The remaining number of berths will be 24. As discussed in 1.8, the present capacity is 0.20 million tons per berth for break-bulk and 0.45 million tons per berth for dry-bulk cargoes. The total cargo volume and number of berths are balanced with the requirements, and it seems that the non-container cargoes could be accommodated at the remaining berths. It is noted, however, that due to the exclusive use of container berths by container ships and the substantial decrease in berth number, the waiting time of dry-bulk and break-bulk ships could be substantial.

In 2005/06, as far as container cargoes are concerned, Port Karachi can accommodate the forecast volumes. The remaining number of berths for break-bulk and dry-bulk ships will be 15. The cargo volume forecasts are 1.8 million tons for dry-bulk and 5.1 million tons for break-bulk

Then the number of berths will barely be sufficient, if we assume the same cargo handling efficiency for break-bulk cargoes as the present efficiency and an improved cargo handling efficiency of 220 tons/hr/berth with modernized handling equipment for bulk cargoes.

(5) Comparison of Plans

The advantages and disadvantages of the tentative conversion plan and the original Western Backwater Plan are compared in Table 3.4.5.

It should be reiterated that the definite planning and final evaluation of the conversion plan requires further detailed site study and extensive technical, economic and social analyses which are to be carried out as part of the feasibility study, and are beyond the scope of the present study.

3.4.5 Temporary Measures for the Improvement of Container Handling Efficiency

Until the time when a new container terminal at Port Karachi will become operational, it is obvious that Port Karachi needs to take measures to improve container handling efficiency, because the container throughput is expected to increase up to 2.25 million tons in 1992/93 from 2.0 million tons at present, provided that the conversion plan at Port Qasim will have been implemented.

This difference of 0.25 million tons could be covered by introducing large mobile cranes such as the 40 ton crawler crane already installed on Berth 24, or preferably crawler cranes with a capacity of 100 to 130 tons so as to reach containers at the outer side of container ships.

Introduction of container gantry cranes on some of the quays, along with the development of the new container terminal, would surely be an over-investment for Port Karachi, because the cost of a gantry crane is much higher than that of a big mobile crane.

Table 3.4.5 Comparison of Container Wharves

Item	Conversion of East Wharf	New Western Backwater Wharf
1. Planning Matter		
(1) Restriction to freedom of plan	(D) Much	(A) Minimal
(2) Berth Length	(S) 300m	(S) 300m
(3) Yard Space	(D) Smaller (400m)	(A) Large (570m)
(4) Road Congestion	(D) Deteriorated at Jinnah Bridge	(A) Dispersed
2. Loss of Residual Value/Assets	(D) Much (Need to demolish warehouses, rails, etc.)	(A) None
3. Utilization factor of existing berths in future	(A) High	(D) Lower
4. Construction Work of Quay Wall, etc.		
(1) Difficulty	(D) Difficult (Troubles anticipated)	(A) Easy
(2) Hindrance to ships	(D) Very high	(A) None
(3) Adjustment of vested rights	(D) Difficult	(A) Easy
5. Basin		
(1) Width*	(N) 220^m–250^m $<1.5L+a=340^m+a$ (S) $390^m > 1.5L+a=340^m+a$	(S) $450^m > 1.5L+a=340^m+a$
(2) Turning Radius	(N) 110^m–195^m $<L+a=225^m+a$	(S) 225^m–280^m $>L+a=225^m+a$
(3) Present Depth	(N) 8.4-9.1^m $<12^m$ (to be dredged)	(N) 0-7.6^m $<12^m$ (to be dredged)
(4) Dredging Volume	(A) Less	(D) Much
(5) Siltation	(D) Anticipated	(A) Minor
6. Construction Cost	(A) Expensive	(D) Expensive
7. Economic and Social Cost	(D) Much more expensive	(D) Expensive
8. Construction Period	(D) Not assured	(A) Can be assured

(A) Advantage (S) Satisfied L: Length of ship
(D) Disadvantage (N) Not satisfied a: allowance

3.5 The Role of Both Ports

As noted in Chapter 1, there are two international sea ports in Pakistan: Karachi and Qasim. The Government has developed and administered both ports based on the policy that Port Qasim should mainly handle bulk cargo and Port Karachi should mainly handle general cargo.

This policy was confirmed in the previous JICA study and reflected in the Sixth Five Year Plan.

In this section, fundamental differences between the two ports are discussed and identified for the consideration of the roles of the two ports.

(1) Port Planning Concept

In the early planning stages about 15 years ago, there were two important concepts for developing the new Phitti Port, i.e. Port Qasim.

One was to provide raw materials to Pakistan Steel Mill as well as other coastal industries expected to be introduced for the development of the national economy. The other was to relieve the congestion of Port Karachi.

Not only the development of the port, but also the development of other transport facilities such as the Pipri railyard and road connections with superhighways and national highways were also planned. This programme might still be considered to be ongoing from the planning point of view.

Therefore, it is clear that Port Qasim has been planned and developed as a bulk-cargo port.

(2) Geographical Features

2-1 Access Road and Railway Conditions

Pakistan extends about 1600 km from south to north, and both ports are located at the southern end of the country.

Judging from these geographical characteristics, the majority of seaborne cargoes have to travel overland to and from the northern part of the country.

There are congested city areas behind Port Karachi. However, the seaborne cargo handled at Port Qasim can be transported smoothly without passing through any congested Karachi city areas.

As for railway transport, Port Qasim is also advantageously located because of the modern large-scale Pipri railyard, which commenced operation in 1980 at the same time as Port Qasim.

2-2 Channel Conditions

When the roles of the two ports are discussed, the difference of channel length between the ports should not be forgotten. The

channel length of Port Karachi is 11 km and that of Port Qasim is 44 km.

Assuming the average ship sailing speed in the channels is 4 knots, ships calling at Port Qasim require an additional 9 hours for sailing the long channel compared with ships calling at Port Karachi. Furthermore, nighttime passage at Port Qasim is not allowed at present.

As the container cargo projection indicates that it is very likely that the majority of general cargoes will be containerized in the future, container ship berthing time should be as short as possible, say, within 1 day at the most, judging from the concept of containerization and actual performance at many foreign ports.

In the meanwhile, the average turn-round time of bulk cargo ships at Port Karachi in 1985/86 was 13.3 days. The ratio of 9 hours to 1 day is 38%, which is undesirably high. On the other hand, the ratio of 9 hours to 13.3 days is only 2.8%.

Thus as far as channel conditions are concerned, Port Karachi is more suitable for container handling.

(3) Port Services

Port Karachi is in a sense a mature port, opened a century ago, and Port Qasim is a new port, which started operation in 1980. Thus, most of Pakistan's port-related functions and assets have been developed and concentrated around Port Karachi.

It is very natural for port users to expect good port service from the port management body and private agents. Under the current situation, most users are likely to choose Port Karachi because of its relatively higher quality services.

(4) Financial Situations of Port Management Bodies

The financial situation of Port Karachi has been very satisfactory. However, the financial condition of Port Qasim is poor and the Government needs to support Port Qasim financially.

One of the most essential matters at present is to improve PQA's financial situation so that PQA can become a truly autonomous body as soon as possible.

The points discussed in this section are summarized in Table 3.5.1.

In spite of the original policy, the Government decided to introduce container terminals at Port Qasim. This project has the following advantages, although there are issues to be adjusted as already discussed in 3.3.

Firstly, this project allows conversion of three existing multipurpose berths into two container terminals without changing the basic structure of the berths. Therefore, this project could provide in a short time container terminals with gantry cranes. Pakistan presently faces a shortage of such facilities.

Secondly, this project will be executed by the introduction of private funds. Therefore, public resources can be conserved.

Thirdly, with the commencement of container terminal operations, some of the container cargo at Karachi could be expected to shift to Port Qasim. As a result, the financial situation of Port Qasim is expected to be improved.

Taking into consideration all the subjects and items discussed above, the Study Team has reached the following conclusions concerning the roles of the two ports:

1) The Government policy that Port Qasin should handle mainly bulk cargo, and Port Karachi should handle mainly general cargo and conventional bulk cargoes should be maintained.

2) However, the conversion project at Port Qasim should be executed expeditiously, paying attention to the harmonious development of both ports.

Table 3.5.1 Characteristics of Port Qasim and Port Karachi

	Port Karachi	Port Qasim
1. Port Planning Concept	· Commercial Port (general cargo port)	· Industrial port to provide raw materials to Qasim coastal industrial zone · Relieving of congestion at Port Karachi
2. Government Policy	To handle mainly general cargo and up to 10 million tons of liquid cargo	To handle mainly bulk cargo and additional liquid cargo
3. Geographical features		
3-1 Accessibility from the land side (Congested Karachi city area)	All road traffic has to pass through congested Karachi city area	Traffic can go upcountry without passing through congested areas. Pipri railyard is favorably located.
3-2 Accessibility from sea side (Channel length)	Channel length is 11 km, short and simple	44 km long, meandering. Additional 9 hours sailing is necessary compared with Karachi.
	Night sailing is possible	Night sailing is not allowed.
4. Port service (from viewpoint of port users)	Most port-related investments are concentrated around Port Karachi. Free choice of stevedores among many firms. More popular among port users. Lower tariff level.	Most cargoes are for PSM and Government. Two stevedoring companies assigned by PQA. Higher tariff level.
5. Financial condition of the port management body	Favourable	Insufficient, supported by Government subsidy.

3.6 Proposed Projects

3.6.1 Cargo Forecast and Berth Requirements

The projected cargo throughput in 1992/93 is estimated based on the methodology explained in 2.4 and on the result of discussions between the Government counterparts and the team.

During the course of the estimation, the cargoes are classified into three groups, general cargo, bulk cargo and liquid cargo, as shown in Table 3.6.1.

General cargo of 6.5 million tons comprises sugar, iron and steel, rice, cotton and others. Most of these cargoes, i.e. 4.5 million tons or 69% of the total, are estimated to be containerized, and to be handled at specialized container terminals at Ports Karachi and Qasim.

The remaining cargoes are assumed to be handled at existing conventional berths at Port Karachi.

It is assumed that three multipurpose berths at Port Qasim will be converted to a container terminal with two berths by 1988/89.

Bulk cargoes comprise wheat, fertilizer, mining products, coal, rock phosphate and rice. After converting three multipurpose berths to a container terminal, there will be four bulk berths left at Port Qasim which can accommodate 1.1 million tons of bulk cargoes, and the rest of the bulk cargo will again have to be handled at conventional wharves at Port Karachi.

Thus the number of necessary berths by the end of the next five years is calculated using the same method explained in Chapter 2 of the Master Plan.

Calculation procedures are presented in Appendix 3-6-4. The results are summarized in Table 3.6.2. New berths to be constructed during the Seventh Five Year Plan period are two container berths and one oil berth at Port Karachi, and one oil berth in addition to two converted container berths at Port Qasim.

