.9	4,104.8	4,295.8	4,512.3	4,850.1	5,127.7	5,426.6
Net factor income from rest of the world	(-) 3.3	(-) 3.6	(-) 3.6	(-) 7.6	(-) 11.5	(+) 1.0	(+) 1.0	(+) 1.0	(+) 1.0	(+) 1.0	(+) 1.0
Gross national Product	3,143.9	3,308.1	3,504.3	3,628.4	3,928.4	4,105.8	4,296.8	4,513.3	4,851.1	5,128.7	5,427.6

Note: 1959-60 cost

Table 2. Changes in Industrial Structure

	1959-60	1960-61	1961-62	1962-63	1963-64	1964-65	1965-66	1966-67	1967-68	1968-69	1969-70
Primary Industry	53.6%	52.5%	52.2%	50.5%	49.6%	48.4%	47.1%	46.2%	46.8%	45.8%	45.8%
Agriculture	53.4%	52.3%	51.9%	50.2%	49.3%	48.1%	46.8%	45.9%	46.6%	45.6%	45.6%
Mining and quarrying	0.2%	0.2%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.2%	0.2%	0.2%
Secondary Industry	11.3%	12.2%	13.0%	13.9%	15.3%	16.0%	15.7%	16.3%	16.3%	17.3%	17.0%
Manufacturing	9.3%	9.8%	10.3%	10.9%	11.0%	11.4%	11.5%	11.8%	11.7%	11.9%	12.0%
Construction	2.0%	2.4%	2.7%	3.0%	4.3%	4.7%	4.2%	4.5%	4.6%	5.4%	5.0%
Tertiary Industry	34.8%	34.9%	34.4%	35.1%	34.5%	34.7%	36.4%	37.5%	36.2%	36.1%	36.4%
Electricity, gas, water and sanitary services	0.3%	0.4%	0.4%	0.5%	0.6%	0.7%	0.8%	0.7%	0.7%	0.8%	0.8%
Total Gross Domestic Product	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Agriculture still has a large share in the industry and accounted for 46% of the GNP as of the year 1969/70. When compared to 10 years ago, however, the share of agriculture has decreased considerably. Mining and quarrying production is very small and accounts for less than 1% of the GNP. Although the manufacturing and construction are the fastest growing industries, their shares in the total production are small with 12% for manufacturing and 5% for construction. Their contribution to the growth of the GNP is still small compared with that of agriculture.

The tertiary industry accounts for 36% of the GNP and there have not been any significant changes in its share in the past 10 years. Judging from the above it may be said that Pakistan is still in the stage of an agricultural country but is in the progress of transforming into an industrial nation because of the steady progress of changes in her economic structure from the primary industry to the secondary industry.

It may well be said that such progress in the industrial expansion began after her separation from India and independence in 1947. Since independence the "Six-Year Plan" (1951/57) introduced in 1950 as part of the Colombo Plan was the first development plan on the national scale. Thereafter, the "First Five-Year Plan" (1956/60), the "Second Five-Year Plan" (1961/65) and the "Third Five-Year Plan" (1965/70) have been worked out one after another and have played the leading role in the economic development of Pakistan. In addition, the "Fourth Five-Year Plan" (1970/75) came into effect in July 1970 with the aim of rapid expansion of the economy.

2) Outline of West Pakistan

West Pakistan borders with India in the east and southeast, with China in the north, with Afghanistan in the northwest and with Iran in the west. If faces the Arabian Sea in the south.

In the north it is cut off from China by the 20,000 feet class Trans-Himalayas and Karakoram Ranges. The basin of the Indus River in the east forms a vast plains which extends to the Arabian Sea. The west part of the lower reaches of the Indus forms the Plateau of Baluchistan and dry hills traverse through highlands from north to south. In the east of the lower Indus, the Tar desert crosses the border and extends to the inside of India.

Fig. 1. Administrative Regions

With the adoption of provisional administrative division in Pakistan in 1970, West Pakistan was divided into four provinces, namely, Sind, Panjab, N.W.F. and Baluchistan. Of the four provinces, Sind and Panjab are blessed with favorable natural and geographical conditions and most of the population and economic activities are concentrated on these two provinces. Other two provinces are the regions where such unfavorable conditions as the dry climate, mountains and deserts must be overcome for their development (see Fig. 1).

Table 3. Comparison between W.P. and E.P.

	Unit	West Pakistan	East Pakistan	Total	Remarks
1. Population (1969-70)	Million	59.9	72.4	132.3	
2. Agriculture Products (1969-70)					
1) Rice	thousand tons	2,300	11,543	13,843	
2) Wheat	thousand tons	7,000	75	7,075	
3) Sugar cane	"	21,860	8,000	29,860	
4) Jute	"	-	7,000	7,000	
5) Cotton	"	3,000	15	3,015	
6) Tea	"	-	70	70	
3. Industrial Products (1969-70)					
1) Sugar	thousand tons	600	130	730	
2) Cotton yarn	Mill. lbs.	570	130	700	
3) Jute goods	thousand tons	15	530	545	
4) Fertilizer (in terms of nutrient)	"	140	55	195	
5) Cement	"	3,200	86	3,286	
6) Oil	"				
7) Iron & Steel		60	90	150	
8) Machinery & Equipment	Mill. Rs.	1,077	189	1,266	

According to the 1961 census, the city with a population of over 100,000 numbers 12 in West Pakistan (Note 1). The largest city in West Pakistan is Karachi with a population of 191 million (estimated at 340 million in the year 1969/70). Next to Karachi are Lahore (with a population of 1.3 million), Hyderabad (with a population of 430,000) and Lyallpur (with a population of 430,000) in that order. Besides, the capital city of Islamabad is being shaped up as a city of politics.

West Pakistan, although its population is smaller than that of East Pakistan, has an overwhelming share in the economic activities (see Table 3). It may be said that the greater part of industrial production in Pakistan concentrates on West Pakistan, though an overall comparison cannot be made because of lack of industrial production statistics.

(Note 1) Assuming the growth rate of population in these cities after 1961 is 3.3%, the mean value of the growth rate of 4% for Karachi City and the national average of 2.7%, the population in each of these cities has probably grown to over 140,000 by now.

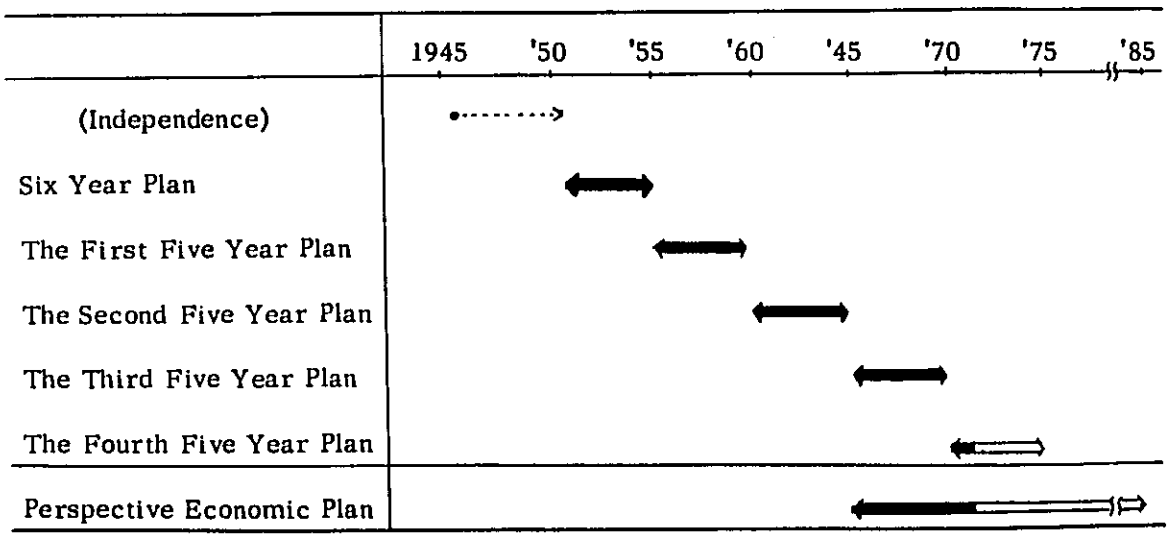
1-2 Outline of Economic Plans

The economic development in Pakistan is being pushed on in accordance with the "Fourth Five-Year Plan" which started in the year 1970/71. This "Fourth Five-Year Plan" is given a status of short-range plan under the long-range economic outlook backed by the "Perspective Economic Plan" with the target set for 1985.

Before describing the outline of the "Fourth Five-Year Plan" and the "perspective economic plans which have been implemented so far will be touched on briefly.

As already mentioned in the previous three sections, the "Six-Year Plan" which began in 1950 and the ensuing first, second and third Five-Year Plans have been implemented successively since independence in 1947 (see Table 4). The outline and the process of implementation of each plan are shown below.

Table 4. Executive Processes of Economic Plans



1) Six-Year Plan (July 1951 ~ June 1956)

This plan was worked out in 1950 as part of the Colombo Plan with the emphasis placed on the development of such infrastructures as communication, power and irrigation facilities and the scale of the plan was relatively small. However, as it became necessary to expand the scope of the plan following the outbreak of the Korean War and the expansion of the world economy, the "Two-Year Plan" attaching importance to the promotion of industrial development was worked out. This revised plan substantially replaced the "Six-Year Plan" placing emphasis on the development of consumption goods manufacturing industry and steel industry and improvement of transport and communication facilities centering on marine transportation.

The termination of the Korean War, however, resulted in the deterioration of her balance of payments position. In addition, the drought which hit the country in the early 1950s, coupled with the negligence of agricultural sector in the Six-Year Plan, brought about a serious food shortage. Under such circumstances, there was a growing need for a new economic plan.

2) First Five-Year Plan (April 1955 ~ March 1960)

This plan was announced in 1956, the year following the start of the plan, and was aimed at maintaining the balance between the expansion of agricultural production and industrial development, as well as developing water and power resources on condition that the aforementioned balance was maintained. To attain the above object, the following four objectives in the economic growth were established.

(a) The GNP is to be increased by 15% and per capita GNP is to be increased by 7%. However, the increase of population is to be held at 1.4%.

(b) Food production is to be increased by 9% and agricultural production is to be increased by 15 ~ 20%.

(c) Industrial production is to be increased by 60%.

(d) Employment opportunities for two million people are to be created.

These objectives, however, resulted in the remarkable expansion of the industrial sector exceeding the planned level and serious lag in the agricultural sector. Against the rapid expansion of industrial production aided by expected large private investment, the standstill of agricultural production which accounts for more than 1/2 of the GNP accelerated the unbalance in the economy.

Consequently, the growth of GNP did not exceed the rate of 11% and because of the increase of the population by more than 12%, per capita GNP decreased slightly instead.

3) Second Five-Year Plan (April 1960 ~ 1965)

Following the coup d'etat in 1958, the Second Five-Year Plan was mapped out by a military government.

The objectives of the second plan were:

(a) The GNP is to be increased by 24%.

(b) Per capita income is to be increased by 12%.

(c) Grain production is to be increased by 60%.

(d) Industrial production is to be increased by 60%.

(e) Foreign currency reserves is to be increased by 15%.

(f) Employment opportunities for three million people are to be created.

The outstanding features of this plan were (1) that emphasis was placed on agricultural production in the government investment sector to achieve self-sufficiency in food production and (2) that measures were taken to encourage private capital investment.

Under the plan, the GNP increased by 30%, food production by 27%, industrial production by 61% and foreign currency reserves by 40%, thus not only achieving the target in each sector but also surpassing the goal by a large margin in some sectors. Attainment of the target in agricultural sector may be taken as a major difference between this plan and the previous two plans.

4) Third Five-Year Plan (1965/70)

The Third Five-Year Plan was worked out as the first phase of the Perspective Economic Plan covering a period of 20 years, which will be described at a later stage. The objectives of this plan were:

(a) The GNP is to be increased by 37% at the minimum at an average annual growth rate of 5%.

(b) Exports are to be increased by 57% within 5 years at an annual growth rate of 9.5%.

(c) The GNP in East Pakistan and West Pakistan is to be increased by 40% and 35% respectively at the minimum.

(d) Employment opportunities for 5.5 million people are to be created to absorb the increase of manpower during the five-year period and at the same time decrease the number of unemployed to less than 1/6.

(e) Key industries that are capable to supply raw materials to high level processing industries are to be promoted.

Compared with the Second Five-Year Plan, this plan placed the emphasis on the improvement of capital output through emphatic development of heavy industry and promotion of public work. However, the drought in West Pakistan and the floods in both West and East Pakistans made it necessary to change the objective of the plan to the agriculture-centered one halfway. As a result, the growth rate of industrial production failed to attain the goal.

1-3 Outlook for Major Economic Activities

1) Perspective Economic Plan

The Second Five-Year Plan had no official views as to the prospect of economic growth for the period following the planned project period. This was because the Pakistani Government knew from its experience in working out economic plans the difficulty of setting a long-range target exceeding the planned project period.

However, the fact that the Second Five-Year Plan had attained the goal and even surpassed it was an indication of the existance of background for formulating long-range plans as a basis of mapping out individual plans under long-range economic forecast. Consequently, the Pakistani Government, in parallel with the formulation of the Third Five-Year Plan, worked out the Perspective Economic Plan covering a period of 20 years from 1965 to 1985 to make definite the position of the Third Five-Year Plan from the universal point of view.

As shown in Table 5, the Perspective Plan put up the following objectives.

(a) The GNP is to be increased to the level four times the level of 1965 and per capita income is to be increased twofold by 1985.

(b) Full employment is to be realized.

(c) Equilibrium of income between West Pakistan and East Pakistan is to be established.

(d) Literacy of all people is to be attained.

(e) Lowering dependency on foreign aid is to be executed.

For the attainment of the above objectives, the GNP had to be increased by 7.2% annually on the average, gross investment by 8.5%, gross domestic savings by 11.4% and exports by 7.9% during the period of 20 years from 1965 to 1985.

Table 5 Basic Framework of Pakistan's Long-term Growth 1965/85 in 1964/65 Prices

(Million rupees)

	1965	1970	1975	1980	1985	1965/85 (annual compound rate of growth) %
A. Key Magnitudes						
1. Gross national product (market prices)	45,540	62,765	89,815	129,690	187,300	7.2
2. Gross investment	8,400	12,700	19,180	28,650	42,800	8.5
3. Gross domestic savings	4,710	8,515	15,180	26,150	40,800	11.4
4. External resources	3,690	4,185	4,000	2,500	2,000	-3.0
5. Exports	3,050	4,800	7,300	11,000	14,000	7.9
6. Imports	6,990[4]	8,985	11,300	13,500	16,000	4.2
B. As a % of the GNP						
1. Gross investment	18.4	20.2	21.4	22.1	22.9	
2. Gross domestic savings	10.3	13.6	16.9	20.2	21.8	
3. External resources	8.1	6.6	4.5	1.9	1.1	
4. Exports	6.7	7.6	8.1	8.5	7.5	
5. Imports	15.3	14.2	12.6	10.4	8.6	
C. Key Assumptions						
1. GNP growth rate (%)'	5.2	6.5	7.3	7.5	7.5	7.2[2]
2. Population growth rate (%)'	2.6	2.7	2.8	2.6	2.1	2.6[2]
3. Marginal rate of savings (%)'	22	22	25	28	25	25[2]
4. Capital-output ratio (gross)[1, 3]	2.8	2.9	2.9	2.9	3.0	2.9[2]
5. Marginal propensity to import (%)'	–	12	9	6	4	6[2]

Notes: 1. In the preceding 5 years.
2. In the preceding 20 years.
3. Assumping no time-lag between investment and output.
4. These imports were financed to the extent of Rs. 250 million by drawing upon foreign exchange reserves.

Sources: Government of Pakistan, Third Five-Year Plan, 1965/70.

2) Fourth Five-Year Plan

The Fourth Five-Year Plan was given official approval by the National Council and put into effect in February 1970. The basic policy of this plan was as follows:

(a) Expansion of the economy through maximum and efficient utilization of natural resources and manpower resources.

(b) Rectification of income differential between regions and within the region.

(c) Self-sufficiency of economy in most important sectors.

(d) Harmony between social development and economic growth.

In line with the above policy, the plan with the following objectives is now pushed forward vigorously.

(a) The GNP is to be increased by at least 6.5% annually and per capita income in the year 1974/75 is to be increased to 660 Rs.

(b) Income differential between regions is to be rectified at the earliest opportunity.

(c) Per capita consumption of grains is to be increased from the present 15.5 ounces to 17 ounces and rice production and wheat production are to be increased to 5.7 million tons and 2.6 million tons.

(d) Export is to be increased at the rate of at least 8.5%.

(e) Export is to be increased at the rate of at least 8.5%.

(f) Up to 1,975,850,000 tons of steel, one million tons (nutrient tons) of fertilizer, 4 million tons of cement, 280 million cubic feet of natural gas, and transport equipment and industrial machinery worth 1,100 Rs are to be additionally produced.

Though the plant put up objectives numbering 20 in all, East Pakistan was hit a disastrous flood immediately after the start of the Fourth Five-Year Plan and for this reason, it may be said that the future of Pakistan is not so rosy even with its potentialities for economic development including manpower and untouched natural resources.

Major economic indicators of the Fourth Five-Year Plan are shown in Table 6.

Table 6. Major Economic Indicators of the Fourth Five-Year Plan

	1969-70	1974-75	Remarks
	M.Rs	M.Rs	
1. GNP	78,600	109,000	at current market price
	Mil.	Mil.	
2. Population	132.3	151.5	
West	59.9	68.4	Current Price
East	72.4	83.1	
	Rs	Rs	
3. GNP per capita	567	720	
4. Trade	Mil.Rs	Mil.Rs	
(1) Import	7,240	9,700	
(2) Export	4,250	6,390	at current price
	Mil.	Mil.	
5. Labour force	42.3	48.8	
6. Crop production	thousand tons	thousand tons	
(1) Wheat	7,075	9,700	
West	7,000	9,500	
East	75	200	
(2) Rice	13,843	19,500	
West	2,300	3,700	
East	11,543	15,800	
7. Industry production			
(1) Cotton yarn	Mil.lbs 700	Mil.lbs 1,100	
West	570	700	
East	130	400	
	thousand tons	thousand tons	
(2) Fertilizer	195	1,425	
West	140	800	
East	55	625	
(3) Cement	3,286	7,300	
West	3,200	6,300	
East	86	1,000	
(4) Steel	150	750	
West	60	500	
East	90	250	

2. Present State and Outlook for Port-Oriented Industries

2-1 General

Although manufacturing industry has a small share of 13% in the GNP in the year 1969/70, it shows a remarkable growth rate as compared with agriculture and the tertiary industry. It may be said, therefore, that Pakistan is heading for industrialization. The distinctive feature of manufacturing industry in Pakistan is that large scale industries show a specially high growth rate.

Because of lack of statistics on the industrial production by industry type, a comparison of production between each industry cannot be made, but it is certain that textile industry centering on cotton yarn spinning plays a central role in the industry of Pakistan. Besides, such industries as fertilizer, cement and food industries are also expanding their production scale, but each of them is a light industry of the resources-dependent type which processes raw materials supplied domestically.

Though such key industries as petroleum refining and steel industries are also located, they operate on a small scale and have not reached the level as to satisfy domestic demands. High level processing industries including machinery manufacturing and chemical industry are still in the incipient stage and supply of these items depends mainly on imports from other countries.

As West Pakistan has a greater share of economic activities and is abundant in natural resources compared with East Pakistan, a greater part of industrial production in Pakistan is turned out in West Pakistan. Table 6 shows a comparison of part of key industrial products between West and East Pakistans.

2-2 Present State of Major Industries in West Pakistan

The following is a brief description of the present state of industries related to the harbour development.

1) Oil Refining

Oil refining in West Pakistan began in 1961 for the first time by importing crude oil from other countries. The amount of oil refined in the year 1969/70 was 3.03 million tons and almost no petroleum products are being imported. At present two refineries are operating in the Rande district of Karachi. The combined production capacity of the two refineries is 4.8 million tons and one of the refineries has been authorized to expand its capacity by 1.5 million tons.

2) Steel Industry

Steel industry in Pakistan has made little progress in the past because of the low grade and small amount of iron ore deposits and additionally of the low quality of coal available.

For this reason, there have been no steel mills of a significant size located in West Pakistan and only a handful iron works with small electric furnaces are now in operation. In East Pakistan, meanwhile, Pakistan's largest steel mill has been established in Chittagong under the Second Five-Year Plan and the capacity of the mill is now being expanded to 250,000 tons.

3) Fertilizer Industry

Fertilizer produced in West Pakistan mostly nitrogenous fertilizer which uses natural gas as raw material and phosphatic fertilizer is produced only in very small quantity from imported sulfur and phosphate.

The output in the year 1969/70 was 140,000 tons (nutrient tons), accounting for 1/3 of the total demand of 340,000 tons with the remainder depending on imports.

The Fourth Five-Year Plan aims at meeting most of demand for fertilizer by domestic supply and for this reason, construction of two urea fertilizer plants (340,000 tons in capacity) in West Pakistan has been approved by the government. Besides, construction of a mono ammonium phosphate plant with a capacity of 120,000 tons has also been authorized. In addition, construction of a nitro phosphate plant with a capacity of 311,000 tons and an ammonium nitrate plant with a capacity of 322,000 tons is also envisaged under the Fourth Five-Year Plan.

4) Cement Industry

Cement industry is one of the key industries in Pakistan and the production of cement in West Pakistan in the year 1969/70 amounted to 3.2 million tons. Because of the abundant raw material limestone resources in West Pakistan, there are many cement plants operating in this part of the country. The aggregated production capacity is 3.5 million tons at present. Expansion and modernization of cement plants in Rohri and Wah and construction of a new plant in Sibi are now in progress.

5) Cotton spinning mills

Cotton spinning industry is most advanced sector of private enterprises and holds an important position as the center of industries in Pakistan.

The output of cotton yarn in West Pakistan in the year 1969/70 amounted to 570 million lbs., far exceeding the goal of 486 million lbs. set under the Third Five-Year Plan. On the other hand, the output of cotton cloth in the year 1968/69 amounted to 710 million yds. It may be said, therefore, that most of the production of yarn and cloth in Pakistan is accounted for by West Pakistan.

6) Shipbuilding

When the fact that the country is geographically divided in West Pakistan and East Pakistan is taken into consideration, shipbuilding industry is a very important industry to Pakistan.

There are large shipyards in Karachi, Charuna and Naraya Ganj and many small shipyards in various parts of the country with a total capacity of about 54,000 D/W. The shipyard in Karachi was constructed in 1964 and launched an ocean-going vessel of 13,000 DWT in 1966.

It seems that no construction of a new shipyard is included in the current five-year project.

2-3 Outlook for Industries – Mainly Port-Oriented Industries

1) Goal under the Fourth Five-Year Plan

Under the Fourth Five-Year Plan the outlook for port-oriented industries is as follows.

(a) Oil Refining

In the year 1974/75, the capacity of one of the existing oil refineries in the Korangi district will be expanded from the present 0.5 million tons to 2.0 million tons and additionally, a new refinery with a capacity of 2.0 million tons will be constructed in West Pakistan.

(b) Steel Industry

With a view of increasing steel production to 7.5 million tons in the year 1974/75, a twofold increase over the year 1969/70, construction of a new steel mill is planned for the waterfront industrial district in West Pakistan with the cooperation of the USSR government. The proposed steel mill is expected to have a capacity of 750,000 tons at the final stage of the current Five-Year Plan and is expected to have an ultimate capacity of one million tons.

Besides, it seems that a technical and economical study is being made on the feasibility of constructing a steel mill at Karabah in West Pakistan, which will use domestically produced iron ore as raw material. However, the plan seems to be encountering major financial problems.

(c) Fertilizer Industry

Production of fertilizer is expected to reach 1.8 million tons (nutrient ton) in the year 1974/75, a twofold increase over the year 1969/70. This will meet most of the demand for fertilizer in West Pakistan, but part of phosphatic fertilizer and all of potassic fertilizer will still have to be imported.

For this reason, approval has been given for construction of two urea plants so far. Each of these plants is to have a capacity of 340,000 tons. Besides, construction of a mono ammonium phosphate plant with a capacity of 120,000 tons has been authorized. In addition, the government plans construction of a nitrophosphate plant with a capacity of 311,000 tons and an ammonium nitrate plant with a capacity of 322,000 tons as compound fertilizer plant. These plants are expected to be in commercial operation within the period of the Five-Year Plan.

(d) Cement

The production goal for the year 1974/75 is 6.3 million tons, a two fold increase over the year 1969/70. This capacity is sufficient for not only meeting demands in West Pakistan but for exporting to East Pakistan and other countries. For this purpose, there is a plan for construction of a large cement plant with an annual capacity of 1.8 million tons specifically for export purpose.

(e) Petrochemical

Under the Fourth Five-Year Plan the capacity of the existing polyethylene plant is to be increased from the present 5,000 tons to 15,000 tons and ethylene is to be supplied from petrochemical plants in the Korangi district. Besides, approval has been given by the government for the construction of a petrochemical plant which will get naphtha from oil refineries in Karachi. The scope of this plant is as follows:

i) Naphtha Cracker: 47,000 tons of ethylene. However, initial capacity is to be 24,500 tons and the ultimate capacity is to be 60,000 tons.

ii) Polyethylene Plant: 10,000 tons

iii) PVC Plant: 15,000 tons

Vinylchloride monomer to feed PVC plant: 16,500 tons
Chlorine Plant to feed VCM plant: 11,000 tons

iv) Polypropylene Plant: 5,000 tons

v) Dodecy Benzene Plant: 5,000 tons

Besides, approval has been given for construction of a gas chemical plant which will use natural gas as raw material for the production of 320,000 tons of urea for specifically export purpose. This chemical plant is expected to start commercial operation at the end of the Fourth Five-Year Plan or at the beginning of the Fifth Five-Year Project.

(f) Cotton Spinning

The production goal for the year 1974/75 is 700 million lbs. of cotton yarn, a two-fold increase over the year 1969/70. To attain this objective, however, additional 70,000 units of spinning machine are required. When there is a fair prospect of export of cotton yarn or cloth, additional expansion of spinning industry will be possible.

For further information, the present state and the goal of the Third Plan and the goal of the Fourth Plan on the major industries in West Pakistan are given in Table 7.

Table 7. Benchmarks and Physical Targets for the Third and Fourth Five-Year Plan Manufacturing Sector-West Pakistan

Industries/Item	Unit	Third Plan	Fourth Plan		Percentage increase over 1969-70
		Targets 1979-70	Bench-marks 1969-70	Targets 1974-75	
1. Food Manufacturing					
(i) White sugar	000 tons	410	600	750	25
(ii) Vegetable Ghee	000 tons	115	151	275	82
(iii) Cigarettes	Th.Mill. Nos.	18.5	22	40	82
2. Manufacture of Textiles					
(i) Cotton Yarn	Mill.lbs	486	570	700	23
(ii) Jute Goods (Hessian/sacking)	000 tons	32	15	40	167
(iii) Broad Loom Jute Products	000 tons	24	-	-	-
3. Paper and Board					
(i) Writing and printing paper	000 tons	35	11	100	810
(ii) Boards all kind	000 tons	70	44	100	127
(iii) Newsprints and Mechanical Papers	000 tons	35	-	10	-
4. Chemical Industries					
(i) Fertilizer (in terms of nutrient)	000 tons	338	140	800	471
(ii) Soda Ash	000 tons	136	70	160	129
(iii) Caustic Soda	000 tons	55	28	120*	330
(iv) Sulphuric Acid	000 tons	320	60*	630*	320
(v) Petrochemical	000 tons	178	10	60	500
5. Non-Metallic Minerals					
(i) Cement	000 tons	4,000	3,200	6,300	97
6. Basic Metals					
Steel	000 tons	900	60	500	733
Steel Furnaces	000 tons	-	60	250	317
7. Machinery and Equipment					
(i) Machinery other than electric Machinery	Mill.Rs.	N.A	259	693	168
(ii) Electric Machinery, apparatus, appliances	Mill.Rs.	N.A	359	537	50
(iii) Transport equipment	Mill.Rs	N.A	359	536	49

* Includes captive capacity

2) Prospect of the Economy under the Perspective Economic Plan

The Perspective Economic Plan forecasts the industrial growth in Pakistan in 1985 as follows.

In Pakistan, agriculture has the largest share in the economic structure and the growth of agricultural production has been supporting the economic expansion in the country so far. Under the plan, however, the leading role of the economic growth in the future is to be played by manufacturing sector.

As a result, the growth rate of manufacturing industry is estimated to reach a high 10.2% which is higher than the growth rate of 7.2% for the GNP, against the growth rate of 5.6% (1965/85) for agriculture.

As shown in Table 8, special emphasis is placed on the production of intermediate products among manufacturing industry and a growth rate of 13.7% (1965/85) is predicted. Intermediate products include basic metal products, raw and processed chemical materials, non-ferrous metal products and petro derivatives.

Following this, a growth rate of 10.0% is forecasted for investment goods, which is an indication of the policy of expanding basic sector of manufacturing industry.

As a result, the share of manufacturing industry in all industry is expected to rise from 11% in 1965 to 27% in 1985.

2-4 Discussion

The description in the preceding section has been centered on the present state and the outlook for industry in all Pakistan. Hereinafter, discussion will be centered on the prospect of industry in West Pakistan.

Table 8. Growth Pattern in the Perspective Plan
(Million Rs.: 1964/65 prices)

	1965-	1970	1985	Annual compound rate of growth (1965-85) %
1. Agriculture	21,055	26,870	62,500	5.6
2. Manufacturing	5,195	8,365	36,500	10.2
a) Consumer goods	(3,235)	(4,515)	(13,000)	(7.2)
b) Intermediate products	(1,620)	(3,300)	(21,200)	(13.7)
c) Investment goods	(340)	(550)	(2,300)	(10.0)
3. Other sectors	17,115	24,165	75,300	7.7
	43,365	59,400	174,300	7.2

Agriculture will still hold a large share in the future economy of Pakistan, but its growth rate will be lower than that of manufacturing industry. Manufacturing industry will play a leading role in the economic expansion of the country in the future.

Manufacturing industry in both West and East Pakistans has so far been centered on such light industry as cotton spinning and cement manufacturing and no significant development of heavy and chemical industries has been witnessed except for fertilizer industry and oil refining. In order for the manufacturing industry to play a leading role in the economic expansion of the country, it is essential to improve the existing economic structure and place emphasis on the expansion of process industry which turns out products with high added-value.

For this purpose, it is necessary to introduce and promote such key industries as steel industry, oil refining and petrochemical industry as well as to raise the level of the existing light industry and promote its productivity.

Steel industry and oil refining industry are the industry which lack sufficient domestic supply of raw materials in all Pakistan including West Pakistan and must depend on foreign markets for supply of raw materials. These industries require large plant facilities. There is a world-wide tendency among these process industries to increase their size to promote production efficiency by making the best of the merit of large facilities. Table 9 shows world's major plants of oil refining, steel industry and petrochemical industry. The table shows the highest production capacities of 500,000 BPSD for oil refining, 10 million tons/year of crude steel for steel industry and 880,000 tons of ethylene for petrochemical industry. As it is advantageous for these industries to be located at one specific place for supply of raw materials and joint use of public facilities, there often are cases in which a combinat is formed by industries closely related each other. The typical example of this combinat is a petro-petrochemical combinat which is a combination of oil refineries and petrochemical plants.

On the other hand, the efficiency of transport is a major question together with the improvement of production techniques for the reduction of production cost. Where the supply of raw materials is dependent on imports, savings of marine transport cost of raw materials and inland transport cost of finished goods must be attempted.

In the marine transport sector, there is an increasing tendency to increase the size of such carriers as oil tankers and ore-carriers. An oil tanker of 470,000 DWT and an ore-carrier of 270,000 DWT are now under construction.

Inland transport of finished goods is unavoidable in West Pakistan where consumer districts are distributed in and around Karachi City and extends to the inland area along the Indus river.

Therefore, the saving of transport cost of raw materials is the only alternative for the industries which entirely depend on import for the supply of raw materials to reduce production cost. It is advisable, therefore, to locate these industries on waterfronts so that large vessels may be used for transporting raw materials and inland transport of raw materials can be avoided to the extent possible.

To materialize the establishment of these large scale process-industries in West Pakistan, it is essential to secure a large lot of land with sufficient space on waterfront which provides a good linkage to inland transport system and allows the entry of large vessels and form a new combinat. This combinat is a new type which cannot be found in the present Pakistan's industries and is expected to play a key role in the economic development of Pakistan.

Establishment of such a combinat, however, cannot be materialized in disregard of Pakistan's own economic, geographical and historic characteristics. Therefore, it is important to plan a waterfront industrial complex most suitable to West Pakistan by fully taking into account these characteristics.

Table 9. World's Largest Plants

Industry	Capacity	Name of Plant (Location)
Oil refining	500,000 BPSD	Shell (Rotterdam; Euro-port)
Petrochemical	Etylene 880,000 ton/day	(Texas City, U.S.A.)
Steel	Crude Steel 10,000,000 ton/year	Shin Nittetsu Iron & Steel Ltd. Fukuyama Factory (Japan)

3. Present and Future of Cargo Traffic Through Port

3-1 Present State and Changes in Cargo Traffic through Port

As the port of Karachi is the only existing port in West Pakistan, the trend of cargo traffic through port in West Pakistan is represented by the cargo traffic through Karachi Port.

The volume of cargo traffic through Karachi Port in the year 1974/75 reached 9.34 million tons. In the past ten years the volume of cargo has increased by two-fold, but it shows a gradual increase following the year 1966/67. Of the total volume of cargo traffic through port, foreign trade cargo accounts for 7.48 million tons or 80% and coastal cargo accounts for 1.86 million tons or 20%. In the past, foreign trade cargo accounted for 80 ~ 90% of the total volume of cargo, but in recent years there has been a remarkable growth of coastal cargo and the ratio of foreign trade cargo shows a sign of decline.

A study on the composition of cargo shows that foreign trade is heavily inclined to import and that domestic trade is inclined to export. More specifically, in the foreign trade cargo section, while the volume of export cargo is 1.86 million tons, that of import cargo shows a high figure of 5.61 million tons. In the coastal cargo section, while the volume of export cargo is 1.54 million tons, that of import cargo is 320,000 tons or 1/5 of the volume of export cargo.

In the foreign trade cargo, the ratio of import cargo has been decreasing while that of export cargo has been increasing annually, indicating changes in trade structure of West Pakistan. For coastal cargo, on the other hand, the ratio of export has been on the increase in the past 10 years, though it cannot be said generally because of the large annual fluctuation.

The fact that the share of export cargo is increasing gradually while the share of import cargo is still large as a whole, may be interpreted as a reflection of part of Pakistan's economic policy placing emphasis on the promotion of export. (Refer to Tables 11 and 12, and Figs. 2 and 3.) Here, the cargo is broken down into oil cargo, dry bulk cargo and general cargo for comparison of cargo traffic. According to the results of cargo handling in the year 1969/70, oil cargo held the largest share amounting to 3.99 million tons (43% of all cargo), followed by dry bulk cargo amounting to 3.2 million tons (34% of all cargo). In other words, bulk cargo accounts for about 77% of the total cargo while general cargo has a small share accounting for only 23%.

Fig. 2. Changes in Cargo Traffic through Ports by Type of Trade

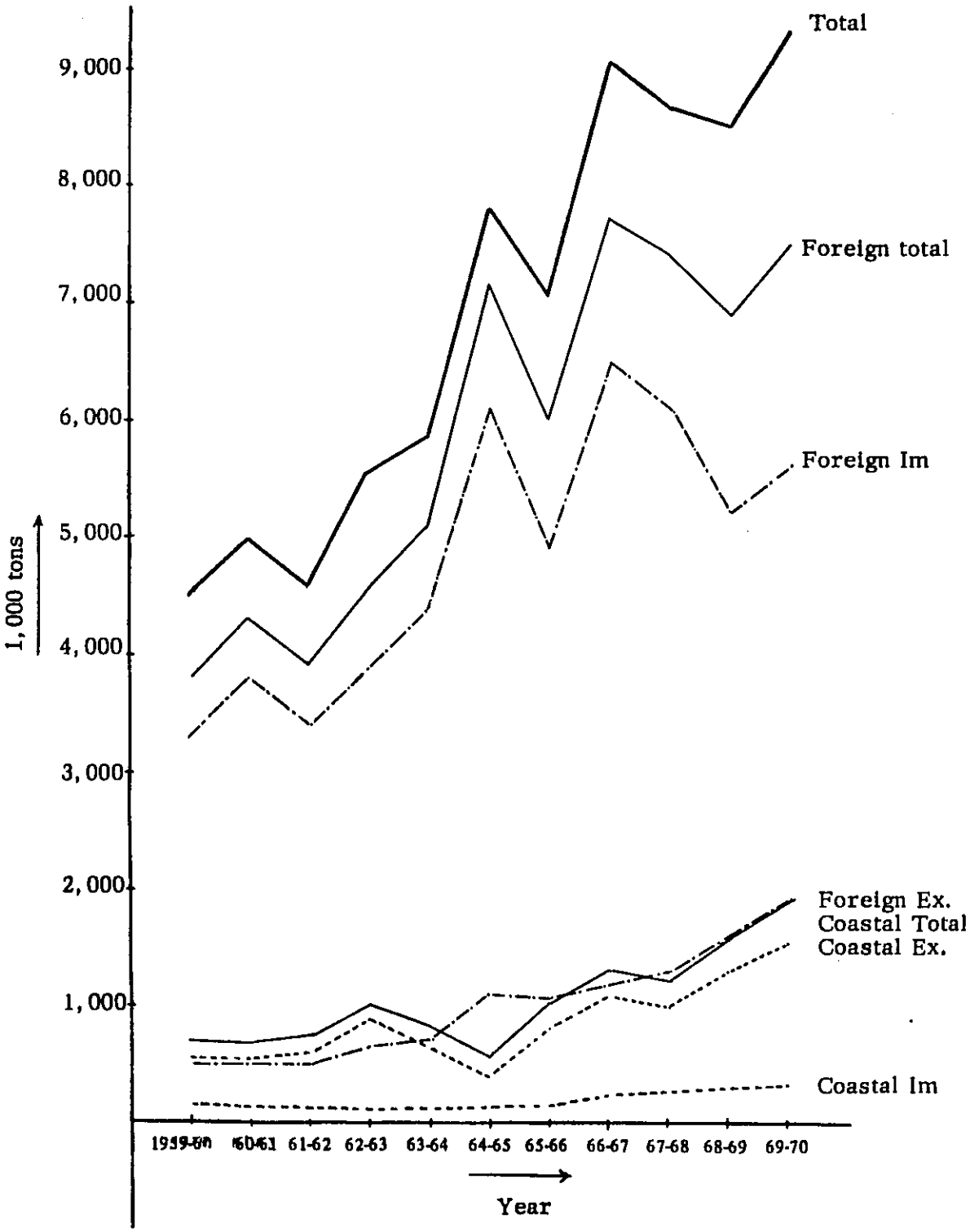


Fig. 3. Component Ratio of Cargo Traffic through Ports by Type of Trade

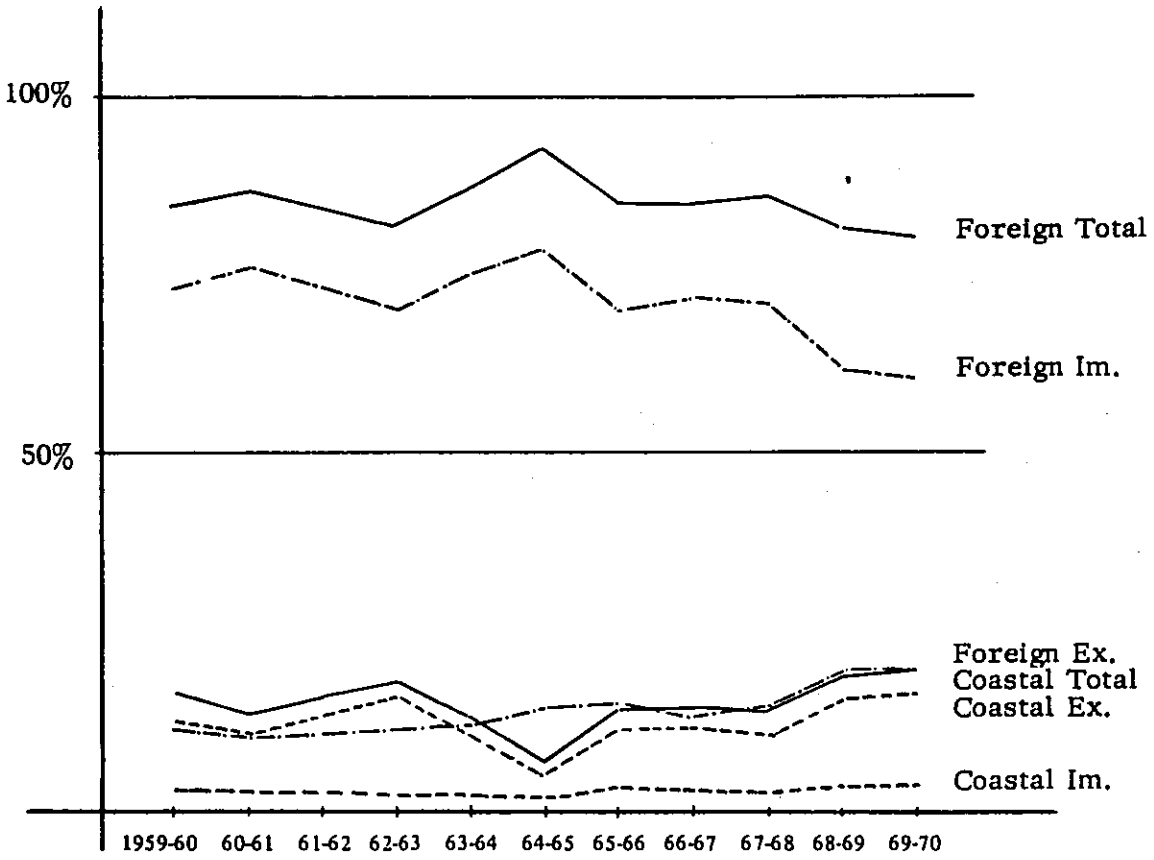
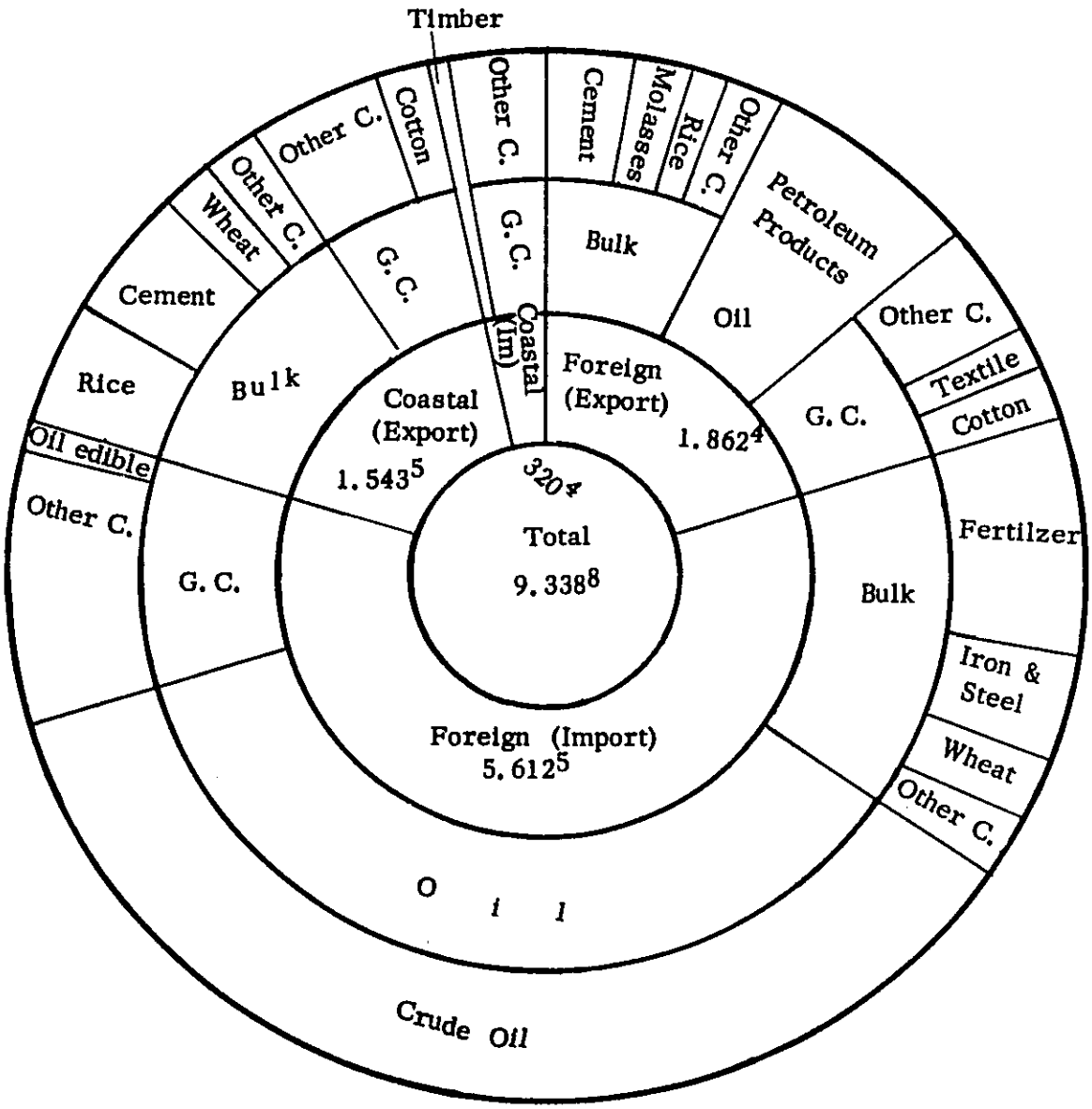


Fig. 4. Cargo Traffic through Port by Type (1969/70)



(In 1,000 tons)

Classification of cargo is shown in Table 10.

Table 10. Classification of Cargo into Bulk Cargo and General Cargo

Bulk Cargo	General Cargo
Molasses	Bones
Rice	Cotton
Sugar	Fish
Wheat	Guar gum
	Hides and skins
Coal and coke	Oil cakes
Gypsum	Tea
Oil (crude)	Vegetable oils and seeds
Salt	Wool
Cement	Chrome ore
Fertilisers	Oil (refined products)
Iron and steel (raw materials)	
	Consumer goods
	Iron and steel (finished products)
	Jute goods
	Machinery
	Paint
	Paper and board
	Sports goods
	Miscellaneous cargo

In the foreign trade cargo section, oil cargo accounts for more than 50% of all cargo and bulk cargo including dry bulk cargo accounts for about 90% of the total cargo.

In the coastal cargo section oil cargo has a small share, but against the 64%, the share of dry bulk cargo, general cargo accounts for 34%, indicating its larger share compared with foreign trade cargo section. (Refer to Table 13 and Fig. 43.) Changes in the volume of each type of cargo will be discussed hereinafter.

1) Dry Bulk Cargo

(a) Foreign Trade Cargo

Of the total of 2 million tons of foreign trade cargo in the year 1969/70, import

cargo amounted to 1.39 million tons surpassing the volume of export cargo which amounted to 610,000 tons by two-fold. However, the volume of export cargo has been on the increase annually and shows a higher growth rate than import cargo.

Fertilizer accounts for nearly 50% of the import cargo, followed by iron & steel and wheat in that order.

Of the above, import of wheat shows a tendency to decrease gradually. When self-sufficiency in wheat production is achieved in West Pakistan, there will be no import of wheat and instead there will be a shift to export. Besides, approximately 60,000 tons of wheat is imported (1969/70) as Afghanistan transient cargo.

Of the export cargo, cement tops the list accounting for 40%, followed by molasses and rice in that order. The cement industries in West Pakistan and is expected to be the central item of export in the future.

(b) Coastal Cargo

Coast cargo in the year 1969/70 totaled 1.2 million tons, of which export accounted for 1.17 million tons or 97%, showing a quite opposite trend compared with foreign cargo. This is because the supply of cement and farm products such as rice and wheat is dependent on West Pakistan due to the fact that the development of East Pakistan lags behind West Pakistan.

There are no import cargos worth mentioning and only a small quantity of lumber, which is scarce in West Pakistan, is imported.

Rice and cement each account for 35 ~ 40% of the export cargo, followed by wheat. In view of the fact that it will be some time before East Pakistan attains self-sufficiency in grain production and that production of wheat has almost stopped, supply of grains in East Pakistan will have to depend on West Pakistan for the time being.

2) Oil

(a) Foreign Trade Cargo

Of the total of 3.99 million tons in the year 1969/70, import accounted for 3.3 million tons and export accounted for 690,000 tons.

Pakistan had been importing petroleum products until the year 1962/63 because of lack of oil refineries in West Pakistan. Following the establishment of oil refineries in West Pakistan in the year 1963/64, however, import of petroleum products has since been stopped.

For export of petroleum products, part of naphtha which has small demand in West Pakistan is exported. The amount of naphtha exported will probably decrease when petrochemical industries become more active in West Pakistan.

(b) Coastal Cargo

According to the results for the year 1969/70, the volume of coastal cargo amounted to only 8,000 tons.

3) General Cargo

(a) Foreign Trade Cargo

Of the total of 1.49 million tons for the year 1969/70, import accounted for

920,000 tons while export accounted for 570,000 tons.

Import cargo has been levelling off since the year 1965/66. The main items of import are oil edible and machinery, but there are no cargo items which have a large share in the total cargo. It is characteristic that the cargo destined to Afghanistan amounted to about 110,000 tons.

Of the export cargo, textile and cotton exceed the 100,000 ton level. Other than these two items, there are no items worth mentioning.

Judging from the changes in the past, export of cotton will decrease gradually. In view of the recent trade policy of the country shifting from raw cotton to finished goods for export, export of cotton textiles will expand more rapidly than that of raw cotton.

(b) Coastal Cargo

Of the total of 760,000 tons in the year 1969/70, import accounted for 290,000 tons while exported accounted for 370,000 tons. There are no major import cargo worth mentioning and export cargo are mainly raw cotton and textiles.

Table 11. Changes in the Volume of Cargo Traffic through Ports by Type of Trade

(1,000 tons)

		1959-60	61	62	63	64	65	66	67	68	69	70
Foreign trade	Export	512.6	520.8	509.9	666.8	702.4	1,126.7	1,073.5	1,224.8	1,279.6	1,644.4	1,862.4
	Import	3,289.3	3,780.1	3,360.1	3,895.7	4,386.3	6,128.9	4,946.8	6,511.9	6,162.6	5,222.6	5,612.5
	Total	3,801.9	4,300.9	3,870.0	4,552.5	5,088.7	7,255.6	6,020.3	7,736.7	7,442.2	6,867.0	7,474.9
Domestic trade	Export	565.5	547.3	607.5	888.9	630.4	407.2	796.6	1,062.2	977.6	1,290.3	1,543.5
	Import	135.7	130.4	128.2	120.3	137.2	146.0	239.3	275.5	242.5	292.2	320.4
	Total	701.2	677.7	735.7	1,009.2	767.6	553.2	1,035.9	1,337.7	1,220.1	1,582.5	1,863.9
Total		4,503.1	4,978.6	4,605.7	5,561.7	5,856.3	7,808.8	7,056.2	9,074.4	8,662.3	8,449.5	9,338.8

Table 12. Component Ratio of Cargo Traffic through Port by Type of Trade

		1959-60	61	62	63	64	65	66	67	68	69	70
Foreign trade	Export	11.4	10.5	11.1	11.8	12.0	14.4	15.2	13.5	16.8	19.5	19.9
	Import	73.0	75.9	73.0	70.0	74.9	78.5	70.1	71.8	71.1	61.8	60.1
	Total	84.4	86.4	84.1	81.8	86.9	92.9	85.3	85.3	85.9	81.3	80.0
Domestic trade	Export	12.6	11.0	13.2	16.0	10.8	5.2	11.3	11.7	11.3	15.3	16.5
	Import	3.0	2.6	2.8	2.2	2.3	1.9	3.4	3.0	2.8	3.5	3.4
	Total	15.6	13.6	16.0	18.2	13.1	7.1	14.7	14.7	14.1	18.8	19.9
Total		100	100	100	100	100	100	100	100	100	100	100

Table 13. Changes in Cargo Traffic Itemized by Import & Export and Type

Export/Import	Foreign/Coastal	Kinds	1965-66	1966-67	1967-68	1968-69	1969-70	Remarks
Foreign	Import	Dry Bulk	1,547.7 (21.7)	2,786.4 (30.4)	2,283.7 (26.1)	1,113.8 (13.1)	1,387.6 (14.9)	
		Oil	2,529.7 (35.5)	2,823.6 (30.6)	3,100.4 (35.4)	3,275.2 (38.4)	3,301.8 (35.4)	
		General	932.9 (13.1)	994.7 (10.9)	877.7 (10.0)	918.0 (10.8)	923.3 (9.9)	
		Total	5,010.3	6,604.7	6,261.8	5,307.0	5,612.7	
	Export	Dry Bulk	295.3 (4.2)	483.1 (5.3)	382.9 (4.4)	468.2 (5.5)	610.2 (6.5)	
		Oil	350.8 (4.9)	313.3 (3.4)	318.8 (3.6)	646.1 (7.6)	678.7 (7.3)	
		General	427.4 (6.0)	428.4 (4.7)	577.9 (6.6)	530.1 (6.2)	573.4 (6.1)	
		Total	1,073.5	1,224.8	1,279.6	1,644.4	1,862.4	
Coastal	Import	Dry Bulk	15.3 (0.2)	21.6 (0.2)	17.7 (0.1)	71.8 (0.8)	31.1 (0.3)	
		Oil	-	-	-	-	-	
		General	224.0 (3.2)	253.9 (2.8)	224.8 (2.6)	220.4 (2.6)	289.2 (3.1)	
		Total	239.3	275.5	242.5	292.2	320.4	
	Export	Dry Bulk	553.2 (7.8)	802.8 (8.8)	699.8 (8.0)	969.0 (11.4)	1,166.3 (12.5)	
		Oil	24.1 (0.3)	4.2 (0.1)	0.2 ( )	0.2 ( )	7.8 ( )	
		General	219.3 (3.1)	255.2 (2.8)	277.6 (3.2)	321.1 (3.6)	369.4 (4.0)	
		Total	796.6	1,062.2	977.6	1,290.3	1,543.5	
Grand Total			7,119.7 (100)	9,167.2 (100)	8,761.5 (100)	8,533.9 (100)	9,339.0 (100)	

Table 14. Changes in Cargo Traffic through Ports by Type of Cargo

		1959/60	60/61	61/62	62/63	63/64	64/65	65/66	66/67	67/68	68/69	69/70
I. Import												
1. Bulk												
1) Cement	Total	–	–	1.7	38.0	131.5	131.6	4.5	0.3	–	0.7	0.6
	Foreign	–	–	1.7	38.0	131.5	131.6	4.5	0.3	–	0.7	0.6
	Coastal	–	–	–	–	–	–	–	–	–	–	–
2) Coal & Coak*	Total	193.7	71.0	35.1	20.9	–	–	202.0	94.1	95.2	78.9	84.1
	Foreign	193.7	71.0	35.1	20.9	–	–	202.0	94.1	95.2	78.9	84.1
	Coastal	–	–	–	–	–	–	–	–	–	–	–
3) Fertilizer	Total	–	139.1	155.4	99.1	22.6	18.4	182.5	497.8	388.6	341.0	687.6
	Foreign	–	139.1	155.4	99.1	22.6	18.4	182.5	497.8	388.6	341.0	687.6
	Coastal	–	–	–	–	–	–	–	–	–	–	–
4) Iron & Steel	Total	153.9	357.4	226.1	222.1	263.7	329.7	299.4	550.6	282.4	396.1	337.8
	Foreign	153.9	357.4	226.1	222.1	263.7	329.7	299.4	548.9	282.4	394.0	334.9
	Coastal	–	–	–	–	–	–	–	1.7	–	2.1	3.2
5) Sugar	Total	–	7.0	93.6	43.8	0.2	78.0	60.8	–	10.6	275.8	–
	Foreign	–	7.0	93.6	43.8	0.2	78.0	60.8	–	8.8	274.3	–
	Coastal	–	–	–	–	–	–	–	–	1.8	1.5	–
6) Wheat	Total	772.9	1,100.4	698.6	553.3	834.4	1,480.6	674.4	1,564.9	1,471.5	15.9	225.5
	Foreign	772.9	1,100.4	698.6	553.3	834.4	1,480.6	674.4	1,564.9	1,471.5	15.9	225.5
	Coastal	–		–	–	–	–	–	–	–	–	–
7) Timber	Total	5.1	4.4	10.4	31.1	36.4	11.1	15.3	19.9	15.9	67.2	27.9
	Foreign	–	–	–	–	–	–	–	–	–	–	–
	Coastal	5.1	4.4	10.4	31.1	36.4	11.1	15.3	19.9	15.9	67.2	27.9
8) Other Cargo												
9) Total		1,125.6	1,679.3	1,220.9	1,008.3	1,288.8	2,049.4	1,438.9	2,727.6	2,264.2	1,175.6	1,363.6
		1,120.5	1,674.9	1,210.5	977.2	1,252.4	2,038.3	1,423.6	2,706.0	2,246.5	1,104.8	1,332.5
		5.1	4.4	10.4	31.1	36.4	11.1	15.3	21.6	17.7	71.8	31.1
10) Intransit Afghanistan Cargo*	Wheat (F)							124.1	80.4	37.2	9.0	55.1
2. Oil and Petroleum												
1) Crude Oil	Total	–	–	–	–	1,673.5	2,491.8	2,305.9	2,661.4	3,007.0	3,271.4	3,300.8
	Foreign					1,673.5	2,491.8	2,305.9	2,661.4	3,007.0	3,271.4	3,300.8
	Coastal											
2) Diesel Oil & Liquid Fuel	Total	953.5	1,005.8	903.2	1,456.6	171.8	65.9	109.6	139.4	27.6	3.8	1.0
	Foreign	953.5	1,005.8	903.2	1,456.6	171.8	65.9	109.6	139.4	27.6	3.8	1.0
	Coastal	–	–	–	–	–	–	–	–	–	–	–
3) Kerosene Oil	Total	216.5	233.9	282.6	223.0	96.5	44.9	–	3.2	38.3	–	–
	Foreign	216.5	233.9	282.6	223.0	96.5	44.9	–	3.2	38.3	–	–
	Coastal	–	–	–	–	–	–	–	–	–	–	–
4) Petrol	Total	163.4	124.2	129.3	51.8	19.5	32.3	54.2	19.6	27.5	–	–
	Foreign	163.4	124.2	129.3	51.8	19.5	32.3	54.2	19.6	27.5	–	–
	Coastal	–	–	–	–	–	–	–	–	–	–	–
5) Total	Total	1,333.4	1,363.9	1,315.1	1,731.4	1,961.3	2,634.9	2,529.7	2,823.6	3,100.4	3,275.2	3,301.8
	Foreign	1,333.4	1,363.9	1,315.1	1,731.4	1,961.3	2,634.9	2,529.7	2,823.6	3,100.4	3,275.2	3,301.8
	Coastal											
3. General Cargo												
1) Oils Edible*	Total	–	–	–	–	–	–	48.6	27.0	41.4	61.7	61.0
	Foreign							48.6	27.0	41.4	61.7	61.0
	Coastal							–	–	–	–	–
2) Motor Cars*	Total	–	–	–	–	–	–	9.3	10.1	6.1	10.6	12.1
	Foreign							9.3	10.1	6.1	10.6	12.1
	Coastal							–	–	–	–	–
3) Other Cargoes	Total	830.3	736.9	824.1	1,156.0	1,136.2	1,404.6	1,035.5	1,018.7	955.8	985.1	1,139.3
	Foreign	699.7	610.9	697.3	1,066.8	1,035.4	1,309.7	811.5	864.8	731.0	764.7	850.0
	Coastal	130.6	126.0	126.8	89.2	100.8	134.9	224.0	253.9	224.8	220.4	289.3
4) Total	Total	830.3	736.9	824.1	1,156.0	1,136.2	1,444.6	1,093.4	1,185.8	1,003.3	1,057.0	1,212.4
	Foreign	689.7	610.9	697.3	1,066.8	1,035.4	1,309.7	869.4	901.9	778.5	837.0	813.1
	Coastal	130.6	126.0	126.8	89.2	100.8	134.9	224.0	253.9	224.8	220.4	289.3
5) Transit A.C.*								63.5	92.8	99.2	81.0	110.2

		1959/60	60/61	61/62	62/63	63/64	64/65	65/66	66/67	67/68	68/69	69/70
II. Export												
1. Bulk												
1) Fertilizer*	Total	–	–	–	–	–	–	–	0.3	–	0.2	8.9
	Foreign											
	Coastal								0.3	–	0.2	8.8
2) Foodgrains*	Total						15.3	43.6	43.6	15.1	23.3	18.7
	Foreign						–	11.7	6.7	1.8	5.3	6.7
	Coastal			17.2	14.7	12.9	15.3	31.9	36.9	13.3	18.0	13.0
3) Molasses*	Total							61.8	88.8	45.0	54.4	136.3
	Foreign							61.5	88.8	45.0	54.4	136.2
	Coastal							0.3	–	–	–	0.1
4) Ores*	Total							7.8	25.0	3.0	0.3	35.9
	Foreign							7.8	25.0	3.0	0.3	34.3
	Coastal							–	–	–	–	1.6
5) Rice	Total	207.0	236.2	156.5	461.5	338.1	213.8	435.3	416.5	258.2	410.0	584.3
	Foreign	98.3	112.6	146.2	153.1	134.2	184.0	137.6	183.9	110.4	135.2	103.8
	Coastal	108.7	123.6	10.3	308.4	203.9	29.8	297.7	232.6	147.8	274.8	480.5
6) Sugar	Total							9.3	38.6	0.1	6.1	26.6
	Foreign							–	0.3	–	0.2	0
	Coastal			6.5	1.3	1.0	0.8	9.3	38.3	0.1	5.9	26.5
7) Wheat	Total	21.7	6.0	31.3	36.6	7.2	31.4	15.6	28.9	14.3	161.6	128.5
	Foreign	0.6	–	0.6	5.4	1.0	2.9	–	0.3	0.8	4.8	1.7
	Coastal	21.1	6.0	26.7	31.2	6.2	28.5	15.6	28.6	13.5	157.4	126.8
8) Cement	Total	89.6	46.3	189.6	220.4	20.7	0.5	97.0	482.9	596.4	625.1	665.1
	Foreign							1.2	88.5	176.4	218.5	253.7
	Coastal	–	–	–	–	–	–	95.8	394.4	420.0	406.6	411.4
9) Salt	Total							97.0	84.0	62.4	70.2	78.2
	Foreign							68.0	73.6	41.0	47.6	71.8
	Coastal	15.6	19.9	45.1	13.0	29.2	31.6	29.0	10.4	21.4	22.6	6.4
10) Rape seeds	Total							75.2	75.2	85.9	84.6	85.6
	Foreign							1.6	14.6	3.8	2.5	1.9
	Coastal						48.0	73.6	60.6	82.1	82.1	83.7
11) Other C.	Total							5.9	2.1	2.3	1.4	8.5
	Foreign							5.4	1.4	0.7	–	–
	Coastal							0.5	0.7	1.6	1.4	8.5
12) Total	Total							848.5	1,285.9	1,082.7	1,437.2	1,776.6
	Foreign							295.3	483.1	382.9	468.2	610.3
	Coastal							553.2	802.8	699.8	969.0	1,166.3
2. Oil and Petroleum												
1) Petroleum Prds.	Total							374.9	317.5	319.0	646.3	686.5
	Foreign							250.8	313.3	318.8	646.1	678.7
	Coastal							24.1	4.2	0.2	0.2	7.8
3. General Cargoes												
1) Cotton	Total	81.9	74.4	111.4	209.8	236.4	179.0	178.6	186.9	260.6	241.4	185.1
	Foreign	63.4	52.0	50.3	175.3	197.6	150.8	132.7	135.8	204.2	174.7	162.9
	Coastal	18.5	22.4	61.1	34.5	38.8	28.2	45.9	51.1	56.4	66.5	82.2
2) Oil Cokes*	Total	–	–	–	–	–	–	52.4	55.0	59.3	31.6	40.3
	Foreign							52.4	55.0	59.3	30.7	40.2
	Coastal							–	0.1	–	0.9	0.1
3) Textiles*	Total							34.4	35.8	50.1	51.0	132.1
	Foreign							23.0	22.9	37.9	41.0	111.4
	Coastal							11.4	12.9	12.2	10.0	20.7
4) Other C.	Total							381.3	405.8	485.5	527.2	585.3
	Foreign							219.3	214.7	276.5	283.5	318.9
	Coastal							162.0	191.1	209.0	243.7	266.4
5) Total	Total							646.7	683.6	866.5	851.2	942.8
	Foreign							427.4	428.4	577.9	530.1	573.4
	Coastal							219.3	255.2	277.6	321.1	369.4

Note: Totals exclude intransit Afghanistan Cargoes.