Table 3.6.1 Cargo Classification and Berth Assignment (Seventh Five Year Plan)

(1,000 tons)

Classification	Cargo Tonnage	Berth Assignment	Cargo Tonnage
1. General Cargo	6,446	Karachi	
		Conventional Berths	2,000
Sugar	214	Container Berth	2,250
Iron & Steel	14		
Rice	258	Qasim	
Cotton	608	Container Berths	2,250
Others	5,302		
Subtotal	6,446		6,500
2. Bulk Cargo	4,791	Karachi	
		Conventional Berths	3,700
Wheat	832		
Cement	14	Qasim	
Fertilizer	1,178	Multipurpose Berths	1,100
Mining Products & Coal	1,603		
Rock Phosphate	391		
Rice	773		
Subtotal	4,791		4,800
3. Iron Ore and Coal for PSM	3,400	Qasim	
		I.O.C. Berths	3,400
Iron Ore and Coal	3,400		
4. Liquid Cargo	8,640	Karachi	
		Oil Berth	8,640
Edible Oil	1,096		
Molasses	844		
Petroleum Products	4,520		
Crude Oil	2,180		
Subtotal	8,640		8,640
5. Liquid Cargo	2,245	Qasim	
		Oil Berth	2,245
Crude Oil	2,105		
Petroleum Products	140		
Subtotal	2,245		2,245

Source: JICA Study Team

Table 3.6.2 Berthing Facilities (7th Five Year Plan)

Port/Berth	Cargoes	Cargo Tonnages (1,000 t/y)	Ship Size/ Quay Depth (DWT/m)	Necessary No. of Berths			Cargo Handling Efficiency tons/hr	Designed Berth Occupancy Rate (%)
				Existing	New	Total		
Karachi								
. East and West	General Cargo	2,000	30,000/-10	11		19	30	71
	Bulk Cargo	3,700	50,000/-11.5	8			84	65
. Container	Container	2,250	30,000/-12	0	2	2	25.7 TEU/hr	51.5
. Oil	Mineral/ Vegetable Oil	8,640	70,000/-13.4	2	1	3	4,000(Mineral) 500(Vegetable)	40
Qasim								
. Multi-purpose	Bulk Cargo	1,100	40,000/-10	4	0	4	68	47
. I.O.C	Iron ore/ Coal	3,400	50,000/-12	1	0	1	1,350	60
. Oil	Mineral Oil	2,245	50,000/-12	0	1	1	4,000	40
. Container	Container	2,250	30,000/-12	0	2	2	25.7 TEU/hr	51.5

Source: JICA Study Team

3.6.2 Evaluation of Candidate Projects

(1) Container Terminal at Port Karachi and Related Matters

As demonstrated in Fig. 2.4.1, containerization will surely develop further in the future. Judging from the demand forecast and the capacity analyses explained above, development of container terminals is most essential as already pointed out by several studies in the past.

However, such projects require a great deal of funds and would become a burden for the Government of Pakistan if conducted by borrowing foreign currency.

Hence additional investigations and discussions are made in 3.4 on the possibility of economically converting some of the existing conventional berths at Port Karachi. The preliminary analyses on the issue from mainly technical viewpoints reveal a possibility with some difficulties in assessing overall feasibility. In order to finalize the evaluation, an in-depth feasibility study is indispensable including field surveys and analyses of operational systems, cost-benefit and other factors from the viewpoint of regional economic and social development. Keeping the urgency of the project in mind, the feasibility study should be conducted in the early stage of the Seventh Five Year Plan period.

(2) Container Terminal at Port Qasim

The Government approved a policy to convert three existing multipurpose berths at Port Qasim into a container terminal using private sector funds as discussed in 3.4. Some additional policy options are touched upon in 3.7, below.

(3) Oil Berth at Port Karachi and Port Qasim

Based on the demand forecast, the capacity and the expected remaining life of the present facilities at Port Karachi (built in 1956 and 1910), replacement of Oil Berths 2 and 3 by a new berth is considered to be one of the most important projects for the 7th Five Year Plan. However, the volume of mineral oil handled at Port Karachi has remained around 6.7 million tons per year during the past four years. It might also be reasonable to consider the difficulties of expanding the oil storage capacity on the land side behind Port Karachi. It should also be remembered that there is some local requirement for oil at Qasim industrial zone including the demand from the Thermal Power Stations and Pakistan Steel Mill.

Therefore, it is assumed that for the time being the same level of oil handling volume will be maintained at Port Karachi, and the rest of the oil will be handled at Port Qasim. In other words, out of the total oil volume of 10.8 million tons, 8.6 million tons to Port Karachi and 2.2 million tons to Port Qasim will be

distributed. At some appropriate time after 1992/93, the planning of terminals at both ports could be reviewed, taking account of the actual tonnage and operation of the terminals.

(4) Cargo Handling Equipment for Container Cargo and Harbour Craft

As explained above, construction of a new container terminal at Port Karachi is expected to take a few more years.

Meanwhile, the present container handling capacity at Port Karachi is considered to be almost saturated. Therefore, introduction of container handling equipment such as big mobile cranes could be helpful as an immediate countermeasure as analyzed in 3.4.5. Introduction of such equipment could be carried out primarily by the private sector as a direct beneficiary, keeping in mind the public nature of the berths.

Harbour craft projects at both ports, which include introduction or replacement of tug boats, pilot boats and others, are also considered to be important in order to improve the overall efficiency of cargo handling at the ports.

(5) Dredger and Channel Dredging

In order to minimize maintenance dredging costs at Port Qasim, a trailing suction dredger should be acquired as already agreed by the Governments of Pakistan and Japan.

(6) Roads, Warehouses and Housing

In order to alleviate land traffic congestion within and just behind the port area at Karachi, access road projects, which are now ongoing, should be executed continuously. There is another ongoing road and housing project at Port Qasim which is expected to be completed in the near future. With the completion of the project, further development of roads and housing at Port Qasim does not seem to have a high priority for the time being.

(7) Projects Concerning Bulk Cargo at Port Qasim

Such projects as the multipurpose berth, fertilizer and wheat terminal, silo, and rock phosphate berth are not required within the Seventh Five Year Plan Period according to the demand forecast.

(8) Coal Berth for Coal Power Station

The coal berth project for the coal power station is not incorporated in the Seventh Five Year Plan at this time, because the power generation project utilizing foreign coal has not been authorized by the Government.

(9) Gwadar Mini-Port

In order to encourage the development of the regional economy, Gwadar fish harbour-cum mini-port should be constructed as stipulated in the Sixth Five Year Plan.

(10) Feasibility Study on Inland Water Transport

In order to examine the possibility of developing an economic inland water transport system, a feasibility study is proposed by the Team.

The results of the above preliminary evaluation of the candidate projects and cost are summarized in Table 3.6.3.

An investment schedule for the selected projects is proposed as shown in Table 3.6.4. The priority of each project is based on the judgement of the Team.

Table 3.6.3 List of Port Projects for Seventh Five Year Plan

(Rs. Million)

Name of Project (No. of Berths)	Project Cost	Remarks
Karachi Port		
• Container Terminal (2)	1,702	
• Feasibility Study on Construction of Container Terminal	16	
• Container Cargo Handling Equipment	-	by Private 1/
• New Oil Berths (1)	230	Sector
• Harbour Craft	458	
• Roads and Warehouses	250	
• Jinnah Bridge	250	
Subtotal	2,906	
Qasim Port		
• Container Terminal (2)	-	by Private
• Oil Berth (1)	216	Sector
• Dredger	646	
• Harbour Crafts	124	
Subtotal	986	
Others		
• Gwadar Mini-port	500	
• Feasibility Study on I.W.T.	18	
Subtotal	518	
Grand Total	4,410	

Note: 1/; Rs. 5 million (one 40 ton crawler crane)

Source: JICA Study Team

Table 3.6.4 Investment Schedule for Seventh Five Year Plan

(Rs. Million)

Name of Project	Estimated Cost (Total)	Yearly Allocation					Total 1988-93	Beyond 1993	Ranking
		1988-89	1989-90	1990-91	1991-92	1992-93			
1. Oil Berth (PQA)	216			70	76	70	216	0	B
2. Dredger (PQA)	646	146	250	250			646	0	A
3. Harbour Craft (PQA)	124	25	25	25	25	24	124	0	A
Subtotal	986	171	275	345	101	94	986	0	
4. Gwadar Mini-port	500	150	200	150			500	0	A
5. Jinnah Bridge Phase-II	250				50	100	150	100	B
6. F.S. on I.W.T.	18				6	12	18		B
Subtotal	768	150	200	150	56	112	668	100	
7. Container Terminal (KPT)	1,702		202	300	500	700	1,702		A
8. F.S. on Container Terminal	16	16					16	0	A
9. Oil Berth	230	70	80	80			230	0	A
10. Harbour Craft	458	90	90	90	90	98	458	0	A
11. Roads & Warehouses	250	125	125				250		A
Subtotal	2,656	301	497	470	590	798	2,656	0	
Grand Total	4,410	622	972	965	747	1,004	4,310	100	

Source: JICA Study Team

3.6.3 Economic Assessment

In order to confirm the viability of the major proposed projects for the Seventh Five Year Plan, a rough cost-benefit analysis is conducted from the national economic points of view. The projects taken up for the economic analysis are those related to the development of infrastructures, i.e. the container terminals with two berths each and the oil berths with one berth each at both Karachi and Qasim Ports. The period of the analysis is 1988/89 - 2005/06.

(1) "With" and "Without" Cases

For the cost-benefit analysis, it is necessary to determine the "with" and "without" investment cases in order to clearly identify the incremental benefits and costs of the project.

In case of the container terminals, the "with" case assumes that the conversion of MPT at Port Qasim will be completed by 1988/89 and the Western Backwater Container Terminal at Port Karachi will be constructed by 1992/93. The "without" case assumes that neither project will be realized by 1992/93 and, just after that time, some measures to cope with the increased containers will be undertaken.

As for the "with" case for the oil berths, a reconstructed oil pier at Port Karachi will become operational by 1990/91 and a new oil pier will be built at Port Qasim by 1992/93. The "without" project case assumptions are the same as those for the container project.

Future cargo volumes under all cases are assumed to equal those forecast in 2.3 and 2.4. After 1992/93, the volumes under the "with" and "without" cases are assumed to remain constant at the 1992/93 level.

It is assumed that there is no difference of cargo handling efficiency or berth capacity between the same type of berths at Port Karachi and Qasim, and the values of the efficiencies employed are those explained in 1.8 and 3.4 for container cargoes and those in 1.8 and 2.5 for oil cargoes.

(2) Benefits

The following items are counted as the benefits of the investment.

a) Saving of voyage time due to introduction of faster container ships owing to the development of the container terminals: Unit savings is taken from the original Feasibility Study Report multiplied by the deflator. This benefit is applicable only for exports.

b) Savings of waiting time of container ships and oil tankers: This is calculated by means of queueing theory, assuming a

Poisson distribution for arrival and a phase three Erlung distribution for berthing time. Berth occupancies under the "with" project case are assigned so that the service level is less than about 5%, and those under the "without" project cases have no restriction because the occupancies are all less than 90%. Only 50% of the computed benefit is considered to accrue to the Pakistani economy.

c) Savings of cargo handling time and cost: This benefit assumes that the improvement of cargo handling efficiency is related to the reduction of ship berthing time, and the savings of the cargo handling cost is counted by its unit savings per ton for only container berths, as analyzed by the original Feasibility Study, adjusted using the deflator.

In addition, no residual values of the facilities and equipment are assumed under the "with" project case at the end of the final year of calculation, i.e. 2005/06, and no rehabilitation cost of conventional wharves and piers for the "without" case are taken into consideration.

(3) Cost

The following cost items are taken into consideration:

a) Construction costs for the "with" project cases: The construction costs for newly developed container terminals and oil piers at Port Karachi and Qasim are counted based on the cost estimates made in 3.4.4 and 3.6.2.

b) Maintenance costs of the "with" project case: The maintenance costs for the projects are assumed to be 1% per annum for civil works and 3% per annum for equipment.

c) Additional operation costs of the "with" project case: The additional operation costs due to the execution of the projects are calculated based on increased costs related to labour, stevedoring, materials and supply, fuel, outside repairs and maintenance and administration & overhead.

(4) Economic Internal Rates of Return

The result of the benefit-cost analysis expressed in terms of the economic internal rate of return (EIRR) is summarized in Table 3.6.5.

The EIRR is 21.2% for the overall project, which is far higher than the opportunity cost of about 12%, and proves the economic feasibility of the project.

The benefit cost ratio for a discount ratio of 12% is about 1.28, which is a pretty good figure.