3-2 Future of Cargo Traffic through Ports

1) Existing Forecast

The latest forecast of cargo traffic through Karachi Port are the following three:

(a) Economic and Engineering Feasibility Study for a Second Port in West Pakistan, April 1967, by Prof. Dr-Ing. Erich Lockner, Bremen, West Germany, and Zafar and Associates, Karachi-Lahor.

(b) Port of Karachi Master Plan (Traffic Forecast) July 1967, by Economist Intelligence Unit Ltd., London.

(c) Traffic Forecast by Planning Commission, Pakistan Government.

A comparison of the above three forecasts is shown in Table 15. Besides, the Karachi Port Trust has entrusted Economist Intelligence Unit Ltd. with the task of providing a forecast of cargo traffic by taking into account the latest economic trends. The Planning Commission, on the other hand, is to check the outcome of the forecast and give a forecast authorized by the Government of Pakistan.

The survey team was to proceed with the work on the basis of the new forecast by EIU and the forecast which has been checked by the Planning Commission. However, these forecasts were not available to the team by the time this report was completed.

Here, a brief explanation will be made on the forecasts made by the above three reports.

(a) Economic and Engineering Feasibility Study for a Second Port in West Pakistan.

This is a feasibility study made by Prof. Dr-Ing. Erich Luckner (Bremen, West Germany), and Zafar and Associates (Karachi-Lahor) commissioned by the Defense Ministry in 1967 for the Second Port on the Las Bela Makran Coast in West Pakistan.

Table 15. A Comparison of Existing Forecast of Cargo Traffic

(000 ton)

		Total	Foreign		Coastal		Remarks
			Import	Export	Import	Export	
a) Economic and Engineering	1964-65	7,809	6,274	1,535			Actual
Feasibility Study for a	69-70	(9,339) 10.482	(5,933) 8,260	(3,406) 2,222			Estimate (Second Method) Coastal cargo is included in foreign cargo. Figures in parenthesis represent actual figures.
Second Port in W.P.	74-75	14,044	10,760	3,284			Estimate (Second Method)
	84-85	23,810	16,778	7,032			Estimate (Second Method)
b) Port of Karachi Master	69-70	13,346	9,066	2,401	212	1,667	Estimate
Plan by E.I.U.	89-90	42,179	33,645	5,418	356	2,760	Estimate
c) Projected West Pakistan	69-70	11,400 -11,600	7,109	3,673 -4,023			Estimate: Coastal cargo is included in foreign cargo.
Traffic by Commodity	74-75	18,053 -19,053	11,680	6,353 -7,353			Estimate: Coastal cargo is included in foreign cargo.
and Export and Import	79-80	24,960 -27,510	17,135	7,825 -10,375			Estimate: Coastal cargo is included in foreign cargo.
for the Period 1964/65	84-85	35,661 -40,261	24,114	11,547 -16,147			Estimate: Coastal cargo is included in foreign cargo.

The forecast of cargo traffic was made as port of the detailed study for determination of the size of a second port. The forecast was made with the year 1964/65 as base year and the year 1984/85 as target year and the year in between was divided into a group of five years. The estimate was made using three different methods and each of them was a macroscopic method based on the Third Five-Year Plan and the Perspective Economic Plan. Accordingly, no forecast was made on the cargo traffic by cargo type. The results of forecast are shown in Table 16.

Table 16. Future Cargo Volume of W.P. by Economic and Engineering Feasibility Study

	1964-65	1969-70	1974-75	1979-80	1984-85
First Method:					
Imports	6,274	7,700	9,459	11,619	14,273
Exports	1,535	2,245	3,285	4,806	7,031
Total	7,809	9,945	12,744	16,425	21,304
Second Method:					
Imports	6,274	8,260	10,760	13,144	16,778
Exports	1,535	2,222	3,284	4,898	7,032
Total	7,809	10,482	14,044	18,042	23,810
Third Method:					
Imports	6,274	7,800	9,360	10,570	12,450
Exports	1,535	2,255	3,350	4,945	6,395
Total	7,809	10,055	12,710	15,515	18,845
Average:	7,809	10,161	13,166	16,661	21,320
Annual Rate of Growth:	5.4%	5.3%	4.8%	5.0%	

Note: The imports and exports include the entire foreign and coastal trade.

As to the method of estimation, the first method extented the volume of export and import in the year 1964/65 to the future by using a growth rate of 7.9% in the amount of export and a growth rate of 4.2% in the amount of import.

The second method divides the cargo traffic into foreign cargo and coastal cargo, while the third method combines foreign cargo and coastal cargo into one. As to the method of estimation, the growth rate of expenditure (divided into development expenditure and non-development expenditure) in West Pakistan for foreign import and the growth rate of expenditure in East Pakistan for coastal export are directly applied to the growth rate of cargo traffic with partial revision.

For foreign export, it applied a growth rate of 7.9% in the amount of export used by the first method to the growth rate of cargo traffic. Cargo traffic in coastal

import was estimated on the basis of future requirements of goods in East Pakistan.

The third method is similar to the second method with respect to the division into foreign cargo and coastal cargo. This method, however, obtains the amount of import and export from the ratio of imports and export to the GNP as determined by the Perspective Economic Plan and then estimates the volume of import and export cargo by using the volume of cargo commensurate to the amount of exports and imports in the year 1964/65. For coastal cargo, it uses the same basis for estimate as the second method.

The following may be pointed out as problematical points of this forecast.

i) The Third-Year Plan and the Perspective Economic Plan are used as the basis of estimation. The Fourth Five-Year Plan has already been in effect and there is need to revise the target of the Perspective Economic Plan set at that time.

ii) The method used for estimation is extremely macroscopic. Such a method may have been sufficient for the survey at that time, but this survey requires a more detailed microscopic analysis.

(b) Port of Karachi Master Plan (Traffic Forecast) July 1967, by Economic Intelligence Unit Ltd., London.

This survey entrusted to Economic Intelligence Unit Ltd. in London was aimed primarily at estimating the volume of cargo traffic through ports in the year 1989/90 and in 2015. The results are summarized in Table 17.

This survey is similar to the one mentioned in the preceeding Paragraph a) in that the Third Five-Year Plan and the Perspective Economic Plan were used as the basis of estimate.

The method used for estimation is a microscopic one which estimates the volume of cargo by cargo type. Generally speaking, it uses a concept that the difference between production and consumption in West Pakistan can be used as the amount of export or import. As for coastal cargo, it uses a precondition that commodities short in supply in East Pakistan are to be imported from West Pakistan to the extent possible and that self-sufficiency is to be maintained in Pakistan as a whole. As it is difficult to use a microscopic method for estimation in 2015, it uses fixed growth rates of 4.0% for export and 5.3% for import for the period after the year 1989/90.

The problematical point of this forecast is that the estimate was made in 1967 and therefore the Third Five-Year Plan and the Perspective Economic Plan had to be used as the basis of estimate as in the case of Paragraph a).

(c) Traffic Forecast by Planning Commission

This forecast is made by the Planning Commission after revaluating and revising the forecast mentioned in Paragraph (b) from a political point of view. Basis of the revision and the method used for estimation have not yet been confirmed. The results of forecast are shown in Table 18.

Because of uncertainty as to the method of estimation, anything definite cannot be said on the results of forecast. However, the following may be pointed out as problematical points.

Table-17 Summary of Cargo and Passenger Traffic Forecasts by Trade Flow, 1954/65-1959/90

CARGO ('000 tons)	IMPORTS						EXPORTS						TOTAL TRADE						TOTAL		
	Foreign			Coastal			Foreign			Coastal			Foreign			Coastal					
	1964/65	1969/70	1989/90	1954/65	1969/70	1989/90	1954/65	1969/70	1989/90	1964/65	1969/70	1989/90	1964/65	1969/70	1989/90	1964/65	1969/70	1989/90	1964/65	1969/70	1989/90
Food and Agricultural Products																					
Bones	-	-	-	-	-	-	19	25	25	-	-	-	19	25	25	-	-	-	19	25	25
Cotten (Incl. cotton textiles)	-	-	-	-	-	-	166	290	450	54	137	250	165	290	450	54	137	250	220	427	700
Fish	-	-	-	-	-	-	18	35	80	-	-	-	18	35	80	-	-	-	18	35	80
Guar gun	-	-	-	-	-	-	20	25	40	-	-	-	20	25	40	-	-	-	20	25	40
Hides and skins (incl. leather)	-	-		2	2	4	4	12	18	-	-	-	4	12	18	2	2	4	6	14	12
Molasses	-	-	-	-	-	-	62[a]	60	156	-	-	-	62[a]	60	150	-	-	-	62[a]	60	150
Oil cakes	-	-	-	-	-	-	52[a]	80	-	-	-	-	52[a]	80	-	-	-	-	52[a]	80	-
Rice	-	-	-	-	-	-	84	315	1,140	30	435	-	84	315	1,140	30	435	-	114	750	1,140
Sugar	78	-	-	-	-	-	-	-	150	1	15	-	78	-	150	1	15	-	79	15	150
Tea	-	-	-	?	26	70	-	-	-	-	-	-	-	-	-	6	26	70	6	26	70
Vegetable oils and seeds	49[a]	45	110	-	-	-	2[a]	-	-	88[a]	45	-	51[a]	45	110	88	45	-	139[a]	90	110
Wheat	1,481	1,380	1,920	-	-	-	3	-	-	29	-	-	1,484	1,380	1,920	29	-	-	1,513	1,380	1,920
Wool (incl. wool textiles)	2	4	5	-	-	-	7	23	25	-	-	-	9	27	30	-	-	-	9	27	30
Total	1,610	1,429	2,035	8	28	74	437	865	2,078	202	632	250	2,047	2,294	4,113	210	660	324	2,257	2,961	4,437
Minerals																					
Chrome ore	-	-	-	-	-	-	30	50	60	-	-	-	30	50	60	-	-	-	30	50	60
Coal and coke	-	70	100	-	-	-	-	-	100	-	-	150	-	70	200	-	-	150	-	70	350
Gypsum	-	-	-	-	-	-	-	-	-	-	475	1,000	-	-	-	-	475	1,000	-	475	1,000
Oil	2,635	4,200	18,000	-	-	-	370	900	-	-	-	-	3,065	5,100	18,000	-	-	-	3,005	5,100	18,000
Salt	-	-	-	-	-	-	68[a]	100	175	29	26	-	68	100	175	29	25	-	97	125	175
Total	2,635	4,270	18,100	-	-	-	468	1,050	335	25	500	1,150	3,103	5,320	18,435	29	500	1,150	3,132	5,820	19,585
Manufacturers																					
Cement	132	-	-	-	-	-	-	200	1,000	-	300	500	132	200	1,000	-	300	500	132	500	1,500
Consumer	245	292	575	19	29	45	-	-	-	-	-	-	245	292	585	19	28	45	264	320	580
Fertilisers (incl. raw materilals)	18	1,153	2,600	-	-	-	-	-	750	-	-	-	18	1,153	3,350	-	-	-	18	1,152	3,350
Iron and steel (incl. raw materials)	781	1,000	8,500	-	-	-	-	-	-	-	-	-	781	1,000	8,500	-	-	-	781	1,008	8,500
Jute goods (incl. raw jute)	-	-	-	38	60	131	-	-	-	-	-	-	-	-	-	38	60	131	38	69	131
Machinary	175	245	510	-	-	-	5	10	25	15	20	30	180	255	535	15	20	30	195	275	565
Paint	6	5	5	-	-	-	2	5	20	-	-	-	8	10	26	-	-	-	8	10	25
Paper and boad	16	10	50	69	80	50	-	10	250	-	-	-	16	20	300	69	80	50	85	100	350
Sports goods	-	-	-	-	-	-	3	4	17	-	-	-	3	4	17	-	-	-	3	4	17
Total	1,373	2,705	12,200	126	168	226	10	229	2,052	15	320	530	1,383	2,934	14,262	141	488	755	1,524	3,422	15,016
Miscellaneous Cargo	323	390	760	12	16	56	204	245	905	161[b]	215	630	527	635	1,665	173	231	886	700	866	2,551
Afghanistan Transit Trade	188[a]	272	550	-	-	-	8[a]	12	38	-	-	-	196[a]	284	598	-	-	-	196	264	558
Total Cargo	6,129	9,036	33,645	146	212	356	1,127	2,401	5,416	407	1,667	2,760	7,256	11,467	39,063	553	1,879	3,116	7,800	13,346	42,179

a 1965/66
b Including about 70,000 tons of raw and manufactured tobacoo
- Nil or negligible

Table 18. Projected West Pakistan Traffic by Commodity and Export and Import for the Period 1964/65 ~ 1984/85

(000 tons)

	1964/65			1969/70			1974/75			1979/80			1984/85		
	Export	Import	Total	Export	Import	Total	Export	Import	Total	Export	Import	Total	Export	Import	Total
A) Bulk Cargo															
1. Cement															
High	–	132	132	1,000	–	1,000	2,100	–	2,100	4,800	–	4,800	8,800	–	8,800
Low	–	132	132	650	–	650	1,100	–	1,100	2,250	–	2,250	4,200	–	4,200
2. Fertilizer	–	18	18	–	481	481	290	1,094	1,384	500	2,003	2,503	700	2,759	3,459
3. Iron ore	–	–	–	–	–	–	–	920	920	–	920	920	–	1,840	1,840
4. Iron & steel	–	834	834	–	1,165	1,165	–	1,435	1,435	100	1,700	1,800	300	1,700	2,000
5. Wheat	32	1,481	1,513	400	–	400	1,050	–	1,050	1,500	–	1,500	2,000	–	2,000
6. Rice	435	–	435	600	–	600	700	–	700	800	–	800	1,000	–	1,000
7. Coal and Coke	–	100	100	–	150	150	–	200	200	–	1,400	1,400	–	2,400	2,400
8. Gypsum	–	–	–	16	–	16	59	–	59	80	–	80	128	–	128
9. Salt	97	–	97	140	–	140	200	–	200	300	–	300	440	–	440
10. Molasses	62	–	62	0	–	60	75	–	75	95	–	95	120	–	120
11. Sugar	1	78	79	15	–	15	30	–	30	50	–	50	90	–	90
12. Afghan Transit	–	124	124	–	185	185	–	150	150	–	120	120	–	100	100
Total Bulk Cargo						1969/70			1974/75						
High	62	2,767	3,394	2,231	1,981	4,212	4,504	3,799	8,303	8,225	6,143	14,368	13,578	8,799	22,377
Low	627	2,767	3,394	1,881	1,981	4,062	3,504	3,799	7,303	5,675	6,143	11,818	8,978	8,799	17,777
B) Oil (Total)	370	2,635	3,005	740	4,200	4,940	510	6,200	6,710	450	9,000	9,450	400	13,000	13,400
C) General Cargo															
1. Raw Cotton	149	–	149	175	–	175	230	–	230	270	–	270	315	–	315
2. Cotton Goods	72	–	72	87	–	87	102	–	102	119	–	119	137	–	137
3. Consumer Goods	–	264	264	–	320	320	–	370	370	–	430	430	–	500	500
4. Machinery and Transport Equipment	20	175	195	30	302	332	35	435	470	40	447	487	47	416	463
5. Paper & Board	–	85	85	10	90	100	50	85	135	100	85	185	155	100	255
6. Vegetable & Seeds	100	49	149	45	45	90	30	65	95	15	85	100	–	105	105
7. Oil Coke	52	–	52	80	–	80	60	–	60	40	–	40	20	–	20
8. Jute Goods	–	38	38	–	57	57	–	75	75	–	94	94	–	112	112
9. Chrome Ore	30	–	30	50	–	50	53	–	53	56	–	56	60	–	60
10. Fish & Fish Products	20	–	20	30	–	30	36	–	36	42	–	42	50	–	50
11. Bones	19	–	19	27	–	27	30	–	30	32	–	32	35	–	35
12. Tea	–	6	6	–	26	26	–	33	33	–	43	43	–	55	55
13. Guar Gum	20	–	20	25	–	25	25	–	25	30	–	30	35	–	35
14. Hides & Skin	4	2	6	8	2	10	10	3	13	12	3	15	13	3	16
15. Wool	7	2	9	9	3	12	11	4	15	12	5	17	14	4	18
16. Afghan Transit (General)	8	64	72	12	87	99	17	131	148	22	198	220	28	300	328
17. Misc.	368	341	709	464	416	880	650	500	1,150	910	602	1,512	1,260	720	1,980
Total General Cargo	869	1,026	1,895	1,052	1,328	2,400	1,339	1,701	3,040	1,700	1,992	2,692	2,169	2,315	4,484
Grand Total (Rounded)															
High			8,300			11,600			18,100			27,500			40,300
Low			8,300			11,400			17,100			25,000			35,700

The forecast estimates export of cement in the 1980/85 period at 8.8 million tons at the maximum. In view of the fact that the production of cement in Japan with the GNP of 19 million dollars is 50 million tons and her export of cement amounts to 2 million tons, it seems that the goal is set a little too high even when the fact that cement is a key industry in West Pakistan.

Estimate of iron-ore import is too low. As it will be necessary to locate steel mills at several sites in the year 1984/85, the greater part of the supply of raw materials must depend on foreign countries and as a result, iron-ore should be imported in large amounts.

2) Estimate of Cargo Traffic through Ports

(a) General

According to the original schedule, the survey team was to proceed with a study on port planning on the basis of the forecast of cargo traffic through ports to be provided by the Pakistani side.

However, the forecast was not available to the team after all and as a result, an estimate of cargo traffic of its own had to be made on the basis of what seemed to be insufficient data. It must be pointed out, therefore, that there could be cases in which revisions should be made to the forecast based on the insufficient data

which were available to the team.

The following will discuss the method used for estimation and the results of the estimate.

i) The economic frame, a basis of estimating cargo traffic, was assumed from the Fourth Five-Year Plan and the Perspective Economic Plan. In particular, the estimate of cargo traffic for the year 1974/75 was made from the target figures of production and consumption under the Fourth Five-Year Plan.

ii) As for the economy in West Pakistan in the year 1984/85, it was assumed that self-sufficiency could be attained in the supply of most of the Key commodities, that any shortage of supply on either side would be met by the other and that any excess or shortage of supply that still exist after these measures would be solved by relying on the overseas market.

iii) Policy of the estimate and the method used for the estimate of each cargo item will be explained briefly.

a) The volume of wheat cargo was obtained from the difference between consumption and production. Per capita consumption in West Pakistan was assumed to be 250 lbs. in the year 1974/75 and 275 lbs. for the year 1984/85 and the production was assumed to double by the year 1984/85.

b) The volume of rice cargo was also obtained from the difference between consumption and production. Per capita consumption in West Pakistan was assumed to be 58 lbs. in the year 1974/75 and 60 lbs. for the year 1984/85 and production was assumed to double by the year 1984/85.

c) The volume of cement cargo was also obtained from the difference between consumption and production, but the estimate of consumption and production was made in correlation with the GNP. Production of cement in West Pakistan is expected to reach 6.3 million tons in the year 1974/75 and 13.9 million tons in the year 1984/85.

d) Per capita consumption of iron & steel in the year 1984/85 was assumed to be 32 kg. It was assumed that demands in West Pakistan would be fully met by production in West Pakistan. Coal, iron-ore and iron scraps required for steel production were assumed to be imported in the amount commensurate with production scale.

e) The volume of sugar cargo was obtained from the difference between consumption and production. Per capita consumption in West Pakistan was assumed to be 17.5 lbs. in the year 1974/75 and 26.0 lbs. in the year 1984/85. Production in the year 1984/85 was assumed to be of the scale that would allow export in the amount approximately the same as in the year 1974/75.

f) As for fertilizer, it was assumed that all demands for nitrogen and phosphatic fertilizer would be met domestically in finished goods in West Pakistan in the year 1984/85 and that raw materials for fertilizer production and potassic fertilizer would be imported. The amount of import for each type of fertilizer was determined by taking into account the growth rate of agricultural production.

g) For petroleum, it was assumed that per capita consumption of energy in Pakistan in the year 1984/85 would be 380 coal-kg and that 50% of this requirement would depend on petroleum. Consumption in West Pakistan was assumed to accounts for 75% of consumption in all Pakistan in the year 1984/85.

h) The volume of cotton cargo was obtained from the difference between consumption and production. It was assumed that both consumption and production in West Pakistan would double in the covered period.

i) In view of the fact that cotton textile is a strategic industry in West Pakistan, it was assumed that 50% of the total production would be exported. The results of the estimate are shown in Fig. 5.

(b) Commodity-wise Estimates

i) Bulk Cargo

a) Wheat

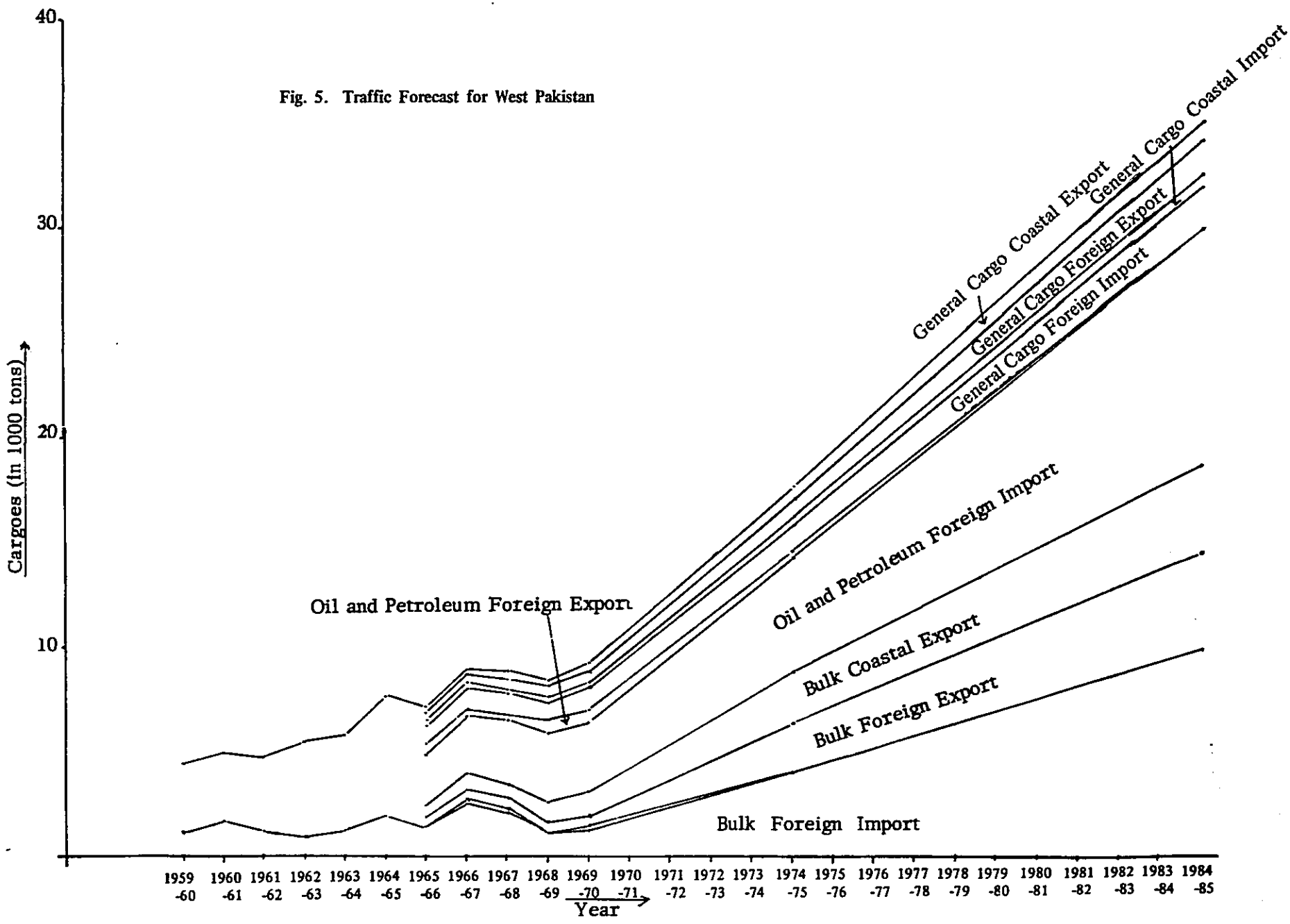
1) Production and Consumption

Wheat production and consumption are shown in Table 19. Figure for the year 1974/75 is the target figure of the Fourth Five-Year Plan (referred to as F.F.Y.P. hereinafter) and the estimate for the year 1984/85 was made in the following manner.

Table 19. Wheat Production and Consumption

	West Pakistan				East Pakistan				All Pakistan	
	Products	%	Consumption	%	Products	%	Consumption	%	Products	Consumption
1960-61	a) 4,317		d) 4,442				d) 263			
62	a) 4,557		d) 4,035				d) 237			
63	a) 4,719		d) 3,991				d) 934			
64	a) 4,710		d) 4,569				d) 686			
65	a) 5,196		d) 5,137				d) 281			
66	a) 4,408	3.7	d) 4,749		b) 35		d) 575			
67	b) 4,226		d) 5,005		b) 58		d) 875			
68	b) 6,317		d) 5,285		b) 58		d) 841			
69	c) 6,513		d) 5,544		b) 92		d) 987			
70	c) 7,000	6.3	c) 6,194		b) 88	17.8	c) 1,070		7,088	
75	c) 9,500	5.0	c) 7,637		c) 200	15	c) 1,397		9,700	
80	12,200	3.0			400	10			12,600	
85	14,200		10,350		650		1,970		14,850	

Fig. 5. Traffic Forecast for West Pakistan



Remarks:

(a): According to EIU Report, June 1967 (referred to as E.I.U. hereinafter)

(b): According to Economic Survey of Pakistan 1969/70 (referred to as E.S.P. hereinafter)

(c): According to Fourth Five-Year Plan (referred to as F.F.Y.P. hereinafter)

(d): According to the data provided by Planning Commission (referred to as hereinafter)

(1) The estimate on production was made by using a growth rate of 5% for the 1975/80 period and a growth rate of 3% for the 1981/85 period for West Pakistan. For East Pakistan, growth rates of 15% and 10% were used for respective period.

(2) Estimate of consumption was made through the medium of future population forecast by the Perspective Economic Plan (referred to as P.E.P. hereinafter) by assuming per capita consumption as shown in Table 20.

Table 20. Per Capita Wheat Consumption

(lbs)

	1964-65	69-70	74-75	1984-85	Remarks
W.P.	224	231.6	250.1 a)	275 (125 kg)	The figure for 1984-85 is 110% of that for 1974-75.
E.P.		33.1	37.7 a)	43 (19)	The figure for 1984-85 is 115% of that for 1974-75.
A.P.		123.5	133.6 a)	318 ( )	

Note: (a): According to F.F.Y.P.

1) Cargo Traffic through Ports

In obtaining the amount of export or import, it was assumed that the difference between production and consumption would be mutually accommodated between West Pakistan and East Pakistan and that an excess or shortage following such measures alone would be handled by foreign trade.

After correcting figures to obtain correct production by deducting various losses, the estimate on cargo traffic through ports following the above preconditions will be as follows.

(1974-75)

		Gross	Net	Remarks
		thousand tons	thousand tons	
W.P.	Prods.	9,500	8,010	from F.F.Y.P.
	Conss.		7,637	
			373 →	to E.P.
E.P.	Prods.	200	180	
			1,397	
			1,217 ←	373 from W.P.
				844 from W.P. (Rice)

(1984-85)

		Gross	Net	Remarks
W.P.	Prods.	14,200	12,000	Net/Gross = 8,010/9,500 = 0.845
	Conss.		10,350	
			1,650 →	1,420 to E.P.
			→	230 to F.A.
E.P.	Prods.	650	550	Net/Gross = 0.845
	Conss.		1,970	
			1,420 ←	from E.P.

As it is not possible in mutual exchange of commodities between West Pakistan and East Pakistan to follow such a pattern as the same item basis, shortage of wheat and rice was assumed to be compensated in the total amount of both items. It was assumed, therefore, that a shortage of wheat in East Pakistan amounting to 844,000 tons would be compensated by rice produced in West Pakistan.

b) Rice

1) Production and Consumption

1. Figures of future production and consumption were obtained in the same manner as in the case of wheat including the growth rate. Rice production and consumption is shown in Table 21. Per capital consumption of rice was assumed as shown in Table 22.

2) Cargo Traffic through Ports

1. (1974/75)

		Gross	Net	Remarks
W.P.	Prods.	3,700	3,330	F.F.Y.P.
	Conss.		1,778	

1,552 → 952 to E.P.
→ 600 to F.A.

Table 21. Rice Production and Consumption

	West Pakistan				East Pakistan				All Pakistan	
	Prods	%	Conss.	%	Prods.	%	Conss.	%	Prods.	Conss.
1960-61	a) 1,014		d) 668				d) 9,021			
62	a) 1,109		d) 874				d) 8,725			
63	a) 1,078		d) 650				d) 8,399			
64	a) 1,173		d) 764				d) 9,765			
65	a) 1,329	8.3	d) 1,001		c) 10,337		d) 9,396	1.9		
66	b) 1,296		d) 710		b) 10,335		d) 9,681			
67	b) 1,343		d) 766		b) 9,424	4.2	d) 8,908			
68	b) 1,475		d) 1,069		b) 10,995		d) 10,149			
69	b) 2,000		d) 1,399		b) 11,165		d) 10,236			
70	b) 2,372		c) 1,442		b) 11,726		c) 10,818			
		9.9				6.5		5.5		
75	c) 3,700		c) 1,778		c) 15,800		c) 14,128			
		5.0				3.0				
80	4,700				18,300			3.4		
		3.0				2.0				
85	5,000		2,250		21,000		19,750			

Remarks:
1. a) by E.I.U.
2. b) by E.S.P.
3. c) by F.F.Y.P.
4. d) by P.C.

Table 22. Per Capita Rice Consumption

(lbs.)

	1964-65	1969-70	1974-75	1984-85	
W.P.	49	54	58	60 (27[2] kg)	The figure for 1984-85 is 104% of that for 1974-75.
E.P.		335	381	410 (183 kg)	The figure for 1984-85 is 107% of that for 1974-75.

Note: 1974/75 by F.F.Y.P.

		Gross	Net	Remarks
E.P.	Prods.	15,800	14,220	Net/Gross = 3,300/3,700 = 0.892
	Conss.		14,128	
			92	
	Deficit		200	Due to reduction in food prices (F.F.Y.P.)
			Δ 4,108 ←	from W. P.

(1984-85)

		Gross	Net	
W.P.	Prods.	5,000	4,500	Net/Gross = 0.892
	Conss.		2,250	
			2,250	1,050 to E.P.
				1,200 to F.A.
E.P.	Prods	21,000	18,900	
	Conss.		19,750	
			Δ 850	
			Δ 200	Due to reduction in food prices
			Δ 1,050	from W.P.

c) Molasses

Molasses is mainly used as raw material of alcohol. However, supply of alcohol by petrochemical industry is a world-wide trend and as a result, any sharp increase in the demand for molasses cannot be expected. Accordingly, future export of molasses was assumed to be of the present level of 150,000 tons.

d) Cement

1) Production and Consumption

Cement production and consumption is shown in Table 23. Consumption in the year 1974/75 was estimated from the following correlation.

$$\text{(Consumption)}\quad Z = 0.601x - 1.078 \quad (\gamma = 0.841) \quad \ldots\ldots\ldots \quad (1)$$

where: Z = Consumptions (1,000 tons)
x = GNP (Crore Rs)
γ = Correlation factor

Table 23. Cement Production and Consumption

(1,000 tons: Crore Rs)

	1960-61	62	63	64	65	66	67	68	69	70	
Prods.	a) 1,056	a) 1,218	a) 1,348	a) 1,386	a) 1,629	b) 1,610	b) 1,950	b) 1,980	b) 2,510	c) 3,200	
Cons.	d) 1,010	d) 1,030	d) 1,166	d) 1,497	d) 1,760	d) 1,518	d) 1,441	d) 1,384	d) 1,885	d) 2,535	
GNP (A.P.)	3,308	3,504	3,629	3,928	4,106	4,297	4,513	4,851	5,129	5,428	Price of 1959-60

Notes:
1. a) by E.I.V.
2. b) by P.C.
3. c) by F.F.Y.P.
4. d) was obtained from (Production - export + import)

From (1) above; 1974/75 $Z \fallingdotseq 4{,}300$
The GNP was assumed as shown in Table 24.

Table 24. GNP Forecast

(In Crore Rs)

	GNP	Remarks
1969-70	5,427	6.5% (F.F.Y.P.)
1974-75	8,880	

Note: Price is at 1959/60.

2) Cargo Traffic through Ports

(1974/75)

Surplus = 6,300 - 4,300 = 2,000 (Prods) (Conss)
1,000 to East Pakistan (F.F.Y.P.)
1,000 to Foreign abroad

As it is necessary to promote clinker transport in order to improve efficiency of transportation and promote cement industry in East Pakistan, 50% of the total export were assumed to be transported in the form of clinker.

(1984/85)
Export of cement after the year 1974/75 depends on the growth of domestic cement industry and market conditions abroad and in East Pakistan. Here, the maximum export volume was assumed to be the volume for the year 1974/75 plus a 50% increase.

Allocation to East Pakistan and Foreign abroad was assumed to be the same as in the year 1974/75. Clinker transport was considered for 50% of the total export as in the case of the year 1974/75.

e) Iron and Steel

1) Production and Consumption

Iron and steel production and consumption is shown in Table 25. For the year 1974/75, target figures under the F.F.Y.P. were used. Consumption in the year 1984/85 was estimated with reference to per capita consumption in each country of the world and through the medium of the population and per capita income in East Pakistan in the year 1984/85. For consumption in West Pakistan and East Pakistan, which is expected to be in the ratio of 3:1 in the year 1974/75 according to the F.F.Y.P. consumption was distributed by using a ratio of 2:1 with a view of narrowing a gap between West Pakistan and East Pakistan. Production was estimated to be the same as consumption on the assumption that complete self-sufficiency would be attained in all Pakistan in the year 1984/85.

Table 25. Steel Production and Consumption

	West Pakistan				East Pakistan				All Pakistan	
	Prods.	%	Cons.	%	Prods.	%	Cons.	%	Prods.	Cons.
1969-70	120		460							
	a)		a)		a)		a)		a)	a)
74-75	750		2,250		250		250		1,000	3,000
79-80										
80-85	4,000		4,000		2,000		2,000		6,000	6,000

Remarks:
1) Steel products in 1974/75, steel in 1984/86.
2) The number in 1974/75 is based on F.F.Y.P.

Estimate of consumption was made in the following order.

Per capita income in all Pakistan in the year 1984/85 was estimated to be $230.00 at the cost in 1968.

From Fig. 6, per capita consumption of iron and steel in the year 1984/85 was determined to be 32 kg.

From the following calculation the total consumption is estimated at six million tons.

32 kg x 186.6 mil. = 6 mil. tons (Note 1)
(population in 1984/85)

d) Accordingly, consumption in West Pakistan is estimated at 4 million tons.

2) Cargo Traffic through Ports

1974/75

Steel Import = 2,250 – 750 = 1,500 (1,000 tons)
(Prods.) (Conss.)

Scrap Import = 285 – 190 = 95 (1,000 tons)
(See f))

1984/85

Scrap Import = 1,200 – 800 = 400 (1,000 tons)
(See f))

(Note 1) Consumption in the year 1974/75 obtained in the same manner as that used for this estimate almost agrees with the target figure of the F.F.Y.P.

1974/75

130 $/person 18 kg/person
18 kg x 151.5 = 2,720 (1,000 tons) 3,000 (1,000 tons)
(F.F.Y.P.)

f) Coal and Coke

Coal and coke required for production of 4 million tons of crude steel are to be imported in addition to the existing import. Table 26 shows requirements for raw materials commensurate to the production scale in the year 1974/75 and 1984/85. From this, cargo traffic through ports may be estimated as follows.

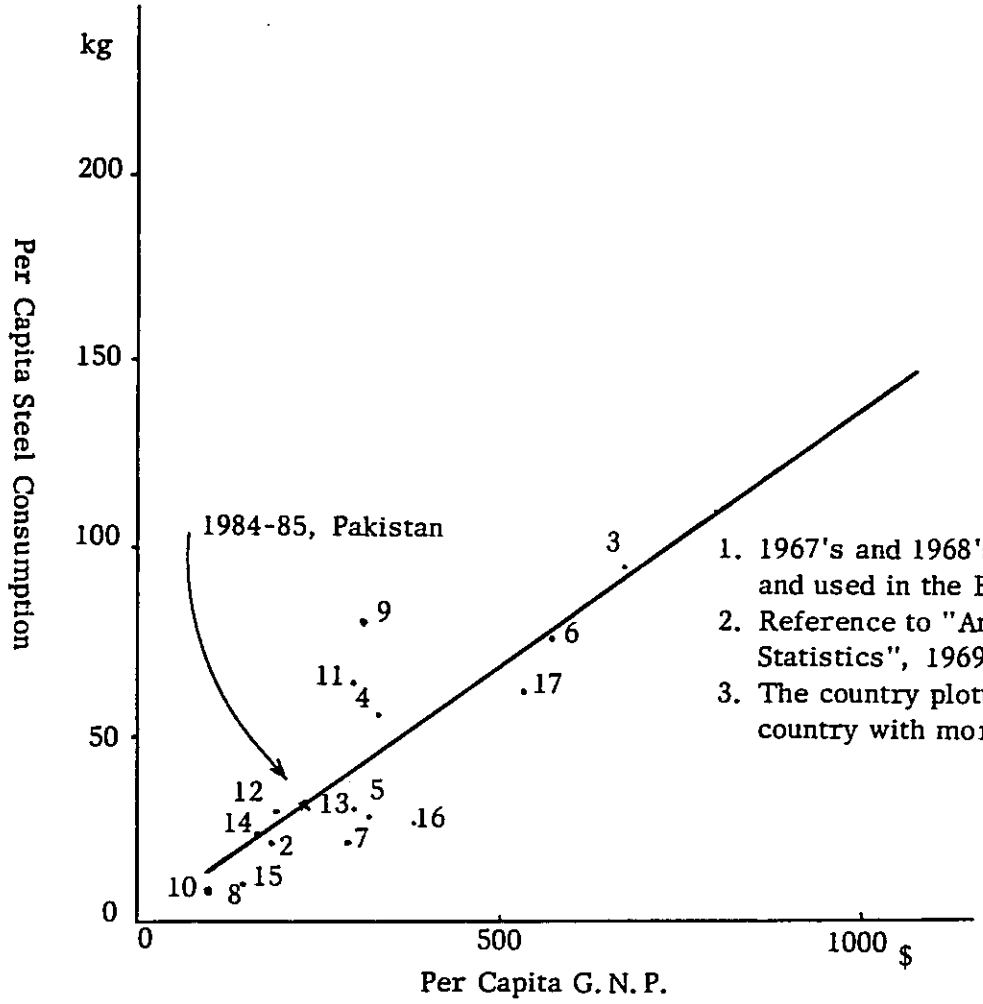
1974/75

Import = 630 + 80 = 710 (1,000 tons)
(For steel mill) (Existing)

1984/85

Import = 2,650 + 80 = 2,730 (1,000 tons)
(For steel mill) (Existing)

Fig. 6. Rotation between Per Capita Steel Consumption and Per Capita G.N.P.



1. South Africa
2. Southern Rhodesia
3. Tunisia
4. U. A. R. *
5. Argentina *
6. Brazil
7. Colombia *
8. Venezuela
9. Peru
10. Ceylon
11. China
12. Pakistan
13. Iran
14. Korea Rep.
15. Philippines
16. Thailand
17. Viet-Nam Rep. *
18. Turkey

* 1967

1. 1967's and 1968's Numbers and used in the Figure.
2. Reference to "Annual of World Statistics", 1969 (U. N.)
3. The country plotted in the Figure is the country with more than 10,000,000 population.

Table 26. Requirements for Raw Material for Crude Steel Production and Delivery of Products

	1974-75	1984-85	Remarks
Crude steel Production	950 (750)	4,000	Figures in parenthesis represent steel
Raw materials:			
Iron ore	1,360	5,800	1.45 t/Crude Steel ton
Coal	630	1,650	0.66 "
Scrap iron	285 (190)	1,200 (800)	0.00 " Figures in parenthesis represent amount generated within steel mill.
Products:			
Pig iron	40	250	
Billet	260	1,750	
Medium sec.	150	1,000	
Flat	300	2,000	

Notes:

1. Basic unit shown is the valve prevailing in Japan.
2. Breakdown of product was made in the same manner as that used for the production of one million tons described in the F.F.Y.P.

Table 27. Sugar Production and Consumption

(1000 tons)

	1960 -61	-62	-63	-64	-65	-66	-67	-68	-69	-70	1974 -75	1984 -85
Prods.	a) 55	a) 122	a) 199	a) 155	a) 156	a) 371	a) 313	a) 268	a) 408	b) 600	750	1,200
%												
Cons.	c) 57	c) 200	c) 235	c) 154	a) 258	a) 324	a) 312	a) 357	a) 445	b) 425	b) 535	1,000
%			←				15.2%				→	

Remarks:

1. a) by E.S.P.
2. b) by F.F.Y.P.
3. c) by E.I.U.
4. d) by P.C.

Table 28. Per Capita Sugar Consumption

(in lbs.)

	1979-70	1974-75	1984-85	Remarks
W. P.	15.9	17.5	25.0	1974-75 by F.F.Y.P. The figure for 1984-85 is 150% of that for 1974-75.
of E. P.	5.6	7.6	15.0	ditto The figure for 1984-85 in 200% of that for 1974-75.

g) Iron Ore

From Table 26 for the preceeding paragraph f), import of iron ore is as follows.

1974/75

Import = 1,360
(For steel mill)

1984/85

Import = 5,800

h) Sugar

1) Production and Consumption

Sugar production and consumption is shown in Table 27. For the year 1974/75, the target figure of the F.F.Y.P. was adopted. Consumption for the year 1984/85 was estimated on the basis of per capita consumption (Table 28) and production was considered to be of the level which allows export to East Pakistan in the same amount as in the year 1974/75. This is due to the fact that the production area of sugar cane distributes widely from the tropic zone to the temperature zone and that the prospect of export to foreign countries is not promising.

2) Cargo Traffic through Ports

1974/75

Surplus = 750 – 535 = 215 to East Pakistan.

1984/85

Export: 200 to East Pakistan.

i) Fertilizer

1) Production and Consumption

Fertilizer production and consumption is shown in Table 29. For the estimate for the year 1974/75, the target figure of the F.F.Y.P. was used and the estimate for the year 1984/85 was made separately.

Table 29. Fertilizer Production and Consumption

(in 1000 tons)

	1960 -61	62	63	64	65	66	67	68	69	70	1974 -75	1984 -85
Prods.	a) 73.9	a) 59.7	a) 150.1	a) 155.7	a) 161.7	a) 149.5				b) 490	b) 2,270	4,850
%												
Cons.	a) 213.0	a) 215.1	a) 249.2	a) 178.3	a) 180.1	a) 332.0	c) 363.5	c) 592.3	c) 774.1	b) 1,075	b) 2,514	4,300
%												

Notes:
1. a) by E.I.U.
2. b) by F.F.Y.P.
3. c) Nutrient ton obtained from the data from P.C. shown by actual weight (LAWT ≒ 0.313 N.T.)

Production and consumption for the year 1974/75, which was estimated on the basis of F.F.Y.P. converted to actual weight is shown in Table 30.

Table 30. Fertilizer Production and Consumption (1974/75)

(1000 ton)

		Nitrogen (N)	Phospherus (P_2O_5)	Potash (K_2O)	Total
Cons.	Nutrient	536	214	50	800
	Actual Weight	2,200	214	100	2,514
Prods.	Nutrient	522	119	-	641
	Actual Weight	2,151	119	-	2,270

Estimate for the year 1984/85 was based on the following assumptions (see Table 31).

(1) Growth rate of consumption for the period from the year 1974/75 to 1984/85 was assumed to be 5.5%, the same growth rate of agriculture under the P.E.P.

(2) As for production, N and P_2O_5 were considered to be supplied 100% by domestic industry and K_2O, for which raw material is not availably locally, was assumed to be imported in total amount. As far as N is concerned, part of urea produced by petrochemical industry and gas-chemical industry was presumed to be allocated for export. (See Note 1.)

Note 1. Urea production by petrochemical industry and gas-chemical industry is expected to reach 880,000 tons in the year 1984/85.
Petrochemical industry – 300,000 tons
Gas-chemical industry – 580,000 tons

(3) Component ratios of N, P_2O_5 and K_2O were assumed to be the same as those for the year 1974/75.

Table 31. Fertilizer Production and Consumption (1984/85)

(in 1000 tons)

		(N)	(P_2O_5)	K_2O	Total
Cons.	Nutrient	900	400	100	1,400
	Actual Weight	3,700	400	200	4,300
Prods.	Nutrient	1,010	400	-	1,410
	Actual Weight	4,140	400	-	4,540

2) Cargo Traffic through Ports

In calculating the volume of cargo traffic supply of raw materials for fertilizer production and shipment of products were considered as follows.

(1) Requirements for raw materials of nitrogen fertilizer (N) are to be met fully by natural gas.

(2) For raw materials of phosphorus fertilizer (P_2O_5), requirements for sulphuric acid is to be met by gypsum and those for phosphate rock are to be met by imports.

(3) Potash fertilizer (K_2O) is to be imported in total amount.

(4) 50% of urea production are to be exported in the year 1984/85.

(5) There will be no need for East Pakistan to import fertilizer from West Pakistan.

1974/75

Import = 2,514 – 2,270 = 244 (1,000 tons)
(Cons.) (Prods.)

Import = 119 x 1.28 (Note 1) = 152 (1,000 tons)
(Phosphate rock)

1984/85

Import = 200 (1,000 tons)
(K_2O)

Import = 400 x 1.28 = 510 (1,000 tons)
(Phosphate rock)

Export = 880 x 1/2 = 440 (1,000 tons)
(Urea)

(Note 1) If the production of P_2O_5 is to be divided into triple superphosphate and single superphosphate at the ratio 3:1, 1.28 tons of phosphate rock is required for the production of one ton of P_2O_5.

j) Miscellaneous Cargo

Cargo traffic of the present level was considered for the year 1974/75 and the maximum cargo traffic of the past was considered for the year 1984/85 (See Table 32).

Table 32. Miscellaneous Cargo (Bulk)

(1,000 tons)

	1969-70	1974-75	1984-85	Remarks
Export	173	190	210	
(Foreign)	(74)	(80)	(100)	
(Coastal)	(99)	(110)	(110)	
Import	28	30	70	
(Coastal)	(28)	(30)	(70)	
Total	201	220	280	

ii) Oil and Petroleum Products

a) Crude Oil

1) Production and Consumption

Crude oil production and consumption is shown in Table 33. For the year 1974/75, the target figure of the F.F.Y.P. was used. For the year 1984/85, total energy consumption in all Pakistan was calculated from per capita consumption of energy as in the case of steel consumption and 5% of total requirement for energy were considered to be dependent on petroleum energy on the basis of the past experience. Then, petroleum consumption was calculated by converting the amount of energy to the amount of petroleum. The ratio of West Pakistan and East Pakistan in petroleum consumption was 3.2:1 in the year 1969/70.

The F.F.Y.P. calls for the ratio of 2.3:1, indicating the effort to maintain equilibrium between West Pakistan and East Pakistan in petroleum consumption. Accordingly, the ratio of 1.5:1 was considered for the year 1984/85 to narrow a gap between West Pakistan and East Pakistan.

Consumption was calculated in the following assumptions.

(a) Per capita GNP in the year 1984/85 is to be $230.00 (In 1968 cost).

(b) Per capita consumption of energy is to be 380 coal-kg from Fig. 7.

(c) Energy consumption in all Pakistan is to be 71 million coal-tons from the following calculation.

$$380 \text{ coal-kg} \times \underset{\text{(Population in '84/85)}}{186.6} = 71 \text{ million coal-tons}$$

(d) The amount of energy dependent on petroleum is 35 million coal-tons, i.e.

71 million coal-tons x 0.5 = 35 million coal-tons

The factor of 0.5 was used following the present pattern of energy

consumption (Note 1) since the future composition of energy cannot be predicted.

(Note 1) Energy consumption in the year 1974/75 calculated by the same method as that used for this estimate agrees with the target figure of the F.F.Y.P.

1. 1974/75: 130-%/person 180 coal-kg/person
2. Energy consumption in all Pakistan = 180 x 151.5 = 27 million coal tons.
3. Energy consumption dependent on petroleum in all Pakistan = 27 x 0.5 = 14 million coal tons.
4. Petroleum consumption in all Pakistan = 14 ÷ 1.3 kℓ/coal-tons = 11 million kℓs = 9.8 million tons

(e) Consumption in West Pakistan is to be 14.4 million tons, i.e.

24 million tons x 0.6 = 14.4 million tons

As for production, the same figure as that of consumption was considered on the assumption that self-sufficiency would be attained both in West Pakistan and East Pakistan in the year 1984/85.

2) Cargo Traffic through Ports

The difference between consumption and domestic production is to be considered as the amount of import. The amount of imports in the year 1974/75 and 1984/85 is shown in Table 33.

Table 33. Crude Oil Import

('000 tons)

	1974-75	1984-85	Remarks
Consumption	6,800	14,400	
Indigenous	1,600	2,800	
Import	5,200	11,600	

b) Petroleum Products

340,000 tons of naphtha is to be exported in the year 1974/75 after deducting domestic consumption from the total amount of naphtha produced by petrochemical industry. Layout of oil refineries and production capacities of oil refineries in the Korangi district by product are as follows:

Fig. 7. Rotation between Per Capita Energy Consumption and Per Capita G.N.P.

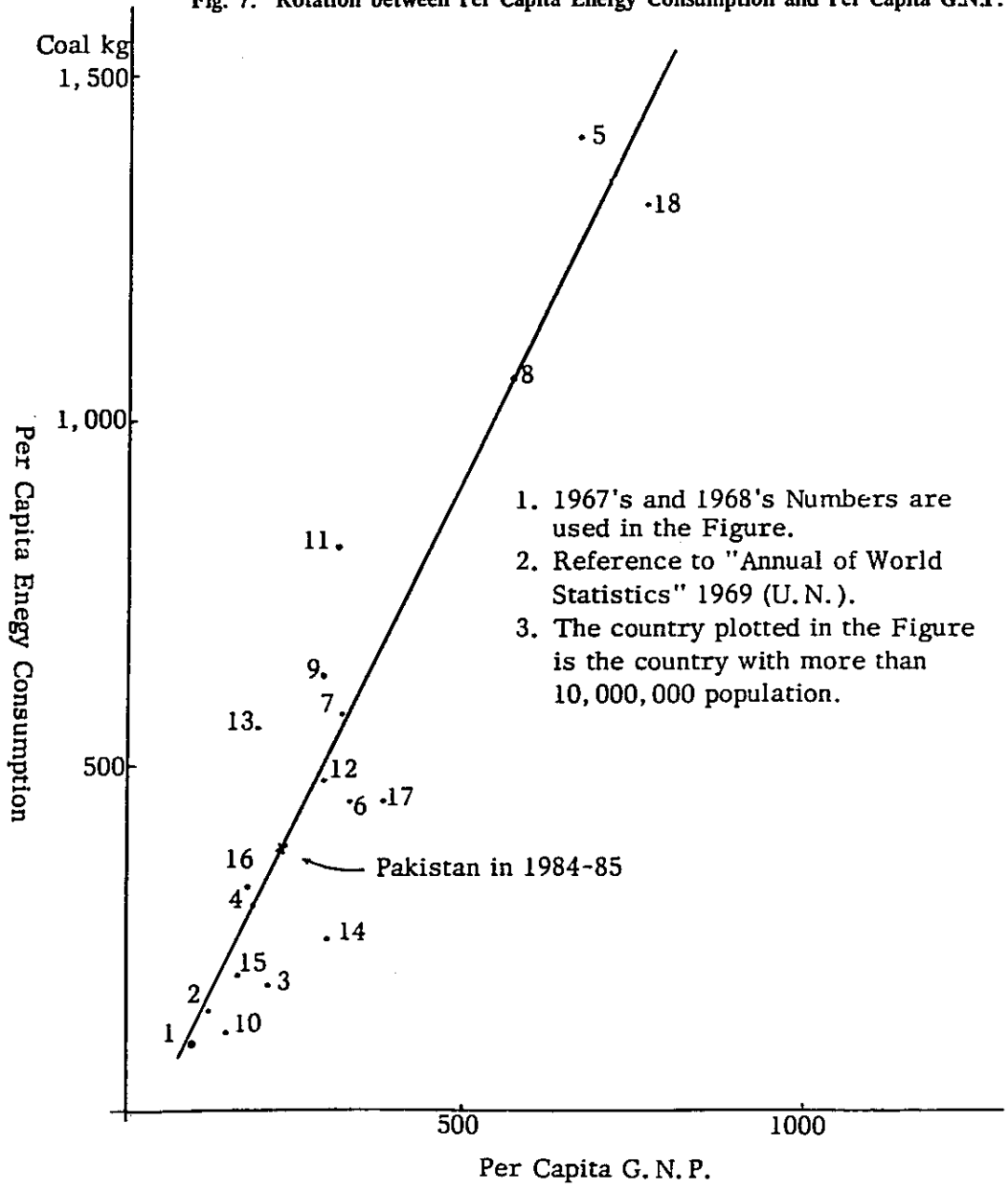
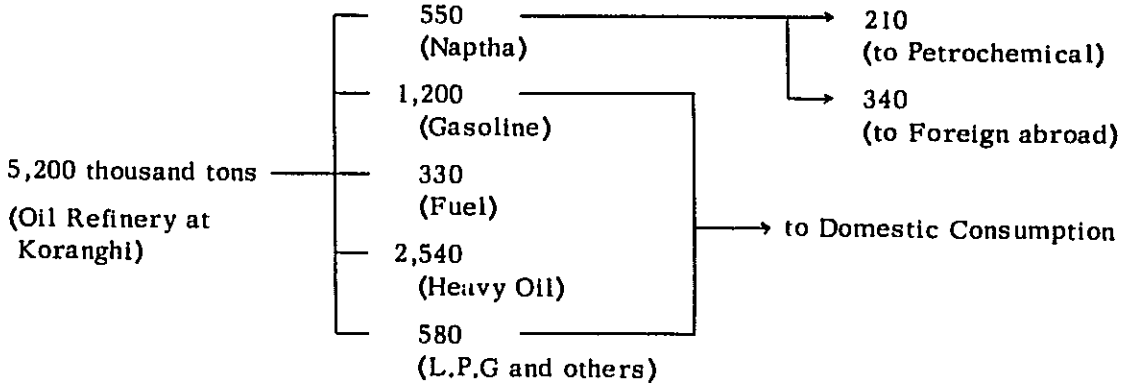


Table 34. Layout and Capacities of Oil Refineries (1974/75)

	Location	Oil consumption	Remarks
Existing factory	Korangi	5.2 mil tons	1 lahk BPD (Rate of operation - 80%)
	Inland	1.3 mil tons	30 thousand BPD (Rate of operation - 70%)
Total		6.5 mil tons	

Fig. 8. Petroleum Production by Item (Korangi District)



The new oil refineries located in the Phitti creek district are expected to start commercial operation in the year 1984/85. As the total amount of naphtha produced by the oil refineries is expected to be consumed by petrochemical plants, there will be no export of petroleum products in the same year. Layout of an oil refinery is shown in Table 35. The capacity of petrochemical industry was assumed to be 250,000 tons (30,000 tons x 1; 50,000 tons x 2; 100,000 tons x 1) and the following process of production was considered.

Table 35. Layout of Oil Refineries (1984/85)

	Location	Oil consumption	Remarks
Existing factory	Korangi	4.8 mil. tons	1 lahk BPD (75% operating rate)
	Inland	2.4 "	0.6 lahk BPD (70% ")
New factory	Phitticreek	6.8 "	1.5 lahk BPD (75% ")
Total		14.0	

iii) General Cargo

a) Cotton

1) Production and Consumption

Production and consumption is shown in Table 36. For the year 1974/75, the target figure of the F.F.Y.P. was adopted. For the year 1984/85, the following assumptions were made.

(a) In view of the fact that cotton textile is a key industry in Pakistan, consumption in both West Pakistan and East Pakistan was considered to double in 10 years after the year 1975/76.

(b) For West Pakistan, an increase of production in the amount approximately the same as that for rice and wheat was considered. In other words, the annual growth rate of production was considered to be 5% for the period from the year 1974/75 to 1979/80 and 3% for the period from the year 1979/80 to 1984/85.