Table 3.6.5 Economic Evaluation of Port Projects

(Rs. Million)

Total	Total Cost	Total Benefit	Discounted Cost	Discounted Benefit
1988/89	777.00	268.00	777.00	268.00
1989/90	332.00	245.00	273.89	202.12
1990/91	477.00	221.00	324.63	150.40
1991/92	587.00	235.00	329.56	131.94
1992/93	833.00	699.00	385.81	323.75
1993/94	170.00	699.00	64.96	267.08
1994/95	198.00	699.00	62.41	220.33
1995/96	198.00	699.00	51.49	181.77
1996/97	198.00	699.00	42.47	149.95
1997/98	198.00	699.00	35.04	123.70
1998/90	198.00	699.00	28.91	102.05
1999/00	198.00	699.00	23.85	84.19
2000/01	198.00	699.00	19.67	69.45
2001/02	198.00	699.00	16.23	57.29
2002/03	198.00	699.00	13.39	47.27
2003/04	198.00	699.00	11.05	38.99
2004/05	198.00	699.00	9.11	32.17
2005/06	198.00	699.00	7.52	26.54
Total	5552.00	10755.00	2476.98	2476.98

B/C Ratio at a Discount Rate of 12%/year: 1.28
Internal Rate of Return: 21.2%

Source: JICA Study Team

3.7 Policy Options

In addition to the projects discussed and proposed above, there are many other policies which should be incorporated, for instance, in the Five Year Plan, such as those elaborated in the Sub-working Group Report. The Study Team would like to propose among others the following policies for consideration by the Government of Pakistan, based on the information from and discussions with parties concerned during the Team's stay in Pakistan.

3.7.1 Expansion of Bonded Areas

In order to develop the door-to-door services of containers and to enjoy the advantages of containerization from the national economic point of view, it seems very important to pursue the possibility of expanding bonded areas to include the premises of consignees and manufacturers. Presently the customs clearance and examination of container cargoes is carried out only within Karachi Port and some other dry ports, which involves unnecessary unloading and loading works and is time consuming and expensive. If a new policy were employed, the effect might be innovative, allowing the amelioration of traffic congestion in Karachi, opening the possibility of construction of a CFS outside the Port, etc.

3.7.2 Fund Raising System for Container Berths

Generally speaking, development of basic port facilities requires heavy financial investment and a long construction period, especially for container berths. In this section, therefore, the Study Team would like to introduce the fund raising systems for container terminals used in Japanese ports and European ports for the reference of the Government of Pakistan. A summary is presented in Tables 3.7.1, 3.7.2 and 3.7.3.

In Japan, the construction cost for exclusive container terminals is raised in the following way:

(1) Investment

Central government investment	10%
Local government investment	10%

(2) Loans

Central government treasury loans	40%
Private capital loans from the exclusive lessees	40%

Table 3.7.1 Fund Raising System for Port Facilities in Japan

Organization or Agent	Exclusive-Use Container Berth		Public Port Facility**			
			Basic Infrastructure (Breakwater, Channel, Quay Wall)		Profitable Facilities (Shed, Cargo Handling equipment)	
Central Government	Investment (subsidy) Loan from Government	10% 40%	Investment (subsidy)	(A%)*		
Local Government (Port Management Body)	Investment	10%	Investment	(B%)	Issuing Bonds	(C%)
Container Yard Lesee	Loan	40%				
Total		100%	A + B	100%	C = 100%	

Source: JICA Study Team

* A is stipulated by port and type of facility in the "Port and Harbour Law" in Japan
** including public container berths

Table 3.7.2 Fund Raising for Container Terminals in European Ports

Port (Country)	Facilities	Organization: Port Management Body	Organization: Lesee	Fund Raising	Remarks
Marseilles (France)	Quay·land	O		Subsidy from Government Quaywall: 60% Breakwater: 80% Dredging: 80% Others; by management body	Management body manages/ operates quaywall, gantry crane and pavement within 50 m from faceline of quay. Stevedoring firms hire pavement beyond 50 m from faceline and utilize as yard.
	Yard pavement	O	O		
	Gantry crane	O			
	Shed/cargo handling equipment		O		
Barcelona (Spain)	Quay·land	O		All cost is raised by management body	Same as at Marseilles
	Yard pavement	O	O		
	Gantry crane	O			
	Shed/Cargo handling equipment		O		
Algeciras (Spain)	Quay·land	O		All cost is raised by management body	Management body manages/ operates quaywall and pavement within 80 m from faceline of quay. Sealand Co. installs gantry crane and hires pavement beyond 80 m from faceline and utilizes as marshalling yard.
	Yard pavement	O	O		
	Gantry crane		O		
	Shed/cargo handling equipment		O		

Source: Ministry of Transportation of Japan

Table 3.7.3 Fund Raising for Container Terminals in European Ports

Port (Country)	Facilities	Organization: Port Management Body	Organization: Lesee	Fund Raising	Remarks
Hamburg (W. Germany)	Quay·land	0		All cost is raised by management body	The lesee hires land and quay from management body, constructs pavement, crane and shed, etc., runs container terminal.
	Yard pavement		0		
	Gantry crane		0		
	Shed/cargo handling equipment		0		
Rotterdam (Holland) Antewerp (Belgium)	Quay·land	0		All cost is raised by management body	Same as Port Hamburg
	Yard·pavement		0		
	Gantry crane		0		
	Shed/Cargo handling equipment		0		
Japanese Container Terminals (for exclusive use)	Quay·land	0		Investment	The Terminal Development Corporation leases out entire container terminal to shipping companies. Utilization of terminals is restricted to the lessee and consortium ships.
	Yard pavement	0		Government 10%	
	Gantry crane	0		Local Government 10%	
	Shed/Cargo	0			
	Cargo handling equipment		0	Loan	
				Government 40%	
				Lesee 40%	

Source: Ministry of Transportation of Japan

Aggregate funds necessary for the construction of container berths include general administrative expenses and interests during the construction term besides direct costs. The construction cost and the general administrative expenses are to be paid by the income from the lease rent. In short, 60% of the total cost is financed by the public sector and 40% is financed by the private sector. On the other hand, funds for construction and improvement of fundamental port facilities such as breakwaters, channels and port transport facilities are provided by central and local governments.

In the meanwhile, the management body finances the construction or provision of profitable facilities such as sheds and cargo handling facilities by issuing bonds. These bonds are redeemed using income from users' fees.

In all the European ports listed in Tables 3.7.2 and 3.7.3, quays and land are constructed by the management body, and sheds and cargo handling equipment are provided by lessees. In the ports of Marseilles, Barcelona and Algeciras, some parts of the yard pavement near the face line of the quays is constructed by the management body and then leased out to lessees. But generally speaking, most of the yard pavement is constructed by lessees.

In the ports of Marseilles and Barcelona, gantry cranes are installed by the management body. In other ports, yard lessees install gantry cranes.

Among the European ports, only Port Marseilles is subsidized by the Government.

3.7.3 Rationalization of Tariff Level

The tariff rate at Port Karachi has remained at the same level for years.

KPT has submitted a revised tariff plan for Government approval, though the present financial situation of KPT is sufficient.

As explained in Chapter 1, the present financial situation of PQA is inadequate, because of heavy dredging cost, payment of interest for loans, depreciation expense and insufficient revenues due to insufficient cargo throughput. However, in order to improve the underutilization of the port facilities and to compete effectively with other ports, it might be necessary to rationalize the tariff of PQA.

3.7.4 Introduction of Coastal Industries to Port Qasim Industrial Zone

According to PQA, the following are the main objectives of the developing Port Qasim:

(1) Provision of additional industrial and multipurpose seaport facilities for increasing foreign trade;

(2) Provision of specialized, exclusive berths for bulk handling of raw material imports for Pakistan Steel Mill;

(3) Provision of a highly efficient alternate port for the national economy;

(4) Provision of environmental and ecological relief for the sprawling city of Karachi.

To realize the above objectives, Port Qasim owns and operates a vast 4000 ha industrial zone just behind the waterfront. In the vicinity of the industrial zone an export processing zone, the industrial areas of Landi and Korangi, and the rice storage and processing facilities of Rice Export Corporation are located advantageously.

Introduction of new coastal industries to these zones would improve the present performance at Port Qasim, and could reduce the current congestion at Port Karachi. Suitable coastal industries are considered to be port-based or port-related including oil refining, petrochemical, iron and steel, shipbuilding, power and other industries. In the case of Japan, each port management body has been making all possible efforts to attract private companies and tends to introduce positive economic incentives including tax reduction, soft loans and other subsidies to private firms.

According to information from private companies in Karachi City, the Pakistani private sector seems to be interested in setting up more industries, especially P.S.M downstream industries, near Port Qasim.

And they hope for some incentives, such as reduction of land cost, a five year tax holiday and exemption of import duties.

Based on the above understanding concerning Port Qasim Industrial Zone, the Study Team would like to suggest that new research be executed. The research should include at least the following items:

(1) To investigate the present land use situation;

(2) To study suitable types of industries and companies to be introduced into the zone;

(3) To survey appropriate incentives or supporting systems in order to attract new industries and firms;

(4) To formulate a new land use plan based on previous studies; and

(5) To formulate an overall policy on the development of the Industrial Zone.

APPENDIX FOR

PORT PLANNING

TABLE OF CONTENTS

PORT PLANNING

App. Table 1-5-1 Cargo Handling Equipment at Port Karachi

	East wharves		West wharves	
Quay portal cranes	3 ton (R19.8m)	x 41	2 ton (R18.3m)	x 16
	3 ton (R22.9m)	x 12	3 ton (R22.9m)	x 4
			30 ton (R17.7m)	x 1
Mobile cranes for containers			40 ton Berth No.24 x 1 40 ton (R21.3m) at Juna Bunder No.25 x1	
Mobile cranes	13/4 ton	x 5		
	6 ton	x 60		
	7 ton	x 17		
Truck cranes	10 ton	x 2	(Diesel)	
Road mobile cranes	2 x 6 ton	x 40	(Diesel)	
Hyester cranes	2 ton	x 1		
Fork lift trucks	2 to 3 ton	x 154	(Diesel)	
"		x 42		
Shunting tractors		x 12		
Towing units		x 45		
Towing trailers		x 750	(Platform)	
Towing tractors		x 15	(Agricultural type)	
Petrol tractors		x 10	(Warehouse)	
"		x 3	(Farm type)	
Tractors		x 10	(Industrial diesel)	
Trucks (Battery)		x 4	(Platform)	
" (Diesel)		x 19	(Loading)	
" (Petrol)	1 1/4 ton	x 4	(Platform)	
Floating cranes	125 ton (R28.95m) "HATHI" (Self propelled Diesel/Elect)			
	60 ton (R24.38m) "PEELTAN" (Self propelled Diesel)			
	30 ton (R7.61m) "PAHALWAN" (Self propelled Steam)			

Source: KPT Year Book of Information 85 - 86

App. Table 1-5-2 Dredgers and Hopper Barges at Port Karachi

No.	Name	Type	Capacity	Dredging depth (m)	Year built	Where built
	Dredgers					
1.	FATEH	Bucket	1250 barge ton/hr	15.23	1965	UK
2.	12HAR	Bucket	1250 barge ton/hr	15.23	1965	UK
3.	KARAMAT	Cutter suction with 4 dump barges and 1 dredging tender	45 ton/hr	15.23	1968	W.Germany
4.	AMINUDDIN	Grab hopper	1000 barge ton		1969	K.S. & E.W. Karachi
5.	RAJHANS	Trailing suction hopper	800 barge ton		1965	K.S. & E.W. Karachi
6.	MAHMUD-UL-HASSAN	Trailing suction hopper			1980	
	Hopper barges					
1.	WHIMBREL	Self-propelled diesel	800 barge ton	-	1959	K.S. & E.W.
2.	CURLEW	Self-propelled diesel	800 barge ton	-	1959	K.S. & E.W.
3.		Self-propelled diesel				
4.	SARAS	Self-propelled	1000 barge ton	-	1971-72	Holland
5.	NEELSAR	Self-propelled	1000 barge ton	-	1971-72	Holland