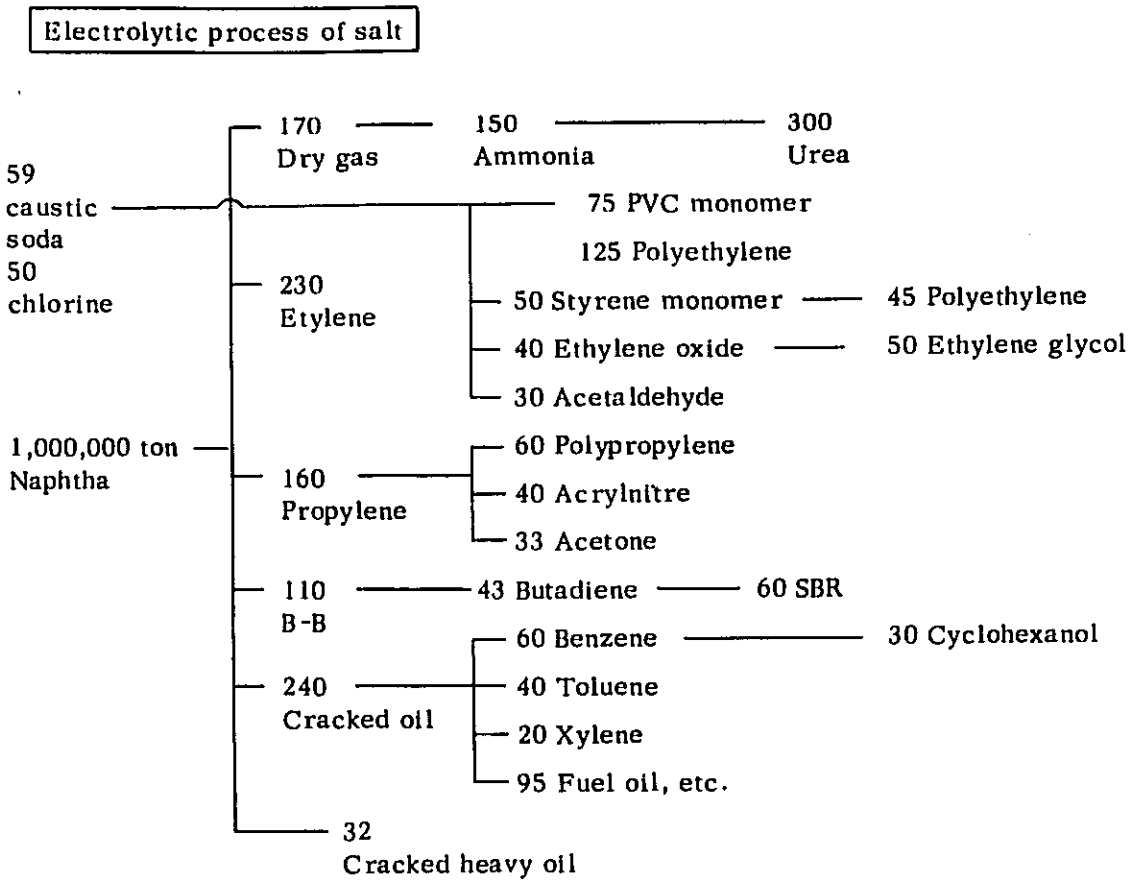
Table 36. Cotton Production and Consumption

	West Pakistan				East Pakistan				All Pakistan	
	Prods.	%	Cons.	%	Prods	%	Cons.	%	Prods	Cons.
	1,000 bales		Million lbs (1,000tons)		1,000 bales		Million lbs (1,000tons)		1,000 bales	Million lbs (1,000tons)
	a)		d)				d)			
1960-61	1,690		(202)				(26)		1,690	(228)
	a)		d)				d)			
62	1,820		(202)				(30)		1,820	(232)
	a)		d)				d)			
63	1,970		(210)				(29)		1,970	(239)
	a)		d)				d)			
64	2,350		(230)				(34)		2,350	(264)
	b)		d)		c)		d)			
65	2,349	6.7	(234)	3.5	15		(38)	8.7	2,364	(272)
	b)		d)		b)		d)			
66	2,620		(227)		16		(40)		2,636	(267)
	b)		d)		b)		d)			
67	2,605		(240)		15		(43)		2,620	(283)
	b)		d)		b)		d)			
68	2,911		(208)		15		(42)		2,934	(310)
	c)		d)		b)		d)			
69	2,961		(291)		13		(50)		2,974	(341)
	c)		570 c)		b)		130 c)			700
70	3,000		(260)		14		(59)		3,000	(319)
		7.5		4.1				2.5		
	c)		700 c)		c)		400 c)			1,100
75	4,300	5.0	(320)		17		(181)		4,317	(501)
80	5,500			7.0	20			7.0	5,520	
		3.0	1,400				800			2,200
85	6,400		(640)		25		(362)		6,425	(1,002)

Remarks:

1. a) by E.I.U.
2. b) by E.S.P.
3. c) by F.F.Y.P.
4. d) by P.C.

Fig. 9. Process of Production for Petrochemical Industry



(Note) As for gas-chemical industry, production of urea was estimated as follows.

For the year 1974/75, production of urea was estimated at 320,000 tons under the F.F.Y.P.

For the year 1984/85, production of urea was estimated: $320,000 \times 1.06^{10} \fallingdotseq 580,000$ tons. One half of the growth rate of natural gas under the F.F.Y.P. was used as growth rate of urea production.

2) Cargo Traffic through Ports

Cargo traffic through ports may be calculated as follows.

(1974/75)

		1,000 bales (P) or mil. lbs (C)	In terms of cotton (1,000 tons)	Remarks
West Pakistan	Prods.	4,300	765	
		In terms of yarn		
	Cons.	700	320	
			445 → 235 to Foreign abroad	
			→ 210 to East Pakistan	
			(Yarn: 181 mil. lbs. F.F.Y.P.)	

(1984/85)

		1,000 bales (P) or Mil. lbs (C)	In terms of cotton (1,000 tons)	Remarks
West Pakistan	Prods.	6,400	1,150	
		In terms of yarn		
	Cons.	1,400	640	In terms of yarn
			510 → 90 to Foreign abroad	
			→ 420 to East Pakistan	
			Yarn: 362 mil. lbs. (East Pakistan)	
			(twice the amount for the year 1974-75)	

b) Cotton Textile

50% of total production were assumed to be exported both in the year 1974/75 and 1984/85. From the production of cotton described in the preceding Paragraph a), therefore, export in the year 1974/75 is estimated at 160,000 tons (350 mil. lbs. in terms of yarn, accounting for 50% of the total production of 700 mil. lbs.) and that in the year 1984/85 is estimated at 320,000 tons (700 mil. lbs. in terms of yarn, accounting for 50% of the total production of 1,400 mil. lbs.).

c) Miscellaneous Cargo

Miscellaneous cargo traffic through ports for the year 1974/75 was estimated in the following manner.

1) Foreign import cargo was estimated from the multiplication of cargo traffic in the year 1969/70 by 1.26, the growth rate of machinery and equipment production under the Five-Year Plan. Coastal import cargo was considered to be 31.3% of foreign import cargo from the results for the year 1969/70.

2) Foreign export cargo was estimated from the multiplication of cargo traffic in the year 1969/70 by 1.30, the growth rate of production of miscellaneous items under the Five-Year Plan. Coastal export cargo was considered to be 74.3% of foreign export cargo from the results for the year 1969/70.

Cargo traffic for the year 1984/85 was estimated in almost the same manner as for the year 1974/75.

1) Foreign import cargo was estimated from the multiplication of cargo traffic in the year 1974/75 by 1.4, the target growth rate of import under the P.E.P. excluding agricultural products. Coastal export cargo was considered to be the same as that for the year 1974/75.

2) Foreign export cargo was estimated from the multiplication of cargo traffic in the year 1974/75 by 1.9, the target growth rate of manufacture among the expansion of export aimed under the P.E.P. Coastal import cargo was considered to be the same as that for the year 1974/75.

Table 37 shows miscellaneous cargo for the year 1974/75 and 1984/85.

Table 37. Miscellaneous Cargo (General)

(1,000 tons)

	1969-70	1974-75	1984-85	Remarks
Export				
(Foreign)	359.2	470	900	
(Coastal)	266.5	340	670	
Import				
(Foreign)	813.1	1,050	1,500	
(Coastal)	289.3	330	500	

d) Intransit Afghan Cargo

Bulk cargo is represented by wheat for import. The present cargo traffic was adopted for the year 1974/75, and the maximum figure in the past was considered for the year 1984/85.

For general cargo, estimate was made on the extension of cargo traffic for the year 1969/70 using the average growth rate of 11% (annual) for the past five years. Estimated cargo traffic is shown in Table 38.

Table 38. Intransit Afghan Cargo

(1,000 tons)

	1969-70	1974-75	1984-85	Remarks
Wheat (Import)	55.1	60	120	
General (Import)	110.2	190	330	

The estimate of cargo traffic by item described in this section, is shown in Table 1, Chapter I, Part I of this report.

3-3 Sharing Cargo between Phitti Creek Port and Karachi Port

1) General Cargo

All general cargoes are to be handled in Karachi Port.

2) Dry Bulk Cargo

(a) Wheat and Rice

All wheat and rice cargoes are to be handled in Phitti Creek Port by silos to be provided.

(b) Molasses

To be handled in Karachi Port in view of the present state of cargo handling.

(c) Cement

In the year 1974/75 the amount of the existing level (500,000 tons) is to be handled in Karachi Port and an increase of 1.5 million tons are to be handled in Phitti Creek Port.

In the year 1984/85 the total amount is to be handled in Phitti Creek Port. 50% of cement cargo handled in Phitti Creek Port are to be clinker.

(d) Iron and Steel

In the year 1974/75 iron and steel for general consumption amounting to 1,500,000 tons and that for the planned steel mill amounting to 750,000 tons are to be handled in Karachi Port. In the year 1984/85 iron and steel for the planned steel mill amounting to 1,000,000 tons is to be handled in Karachi Port and that for the new steel mill amounting to 3,000,000 tons is to be handled in Phitti Creek Port.

(e) Coal and Coke

In the year 1974/75 the total amount is to be handled in Karachi Port. In the year 1984/85 coal and coke for general consumption and for the planned steel mill, amounting to 740,000 tons is to be handled in Karachi Port and that for the new steel mill amounting to 990,000 tons is to be handled in Phitti Creek Port.

(f) Iron Ore

In the year 1974/75 the total amount is to be handled in Karachi Port. In the year 1984/85 iron ore for general consumption and for the planned steel mill, amounting to 1.53 million tons, is to be handled in Karachi Port and that for the new steel mill amounting to 4.35 million tons is to be handled in Phitti Creek Port.

(g) Fertilizer

In the year 1974/75 general fertilizer amounting 244,000 tons is to be handled in Karachi Port and phosphate rock amounting to 152,000 tons is to be handled in Phitti Creek Port. In the year 1984/85 all fertilizer cargoes are to be handled in Phitti Creek Port.

(h) Sugar, Miscellaneous, Intransit Afghanistan Cargo

These cargoes are to be handled in Karachi Port both in the year 1974/75 and 1984/85.

(i) Oil

All oil cargoes are to be handled in Karachi Port in the year 1974/75 but all in Phitti Creek Port in the year 1984/85.

In allocating cargo between the two ports the normal cargo handling capacity of Karachi Port (40 berths including those under plan) except oil cargo was estimated at 5.9 million tons in the year 1974/75 and 5.5 million tons in the year 1984/85 (see APPENDIX 6-4). For the cargo related to the planned steel mill, it was assumed that cargo handling facilities would be provided at the Western Backwater of Karachi.

3) Supplement – A Study of EIU Draft Report (Traffic Forecast for the Karachi Port Expansion Feasibility Study)

As previously stated in the section for the existing forecast, estimate of cargo traffic in the current project planning was to be based on the EIU Report checked by the Government of Pakistan. However, due to the fact that the said EIU Report was not available to the Survey Team in time, the forecast of cargo traffic through ports mentioned in the previous section was made on the basis of the existing forecast and the subsequent economic trends. The EIU Draft Report came to the hand of the Survey Team when the work was nearing completion.

Consequently, the forecast made by the team was checked against the forecast contained in the Draft Report. In view of the facts that both of them are predictions based on assumptions and that the Draft Report presents some problematical points which will be discussed hereinafter, it was considered appropriate to use the estimate mentioned in the preceding section for the current project planning as originally planned.

In the Report, the estimate of cargo traffic covers a period from the year 1969/70 to 1994/95. In particular, estimate is made for each year up to the year 1984/85 and for every five years up to the year 1994/95.

The method used in the Report in principle is such that the difference between consumption and production is used as import and export cargo. As a precondition of estimate, the Report adopts the frame of the Fourth Five-Year Plan and Perspective Plan in principle. However, the Report does not necessary stick to the Fourth Five-Year Plan for some of cargo items and it uses its own assumptions on the economic frame of West Pakistan with reference to the Perspective Plan in making a long-range forecast. Besides, the Report makes various studies from an international point of views and is regarded as an excellent report. It may be pointed out, however, that the Report presents the following problematical points centering on its contents:

(a) That the Report is a draft report and has not been approved specifically by the Government of Pakistan so far.

(b) That the Report does not contain a forecast of demands for petroleum products, which have a major influence on the development of the Phitti Creek, in the estimate of cargo traffic.

(c) In the estimate of farm production, the Report predicts that East Pakistan will attain self-sufficiency in the supply of major farm products by the year 1979/80. As far as wheat is concerned, however, this prediction is not reasonable when the present supply and demand situation in East Pakistan is taken into consideration. It is considered necessary, therefore, to meet the shortage of wheat in East Pakistan with export from West Pakistan from the standpoint of saving foreign currency.

(d) For cement, the Report gives a rather low estimate on the basis of its own forecast with the past results and the outlook for steel industry as background by deviating from the target figure of the Fourth Five-Year Plan.

In view of the fact that cement industry is a leading industry in West Pakistan together with textile industry and that the future size of steel industry greater than that forecast by EIU should be estimated and can be expected, expansion of cement industry should be planned positively with the premise of attaining the goal under the Fourth Five-Year Plan. With vigorous cement production at home as background, expansion of export market should be promoted through positive sales campaigns not only in East Pakistan but also in the Near Middle East countries.

The Report takes a pessimistic view on the export of clinker. As the transport of clinker is far advantageous than the transport of cement in bag to meet the future requirement for rationalization of transport, shipment in clinker must be adopted positively.

(e) In forecasting steel production the Report gives a low estimate on the demand from the present steel market condition in West Pakistan. However, steel industry is one of the basic industry of the nation and is indispensable to West Pakistan if it is to become an industrial nation. For this reason, promotion of steel industry should be planned positively as a national policy (see APPENDIX 2).

(f) Although the Report gives an analysis of the present condition of West Pakistan and uses the results for the estimate of cargo traffic, application of such a method placing emphasis on the trend to Pakistan is questionable. For the country like Pakistan, which is in the process of becoming an industrial nation, there must be new positive measures for development. In this connection, promotion of heavy and chemical industries, the basic industries of the nation, will be a most effective means for development of West Pakistan. Therefore, promotion of heavy and chemical industries, in addition to steel industry, must be planned strategically. Accordingly, the forecast of cargo traffic must reflect these concept.

A comparison between the forecast by the EIU Draft Report (shown in Table 39) and the forecast by the Team is shown in Table 40.

Table - 39 A Comparison with EIU Forcast

(In thousand tons)

	Total			Foreign						Coastal					
				Import			Export			Import			Export		
	1969/70	1974/75	1984/85	1969/70	1974/75	1984/85	1969/70	1974/75	1984/85	1969/70	1974/75	1984/85	1969/70	1974/75	1984/85
1. Dry Cargo															
Wheat	354	440 373	- 1,650	226			2	- -	- 230	-	- -	- -	127	440 373	1,420
Rice	584	1,500 1,552	1,720 2,200	-			104	500 600	1,320 1,700	-	- -	- -	481	1,000 952	400 500
Molasses	136	190 150	120 150	-			136	190 150	120 150	-	- -	- -	-	- -	- -
Cement	666	1,100 2,000	1,200 3,000	1			254	300 1,000	400 1,500	-	- -	- -	411	800 1,000	800 1,500
Iron & Steel	338	730 1,595	430 400	335	730 1,595	430 400	-	- -	- -	3	- -	- -	-	- -	- -
Coal & Coke	84	90 710	1,030 2.730	84	90 710	1,030 2,730	-	- -	- -	-	- -	- -	-	- -	- -
Iron Ore	36	- 1,360	2,000 5,800	-	- 1,360	2,000 5,840	34	- -	- -	-	- -	- -	2	- -	- -
Sugar	27	150 215	130 200	-	- -	- -	-	- -	- -	-	- -	- -	27	150 215	130 200
Fertilizer	696	470 396	1,200 1,150	688	470 396	1,100 710	-	- -	- 440	-	- -	- -	-	- -	- -
Cotton	185	340 445	640 510	-	- -	- -	103	250 235	470 90	-	- -	- -	2	90 210	170 420
Textile	132	210 160	250 320	-	- -	- -	111	180 160	190 320	-	- -	- -	21	80 -	40 -
Miscellaneous	2,057	2,392 2,410	3,705 2,850	813	527 1,050	580 1,500	438	1,105 550	1,975 1,000	317	352 360	470 570	377	410 480	680 780
Intransit Afgan C.	165	148 250	185 450	165	133 250	160 450	-	15 -	25 -	-	- -	- -	-	- -	- -
Total	(5,351)	(7,760) (11,616)	(12,610) (22,410)	(10.621)	(1,950) (5,360)	(5,400) (11,590)	(1,182)	(2,500) (2,695)	(4,500) (5,430)	(320)	(350) (360)	(470) (570)	(1,507)	(2,920) (3,230)	(2,240) (4,820)
2. Oil															
Crude Oil	3,301	5,200	11,600	3,301	5,200	11,600	-	-	-	-	-	-	-	-	-
Petroleum Products	688	340	-	1	-	-	679	340	-	-	-	-	8	-	-
Total	(3,988)	(5,540)	(11,600)	(3,302)	(5,200)	(11,600)	(679)	(340)	(-)	(-)	(-)	(-)	(8)	(-)	(-)
3. Grand Total	(9,339)	(17,156)	(34,010)	(13,923)	(10,560)	(23,190)	(1,861)	(3,035)	(5,430)	(320)	(360)	(570)	(1,545)	(3,230)	(4,820)

1. The top figures are those forecast by EIU and the bottom figures are those used for the current project planning.
2. No forecast is made on oil by EIU Draft Report.

Table 40. Projection of Traffic Flows (Dry Cargo)

(In million tons)

	Total	Foreign		Coastal	
		Import	Export	Import	Export
1969/70	5.42	2.10	1.56	0.32	1.44
74/75	7.76	1.95	2.54	0.35	2.92
79/80	10.60	4.50	3.63	0.41	2.06
84/85	12.61	5.40	4.50	0.47	2.24
89/90	14.80	6.18	5.48	0.55	2.59
94/95	16.90	7.15	6.25	0.66	2.84

4. Present State of Inland Transport

Although railways and roads plays a central role in the transportation of cargo among the means of inland transport in West Pakistan, it seems that the transportation of more than half of the total inland cargo depends on railways at present. Under the Fourth Five-Year Plan, however, it is estimated that the share of road transport will exceed that of railway transport in ton-mile and the extension of the expressway-class roads by 2,500 miles by the year 1974/75 is also planned.

Table 41. Forecast of Transport Capacity

	Projected traffic 1975 (billion ton miles)	Total percentage of growth over 5 years	Remarks
West Pakistan	14.1		
Rail	(6.5)	15	
Road	(7.6)	73	
East Pakistan	4.2		
Rail	(1.4)	30	
Road	(1.8)	100	
Inland Water Transport	(1.0)	150	
All Pakistan	18.3	47	
Rail	(7.9)	20	
Road	(9.4)	77	

Note: Forecast under the Fourth Five-Year Plan

1) Railways

The railways in West Pakistan are operated by PWR (Pakistan Western Railway) which, in turn, is administered by the Government of Pakistan.

PWR has a total route mileage of about 5,300 miles in West Pakistan. Major routes are: Peshawar-Karachi (1,045 miles), Karachi-Quetta (533 miles), Rohri-Chaman (327 miles) and Lahore-Mari Indus (330 miles).

Table 42. Route and Track Mileage of PWR

	Route mileage	Track mileage	Remark
Broad Guage	4,678.31	6,896.10	
Metre Guage	276.76	344.13	
Narrow Guage	379.72	453.03	
Total	5,334.79	7,603.26	

Note: Economic Survey 1968/69

The past results of transportation were 136 million passengers (1968/69) and 14.6 million tons of cargo (1968/69). Both passenger traffic and cargo traffic have not shown any significant growth in the past several years. Main items of cargo are farm products, gravel and sand, coal, fuel wood, cement and petroleum.

Table 43. Railway Freight Traffic (PWR)

	Passengers		Goods	
	Nos. (Million)	Passenger Miles (Million)	Tons (Million)	Ton Miles (Million)
1964-65	131.6	6,258.3	14.7	4,941.0
66	122.9	6,005.0	13.5	4,741.8
67	128.4	6,206.8	14.7	5,053.8
68	132.8	6,274.6	14.9	4,927.3
69	135.8	6,480.0	14.6	4,760.8

Source: Development Statistics of West Pakistan

Under the Fourth Five-Year Plan, improvement of railway facilities with emphasis placed on meeting the requirement for locomotives is positively planned.

2) Roads

The total length of roads in West Pakistan at the time of independence was only 13,781 miles. In 1970 when the Third Five-Year Plan came to an end, the total length of road expanded by nearly 10,000 miles to 23,283 miles to provide a road network in West Pakistan. Of this total length, approximately 10,000 miles are of all weather roads which permit traffic in the inclement weather and the remaining length is for those roads which are in unsatisfactory condition.

For super highways, the Karachi-Hyderabad section (100 miles) has opened recently. Besides, super highways are planned for the Lahore-Multan section, Lahore-Lyallpur section and Sheikhupuna-Sargoda Section.

On the other hand, the number of motor vehicles has been increasing annually as shown in Table 44 In the future, construction of roads and the increase in motor vehicle transport will progress side by side and this trend will be more conspicuous in the country like West Pakistan where the development of inland transport system has been preceded by railways.

Table 44. Number of Motor Vehicles in West Pakistan

	1964/65	65/66	66/67	67/68	68/69
All Vehicles	132,758	134,317	135,442	149,335	159,255
Motorcars, Jeeps and Station Wagons	51,146	50,334	50,835	56,447	61,176
Motor Cycles and Scooters	35,779	34,698	36,744	42,165	47,015
Trucks and Delivery Vans	19,095	32,018	21,422	22,402	22,236
Buses	7,330	7,676	7,871	8,708	8,957
Taxis and Auto Riskshaws	16,055	15,867	15,838	17,074	17,404
Others	3,353	3,724	2,712	2,539	2,467

5. Karachi Metropolitan Region Development Plan

5-1 Outline of Karachi City

Karachi City with a population of 3.3 million is the largest city not only in West Pakistan but in all Pakistan. The city had been the center of politics and economy as the capital city of Pakistan from olden times. Since the capital of the nation was transferred to Islamabad, the city has been developing as the center of the nation's economy and has a strong color as an international city linked with other countries through Karachi Port and the Karachi Airport.

When the federalism was put into effect, it was designated the capital city of Sind province.

The climate is a dry desert-like climate with an annual rainfall of 8.3 inches, which concentrates on the summer monsoon season. The temperature is moderate ranging from 19°C to 21°C in winter (December ~ February) but intense heat (maximum 30°C) dominates other seasons.

The population as of 1970 is 3.20 million. The population of 400,000 in 1947 when the country was separated from India rose to 1.1 million in 1951 and to two million in 1960 at an explosive annual growth rate of 5.5% since 1951 (The increase during the 1947/51 period is attributed mainly to the inflow of refugees).

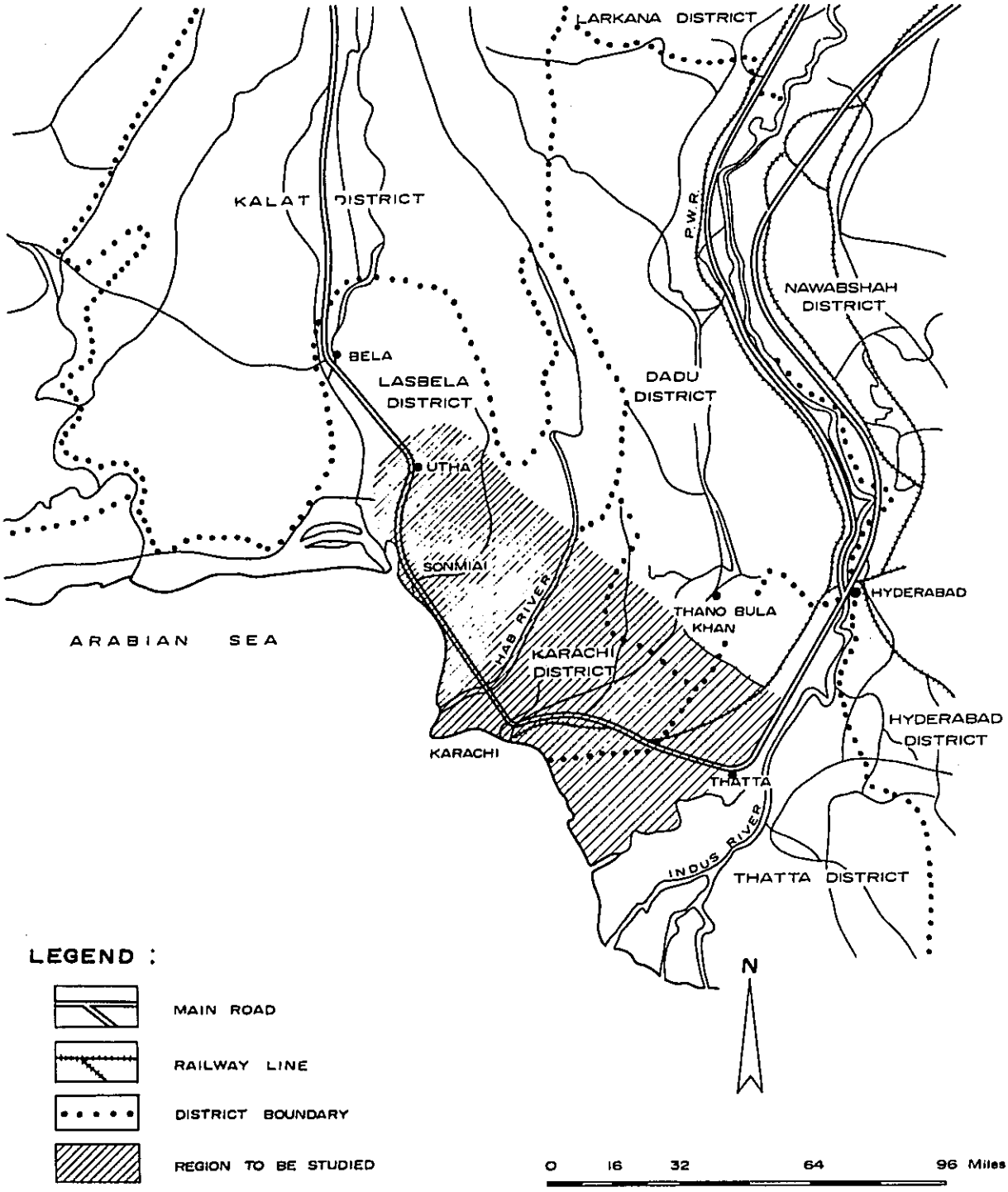
Mainly due to the shortage of water, almost no agriculture is seen in the City of Karachi, but 30 to 40% of industries in West Pakistan are said to be located in the city. Another feature of Karachi City is that it is not only the center of economic activities in West Pakistan but is also the center of commercial activities in all Pakistan. Inroads of foreign capital in addition to domestic capital are remarkable.

Development of Karachi City is being progressed by K.D.A.* which is also hastening the completion of a master plan for the Karachi Metropolitan Region. The Karachi Metropolitan Region, as shown in Fig. 10, covers an area of 4,000 sq. miles and includes Uthal and Sommiani in the west and Thatta in the east as well as the entire Karachi district. The City of Karachi is still the center of this region and most of the economic activities are included in the city.

Note: * KDA is an abbreviation of the Karachi Development Authority which was established in 1957 with the aim of formulating a master plan of the Greater Karachi Area and unifying various projects and is a non-profit semipublic organization.

In the following discussion the present and future of Karachi City will be touched on with respect to the population, industry, land use, transportation and water supply in relation with the development of a port in the Phitti Creek district, the main subject of discussion. It must be pointed out, however, that KDA is still working on the master plan of the Karachi Metropolitan Region and has not yet completed the future development plan. Therefore, the discussion will be centered on the present state and an attempt will be made only to forecast the direction of future course from the data obtained from KDA and the results of discussions with KDA officials.

Fig. 10 KARACHI METROPOLITAN REGION



5-2 Population and Industry

As previously stated, the population as of 1970 reached 3.2 million, of which one million are employed. Of the total employed population, 34 ~ 35% are employed by the industry.

According to the forecast by KDA, the population is expected to reach four million in 1975, 5.4 million in 1985, an increase of 1.7 times and 7 million at the beginning of the 21st century. KDA considers it possible to provide comfortable accommodations for this population by efficient land use of Karachi.

As for industrial structure, the share of agriculture is extremely small and manufacturing and commerce are the center of the industry. Even with the manufacturing industry and commerce, the number of industrial plants and commercial establishments was only 46 in 1946. By 1969, however, the number had increased to 6,500 and countless small factories and stores had been established.

Construction of a steel mill and establishment of a petro-chemical complex are being planned. Under these circumstances, Karachi City must continue to play a more important role in the future as the nucleus of economic activities including manufacturing industry and commercial activities.

5-3 Land Use

As shown in Fig. 11, the urbanized area of Karachi City is limited to a radius of 10 miles from the city center. The sections in the east and north have been more developed than the section in the west mainly due to favorable transport conditions.

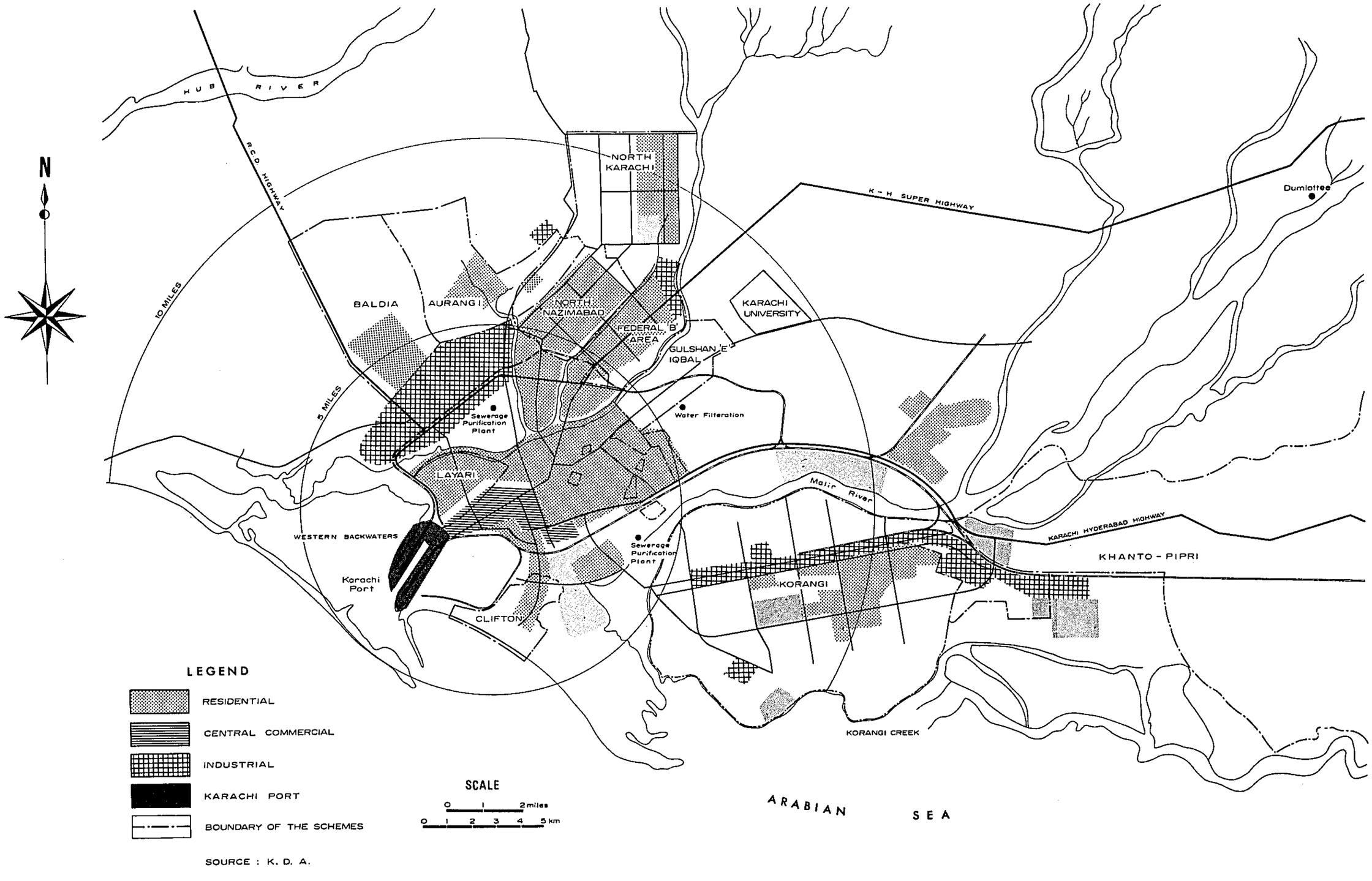
Commercial activities which may be called the nucleus of Karachi City are located mainly along Jinnah Road which originates in Karachi Port and runs through the heart of the city and the residential district extend from north to east as if it encircled the commercial district. As the master plan of Karachi region is not complete, housing development is being pushed forward by KDA with reference to the First Phase Master Plan (Draft) prepared by an European consultant consortium in 1951. At present, a large scale development project is in progress in North Karachi and the Korangi district in the east.

Industry is distributed to the Korangi district in the east, S.I.T.E. in the west and the Goth district in the north. In the Korangi district heavy and chemical industries including oil refineries, thermal power plant and chemical plants, as well as such light industries as cement and textile are being located, forming a strip-like industrial district The S.I.T.E. district in the west, meanwhile, is an old industrial district where such light industries as textile and metal ware manufacturing have been located from olden times and the northern section is a new industrial district which awaits development centering on light industries.

As the transport condition is more favorable in the eastern section than in the western section of Karachi City as will be discussed later, the future urbanization is also expected to develop from the north to the east of the city. In particular, land use along the National Highway and Superhighway will be promoted further.

In the Korangi district, for which KDA has a plan for the development of heavy industries, development of a waterfront industrial complex will be possible for the first time in Pakistan with effective use of favorably situated creeks and a vast land on the waterfront and coordination between the existing industries and housing development.

Fig. II LANDUSE 1970



5-4 Transportation

Railways and road transport are the chief means of communication between the city area and suburbs. As far as the transportation of commodities is concerned, railways seem to have a slightly larger share than trucking at present.

Three trunk roads – RCD Highway, Karachi-Hyderabad Superhighway and Karachi Hyderabad Road (National Highway) – start from Karachi City radially. Each of these roads is a two-four-lane road (Two outer lanes of a four-lane road are not paved in many cases).

As shown in Fig. 12, vehicular traffic on the National Highway is quite large with 5,300 cars/day. Traffic on the Superhighway is only in the order of 70 cars/day mainly due to the fact that it is a toll road and that it has just been completed and is new to the public. Traffic on RCD Highway is 230 cars/day. Such a low rate of utilization is considered natural when the progress of development in the western section of West Pakistan is taken into consideration. It may be said, therefore, that the two trunk roads have considerable room for the future increase in the vehicular traffic.

It must be pointed out, however, that such a through traffic on the trunk road in order to reach the port area, must get on the network of city traffic in the case of the National Highway and the Mauripur Road which links RCD Highway and the Superhighway with the port area has a major disadvantage of level crossing with railways. In order to meet the future increase of cargo traffic through port, it is absolutely necessary to provide a road specifically aimed at linking the port area with trunk roads. This question, however, involves many difficulties in view of the fact that Karachi Port is located just in front of the city area.

The roads shown by dotted lines in Fig. 13 are a new road plan proposed by the related organizations including KDA. If this plan is materialized, traffic situation on the roads linking the port area with the city area and suburbs will be improved considerably. The question is whether these roads have enough room for the traffic of trucks originating in the port.

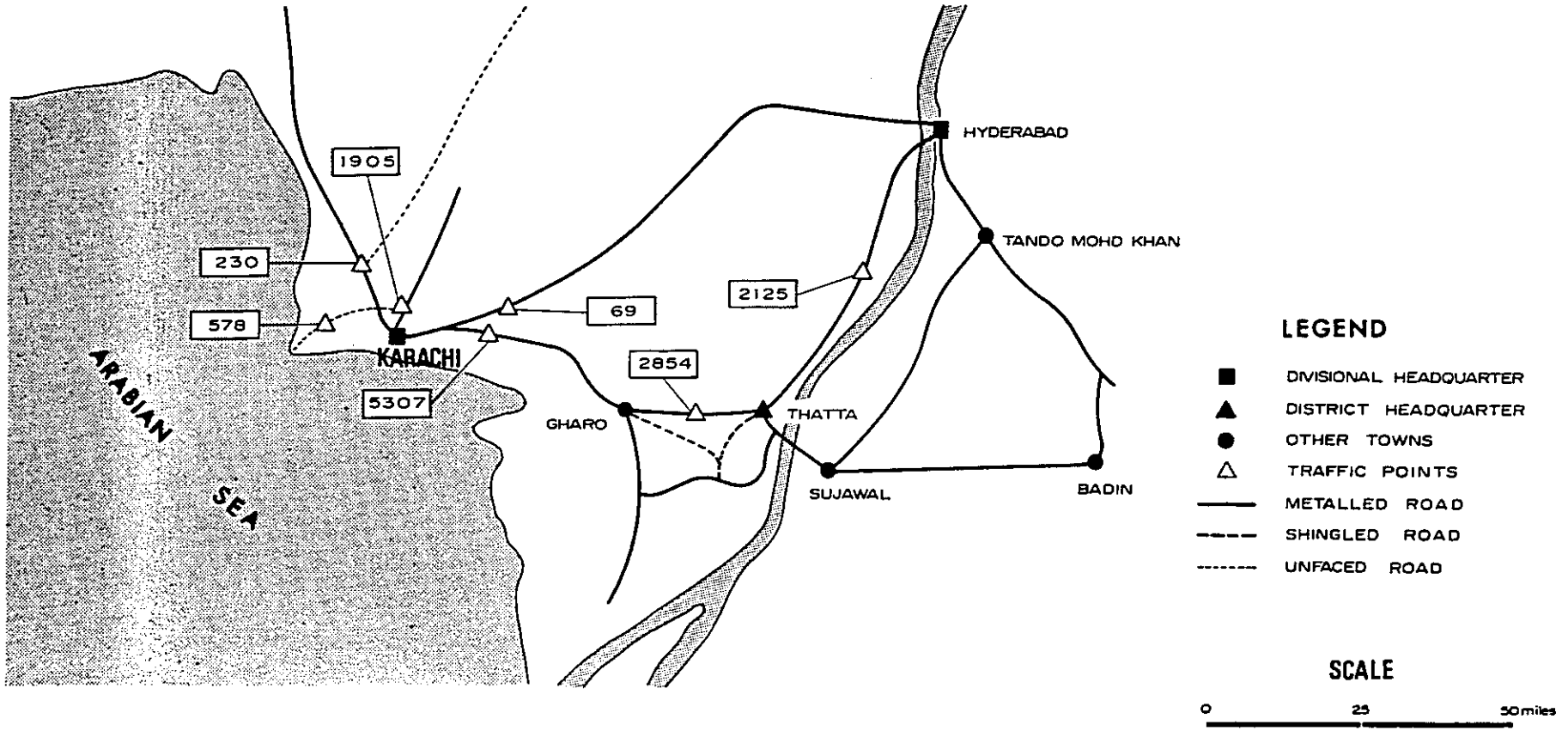
Besides, the First Phase Master Plan (Draft) 1951 proposes construction of an outer circular road outside of the existing circular road. If this road is completed, transport situation in the industrial district of Korangi will be improved considerably.

As for railway transport, the Main Railway Line (Karachi-Kotri Line) which links Karachi with the inland area of West Pakistan and three suburban routes which connects Karachi City with outlying areas via the Main Line, namely, Karachi-Landhi Route, Karachi-Malir Contt. Route and Karachi-Landhi-Koranghi Route- are available. Besides, P.W.R. Circular Railway which connects the northern Karachi with the Main Line is in operation as commuters line. This Circular Railway, however, does not have a linkage in the section between the East Wharf and the West Wharf, and therefore does not form a circle. This causes a bottleneck in the railway transport in the port area.

The Karachi-Landhi-Korangi Route was opened in 1959 following the development of the Korangi district and is now used for transport of raw materials and products originating in the industrial area.

The Main Line is double tracked but the same track is used for passenger trains and freight trains, with the former accounting for about 70% of the total train operation. As the ratio of passenger transport is expected to increase annually, there will be a limit in freight transport in the future.

Fig. 12. Highway Traffic Volume Karachi Region 1969



PWR has a plan to provide a marshalling yard in Pipri in the east of Karachi to handle cargo originating in the Karachi industrial district and the city area. Linkage of this marshalling yard with Karachi Port and further with industrial districts in Korangi and Phitti Creek will expand the use of railways considerably.

Fig. 14 shows the existing railways and the new routes proposed by related agencies so far.

5-5 Water Supply

Karachi City has been suffering from a water shortage since 1964 and water supply is an important factor for the development of Karachi.

The sources of water supply to Karachi are a group of deep wells in Dumllotte, along the Malir River, and the Indus River (taken via Haleji Lake). The amount of water supplied by the wells is not known, but that taken from the Indus River is 140 MGD (630,000 tons/day) at present. This is part of the work under The Greater Karachi Bulk Water Supply Scheme which aims at supplying 280 MGD (1.26 million tons/day) ultimately and is the result of the First Phase Work (1954/62) and the Second Phase Work (1968/71). A total capacity of 280 MGD is to be provided by the Third and Fourth Phase Plans, but details of these plans have not yet been worked out.

Of the present water supply, 27% are used by the industry and the remaining portion is used as city water.

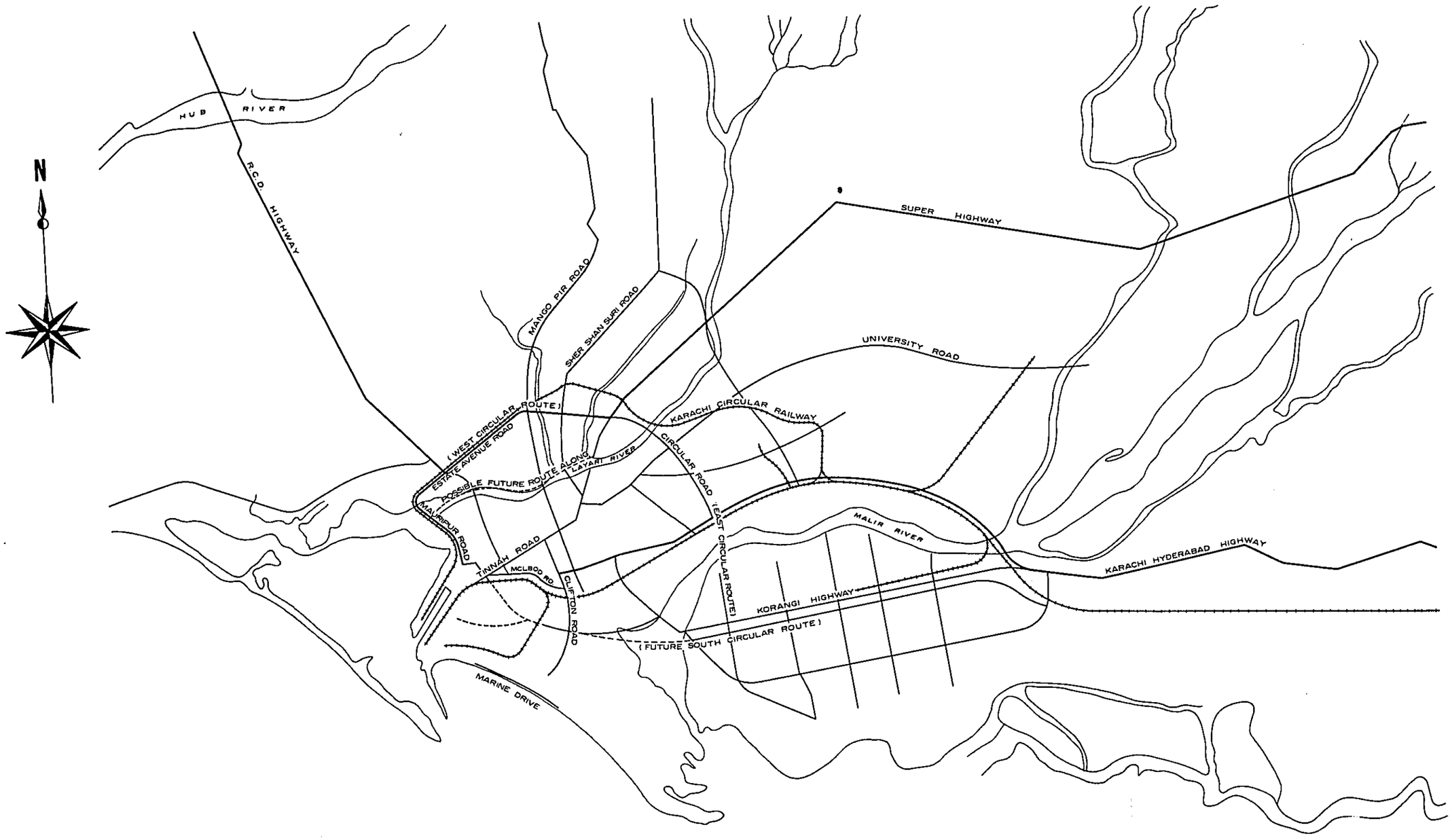
As for future water consumption, KDA forecast shown in Table 44 estimates the consumption in 1985 at 324 MGD (this forecast does not consider water consumption at the time of industrial development of Phitti Creek). To meet this requirement, the Karachi Bulk Water Supply Scheme is not considered sufficient and for this reason, KDA also plans to double the water supply capacity under this scheme.

Of the total water consumption in the future, 60% are needed for city water and the remaining 40% will be used as industrial water.

Table 45. Water Consumption Forecast

	Volume	Remarks
1970-71	140 MGD	Supply Capacity
1975	200	
1985	324	
2000	525	

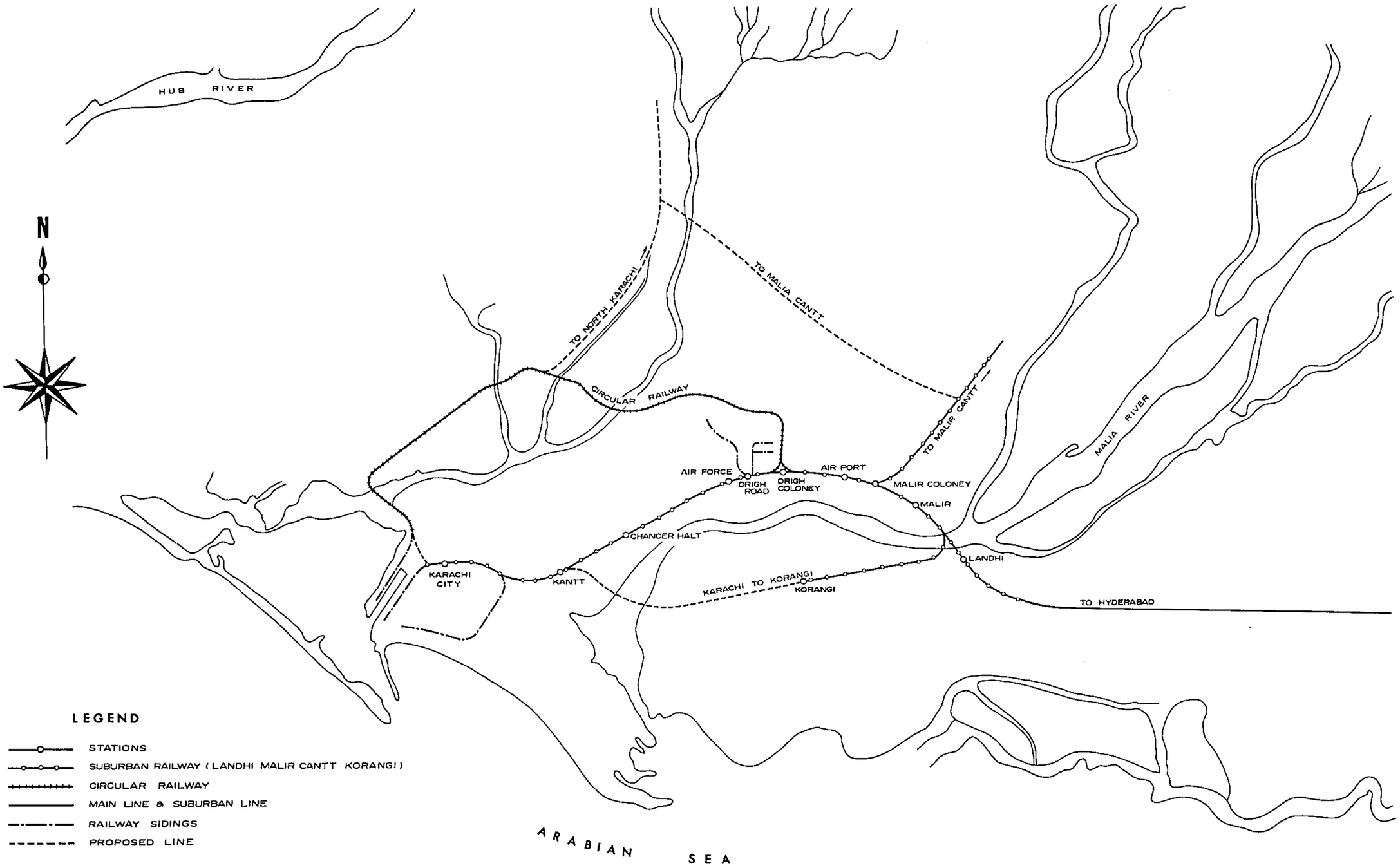
Fig. 13 ROAD APPROACHES



SOURCE : Karachi Port and its relation to the transport sector of West Pakistan by Drs. J.A. Jansen

Fig. 14 RAILWAY APPROACHES

— THE EXISTING & PROPOSED PATTERN —



6. Present State of Karachi Port

6-1 General

The port of Karachi is the largest port in Pakistan and is also the only port in West Pakistan. With the harbour area extending over 310,236 sq. miles, the port of Karachi is an excellent port protected from the stringent climate of the Arabian Sea by natural topography. The port serves a port of call for coastal vessels and ocean-going vessels and is also a base of the Pakistan merchant fleet and the Pakistan Navy.

South and southwest winds are predominant throughout the year, but the southwest winds dominate during the monsoon season. As for tide level, H.H.W.L. is 10.8 feet above the Karachi Port Datum Level and L.L.W.L. is −1.9 feet with the mean high water of about 7 feet.

Until 1880 Karachi Port was under the administrative control of the Bombay Government. With the establishment of the Karachi Harbour Board in 1880 as a turning-point, the Karachi Port Trust Act came into force in 1886, upon which the Karachi Port Trust (KPT) was established The management of Karachi Port has since been in the hand of the Board of eleven trustees organized within KPT.

Cargo traffic through the port in the year 1969/70 totaled 9.34 million tons consisting of 7.48 million tons of foreign cargo and 1.86 million tons of coastal cargo. The number of vessels entering the port in the year 1969/70 reached 1,600 with a total tonnage of 6.76 million gross tons.

6-2 Port Facilities

Karachi Port is divided broadly into the East Wharf district and the West Wharf district. In the East Wharf district waterfronts are utilized as deepwater wharf, lighterage wharf and anchorage for small crafts. The backyard of mooring facilities is used for sheds and freight car marshalling yard. To the south, there is an oil berth, behind which is a group of oil tanks, as a source of energy in West Pakistan. In the West Wharf district, meanwhile, there are some berths under work (mainly dredging) beside a deepwater wharf and other parts are used as shipyard and fishing port facilities.

Main facilities of Karachi Port are as follows.

1) Mooring Facilities

In Karachi Port there are 21 deepwater berths, of which 17 berths are provided in the East Wharf district and 4 berths in the West Wharf district. Each of the 17 berths in the East Wharf district has a depth of 28 to 34 feet and a length of 484 to 550 feet. The total length of the 17 berths reaches 7,722 feet

The cargo handled at these berths is mostly general cargo and amounts to about 4.5 million tons (1969/70): No. 17 berth, in particular, handles 451,000 tons of cargo annually. Each of the 4 berths in the West Wharf district has a depth of 32 to 34 feet and a length of 550 to 600 feet. The total length of the four berths is 2,300 feet and the total volume of cargo handled is 864,000 tons. Besides these 4 berths, the West Wharf district has 3 more berths already completed but yet to provide dredging. Therefore, a total of 24 berths are available for handling general cargo.

Besides, three deepwater oil berths are provided in the southern section of the East Wharf

district and are used mainly for handling imported crude oil. Each of these oil berths has a depth of 31 to 38 feet and a length of 403 to 644 feet. The total length of the 3 berths is 1,691 feet. In the anchorage off the East Wharf there are 10 fixed buoys and 3 swinging buoys, which are used for lighterage and mooring of ships awaiting berth.

As for lighterage wharf, there is a wharf with a depth of 24 feet and a length of 1,800 feet in the West Wharf district and a wharf with a depth of 16 feet and a length of 1,800 feet (20 berths) at the Napier Mole Boat Wharf area in the East Wharf district.

Table 46. Present Conditions of Mooring Facilities (1959/70)

	Location	Name of Berth	Depth	Length	Volume of Cargo (1969/70)	tons/ft	Remarks
					thousand tons		
Shipping Berth	East Wharf	No. 1	34	-	-	-	Under Reconstruction
		2	34	-	-	-	
		3	34	550	72	130	
		4	34	550	81	148	
		5	28	484	397	820	
		6	28	550	310	560	
		7	28	484	353	730	
		8	31	550	280	510	
		9	34	484	327	630	
		10	34	484	357	740	
		11	34	550	300	540	
		12	34	484	327	630	
		13	34	550	326	590	
		14	34	484	296	610	
		15	34	484	360	740	
		16	34	550	275	500	
		17	34	484	451	930	
		Total		7,722	4,512	590	
	West Wharf	No.18	32	550	214	390	
		19	34	550	207	380	
		20	34	600	288	520	
		21	34	600	155	280	
		20		-	-	-	Under Construction
		23		-	-	-	
		24		-	-	-	
		Total		2,300	864	370	
Oil Berth	Oil Pier	1	31'	403'			
		2	31'	644'			
		3	38	644'			

Table 46 (Cont'd)

	Location	Name of Berth	Depth	Length	Volume of Cargo (1969/70)	tons/ft	Remarks
	West Wharf	Lighter-age berth	24'	1,200'			
Lighter-age Berth	East Wharf	Napier Mole Boat Wharf	16'	1,800			for Country Craft
	Juno Bunder		8'	1,235			for Lighters & Boats
Moor-ings			24-27	500-600'			Ten Fixed Moorings
				350-450'			Three Swinging Moorings

Source: K.P.T.

The shortage of mooring facilities is very acute at Karachi Port. As shown in Table 46, the volume of cargo handled at deepwater berths reaches 540 tons per foot and even comes close to 1,000 tons per foot at some berths. The berth occupancy rate exceeds 100% ever since the year 1967/68 as shown in Table 47. As a result, two large vessels are moored at the same berth at times.

Table 47. Berth Company

	1967/68	68/69	69/70	Remarks
	T			
A	5,191,196	4,431,162	5,355,313	
	T/B			
B	273,221	233,219	281,859	
	Days			
C	7,584	7,012	7,612	
D	20.71	19.25	20.89	
E	1.09	1.01	1.10	

Note: 1. Source: K.D.T.

2. A – E are as follows:

A: Total Handled at Ship Wharues (excluding Petroleum)
B: Average Handled per Berth
C: Total Number of Ship Days
D: Average Ships per Day
E: Average of Actual Berth Occupancy for 19 Berths

2) Channel

The main channel has a total length of 4.27 miles and may be divided into the following section according to water depth. The port entrance has a depth of 29 feet, the Lower Harbour 27 feet and the Upper Harbour 30 feet. The channel leading to the shipyard and fishing port facilities has a depth of 20 to 25 feet.

The allowable draught for the main channel at average spring tide is 32 feet. Therefore, the entry of an oil tanker with a draught of 34 feet (32,000 to 34,000 D/T) is possible only at the time of optimum tide condition.

3) Anchorage

The area of anchorage consists of the following.

More than 21 feet in depth	658.1 acres	
More than 27 feet in depth	483.47 acres	(Harbour entrance excluded)
More than 28 feet in depth	559.88 acres	(Harbour entrance included)
More than 29 feet in depth	466.16 acres	(Harbour entrance included)
More than 30 feet in depth	424.14 acres	(Harbour entrance included)

4) Storage Facilities

Storage facilities are shown in Table 48.

Table 48. Storage Facilities

Location	Open Area	Covered Area
o Storage		
T.P. Yard	1,879,587 Sq. Ft.	1,256,049 Sq. Ft.
Keamari	732,852 " "	
o Transit Storage		
Keamari	1,065,960 Sq. Ft.	580,320 Sq. Ft.
M. I. Yard	393,300 " "	421,794 " "
West Wharf	1,881,000 " "	507,006 " "
Juna Bunder	114,399 " "	54,999 " "
Total	6,067,098 Sq. Ft.	2,820,168 Sq. Ft.

Table 49 shows the flow of cargo at port, which may be useful for understanding the use of storage facilities.

Table 49. Flow of Goods Inside the Port

Flow	Volume (thousand), Tons	Major Commodities
EXPORTS		
1. Origin-to-Ship	1,772	Cement, Salt, Fish, also Molasses & petroleum products at described in foot-note.
2. Origin-to-Warehouse-) Shed-Ship)	Nil	
3. Origin-to-Shed-to-Ship	"	
4. Origin-to-Stocking Yard-to-Ship	1,634	Rice, Wheat, Cotton, Rape-seed, Ores
5. Total:	3,406	
IMPORTS		
1. Ship-to-Destination	4,317	Crude Oil, Petroleum Products, Edible Oils, Wheat, Fertilizers, Rock Phosphate, Coal & Coke, and Iron & Steel
2. Ship-to-Shed-to-Warehouse-to-Destination)	1,372	Afghan Cargo, General Cargo, Motor Cars
3. Ship-to-Shed/Plinth-to-Destination)		
4. Ship-to-Stocking, Yard-to-Destination	244	Wheat, Pertilizers
5. Total:	5,933	

Notes:

1. The figures are estimated approximates based on practical observations.
2. The figure '1,772' thousand tons, shown as the traffic from "Origin to Ship" includes 686 thousand tons petroleum products which, generally, are known to be brought to the exporter's shore based storage installations by pipe line and shipped likewise. Also, about 156 thousand tons Molasses which is brought by road and rail to such storage installations and is latter on shipped through pipe line.
3. a) The figure '4,317' thousand tons includes about 3,376 thousand tons of Crude Oil, Petroleum Products, Edible Oils and Tallow which are generally delivered ex-ship through pipe lines to shore based importer's storage installations. Further disposal of these commodities is not known to K.T.T.

5) Dock Railway Sidings

It is said that 60% of cargo transferred to inland transport at Karachi Port depend on railways. For this reason, KPT provides a dock railway network extending over 100 miles. In the case of Karachi Port, railways are used not only for inland transport but even for handling cargo within the port area. Use of railways for transport of cargo for such a short distance is characteristic of Karachi Port.

Because of the high density of railway network in the port area, the dock roads are not necessarily used to full extent, but the capacity of roads is considered sufficient in this stage. However, the traffic of trucks originating in the port must pass through the Karachi Metropolitan Area with the resultant concurrence with city traffic.

6-3 Entry of Ships

The number of ships entered Karachi Port in the year 1969/70 was 1,598, of which ocean-going ships accounted for 1,432 or 89%. The number of ships entering the port has been steady since long ago, but the gross tonnage of ships entering the port has increased to some extent, indicating an increase in the size of ships.

Table 50. Shipping Ships with Classification Handled at Karachi Port

Ship Size Gross (Tonnage)	Foreign Shipping (Nos.) Year		Coastal Ships (Nos.) Year	
	1968/69	1969/70	1968/69	1969/70
0 to 499	69	28	-	-
500 to 999	23	39	-	-
1,000 to 1,999	60	108	8	-
2,000 to 2,999	87	58	1	-
3,000 to 4,999	139	139	-	-
5,000 to 9,999	751	766	127	156
over 10,000	293	294	6	10
Total	1,346	1,432	142	166

Table 51. Ships Entered in The Port of Karachi (for the Period 1959/60 to 1969/70)

	1959/60	60/61	61/62	62/63	63/64	64/65	65/66	66/67	67/68	68/69	69/70
(A) Vessels Entered in Foreign Trade (excluding country craft)											
i) Total No. entered	1414	1434	1337	1442	1435	1513	1134	1234	1269	1346	1432
ii) Total net tonnage registered	5408,347	5651,769	5504,250	6186,295	6258,779	7071,584	5277,211	6268,927	5923,906	5680,635	6027,079
(B) Vessels Entered in Coastal Trade (excluding country craft)											
i) Total No. entered	55	60	84	87	87	85	94	123	136	142	166
ii) Net Tonnage registered	193,848	242,621	306,978	304,802	338,025	362,897	362,011	521,199	577,806	585,431	728,378
(C) Total Vessels Entered Foreign and Coastal Trade (excluding country craft)											
i) Total No. entered	1469	1494	1421	1529	1522	1598	1228	1407	1405	1488	1598
ii) Net Tonnage registered	5602.245	5894,390	5811,223	6491,097	6596,804	7434,481	5639,222	6790,126	6501,712	6266,066	6755,457

Note: 1. The statistics as required under Table 3.1 is not maintained in terms of "Gross Tonnage". Therefore, it is provided in terms of Net Registered Tonnage.

2. As regards the break-up of Shipping Statistics for vessels coming in various groups of "Gross Tonnage" it is not also readily available. However, an estimated percentage for the current period can be ascertained from the 6 months data supplied against Table No. 3.3.

Because of the inadequate berthing facilities, there is a chronic delay of berthing at the port. According to the record for the period from January to March 1969, the duration of off-shore waiting for berth averaged 40 hours. This waiting hour tends to become longer annually. Changes in off-shore waiting hours are shown in Table 52.