Source: KPT Year Book of Information 85 - 86

App. Table 1-5-3 Tugs at Port Karachi

S. No.	Name of Tug	Type	Engine Screw	Bollard Pull in tons	Horse Power	Speed Knots	Year of Make	Where Built
1.	SOHRAB	Harbour-Tug	Twin	35	2,200	12	1983	Karachi Shipyard Eng. Works
2.	BAHADUR	Harbour-Tug	Twin	26	2,200	12	1978	-do-
3.	MAZBOOT	Harbour-Tug	Twin	27	3,200	13	1968	Japan
4.	TAQATWAR	Harbour-Tug	Twin	12	1,200	10	1959/6	Holland
5.	PURJOSH	Harbour-Tug	Twin	19	1,500	10	1962	Karachi Shipyard Eng. Works
6.	SHEHZORE	Harbour-Tug	Twin	19	1,500	10	1962	-do-
7.	FIRDOUSI	Seagoing-Tug	Single	18	1,500	10	1959	Yugosalvia
8.	TANOMAND	Harbour-Tug	Single	3	265	10	1960	M/s. Chatiers Navale,Italy
9.	ZORAWAR	Harbour-Tug	Single	3	265	10	1960	-do-
10.	CHABUK	Harbour-Tug	Single	3.3	320	10	1970	Karachi Shipyard Eng. Works
11.	TAWANA	Harbour-Tug	Single	3.3	320	10	1970	-do-
12.	Sindbad	Harbour-Tug	Two VSP	35	3,200	12	1985	M/s Neve Jadewesft W. Germany
13.	Shanawar	Harbour-Tug	Two VSP	35	3,200	12	1985	-do-

Source: KPT Year Book of Information 85-86

App. Table 1-5-4 Cargo Handling Equipment at Port Qasim

Trailer	20 ton	73
Tractor	4.5/1.0 ton	37

Cranes		
Type	Capacity (ton)	Number
971 HLB	24	4
971 M	40	2
565 HLB	8	2
571 M	32	2
851 M	30	1
565 C	30	1
Sub total		12

Fork lift trucks		
Type	Capacity (tons)	Number
VA10 Climax	9.0	4
VA70 Climax	3.5	30
Vulken Car	3.2	5
Hyster	4.0	15
Sub total		54

Source: PQA

App. Table 1-5-5 Harbour Craft at Port Qasim

Harbour Craft	Number
Buoy Tender	1
Tug	3
Lighterage Tug	2
Pilot Launch	2
Inspection Launch	1
Survey Launch	3
Work Boat	6
Water Barge	1

Source: PQA

App. Table 1-6-1(1) Cargo Tonnage at Port Karachi by Commodity Group

(Unit: 1000 tons)

Commodities \ Year	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86
Grand Total	14,654	15,137	14,789	14,758	14,898	15,820
Import Total	11,037	11,589	11,709	12,412	12,401	12,511
Export Total	3,617	3,548	3,080	2,346	2,497	3,309
Dry Import						
Cement	444	1,302	647	871	722	217
Fertilizer	1,294	314	692	491	569	456
Rock Phosphate	191	191	197	283	276	225
Sugar	74	-	7	6	21	268
Wheat	308	242	213	322	819	1,094
Chemicals	139	139	114	104	93	139
Iron & Steel	442	442	426	468	442	430
Scrap	116	175	115	115	143	172
Jute	62	48	64	79	76	140
Paper	80	80	95	101	127	128
Tea	91	67	56	72	48	50
Timber	7	10	4	11	12	29
Others	1,583	1,884	2,162	2,089	1,792	1,868
Total	4,831	4,894	4,792	5,012	5,140	5,216
Liquid Import						
Petroleum	5,598	6,058	6,161	6,483	6,499	6,669
Edible Oil	608	636	755	917	761	626
Total	6,206	6,694	6,916	7,400	7,260	7,295
Dry Export						
Cotton	315	187	90	25	97	511
Cotton Yarn	14	2	5	2	7	55
Rice	1,257	956	606	261	135	158
Textiles	22	15	11	19	15	65
Cow dung	21	43	145	79	74	106
Fertilizer	-	-	-	135	185	349
Grain	71	65	83	59	37	3
Others	658	774	978	1,100	983	1,068
Total	2,358	2,042	1,918	1,680	1,533	2,315
Liquid Export						
Molasses	264	434	640	389	670	736
Petroleum Products	994	1,069	511	280	290	9
Edible Oil	-	4	10	7	4	249
Total	1,258	1,507	1,162	666	963	994

Source: KPT

App. Table 1-6-1(2) Cargo Tonnage at Port Qasim by Commodity Group

(Unit: 1000 tons)

Commodities \ Year	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86
Grand Total	376	1,409	1,740 +4,916TEUs	2,922	3,011 +8TEUs	4,433 +9TEUs
Import Total	375	1,245	1,295 +2,786TEUs	1,358	2,150	3,044 +9TEUs
Export Total	1	163	445 +2,130TEUs	1,563	861 +8TEU	1,389
Import						
Wheat	-	-	-	-	253	855
Ore	195	707	744	839	1,185	1,303
Coal	156	538	520	491	711	853
Manganese Ore	23	-	25	27	-	33
General Cargo	-	-	5	1	0	0
Containers (TEUs)	-	-	2,786TEUs	-	-	9TEUs
Vehicles	-	-	-	-	-	(251)
Export						
Pig iron	-	137	127	398	40	92
Coke	-	25	1	-	-	19
Rice	-	-	295	1,048	595	1,162
Cotton	-	-	51	10	-	5
Fertilizer	-	-	-	100	186	29
Cow dung	-	-	-	-	19	84
General Cargo	1	1	5	0	0	0
Others	-	-	-	5	21	-
Containers (TEUs)	-	-	2,130TEUs	-	8TEUs	-

Source: PQA

App. Table 1-6-2 Historical Trend of Cargo Tonnage, Berth Length and Cargo Tonnage per Unit Berth Length

Year	Cargo Tonnage (A) (Million Tons) KPT	PQA	Total	Berth (B) Length (m)	(A/B) tons/m
1965-66	7.06		7.06	3,083	2,290
66-67	9.07		9.07	3,279	2,766
67-68	8.66		8.66	3,279	2,641
68-69	8.45		8.45	3,653	2,313
69-70	9.34		9.34	3,653	2,557
70-71	9.44		9.44	3,653	2,584
71-72	9.31		9.31	3,653	2,549
72-73	10.35		10.35	3,653	2,833
73-74	10.49		10.49	4,238	2,475
74-75	10.00		10.00	4,238	2,360
75-76	9.93		9.93	4,864	2,042
76-77	9.59		9.59	4,864	1,972
77-78	11.76		11.76	4,864	2,418
78-79	15.03		15.03	5,185	2,899
79-80	14.66		14.66	5,185	2,827
80-81	14.65	0.38	15.03	5,464	2,751
81-82	15.14	1.41	16.55	7,241	2,286
82-83	14.79	1.74	16.53	7,241	2,283
83-84	14.76	2.92	17.68	7,241	2,441
84-85	14.90	3.01	17.91	7,241	2,473
85-86	15.82	4.43	20.25	7,241	2,797

Source: KPT, PQA

App. Table 1-8-1 Cargo Tonnage Handled per Ship

Unit: tons/ship

Year	Pt. Karachi			Pt. Qasim	
	General Cargo	Bulk	Oil	Bulk	Iron Ore, Coal
1974-75	2,695		20,732	-	-
75-76	3,001	13,455	20,110	-	-
76-77	2,882	14,808	20,627	-	-
77-78	2,697	21,525	23,581	-	-
78-79	2,668	21,913	24,002	-	-
79-80	3,351	17,745	24,914	-	-
80-81	3,472	15,869	27,342	-	25,036
81-82	3,014	13,572	29,716	9,627	25,426
82-83	3,151	16,460	27,290	7,813	28,041
83-84	3,434	20,312	31,260	11,676	34,812
84-85	3,439	18,828	27,783	11,992	37,923
85-86	3,616	19,164	26,484	11,875	41,307

Source: KPT, PQA

App. Table 1-8-2 Average Waiting Time per Ship (Hours), Wq

Year	Pt. Karachi		
	General Cargo	Bulk	Oil
1974-75	79.4	137.0	66.0
75-76	167.3	176.0	49.8
76-77	213.5	330.0	48.8
77-78	224.6	260.2	68.7
78-79	239.0	448.8	38.1
79-80	127.1	169.9	45.4
80-81	31.9	54.9	34.3
81-82	36.7	110.2	29.4
82-83	41.3	123.2	33.7
83-84	30.7	150.6	30.7
84-85	15.2	108.6	33.4
85-86	16.1	63.6	37.0

Source: KPT

App. Table 1-8-3 Average Operation Time per Ship (Hours), Tb

Year	Pt. Karachi			Pt. Qasim	
	General Cargo	Bulk	Oil	Bulk	Iron Ore, Coal
1974-75	222.3	171.0	71.0	-	-
75-76	215.5	232.5	63.9	-	-
76-77	244.8	319.8	66.9	-	-
77-78	215.2	223.0	63.2	-	-
78-79	194.1	197.6	59.5	-	-
79-80	169.1	181.5	58.3	-	-
80-81	137.8	166.0	48.8	-	-
81-82	103.6	158.5	53.8	-	55.9
82-83	107.4	220.0	51.1	135	57.5
83-84	104.4	221.5	48.3	179	64.8
84-85	86.9	262.9	44.4	207	73.6
85-86	79.9	257.1	44.7	218	85.1

Source: KPT, PQA

App. Table 1-8-4 Cargo Tonnage Handled per Ship per Hour, Eb

(Unit: tons/ship·hour)

Year	Pt. Karachi			Pt. Qasim	
	General Cargo	Bulk	Oil	Bulk	Iron Ore, Coal
1974-75	12.1		292.0	-	-
75-76	13.9	57.9	314.7	-	-
76-77	11.8	46.3	308.3	-	-
77-78	12.5	96.5	373.1	-	-
78-79	13.7	110.9	403.4	-	-
79-80	19.8	97.8	427.3	-	-
80-81	25.2	95.6	560.3	-	-
81-82	29.1	85.6	552.3	-	454.8
82-83	29.3	74.8	534.0	57.9	487.7
83-84	32.9	91.7	647.2	65.2	537.4
84-85	39.5	71.6	625.7	57.8	515.3
85-86	45.2	74.5	592.5	54.2	485.3

Source: KPT, PQA

Appendix 2-5-1 Estimation of Cargo Handling Efficiency

(1) General Cargo

The cargo handling efficiency of general cargo at conventional berths is set at 30 tons/hr in both 1992/93 and 2005/06, as analysed in Chapter 1.8. As the actual cargo handling performance of general cargo handled by NLC during the past 4 years has remained at the same level, 19 tons/hook/hr, this value is assumed to be constant in 1992/93 and 2005/06.

(2) Container Cargo

The cargo handling efficiency of containers is set at 25.7 TEU/hr in 1992/93 and at 37.5 TEU/hr in 2005/06. These values are studied in Chapter 3.4 (refer to Table 3.4.2). The required number of berths are 4 in 1992/93 and 8 in 2005/06, provided the service level to be 6.7% and 0.3% respectively.

(3) Bulk Cargo

The cargo handling efficiency of bulk cargo in 2005/06 is assumed to be 220 tons/hr, considering introduction of mechanized handling equipment. The handling speeds of bulk cargo in 1992/93 are assumed to be 84 tons/hr in Port Karachi and 68 tons/hr in Port Qasim. These values are calculated based on the following conditions. The present handling speeds of bulk cargo are 74.5 tons/hr and 54.2 tons/hr at Port Karachi and Qasim, respectively.
These values are assumed to improve linearly, and to reach 110 tons/hr in 2005/06 which is the maximum speed in the past realized in Port Karachi in 1978/79.

(4) Iron Ore and Coal at PSM Terminal

The cargo handling efficiency at PSM terminal is obtained from the following calculation.

Handling efficiency = 1200 x 2 x 0.8 x 0.7
= 1350 tons/ship berthing time (hr)

1200: nominal handling efficiency tons/(hr) net operation time
2: number of unloaders
0.8: coefficient of working efficiency
0.7: idle time ratio, which is defined as the ratio of cargo handling time to ship berthing time.

(5) Oil Cargo

(A) Mineral Oil

The cargo handling of oil is performed using the pumping equipment of each tanker. In estimating handling efficiency, "JOHAR" owned by NTC is taken as a model ship, of which nominal handling efficiency is 6000 tons/hr.

Thus, handling efficiency is calculated as follows.

Handling efficiency = 6000 x 0.9 x 0.7
≒ 4000 tons/(hr) ship berthing time

0.9: coefficient of working efficiency
0.7: idle time ratio

(B) Vegetable Oil

It is assumed that ship size of vegetable oil is 10000 DWT based on an analysis executed in the course of our study on port activities. Thus, handling efficiency is calculated as follows.

Handling efficiency = 10000 x 8/100 x 0.9 x 0.7
= 500 tons/hr.

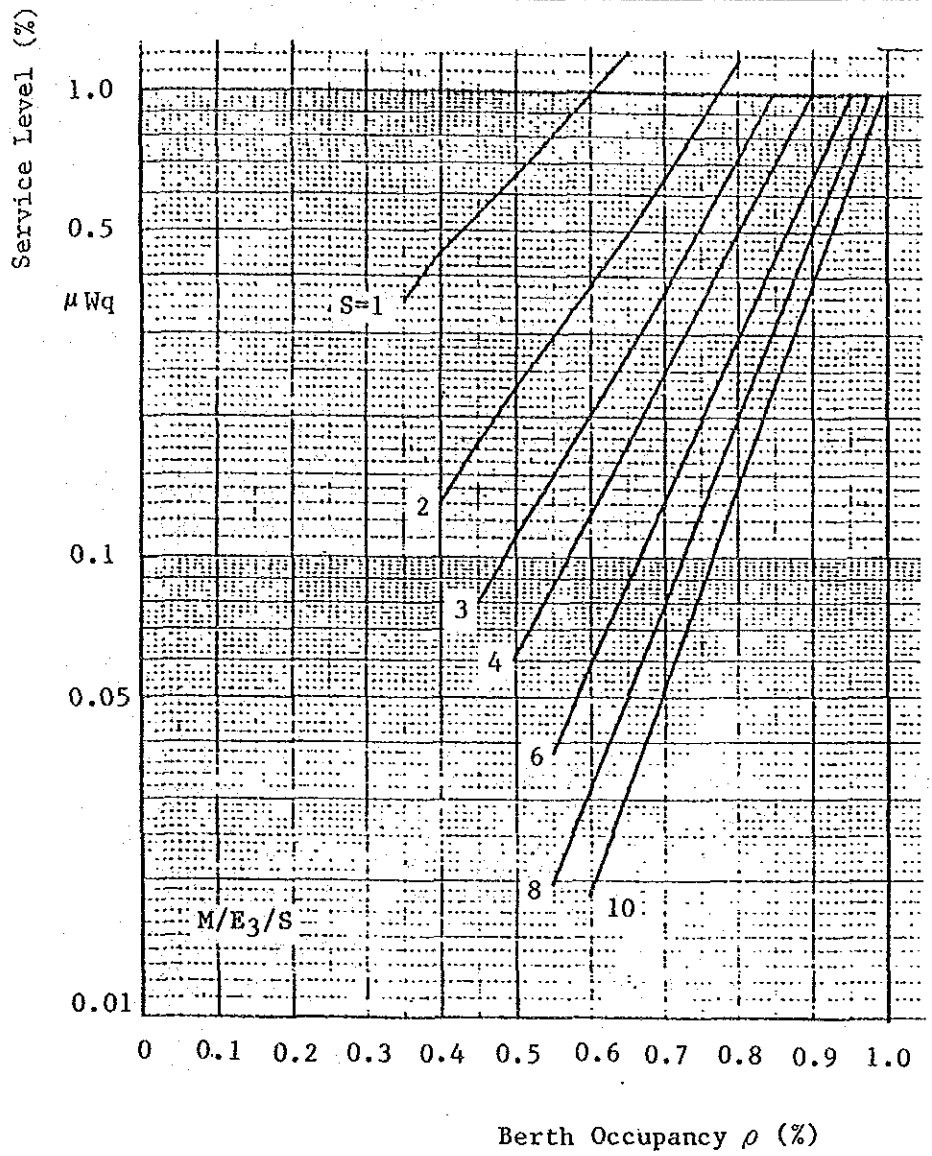
0.9: coefficient of working efficiency
0.7: idle time ratio

Note 1: Actual average performances in Port Karachi in 1985/86 was 250 tons/hr. It is expected that pumping efficiency will be doubled in the future.

2: According to K.P.T, the handling ratio of edible oils and molasses vary between 100 tons to 300 tons per pipeline. The vessel may use upto 4 pipe lines for loading and/or unloading. Accordingly the pumping ratios from the vessels handling vegetable oil could vary between 100 tons per hour to 1200 tons/hr.

3: According to KPT average vegetable oil load per ship is 4700 tons/ship in 1985/86. Therefore it is assumed that considerable increase in ship size will take place in the future.

App. Fig. 2-5-1 Service Level and Berth Occupancy



Source: JICA Study Team

Note: M/E3/S is called Kendall's symbol. The first letter signifies arrival distribution, the second letter service time distribution and the third letter, the number of service points. M is a Poisson distribution and E3 is an Erlang distribution of phase 3.

Appendix 2-5-2 Required Number of Berths in 2005/06

(1) Karachi

1) General Cargo Berth

Forecast Conditions

Cargo Throughput	1.8 millions tons
Handling Efficiency	30 tons/hr
Berth Occupancy	70%

$$\text{No. of Berths} = \frac{1{,}800{,}000}{30 \times 365 \times 24 \times 0.7} = 9.8$$

Therefore 10 berths will be necessary.

2) Bulk Cargo Berth

Forecast Conditions

Cargo Throughput	5.1 million tons
Handling Efficiency	220 tons/hr
Berth Occupancy	53%

$$\text{No. of Berths} = \frac{5{,}100{,}000}{220 \times 365\ 24 \times 0.53} = 5.0$$

Therefore, 5 berths will be necessary.

3) Oil Berth

3-1 Mineral Oil

Forecast Conditions

Cargo Throughput	6.7 million tons
Handling Efficiency	4000 tons/hr
Berth Occupancy	40%

$$\text{No. of Berths} = \frac{6{,}700{,}000}{4000 \times 24 \times 365 \times 0.4} = 0.48$$

Therefore, one berth will be necessary.

3-2 Vegetable Oil

Forecast Condition

Cargo Throughput	2.892 million tons

Handling Efficiency 500 tons/hr
Berth Occupancy 40%

$$\text{No. of Berths} = \frac{2,892,000}{500 \times 24 \times 365 \times 0.4} = 1.7$$

Therefore, two berths will be necessary.

(2) Qasim

1) Multi Purpose Berth

Forecast Conditions

Cargo Throughput 3.66 million tons
Handling Efficiency 220 tons/hr
Berth Occupancy 47%

$$\text{No. of Berths} = \frac{3,660,000}{220 \times 24 \times 365 \times 0.47} = 4.0$$

Therefore, 4 berths will be necessary.

2) I.O.C. Berth

Forecast Conditions

Cargo Throughput 7.0 million tons/year
Handling Efficiency 1350 tons/hr
Berth Occupancy 60%

$$\text{No. of Berths} = \frac{7,000,000}{1350 \times 24 \times 365 \times 0.6} = 0.99$$

Therefore, one berth will be necessary.

Note: Berth Occupancy of 60% is determined considering program ship calling because IOC terminal is exclusively utilized only by Pakistan Steel Mill.

3) Oil Berth

Forecast Conditions

Cargo Throughput 7.829 million tons
Handling Efficiency 4000 tons/hr
Berth Occupancy 40%

$$\text{No. of Berths} = \frac{7,829,000}{4000 \times 24 \times 365 \times 0.4} = 0.55$$

Therefore, one berth will be necessary.

Appendix 2-5-3 Case Study of Optimum Number of Oil Berths and Berth Occupancy

This study is executed in order to analyze the relation between berth occupancy ρ and total cost for oil berths, which comprises berth construction cost and ship waiting cost.

Necessary assumptions are tabulated in App. Table 2-5-4.

App. Table 2-5-4 Necessary Assumptions for Oil Berth

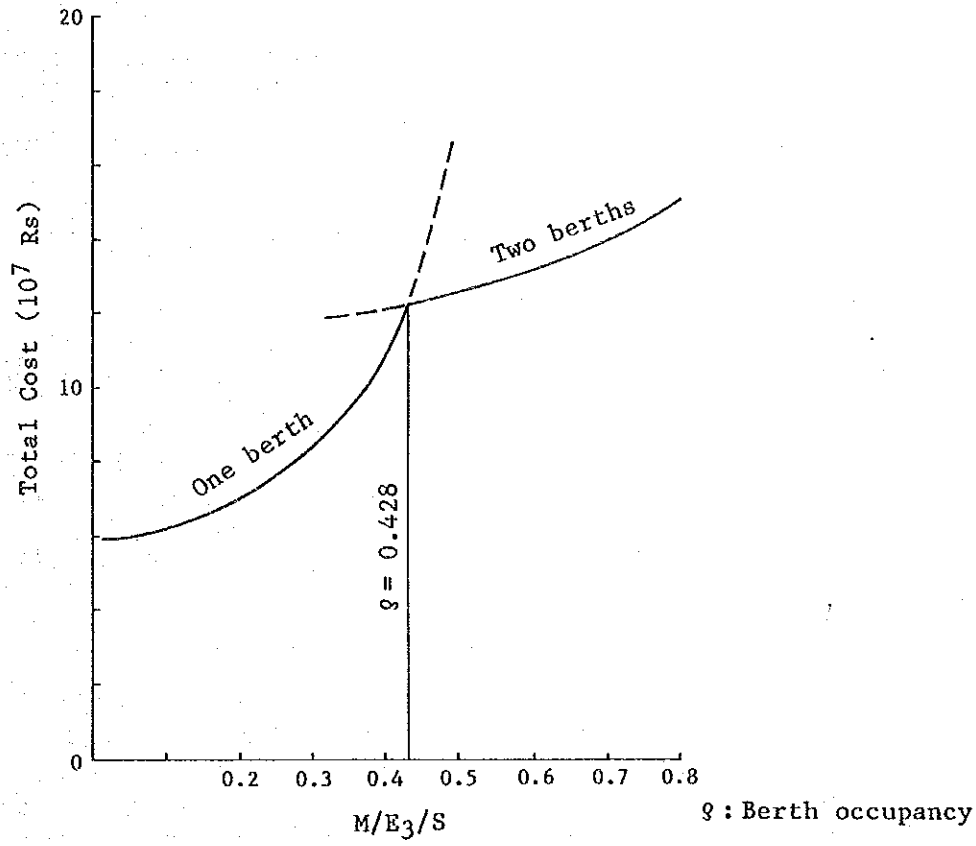
Items	Values	Remarks
Ship Size	90,000 DWT	
Ship Charter Cost	0.92 Rs/DWT·month	Source: General Council of British Shipping
Ship Waiting Cost	82,800 Rs/day·ship	Average cost during 1984-87
Berth Cost	240 million Rs/berth	Subworking Group Report
Berth Cost/Day	16,438 Rs/day·berth	Life time: 40 years
Cargo Tonnage Handled per Ship	60,000 DWT/ship	
Handling Efficiency	4,000 tons/hr	
Ship Service Rate	1.6 ships/day	
Cargo Throughput (ship arrival rate)	Variable	

The results of calculations are shown in App. Fig. 2-5-2.