Table 52. Turn-Round of Ships at The Port of Karachi – Vessels over 500 G/T (for the period 1964/65 to 1968/69)

Years	No. of Vessels calling at the port	*Average waiting time off port	Average time taken in cargo operation	Average total turn-round time	Remarks
1964/65	1598	25 hours	101 hours	138 hours	
1965/66	1228	20 "	95 "	129 "	
1966/67	1407	36 "	105 "	232 "	
1967/68	1405	37 "	112 "	173 "	
1968/69	1492	25 "	78 "	134 "	

* Average waiting time does not include waiting time for vessels coastal trade and vessels described as Oil Tankers which have separate berthing facilities at Oil Piers.

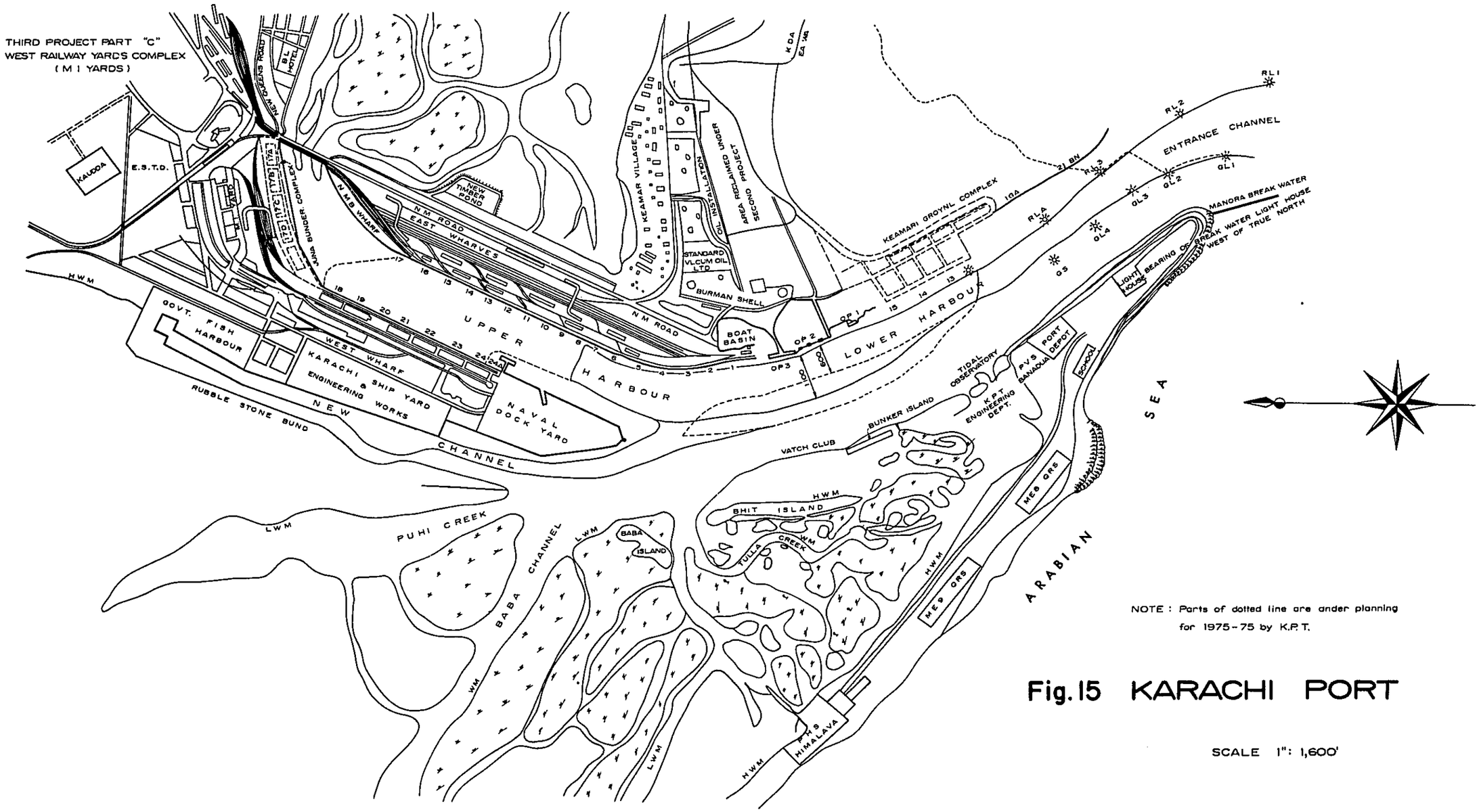
6-4 Future Plans for Karachi Port

The most serious problem of the present Karachi Port is that there is a shortage of berthing facilities. For this reason, a deepwater wharf with 3 berths for general cargo is under construction in the West Wharf district by the hand of KPT in addition to the existing 21 deepwater berths and 3 oil berths. The three berths under construction are expected to complete in the year 1971/72. Then, the cargo handling capacity of Karachi Port will increase to 6 million tons except for petroleum products if the present work is to be continued.

Succeeding the improvement of facilities in the West Wharf district, KPT also plans construction of 4 deepwater berths (each having a depth of 30 feet and a length of 525 feet) at Keamari Groyne and 4 medium sized berths (each having a depth of 24 feet and a length of 540 feet) at Juna Bundar in the West Wharf district by the year 1975/76. This plan has already been approved by the National Economic Council of the Pakistan Government. Construction of these berths under the plan is scheduled to start in 1971 and complete in 1975. According to the "Karachi Port and Its Relation to the Transport Sector of West Pakistan by Drs. J.A. Jansen, dry cargo handling capacity of Karachi Port upon completion of these berths is expected to reach about 5.5 million tons. In this calculation the berth occupancy rate is held at about 70%, the rate which is generally considered acceptable. A berth utilization plan is shown in Table 53.

The plans mentioned so far are for the year up to 1975/76. In order to meet the increase in the volume of cargo in the subsequent period, KPT plans construction of a second port mainly for bulk cargo handling in the Western Backwater of Karachi.

Under the plan, handling of raw materials for a steel mill to be located in the area is conceived and various surveys and investigations have been conducted so far in relation to this plan.



NOTE : Parts of dotted line are under planning for 1975-75 by K.P.T.

Fig. 15 KARACHI PORT

SCALE 1": 1,600'

7. Determination of the Requirements for Port Facilities

7-1 Deepwater Wharves

Except for special cases, ships enter the port at random as far as the time is concerned and the service received from the port (duration of cargo handling, etc.) is not uniform but versatile in nature. Under these circumstances, the requirement for berthing facilities is generally determined by judging the balance between the cost of berth construction and the demmurage resulting from off shore waiting. As a typical example of calculations for this purpose, the queuing theory advocated by the operations research (O.R.) is available.

For calculation under the queuing theory, observation data for a long period of time such as the conditions of ship arrival and cargo handling are required. As the required data were not available during the current survey, the following simple method was used for calculation.

The requirement for berthing facilities was determined from the following equation. When the type of ships and cargo is fixed and cargo handling method is standardized, as often seen at a wharf for a plant, this equation is quite dependable.

Table 54. Normal Port Capacity in 1,000 Tons without OFF-Shore Waiting for Berths

Dry Cargo-Min. OTIS	1969/70		1975/76	
Dry-Cargo	B	CAP	B	CAP
E. Wharf berths 1, 2, 3, 4	2	280	44	630
E. Wharf berths 5 - 17	13	2,080	13	2,080
East Wharf	15	2,360	17	2,710
West Wharf		-		
W. Wharf berths 17A-B-C.D	-	-	4	660
W. Wharf berths 18-21	4	700	4	700
W. Wharf berths 22, 23-24	-	-	3	560
West Wharf	4	700	11	1,920
K. Groyne 1-4	-		4	640
	-		4	640
	19	3,060	32	5,270
Bunders				
Lighterage Wharf		160	-	250
Juna Bunder		220		
Bunders (o/s Cargo)		380	-	250
Dry Cargo capacity	19	3,440	32	5,520

Port capacity under normal conditions of 70% berth occupancy (243 laydays and about 1,000 tons per m) 914 tons per yard per year. 1968/69 based upon actual outputs; 1969/70 onward upon traffic forecast Planning Commission.

$$B = V/v \times t/365 \times 1/2$$

$$t = v/\mu + \gamma$$

$$\mu = A \times n \times T \times \beta$$

where: B = number of berths
V = total volume of cargo to be handled (ton)
v = average load of cargo per ship (ton)
t = number of ship days per ship (day)
α = berth occupancy rate
μ = average cargo handled per day (ton)
γ = number of days preparing for arrival and departure (day)
A = capacity of cargo handling equipment (ton/hour)
T = average cargo handling time per day (h)
n = number of cargo handling equipment
β = operating rate of cargo handling equipment.

Table 54. Determination of Requirement for Berthing Facilities in 1974/75

Cargo item	Volume of cargo to be handled V	Average cargo load per ship	Berth occupancy rate	Number of days preparing for arrival & departure	Capacity of cargo handling equipment A	Number of cargo handling equipment Y	Average cargo handling time per day T	Operating rate of cargo handling equip.	Number of berths B
	1,000 ton	ton		day	ton/h	unit	hour		
Cement clinker	750	10,000	0.6	1.0	500	1	12	0.9	1
In bag	750	10,000	0.8	1.0	200	2	12	0.9	1
Phosphate rock	752								
Grains	1,925	8,000	0.6	1.0	500	1	12	0.9	3

Note: Although one unit of equipment is sufficient for handling cement clinker, two units are to be provided in case one should fail to operate.

Table 55. Determination of Requirement for Berthing Facilities in 1984/85

	Volume of cargo to be handled V	Average cargo load per ship	Berth occupancy rate	Number of days preparing for arrival & departure	Capacity of cargo handling equipment A	Number of cargo handling equipment Y	Average cargo handling time per day T	Operating rate of cargo handling equip.	Number of berths B
	1,000 ton	ton		day	t/hr	unit	hr		
Petroleum	11,600	40,000	0.6	1.0	1,500	1	24	0.9	3
Iron ore	4,310	40,000	0.6	1.0	1,000	2	12	0.7	2
Coal	1,990	24,000	0.6	1.0	1,000	2	12	0.7	1
Iron scrap	300	20,000	0.6	1.0	200	2	12	0.5	1
Cement clinker	1,500	10,000	0.6	1.0	500	1	12	0.9	2
Bag	1,500	10,000	0.6	1.0	200	2	12	0.9	2
Grains	3,850	8,000	0.7	1.0	200	1	12	0.9	6
Phosphate rock	510								1
Urea	440								1
Potassic salt	200								1

Note: One berth was allocated to each of phosphate rock, Urea and Potassic salt on the basis of the results at other ports.

7-2 Silos and Sheds

1) Silos

Silos are to be provided for handling grains (wheat and rice) and cement clinker. At least one silo is to be provided at the back of each berth according to the volume of cargo handled at the berth. Silos of the following capacities have been adopted as standard type.

Table 56. Standard Type of Silo

	Grains	Cement clinker
Capacity of silo	53,000 ton/unit	13,000 ton/unit
Effective dimensions of main silo	ø 265' x 750' height	ø 30' x 70' height
Number of main silos	80	10
Floor space of a silo	150' x 460' = 69,000 sq.ft	65' x 170' = 11,000 sq.ft

The number of silos was obtained from the following formula.

$$N = T \times 1/c \times 1/n \quad (1)$$

where: N = number of silos
T = volume to be handled (tons/year)
c = capacity of silo (tons/unit)
n = turnover rate (times/year)

From equation (1), the number of silos for grains and clinker may be calculated as shown in Table 57.

Table 57. Calculation of the Number of Silos

	1974/75	1984/85	Remarks
1) Grains	'000 tons	'000 tons	
Volume to be handled : T	1,925	3,900	
Capacity of silo : C	53,000 tons	53,000 tons	
Turnover rate : n	12	12	
No. of silos : N	3	6	
2) Cement clinker	'000 tons	'000 tons	
Volume to be handled : T	750	1,500	
Capacity of silo : C	13,000 tons	13,000 tons	
Turnover rate : n	33	33	
No. of silos : N	2	4	

2) Sheds

Sheds are to be provided for handling cement in bag, phosphate rock, urea fertilizer and potassic salt and one shed is to be provided for each berth handling these cargoes. The standard capacity of shed may be calculated by the following formula.

$$W = N \times 1/R \times 1/n$$

where: W = capacity of one shed (ton)
N = volume of cargo to be handled annually (ton)
R = turnover rate (times/year)
n = number of sheds

As the volume of cement in bag reaches 750,000 tons in the year 1974/75 and that of phosphate rock 152,000 tons, two sheds of the following sizes for cement and phosphate rock, one for each, are to be provided on the assumption that the turnover of the shed is 40 times/year.

Cement	Capacity:	18,500 ton
	Length:	500 feet
	Width:	150 feet
	Height:	18 feet
Phosphate rock	Capacity:	14,000 ton
	Length:	460 feet
	Width:	120 feet
	Height:	18 feet

As the number of berths requiring a shed is expected to reach 5 in the year 1984/85, a total of 5 sheds of the above-mentioned sizes are to be provided by that time, one for each berth: two for cement, two for fertilizer, and one for phosphate rock.

7-3 Power and Water Facilities

1) Power

Major power consumers except industries are cargo handling equipment and belt-conveyors. Power consumption by these machinery is shown in Table 58.

Table 58. Power Consumption by Cargo Handling Equipment

	1974/75		1984/85		Remarks
	No. of units	Consumption	No. of units	Consumption	
1,000 t/h unloader	-	-	6	7,200	120 KVA per unit
500 t/h unloader	5	3,500	8	5,600	700 KVA per unit
200 t/h level luffing crane	2	700	6	2,100	350 KVA per unit
Conveyor (400 m long)	5	500	17	1,700	100 KVA per set
Pump	-				
Total		4,700		16,600	

Although power consumption at the port in the year 1974/75 is estimated at about 4,700 KVA, power cables with a capacity of 5,000 KVA are to be provided to be on the safe side.

Power consumption in the industrial complex in the year 1984/85 is estimated at 4,500 KWH/day. On the basis of about 10 working hours a day, the daily power requirement is estimated at about 40,000 KW. As already mentioned in the main part of this report, all power requirements at the port including those for other facilities are to be met by a thermal power plant to be located adjacent to the port.

2) Water

(a) The present water consumption at Karachi Port, at the East Wharf and West Wharf, amounts to 2.5 million gallons/day in the summer peak season (Source: Karachi Port Yearbook).

(b) Assuming that the volume of cargo traffic through Phitti Creek Port in the year 1974/75 would be about half of the volume of cargo presently handled at Karachi Port and considering the fact that the water requirement at Karachi Port include the requirement by industrial plants and residential districts, the water requirement at Phitti Creek in the year 1974/75 is estimated at 650,000 gal/day about 25% of the present requirement at Karachi Port.

(c) In addition to water consumption in the industrial district, water consumption in the year 1974/75 is estimated at 4.5 million gallons consisting of 4 million gallons at the port and 600,000 gallons of drinking water in the industrial district. These estimates are based on the following.

- Port facilities:

  Although the volume of cargo traffic through Phitti Creek is estimated at about half of the volume presently handled at Karachi Port, water consumption at Phitti Creek Port was considered to be 1.5 times greater than that at Karachi Port because the requirement in the industrial district and residential district is included in the requirement at Karachi Port.

- Industry

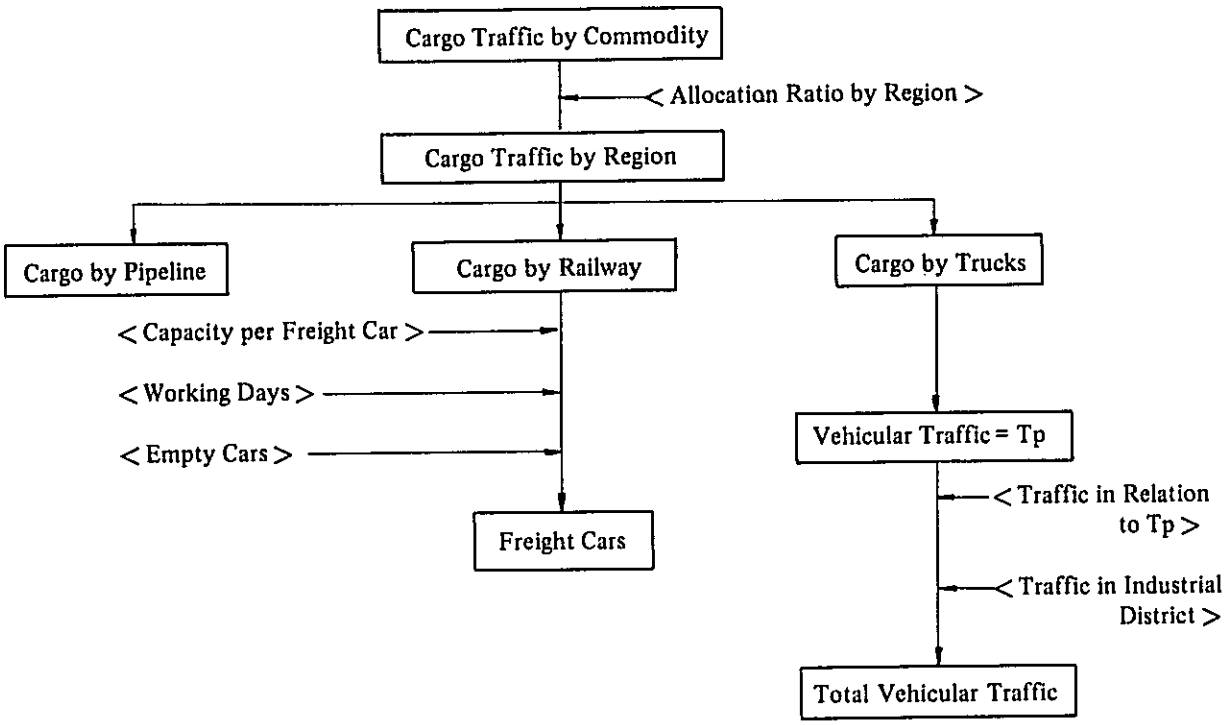
  Assuming that each employee of the industry consumes 20 gallons of water a day, the daily water consumption in the industry is estimated at about 600,000 gallons.

8. Estimate of Port-originated Traffic Volume

8-1 Method of Estimation

Estimate of future port-originated traffic volume is very difficult unless survey data on such subjects as the type of cargo, share of railways and motor cars in cargo transport, OD traffic volume, loading capacity per freight car and traffic volume at port area by vehicle type are available.

As the data on the port-centered traffic were not available during the current survey, the estimate of port-originated traffic volume was made with the following simple method.



8-2 Cargo Traffic by Region (Point of Origin)

The cargo traffic was distributed to regions by itemwise in the following manner. As for distribution regions, 12 divisions in West Pakistan were adopted. As the cargo traffic in the year 1974/75 was assumed to be entirely dependent on truck transport, this calculation was made only for the year 1984/85.

1) Rice and Wheat

Distribution was made according to the average production share of each region in the 1968 – 75 period based on the data on production and consumption of rice and wheat under the Fourth Five-Year Plan. However, the regions where the production is less than 100,000 tons were omitted and the allocations to these regions were distributed to other qualified regions.

Table 59. Divisionwise Main Index

Division		Population (1975)	Major Crop		Cement 1974/75	Iron x Steel 1974/75	Industrial Employment 1974/75	Remarks
			Rice	Wheat				
	'000 sq.miles	M:l Poputation	%	%	Lac tons	'000 tons	'000 Employee	
Peshawar	25.2 (8.1)	10.5 (15.0)	2	4.0	7.65 (16.1)	33 (4.0)	(6.4)	
D.I. Khan	11.1 (3.6)	2.2 (3.1)	-	2.5			(0.4)	
Rawalpindi	11.2 (3.6)	5.8 (8.4)	3	7.0	10.10 (21.2)		(6.6)	
Sargodha	17.1 (5.5)	9.7 (13.9)	4	22.0	2.50 (5.3)	3 (0.4)	(14.4)	
Lahore	8.9 (2.9)	9.9 (14.2)	34	12.0		392 (49.0)	(18.0)	
Multan	24.8 (8.0)	10.5 (15.1)	6	29.0			(6.0)	
Bahawalpur	17.5 (5.6)	4.6 (6.5)	2	8.0			(1.8)	
Khaipur	20.3 (6.6)	5.1 (7.3)	33	7.0	3.00 (6.3)		(2.6)	
Hydorabad	36.8 (10.9)	5.4 (7.7)	16	7.0	14.65 (30.1)	5 (0.6)	(7.0)	
Quetta	53.1 (17.1)	1.7 (2.4)	-	1.0	3.65 (7.7)		(0.6)	
Kalat	72.9 (23.5)		-					
Karachi	8.4 (2.7)	4.5 (4.5)	-	0.5	6.00 (12.6)	329 (41.0)	(36.2)	
Total	310.4 (100)	69.9 (100)	100	100	47.55 (100)	802 (100)	398.2	

Source

Area: Pakistan Year Book 1970, National Publishing Ltd.

Population: Rough Estimation with Growth Rate by 3%, Wheat Production, Consumption and Exports Fourth Plan Projection, Transport Planning Cell Report

Rice: Average Estimates Level, 1968/75 Rice Production, Consumption and Exports Fourth Plan Projection, Transport Planning Cell Report

Wheat: Average Estimated Level 1968/75, Wheat Production, Consumption and Exports Fourth Plan Projection, Transport Planning Cell Report

Cement: Cement Production, Consumption and Exports Fourth Plan Projection, Transport Planning Cell Report

Iron & Steel: Iron and Steel Demand Production, Consumption and Imports Fourth Plan Projection, Transport Planning Cell Report

Industrial Employment: Statement Showing the Number of Industrial Employment W.P. 1967/68, Offered by Planning Commission

6) Cargo traffic by region obtained with the above-mentioned method is shown in Table 59.

2) Cement

Distribution was made according to the production share of each region in the year 1974/75 on the basis of the data on cement production and consumption under the Fourth Five-Year Plan.

3) Iron & Steel

Distribution was made in the same manner as in the case of cement, but part of production was considered to be consumed at Phitti Creek.

4) Oil

Although refined oil is to be transported to the Korangi distribution center or the Pipri distribution center by pipeline, distribution was attempted on the basis of the size of refinery by region (represented by the number of employees) in the year 1967/68 for reference purpose.

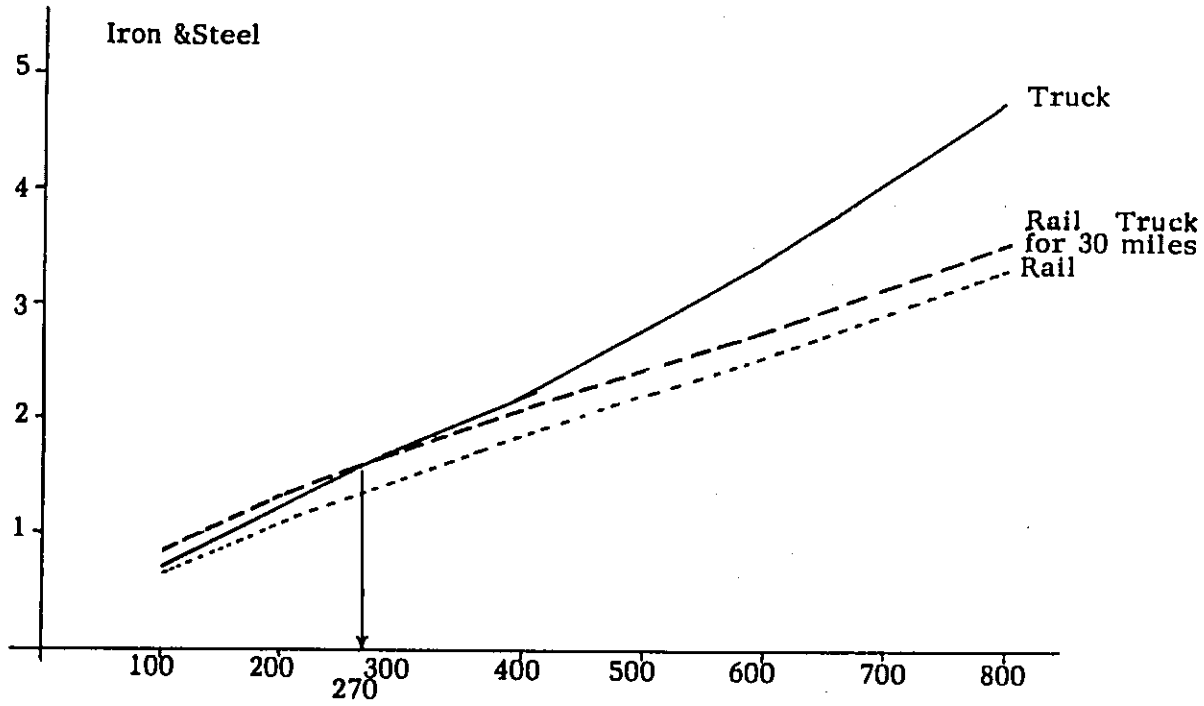
5) Fertilizer

Imported fertilizer was distributed to the group of Rawalpindi and Sargadha and the group of Multan, Khaipar and Hyderabad at the rate of 50% each (this is equivalent to the ratio of rice and wheat production). Urea was considered to be exported from Karachi Division and phosphate rock was considered to be imported from Karachi Division. (Refer to Table 60.)

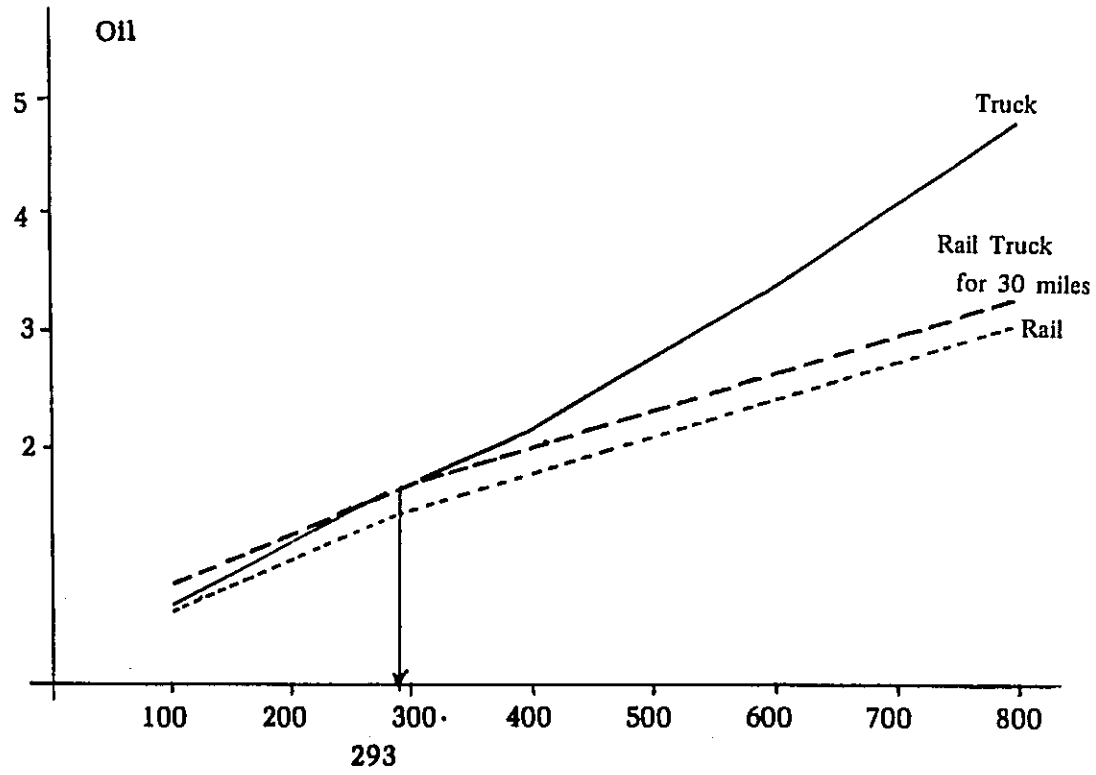
Table 60. Divisionwise Cargoes Handled at Phitti Creek Port

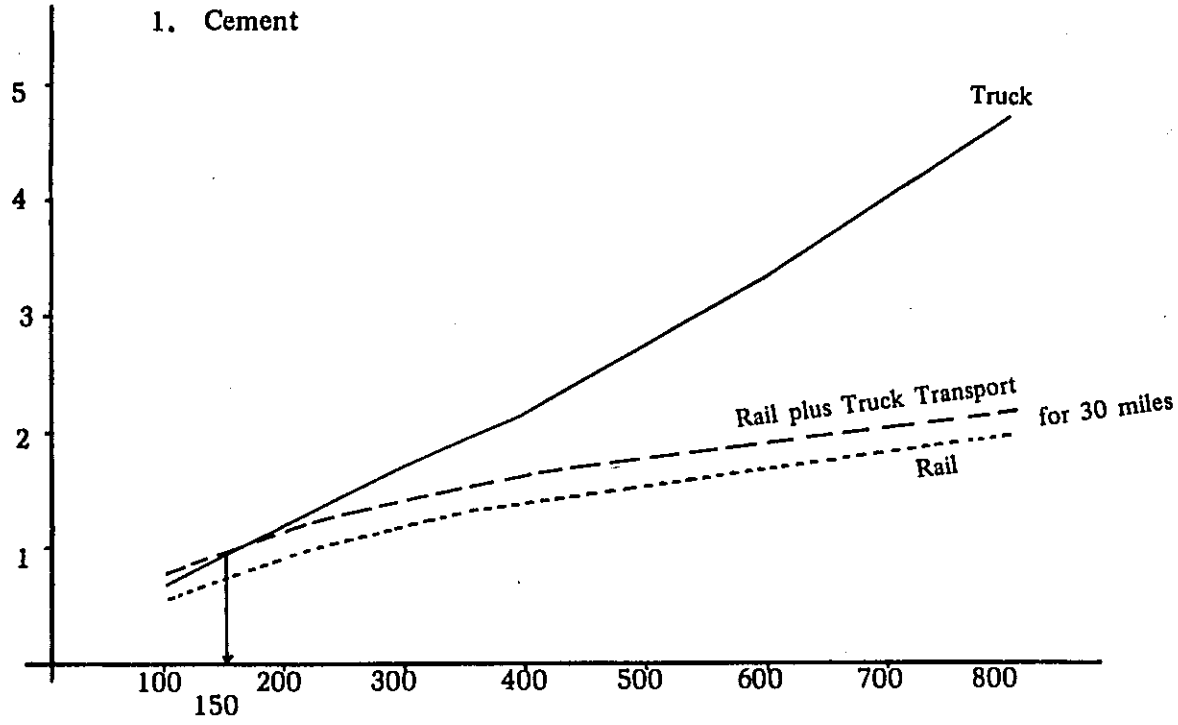
	Major Crops		Cement (Ex)	Iron & Steel (IM)	Petroleum	Fertilizer	Remarks
	Rice (Ex)	Wheat (Ex)					
Poshawar			630	100	260 (100)		
D.I. Khan							
Rawalpindi		160	830		290 (100)		
Sargodha		420	210		590 (220)	100	
Lahore	960	200		1,240	740 (270)		
Multan	140	480			250 (90)		
Bahamahpur		130			70 (30)		
Khairpur	790	120	250		110 (40)	100	
Hyderabad	360	140	1,190		310 (110)		
Quetta			300		-		
Kalat					-		
Karachi			490	1,160	1,480 (540)	950	
Total	2,250	1,650	3,900	2,500	4,100 (1,500)	1,150	

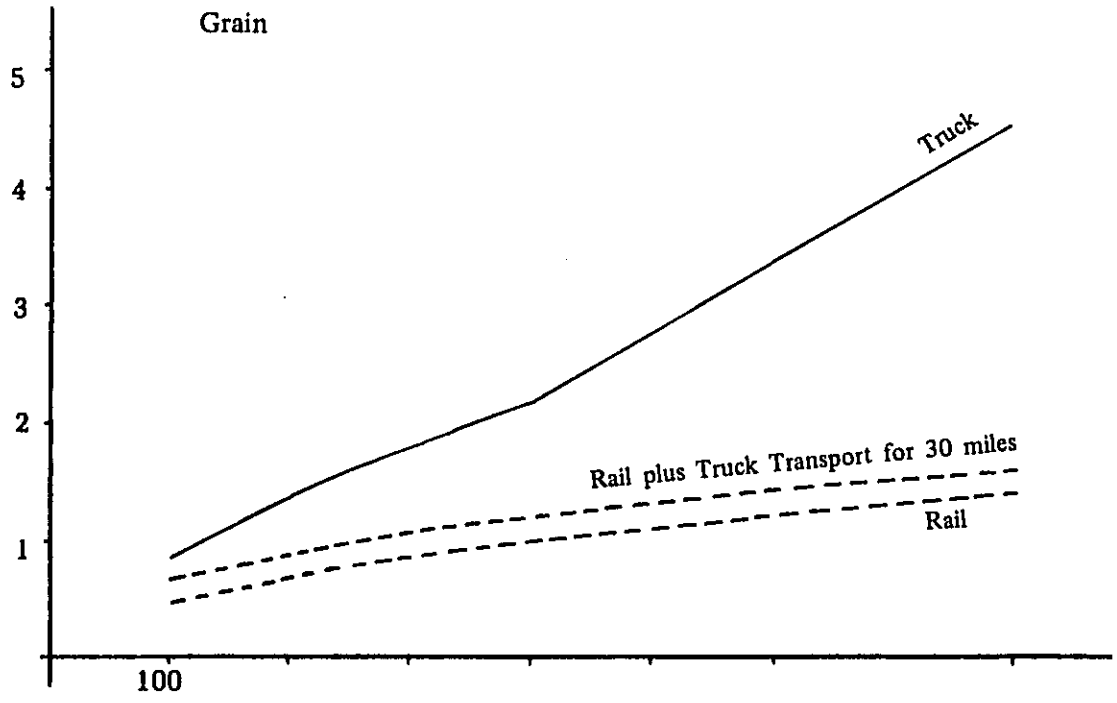
Fig. 16. Distancewise Transport Cost



Note: For the transport cost by rail, "Iron & Steel Division' B'" was adopted.