Horizontal axis is berth occupancy ρ which is proportional to cargo throughput, and vertical axis is the total cost. As seen in the figures there are two curves i.e. lines for one berth and two berths crossing at ρ = 0.428.

Up to 0.428 of ρ it is understood that one berth is more economical than two berths. However if berth occupancy exceed 0.428, construction of two berths is more economical than one berth. This is because once berth occupancy ρ becomes larger than 0.428, ship waiting cost increase sharply, and additional one berth can reduce these ship waiting time to moderate level. Thus it might be reasonable that occupancy rate ρ of 40% is adopted in the estimation of required number of oil berth.

App. Fig. 2-5-2 Total Cost and Berth Occupancy for Mineral Oil Berth



Source: JICA Study Team

App. Table 2-5-5 Harbour Craft & Cargo Handling Equipment for Master Plan

Port Karachi (Unit: Rs. Million)

Equipment	Capacity	Number	Unit Cost	Total Cost
Bucket Dredger	0.8 m^3/bucket non-propell	2	243.9	487.8
Hopper Barge	800 ton self propell	5	34.6	173.0
Tug Boat	3200 HP	6	51.2	307.2
Pilot Boat	12 Knot	5	6.3	31.5
Quay Crane	40 ton	16	4.9	78.4
Antipollution Measures		3	44.4	133.2
Unloader for Bulk Berth	400 ton/hr	5	36.6	183.0
Total				1,394.1

Harbour Craft & Cargo Handling Equipment at Pt Qasim for Master Plan

Port Qasim (Unit: Rs. Million)

Equipment	Capacity	Number	Unit Cost	Total Cost
Bucket Dredger	0.8 m^3/bucket non-propell	2	243.9	487.8
Hopper Barge	800 ton self propell	6	34.6	207.6
Tug Boat	3200 HP	6	51.2	307.2
Pilot Boat	12 Knot	6	6.3	37.8
Mobile Crane	40 ton	4	4.9	19.6
Antipollution Boat	-	2	43.9	87.8
Unloader for Bulk Berth	400 ton/hr	4	36.6	146.4
Total				1,294.2

Source: JICA Study Team

App. Table 3-4-1 Container Handling Equipment and Cost

(Unit: Rs. thousand)

Item	Quantity	Unit Cost	Total Cost
(Ship operation)			
Container crane (Rail span: 16m)	4	71,208	284,832
Yard tractor	16	912	14,592
Yard chassis 40'(20' x 2)	16	224	3,584
(Unit train operation)			
Rail-mounted transfer cranes	2	23,736	47,472
Road tractor	8	912	7,296
Road chassis 40'(20' x 2)	8	224	1,792
(Container Yard operation)			
Rubber-tire transfer cranes	8	14,242	113,936
(Gate operation)			
Weighing scales	2	1,548	3,096
(MT yard operation and maintenance)			
Fork lift truck			
3.0 tons	5	413	2,065
35.0 tons with telescopic side spreader	2	6,639	13,278
(CFS operation)			
Fork lift truck			
3.0 tons	36	413	14,868
6.0 tons	4	894	3,576
Road tractor	8	912	7,296
Road chassis			
20 footer	36	172	6,192
40 footer	18	224	4,032
Pallets	3,950	1.03	4,068
(Multipurpose)			
Mobile crane 35 tons	1	4,747	4,747
Fork lift truck			
3.0 tons	3	413	1,239
15.0 tons	1	2,133	2,133
Toplifter with telescopic spreader 35 tons	1	6,639	6,639
(Terminal office)			
Computer	1	17,802	17,802
Wireless telephone (VHF)	50	52	2,600
Grand total			567,135

Source: JICA Study Team

App. Table 3-4-2 Rough Cost Estimate of Container Terminal for Master Plan

(Unit: Rs. Million)

No.	Items	Quantity	Unit Cost	Amount
1	Preparations & Temporary W.	L.S.		19
2	Container Berth Quay Wall	1,800 m	0.3 million Rs/m	540
3	Dredging & Reclamation	8,950,000 m^3	50 Rs/m	448
4	Slope Protection & Retaining Wall			
	Slope Protection	9,300 m	3,710 Rs/m	35
	Retaining Wall	144 m	123,500 Rs/m	18
5	Access Railway and Road			
	Railway	14,000 m	2,300 Rs/m	32
	Road	4,100 m	4,000 Rs/m	16
	Interchange or Flyover	1 Nos		37
6	Container Terminal			
	Pavement	846,750	690 Rs/m^2	584
	C.F.S.	59,400	3,000	178
	Office & Other Building	30,147	2,760	83
	Railway	10,800	1,800 Rs/m	19
	Foundation of Rail Mountain Transfer Crane	1,800	55,000 Rs/m	99
	Utilities	L.S.	-	111
7	Mobilization & Demobilization	L.S.	-	37
8	Demolition & Removal	L.S.	-	-
9	Equipment			
	Cargo Handling Equipment	L.S.	-	1,701
	Navigational Aids	L.S.	-	2
	Subtotal			3,959
10	Engineering Study & Supervision	L.S.		140
11	Physical Contingency	L.S.		423
	Total			4,522

App. Table 3-6-1 Harbour Craft & Cargo Handling Equipment for the Seventh Five Year Plan

Port Karachi

(Unit: Rs. Million)

Equipment	Capacity	Number	Unit Cost	Total Cost
Bucket Dredger	0.8 m^3/bucket non-propell	1	243.9	243.9
Hopper Barge	800 ton self propell	2	34.6	69.2
Tug Boat	3200 HP	2	51.2	102.4
Pilot Boat	12 Knot	2	6.3	12.6
Quay Crane	40 ton	6	4.9	29.4
Total				457.5

Port Qasim

(Unit: Rs. Million)

Equipment	Capacity	Number	Unit Cost	Total Cost
Pilot Boat	12 Knot	2	6.3	12.6
Conservancy Boat		1	6.3	6.3
Tug Boat	3000 HP	1	51.2	51.2
Antipollution Boat		1	43.9	43.9
Mobile Crane	40 ton	2	4.9	9.8
Total				123.8

Source: JICA Study Team

Appendix 3-6-2 Cost of Feasibility Study on the Container Conversion Project

In order to estimate the cost of the feasibility study on the container conversion project, the following factors are considered to be important:

(1) Contents of the Study

The Scope of Works should cover at least the following fields:

1) Traffic forecast and port planning.
2) Survey of natural conditions especially soil conditions and technical examination of structural strengths.
3) Construction method/design and cost estimates.
4) Financial and economic analysis.

(2) Period of Study

The necessary period for this feasibility study will be about 12 months including a few months for boring, site survey, data collection/ analysis, discussions with counterparts and reporting.

(3) Man-months

In order to execute the feasibility study, 4 specialists in the fields listed in section (1) above will be necessary.

Thus, the required total man-power will be about 40 man-months.

(4) Expenses

Taking into account all the factors above, the expenses are estimated as follows:

		(Rs thousand)	
1)	Travelling	650	4 persons, 2 trips, 3 months stay
2)	Local Survey	200	Transportation expenses communications, typists fees
3)	Reporting	600	Interim (30), Draft Final (30) and Final Report (60)
4)	Computer Fee	250	Demand forecast, OD table technical, calculations, financial and economic analysis
5)	Soil Boring & Survey	900	3 holes
6)	Personnel	4,700	40 man-months
7)	Overhead	7,900	170% of personnel
8)	Contingency	800	5% of total cost
	Total	16,000	

Note: In the case of ADB port projects, consultant service fee is usually about 5% of the total construction cost.

Appendix 3-6-3 Cost of the Feasibility Study on Inland Water Transport

In order to estimate the cost of the feasibility study on inland water transport, the following factors are considered to be essential:

(1) Contents of Study

The study should cover at least the following fields:

1) Transport planning and demand forecast.
2) Study on natural conditions and other technical matters concerning riparian engineering.
3) Design/scheduling and cost estimate for major structures such as river ports, remodelling of bridges, and lock gates of barrages.
4) Financial and economic analysis and institutional study.

(2) Period of Study

The necessary period for this feasibility study will be about 15 months, including site surveys, aerophotographs, data collection/analysis, discussion with counterparts and reporting.

(3) Man-months

In order to execute the feasibility study, 4 specialists in the fields listed in (1) above will be necessary. The required total man-power is estimated to be about 40 man-months.

(4) Expenses

Taking into account all the items explained above, the necessary expenses are estimated as follows.

		(Rs thousand)	
1)	Travelling	650	4 persons, 2 trips, 3 months stay
2)	Local Survey	200	Transportation expenses communications, typists fees
3)	Reporting	600	Interim (30), Draft Final (30) and Final Report (60)
4)	Computer Fee	240	Demand forecast, OD tabulation, technical calculations
5)	Aerophotograph	2,400	Covering 15% of total river length
6)	Cross-section Survey	410	300 m interval
7)	Personnel	4,700	40 man-months
8)	Overhead	7,900	170% of personnel
9)	Contingency	900	5% of total cost
	Total	18,000	

Appendix 3-6-4 Required Number of Berths in 1992/93

(1) Karachi Port

1) General Cargo Berth

Forecast Conditions

Cargo Throughput	2.00 million tons
Handling Efficiency	30 tons/hr
Berth Occupancy	71%

$$\text{No. of Berths} = \frac{2{,}000{,}000}{30 \times 365 \times 24 \times 0.71} = 10.7$$

Therefore 11 berths will be necessary.

2) Bulk Cargo Berth

Forecast Conditions

Cargo Throughput	3.7 million tons
Handling Efficiency	84 tons/hr
Berth Occupancy	65%

$$\text{No. of Berths} = \frac{3{,}700{,}000}{84 \times 365 \times 24 \times 0.65} = 7.7$$

Therefore 8 berths will be necessary.

3) Oil Berth

A) Mineral Oil

Forecast Conditions

Cargo Throughput	6.7 million tons
Handling Efficiency	4,000 tons/hr
Berth Occupancy	40%

$$\text{No. of Berths} = \frac{6{,}700{,}000}{4000 \times 24 \times 365 \times 0.4} = 0.47$$

Therefore, one berth will be necessary.

B) Vegetable Oil

Forecast Conditions

Cargo Throughput	1.94 million tons

Handling Efficiency 500 tons/hr
Berth Occupancy 40%

$$\text{No. of Berths} = \frac{1,940,000}{500 \times 24 \times 365 \times 0.4} = 1.1$$

Therefore, two berth will be necessary.

(2) Qasim Port

1) Multi Purpose Berth

Forecast Conditions

Cargo Throughput 1.1 million tons
Handling Efficiency 68 tons/hr
Berth Occupancy 47%

$$\text{No. of Berths} = \frac{1,100,000}{68 \times 24 \times 365 \times 0.47} = 3.9$$

Therefore 4 berths will be necessary.

2) I.O.C Berth

Forecast Conditions

Cargo Throughput 3.4 million tons
Handling Efficiency 1,350 tons/hr
Berth Occupancy 60%

$$\text{No. of Berths} = \frac{3,400,000}{1350 \times 24 \times 365 \times 0.6} = 0.48$$

Therefore, one berth will be necessary.

Note: Occupancy rate of 60% is determined considering programme ship calling because IOC terminal is exclusively utilized only by Pakistan Steel Mill.

3) Oil Berth

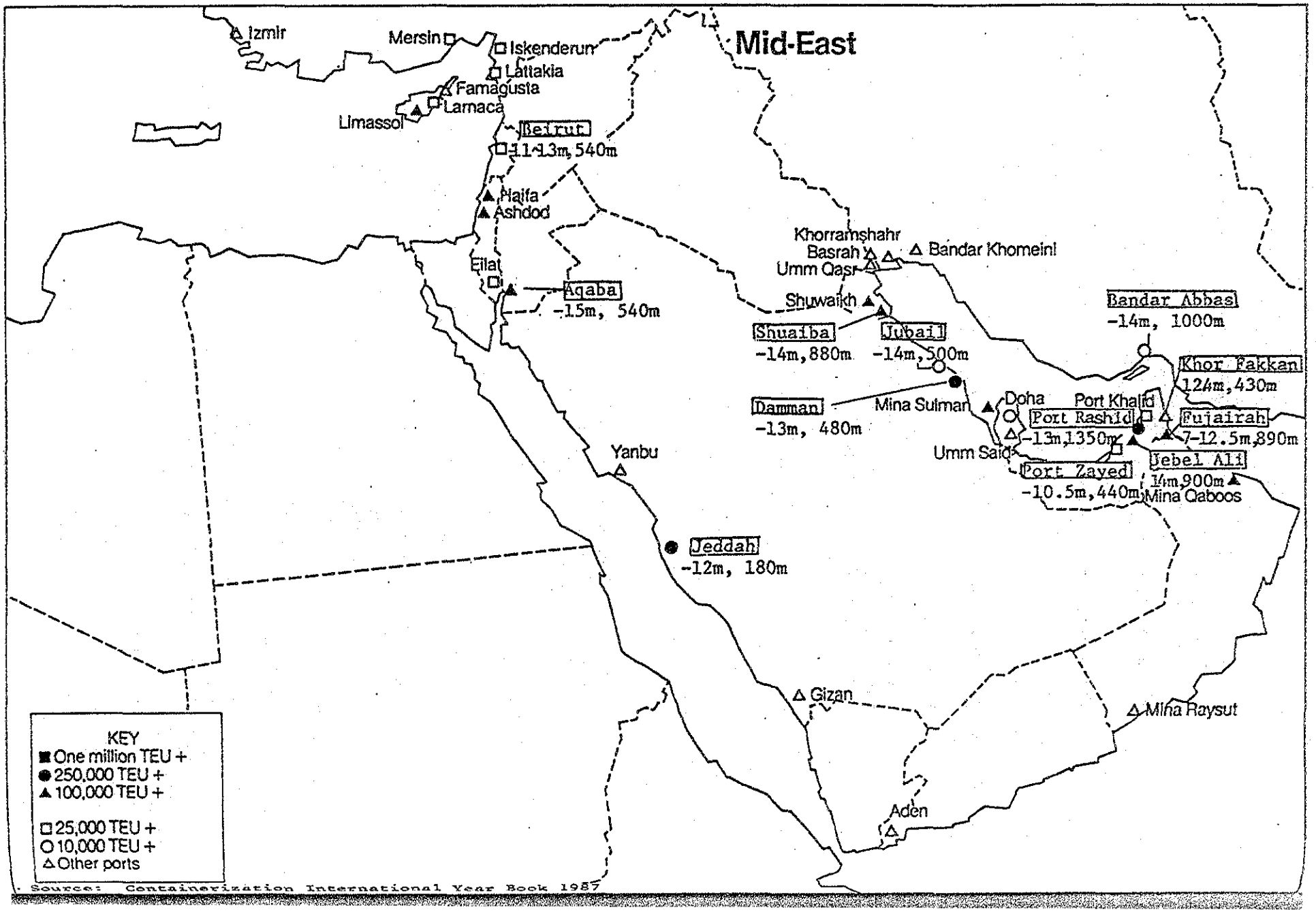
Forecast Conditions

Cargo Throughput 2.245 million tons
Handling Efficiency 4000 tons/hr
Berth Occupancy 40%

$$\text{No. of Berths} = \frac{2,245,000}{4000 \times 24 \times 365 \times 0.4} = 0.16$$

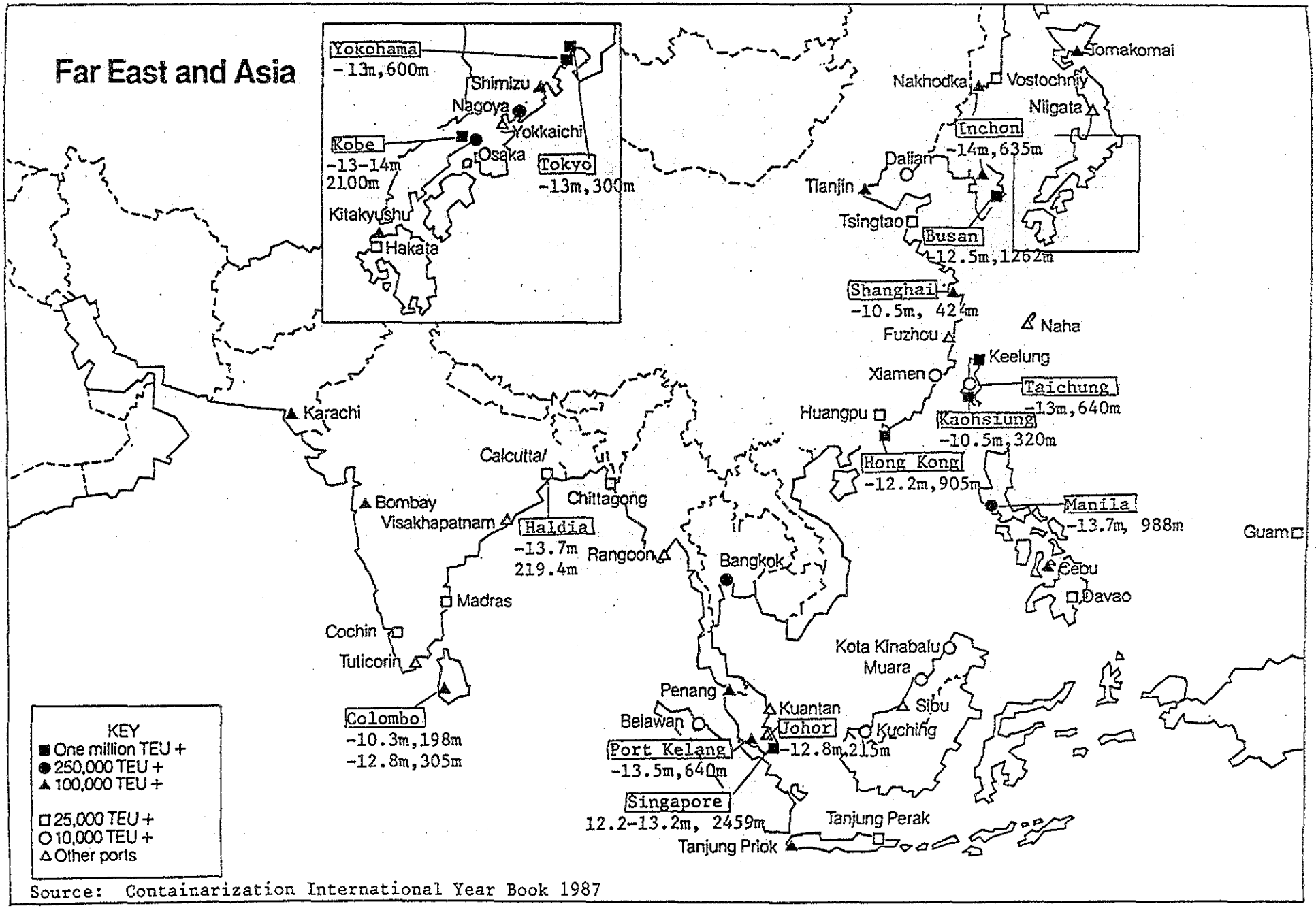
Therefore, one berth will be necessary.

App. Fig. 3-4-1(1) Water Depth of Container Terminals (Mid-East)



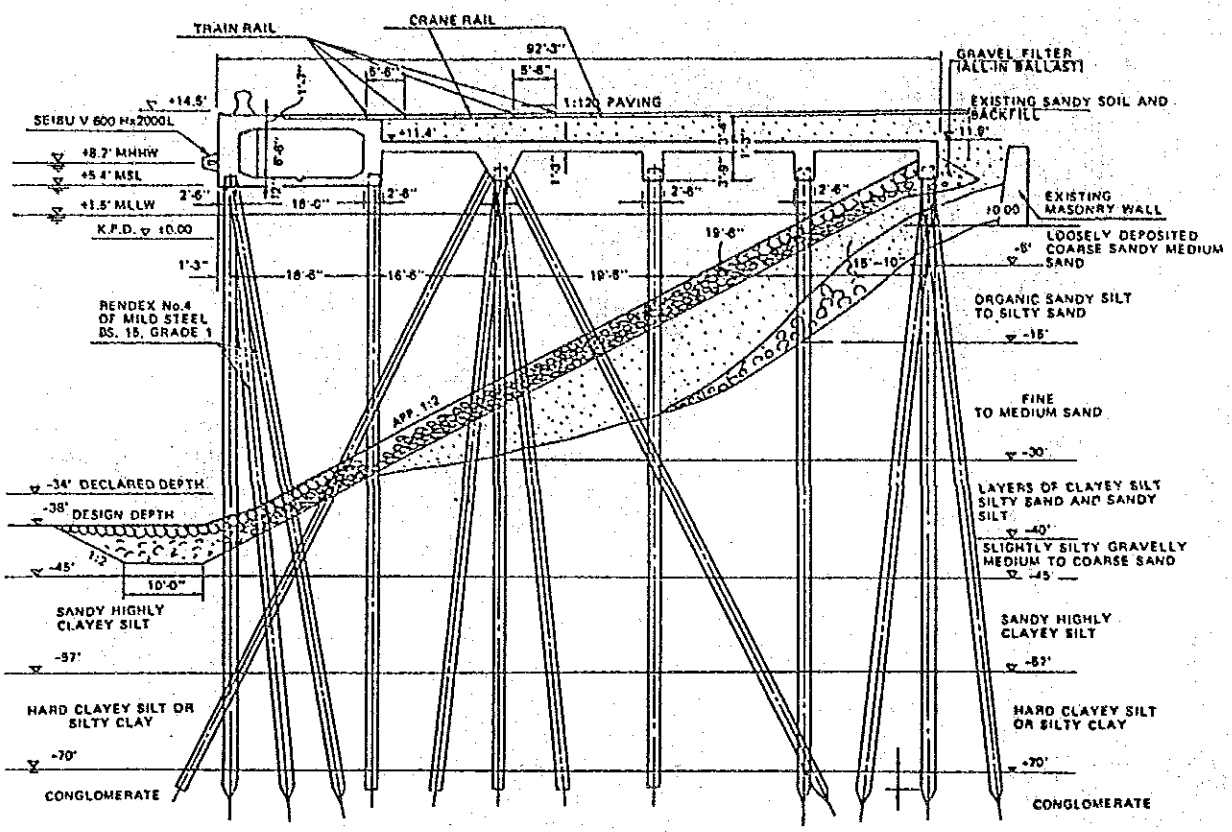
Source: Containerization International Year Book 1987

App. Fig. 3-4-1(2) Water Depth of Container Terminals (Far East and Asia)