1. Cement
5
4
3
2
1
Truck
Rail plus Truck Transport
for 30 miles
Rail
100
150
200
300
400
500
600
700
800


Grain
5
4
3
2
1
Truck
Rail plus Truck Transport for 30 miles
Rail
100

8-3 Allocation of Cargo to Trucks and Freight Car

1) Whether the exported (or imported) cargo should choose railways or trucks for inland transport is determined after making comparison of various factors such as transport cost, transport time, type of cargo lot and local practices.

2) For the current study, however, allocation was made by placing emphasis on transport cost by taking into account the fact that the cargo handled at Phitti Creek is mainly bulk cargo which is relatively free from transport time, that a large quantity of cargo is transported in one lot, that Phitti Creek Port is a new port and that a new inland transport system would be established. As to the choice between railways and trucks, a graph showing transport cost of cargo by item and distance (Fig. 15) was prepared with reference to the Report on Freight Pricing Characteristics of Rail and Highway, June 1969, by Noor Mohammad Research Officer and from this graph, either railway or trucks, whichever is cheaper for transport between Karachi Division and respective divisions, was selected. Because of the fact that railway transport inevitably requires the secondary transport for a distance of about 30 miles, corresponding transport cost by truck was added to the transport cost by railway.

3) Both crude oil to be transported to the refineries in the Korangi district and petroleum products to be shipped from the refineries in the Phitti Creek district are to be transported first to the Korangi and Khipliwale districts by pipeline for transport efficiency and safety.

4) Cargo traffic by type of transport calculated by the above method is shown in Table 61.

Table 61. Assignment of Rail Transport and Truck Transport (1984/85)

	Distance	Rice (Ex)		Wheat (Ex)		Cement (Ex)		Iron & Steel (I_M)		Fertilizer(Ex I_M)		Total	
		Rail	Truck	R	T	R	T	R	T	R	T	Rail	Truck
Peshawar	1,000					480	--	100				580	
D. I. Khan	800												
Rawalpindi	900			160	–	630	--					790	
Sangodha	800			420	–	160	--			100		680	
Lahore	800	910	–	200	–			1,240				2,400	
Maltan	600	140	–	480	–							620	
Bahawalpur	570			130	–							130	
Khairpur	300	790	–	120	–	190	--					1,100	
Hyderabad	120	360	–	140	–	–	910				100	500	1,010
Quetta	570					230	--					230	
Kalat													
Karachi	–					–	400		1,160		950		2,510
Total		2,250	–	1,650	–	1,690	1,310	1,340	1,160	100	1,050	7,030	3,520

8-4 Estimate of Total Vehicular Traffic

Total vehicular traffic was obtained from the following formula.

$$T = T_p + T_p^r + T_i + T_i^r \quad \cdots\cdots (1)$$

where: T = Total vehicular traffic

T_p = Vehicular traffic originating from cargo at port

T_p^r = Traffic originating in relation to T_p

T_i = Vehicular traffic originating in the industrial district

T_i^r = Traffic originating in relation to T_i

T_p was obtained from the following formula.

$$T_p = Ct \times 1/D \times 1/t \times \gamma \quad \cdots\cdots (2)$$

where: Ct = Cargo transported by truck

D = Number of working days per year

t = Carrying capacity per truck

α = Annual rate of variability

For the current study, C, D, t and α were considered as follows.

	1974/75	1984/85	Remarks
	'000 tons	'000 tons	
Ct	3,577	3,520	
D	300 days	300 days	
t	2.0 ton/truck	2.0 ton/truck	4-ton truck on the average (one trip is without load)
	1.5	1.5	

T_p^r is to be 50% of T_p for the year 1974/75 and 100% for the year 1984/85 in anticipation of the start of production by the industrial plants.

T_i was obtained from the following formula.

$$T_i = \beta \times A \times 1/D \times 1/t \times \alpha \quad \cdots\cdots (3)$$

where: P = Cargo originating in the industrial district per yd^2

A = Acreage of industrial district

D, t, α = Same as for T_p

For the current study, β, A, t and α were considered as follows.

	1974/75	1984/85	Remarks
β		tons/yd^2 1.2	
A		1,000 yd^2 2,400	Only those plants related to oil refineries and steel mills are covered.
D		300 days	
t		2.0 ton/truck	
α		2.0	

Like T_p^r, T_i^r was considered to be 100% of Ti.
As a result, total vehicular traffic, T, will be as follows.

('000 trucks/day)

	1974/75	1984/85	Remarks
T_p	9.0	9.0	
T_p^r	4.5	9.0	
Ti	–	9.5	
T_i^r	–	9.5	
T (Total)	13.5	37.0	

Note: Besides, additional 2 or 3% of animal vehicles are anticipated in the year 1974/75.

8-5 Number of Freight Cars

The number of freight cars was obtained from the following formula.

$W = (W_D \text{ or } W_a, \text{ whichever is greater}) + W_E$

where: W_D = Number of cars departing from Phitti Creek Port
W_A = Number of cars arriving at Phitti Creek Port
W_E = Number of empty cars

$W_D \text{ (or } W_D) = C_r^A \text{ (or } C_r^D) \times 1/D \times 1/t$ ..... (4)

W_D and W_A were obtained from the following formula.

where: C_r^A = Cargo arrived by railway
C_r^D = Cargo departed by railway
D = Number of working days
t = Carrying capacity per freight car

For the current study, D and t were considered as follows. C_r^A and C_r^D were also presumed to be as shown in the following table on the basis of estimated cargo traffic

and allocation of cargo to railways and trucks.

	1984/85	Remarks
C_r^A	'000 tons 5,540	Rice, wheat, cement
C_r^D	'000 tons 1,440	Iron & steel, fertilizer
D	360 days	
t	15 ton/wagon	

WE was considered to be the difference between WA and WD.

The number of freight cars obtained from the above is as follows.

	Number	Remarks
W_A	1,030	
(W_D)	(270)	
W_E	760	
W (Total)	1,790	

9. Reference Materials for Economic Studies

9-1 Estimate of Cargo Traffic and Gross Tonnage of Ship Entering Port by Year

Cargo traffic by year was estimated by interpolating the cargo handled at Phitti Creek in the year 1974/75 and that handled in the year 1984/85. For fertilizer, however, it was considered that cargo would be handled only at Phitti Creek from the year 1979/80. For part of petroleum products, handling of which is to be shifted from Karachi to Phitti Creek, it was considered that 25% would be transferred in the year 1977/78, 75% in the year 1978/79 and 100% in the year 1979/80. For oil refineries to be located at the back of Phitti Creek Port, estimate was made on the assumption that 50% operation would start in the year 1979/80 and 100% operation in the year 1984/85 and an interpolation was made between the two. For iron ore and coal, estimate was made on the assumption that the steel mill would start 50% operation in the year 1979/80 and 100% operation in the year 1984/85 as in the case of oil refineries.

The results are shown in Table 62.

Table 62. Cargo Traffic by Year

	Grain		Cement	Phosphate rock	Fertilizer (K_2O^o) IM	Fertiliger (Urea) Ex	Oil	Coal & Coke, Iron ore	Total
	Rice	Weat							
1974/75	1,552	373	1,500	152	(100)		(5,200)		3,577
1975/76 – 1979/80	1,690	570	1,830	215	(130)		1,300		5,605
1980/81 – 1984/85	2,010	1,180	2,610	380	180	320	10,200	5,200	2,2080
1984/85	2,200	1,650	3,000	510	200	440	11,600	6,600	26,200

Note: Figures in parenthesis represent cargo handled at Karachi Port.

Table 63. Gross Tonnage of Ships Entering Port by Year

	a) Tonage (Net register)	b) Cargo	c) b)/a)	Remarks
Karachi Port				
	'000 tons	'000 tons		
1960 - 61	5,894	4,979	0.85	
62	5,811	4,606	0.79	
63	6,491	5,562	0.86	
64	6,597	5,856	0.89	
65	7,434	7,809	1.05	
66	5,659	7,056	1.25	
67	6,790	9,074	1.34	
68	6,502	8,662	1,33	
69	6,266	8,450	1.35	
70	6,755	9,339	1.38	
Phitti Creek				
1974/75	2,550	3,557	1.40	
1975/76 – 1979/80	4,000	5,605	1.40	Figure for the year 1977/78 is to be used as the average of 5 years.
1980/81 – 1984/85	15,800	22,080	1.40	Figure for the year 1982/83 is to be used as the average of 5 years.
1984/85	18,700	26,200	1.40	

Gross Tonnage of Ships Entering Port by Year

Estimate of the gross tonnage of ships entering port shown in Table 63 was based on the past record on the volume of cargo and the gross tonnage of ships entering port.

Although the ratio of cargo/tonnage of ship has been increasing annually, there is a limit in the increase of the coefficient. Also, in view of the fact that the difference between the deadweight ton and the gross tonnage is about 1.50, the gross tonnage of ships entering port was obtained from the volume of cargo by assuming that the future difference between the two would be 1.40, about the same as the present.

9-2 Special Rates of Wharfage for Grains and Cement (Clinker)

Phitti Creek Port is equipped with modern facilities for efficient cargo handling as a port specializing in bulk cargo. For handling grains and cement (clinker), in particular, the port equipped with a 500 ton/h cargo handling equipment and silos can cut cargo handling time drastically as compared with Karachi Port. As the installation of these facilities requires an

enormous investment, it was decided to collect special rates of wharfage from the shipowner or consigners in return for quick dispatch of ships as a result of the shortened cargo handling time and appropriate the sum for port operating funds.

The special rates were determined to be 1.9 Rs/ton for grains and 2.6 Rs/ton for cement (clinker) based on the following.

Assuming the cost of a 10,000 D/W cement carrier is 6,000 Rs/day, a cut in the number of cargo handling days by 667 days will save about 4,000,000 Rs annually. 4,000,000 Rs, when converted to per ton wharfage, is equivalent to 5.3 Rs/ton. Of this, 2.6 Rs or about 50% are to be collected as special wharfage.

1) Clinker

	Phitti Creek Port	Karachi Port	Remarks
Cargo handled annually (1974/75)	750,000 tons	750,000 tons	
Number of ships entering port annually	75	75	10,000 D/W
Daily cargo handling capacity	5,400 ton/day	925 ton/day	Actual handling capacity of Karachi
Number of cargo handling days per ship	2.9 day/ship (10,000/5,400 + 1 = 2.9)	11.8 day/ship (10,000/925 + 1 = 11.8)	
Ship (day/year)	218 ship day/year (2.9 x 75 = 218)	885 ship day/year (11.8 x 75 = 885)	
Number of cargo handling days shortened	-667 ship day/year	0	

2) Grains

	Phitti Creek Port	Karachi Port	Remarks
Cargo handled annually (1974/75)	1,925,000 tons	1,925,000 tons	
Number of ships entering port annually	240 ship/year	240 ship/year	8,000 D/W
Daily cargo handling capacity	5,400 ton/day (Same as cement)	1,200 ton/day ton/hook hour hatch (2.8 x 3.5 x 12)	Result at Karachi Port
Num ber of cargo handling days per ship	2.5 day/ship (8,000/5,400 + 1)	7.6 day/ship (8,000/200 ± 1)	
Ship days/year	606 ship days/year (240 x 2.5)	1,824 ship days/year (240 x 7.6)	
Number of cargo handling days shortened	-1,224	0	

6,000 Rs x 1,224 = 7,344 000

7,344,000 - 1,925 = 3.8 Rs/ton ..... 1.9 Rs/ton

APPENDIX:

REVIEW OF ESTIMATE OF CARGO TRAFFIC PREPARED BY EIU

1. General

The estimate of cargo traffic contained in this report is team's own estimate. It was decided, however, that various calculations be made with the use of EIU's estimate on cement and wheat, which is understandable as a difference in the basic concept between the two parties, among the estimates on cement, wheat and steel related cargoes (steel, iron ore and coal) for the year 1984/85, which show drastic changes in the final stage in the EIU report.

Supplementary Table 1. Wheat and Cement Cargoes

	EIU	Estimate in this report
1974/75		
Wheat	440	373
Cement	1,100	2,000
Others	14,783	14,783
Total	16,323	17,156
1984/85		
Wheat	-	1,650
Cement	1,200	3,000
Others	29,360	29,360
Total	30,560	34,010

Note: For other cargoes, the estimate given by the draft report was adopted.

2. Calculation of the Number of Berths

The number of berths obtained from calculation on EIU's estimate of cargo traffic (wheat and cement) is as shown in Table 2. The number of berths required in the year 1974/75 is five, which agrees the number of berths given in the report.

Supplementary Table 2. Number of Berths Calculated on EIU's Estimate of Cargo Traffic

	Volume of cargo V	Cargo load per ship ν	Wharf occupancy rate α	Number of days for preparation for arrival and departure γ	Capacity of cargo handling equipment A	Number of cargo handling equipment n	Average cargo handling time per day T	Operating rate of cargo handling equip. β	Number of berths B	Remarks
1974/75	1,000 t									
Cement	1,100									
Clinker	(550)	10,000 t	0.6	1.0	500 t/hr	1	12	0.9	1	
In bag	(550)	10,000 t	0.6	1.0	200	2	12	0.9	1	
Phosphate rock	152									
Grains	1,940	800 t	0.6	1.0	500	2	12	0.9	3	Wheat-440 Rice-1,500
Total	3,192									
1984/85										
Cement										
Clinker	600	10,000 t	0.6	1.0	500	1	12	0.9	1	
In bag	600	10,000 t	0.6	1.0	200	2	12	0.9	1	
Grains										
Wheat	0	8,000 t	0.6	1.0	500	2	12	0.9	3	
Rice	17,200									
Others	19,350								10	See
Total	22,270								15	Appendix

Note: Two clinker handling equipment are to be provided in case one fails to operate.

In the year 1984/85, there will be a reduction of 2 cement berths and 3 grain berths as compared with the draft report, thus leaving a total of 15 berths.

3. Calculation of Cost of Construction

As the number of facilities in the year 1974/75 is the same as that estimated in the draft report, the cost of construction is to be the same as calculated in the draft report.

As there will be a reduction of 5 berths in the year 1984/85 as compared with the draft report, the cost of construction given in the draft report minus the cost of cargo handling equipment and silos, the number of which will also be reduced as a result of reduction in the number of berths, is to be used for this report.

Although the decrease in the volume of cargo handled at port will affect the cost of related land, roads and railways to some extent, such a factor was ignored in the economic analysis, which will be discussed in the following section, to be on the safe side in the calculation.

Supplementary Table 3. Calculation of Cost of Construction

		Local currency	Foreign currency	Total	Remarks
a)	Cost of construction in the draft redport	29.28	38.46	67.74	
b)	Reduction in cost of construction as compared with draft report	3.90	8	11.90	
	Berth	2.79	1.87	4.66	A reduction of 2 cement berths and 3 grain berths
	Cargo handling equipment	0.28	1.57	1.85	2 for cement & 3 for grains
	Silo & shed	0.83	4.56	5.39	5 silos (2 for cement, 3 for grains), one silo (2 for cement)
c)	Cost of construction a) - b)	25.38	30.46	55.84	

4. An Economic Analysis

An economic analysis was attempted to determine the feasibility of Phitti Creek Port as in the case of draft report. The method used and the facilities covered were the same as those in the draft report. This analysis was made only for the long-range plan.

The discount rate used was 6% as in the case of draft report and a study period of 30 years was considered. The benefit/cost ratio obtained was 1.59 and internal rate of return was 10.7%. (The table of business analysis is omitted.)

If the project with internal rate of return of more than 12% is considered as a sound project, the internal rate of return in this case falls short of the goal by a small margin.

However, because of the fact that the cost of construction except for the cost of mooring facilities and cargo handling equipment used in the current plan is the same as that used in the draft report in addition to the cost of reclamation mentioned in Section 1). An Economic Analysis, Chapter 3, Economic Appriasal of the Project, Part III of this report, for the convenience of calculation, a higher internal rate of return was sought under the current plan.

If computation of the cost of construction is made on the more detailed requirement for facilities according to the volume of cargo traffic, a higher internal rate of return can be expected and the requirement as a sound project will be fulfilled.

10. Numerical Calculation of Tidal Current at Harbour Entrance

10-1 Introduction

When the water surface of a certain area joins the open sea through a narrow channel as in the case of Karachi Port and Miani Hor, the tide of the open sea flows in and out of the basin according to the difference of water level in and out of the channel. Where there is a sufficient cross sectional area of the channel against the surface area of the basin, the tide amplitude within the basin is almost the same as that in the open sea. When the cross section of the channel is small, however, the volume of water flows in and out of the basin is restricted accordingly and the tide amplitude within the basin becomes smaller than that in the open sea.

In order to clarity these tidal phenomena within the basin, such methods as tide observations, hydraulic model test and numerical calculation by electronic computers must be used.

Here, a calculation will be attempted for the case in which the distance between the harbour entrance to the innermost section of the basin is not too great and the change of water level is uniform throughout the basin and the results of calculation for Karachi Port and Miani Hor will be mentioned.

10-2 Method of Calculation

If the area of water surface of the basin is expressed by S, cross section of the channel by A, water level (above detum level) by n, water level in the basin by y, and mean velocity of tidal current flowing in and out of the channel by V, the velocity, V, may be obtained from the following formula.

$$V = C\sqrt{2g\,(n - y)} \quad (n > y)$$
$$= C\sqrt{2g\,(y - n)} \quad (n < y) \qquad \cdots\cdots (2)$$

Here, C is a coefficient of velocity, which may be obtained from the following expression (2) when the cross section of the channel is almost constant.

$$C = 1/\sqrt{fe + fo + \frac{2gn^2}{R^{1/3}}\frac{\ell}{R}} \qquad \cdots\cdots (2)$$

where: fe = Coefficient of flow-in loss at the entrance of channel = 0.5

fo = Coefficient of flow-out loss at the entrance of channel = 1.0

g = Acceleration of gravity = 9.8 m/sec.^{2}

n = The manning roughness coefficient

R = Hydraulic mean depth of channel

ℓ = Total length of channel

The change in water level within the basin may be obtained by distributing the volume of water flowing in from the channel of sectional area of A at the speed of V to the area of water surface, S.

$$\frac{dy}{dt} = \frac{AV}{S} \qquad \cdots\cdots (3)$$

Consequently, the hourly fluctuation of y may be obtained with use of expression (a) and formula (3) and calculating y with the progressive difference equation while providing hourly change of n. In this case, the fact that the change in water level results in changes of sectional are of channel, A, and the area of water surface, S, must also be taken into consideration.

10-3 Results of Calculation

Results of calculation for three different cases, namely, the present Karachi Port, reclamation of 100 ha. of the Western Backwater of Karachi and the present Miani Hor, are shown in Table 64. Changes of sea level in the open sea were shown by a sine curve. For tidal range, three figures, namely, the theoretical maximum range of 3.66 m, spring range of 3.08 m and 1.54 m, 1/2 of the spring range, were adopted. For coefficient of velocity for the channel, calculation of the Manning roughness coefficient was made by expression (2) with n = 0.03 (m-sec. unit group) and C = 0.45 was used for Karachi Port and C = 0.25 was used for Miani Hor.

A curve of hourly changes in sea level and tidal current at spring tide in Miani Hor obtained from the calculation is shown in Fig. 17.

Table 64. Calculation of Tidal Current at Harbour Entrance

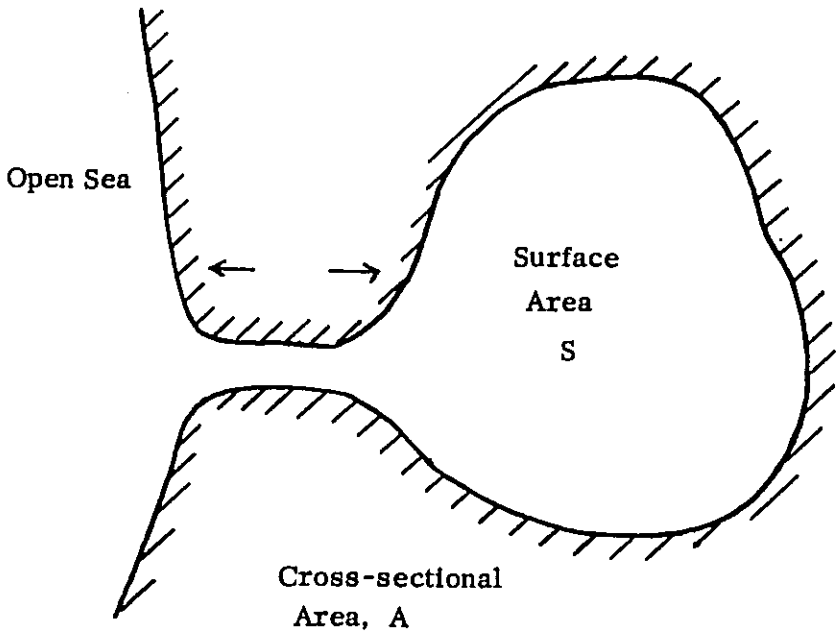
Name of Port	S (m^2)	A [1] (m^2)	C	N_{max} (m)	Y_{max} (m)	V_{max} (m/s)	V_{min} m/s
Present Karachi Port	4.27×10^7 (High tide)	4,850	0.45	1.83	1.82	1.11	-11.7
	0.95×10^7 (Low tide)			1.54 0.77	1.53 0.77	0.93 0.46	- 0.97 - 4.7
Reclamation of Karachi	3.27×10^7 (High tide)	4,850	0.45	1.83	1.83	0.89	- 0.92
	0.72×10^7 (Low tide)			1.54 0.77	1.54 0.77	0.74 0.36	- 0.76 - 0.36
Sommiani	4.73×10^8 (High tide)	12,000	0.25	1.83	0.62	1.40	- 1.52
	1.13×10^8 (Low tide)			1.54 0.77	0.57 0.40	1.28 0.89	- 1.38 - 0.93

Note: 1) shows cross sectional area of channel below datum level.

Results of calculation show that there is little change in tide range between the basin of Karachi Port and the open sea because of the sufficient cross sectional area of the harbour entrance against the area of water surface in the basin. Consequently, the maximum velocity of tidal current at harbour entrance is in direction proportion to tide range and the area of water surface. The maximum velocity of tidal current at spring tide is 1.7 knots under the present condition and 1.4 knots when the basin is reclaimed. The slightly higher current

velocity at ebb current than at flood current is believed to be attributed to the change in the area of water surface of the basin according to sea level. In the case of Sommiani Port, meanwhile, tide range of Miani Hor is far smaller than that of the open sea due to the small coefficient of velocity as a result of a greater area of surface water and a greater length of channel at the inlet of Miani Hor, and it is influenced very little by the change of tide range in the open sea. The maximum current velocity at the inlet is about 2.5 knots at Spring tide. The current velocity is slightly higher at ebb current than at flood current as in the case of Karachi Port.

The above results show mean current velocity and therefore do not include local changes in current velocity or current velocity within the basin. Besides, there is a possibility that the estimate value of coefficient of current velocity, C, differs slightly from the actual value. However, the above calculation clearly shows changes of sea level within the basin, characteristics of tidal current at the inlet and provides approximate figures.



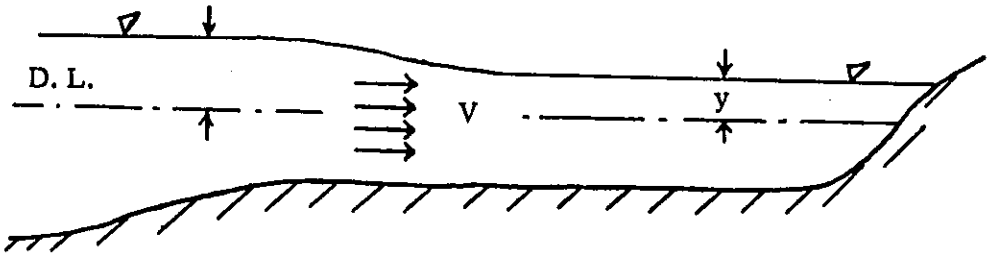


Fig. 17. Sketch of Tidal Current at Basin Inlet

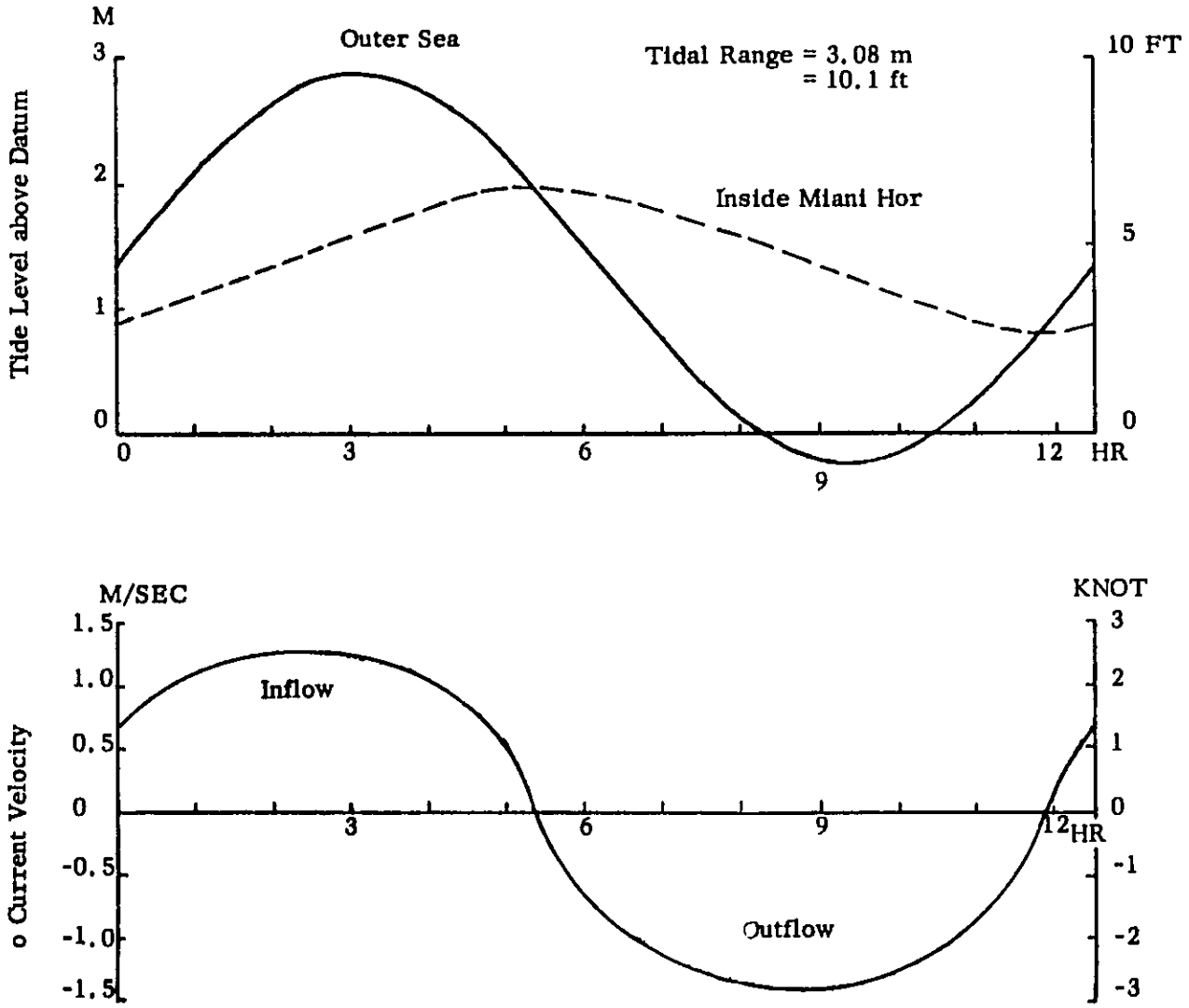


Fig. 18. Tidal Current at the Entrance of Miani Hor