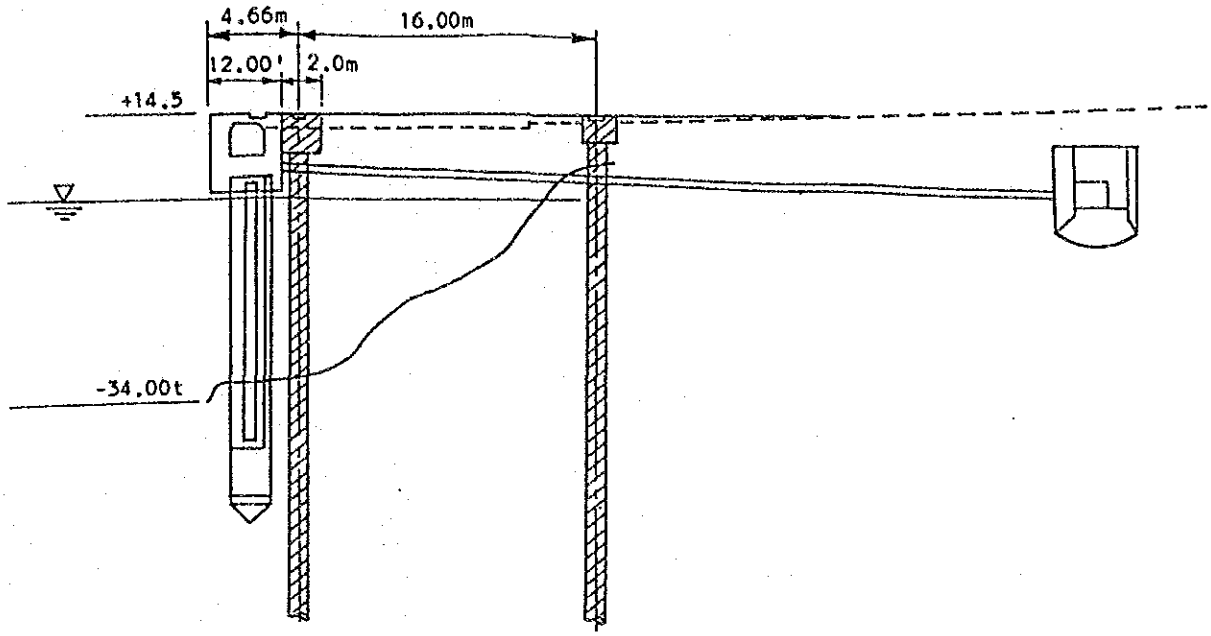


Source: Containarization International Year Book 1987

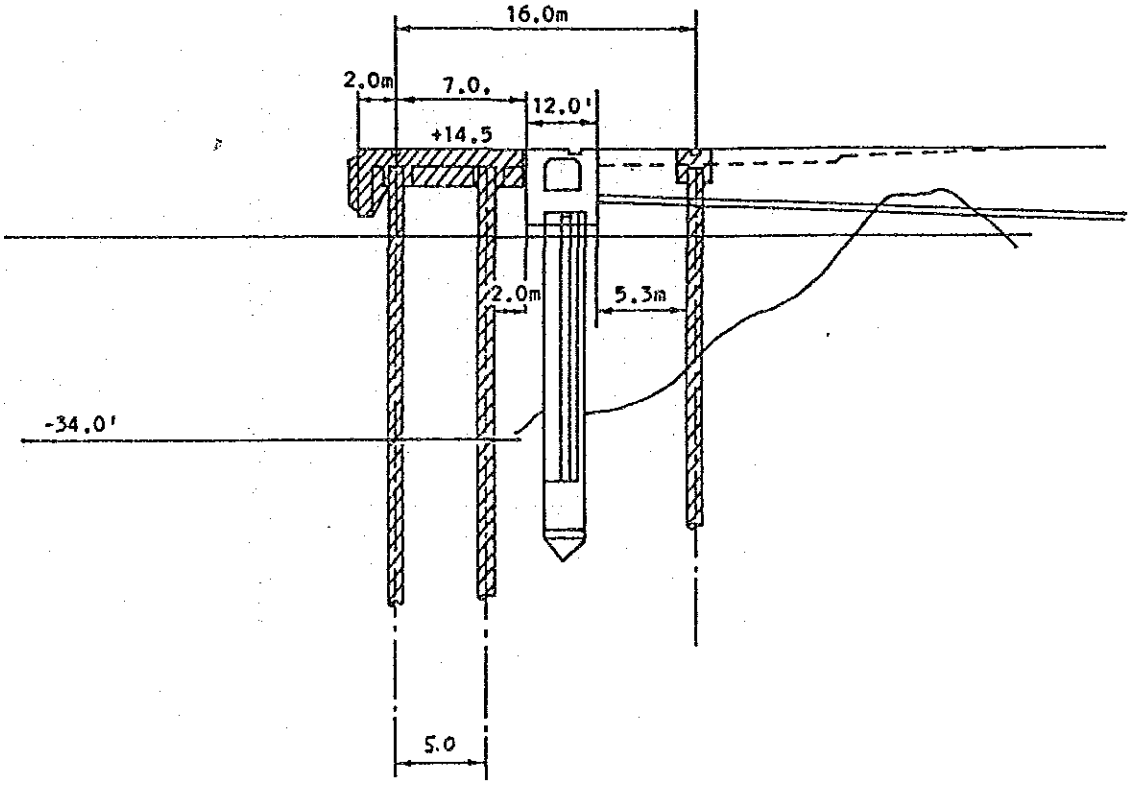
App. Fig. 3-4-2 Karachi Port East Wharf Berths 1-4



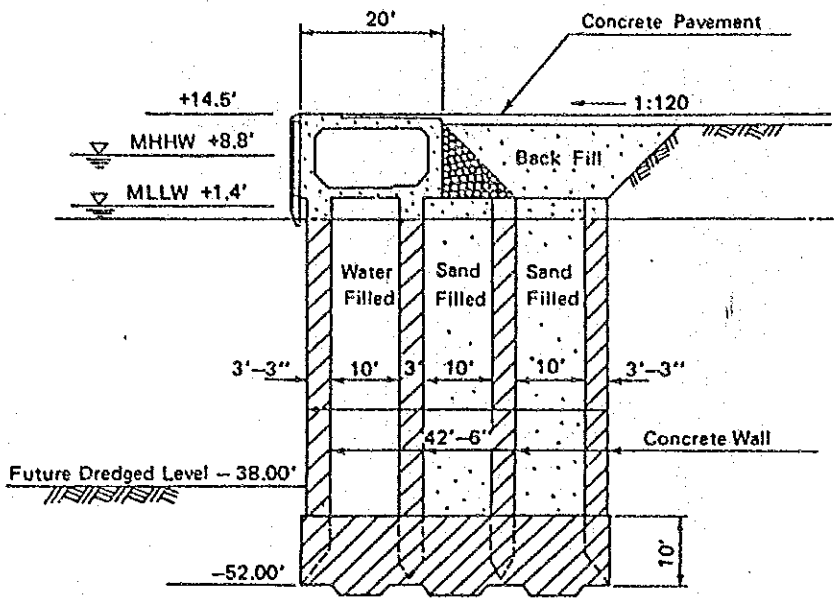
App. Fig. 3-4-3(1) A Conversion Plan (Existing Structure)



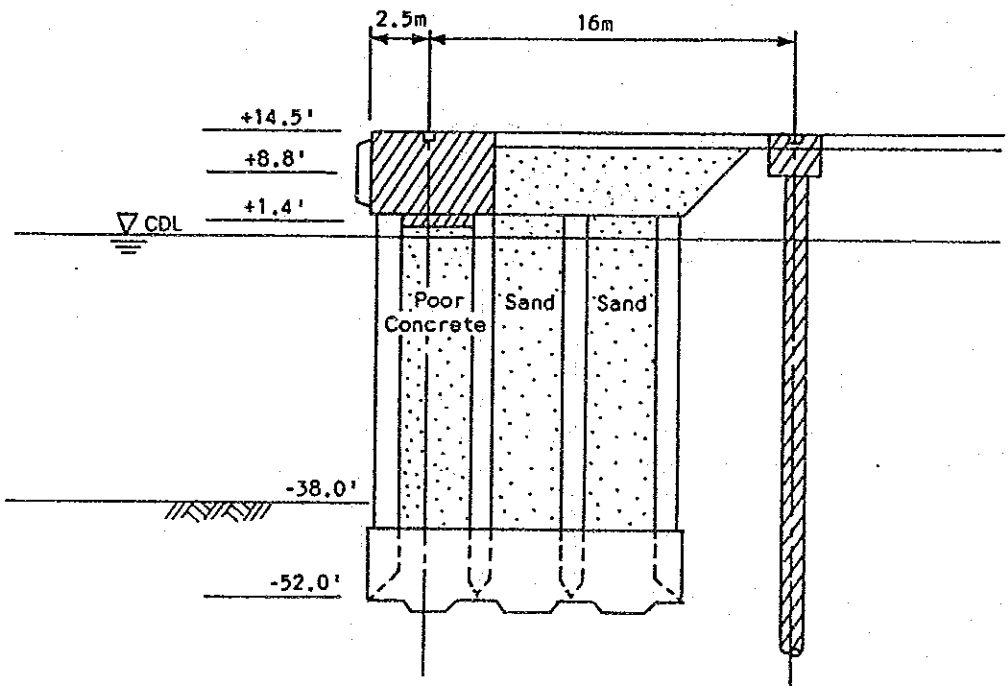
App. Fig. 3-4-3(2) A Conversion Plan (Pile Structure)



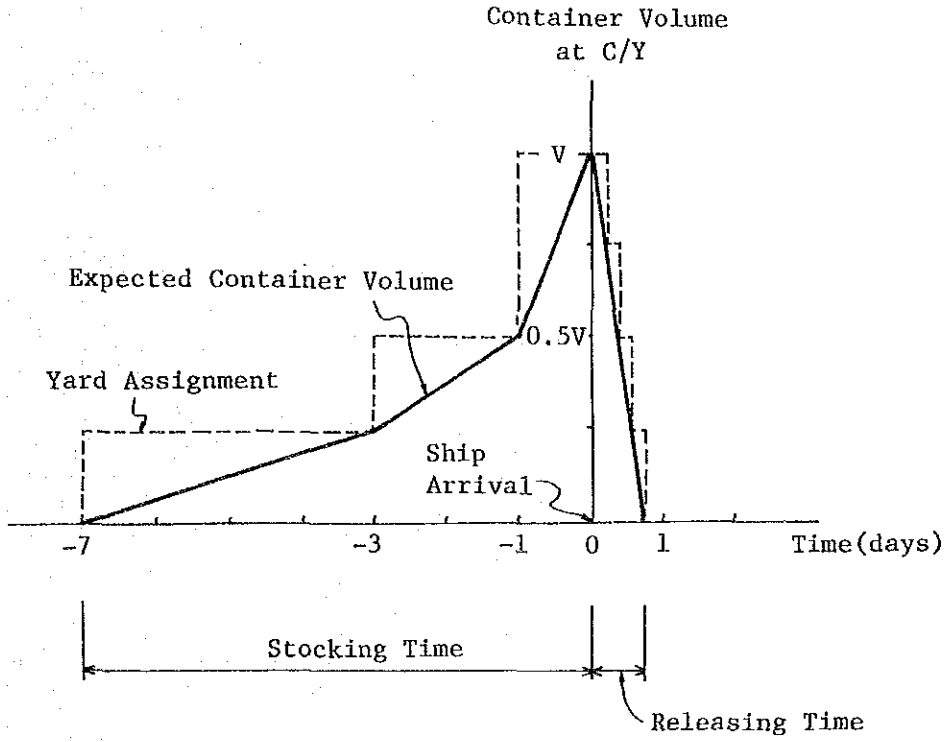
App. Fig. 3-4-4 Karachi Port West Wharf Berths 22-24



App. Fig. 3-4-5 A Possible Conversion Plan (West Wharf)



App. Fig. 3-4-6 Management of Export Containers at Container Yard



SHIPPING

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SHIPPING

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SHIPPING

CHAPTER 1 PRESENT CONDITION AND PROBLEMS

1.1 Introduction

There are three shipping companies which handle the ocean-going vessels in Pakistan, they are:

PNSC: Pakistan National Shipping Corporation,
PISC: The Pan-Islamic Steamship Company, and
NTC: National Tanker Company.

By these three shipping companies with carrying capacity of 32 vessels/549,133 DWT, 3,646,000 tons of cargo was carried in 1985-86, and this tonnage is about 18% of the total cargo movement (20,239,000 tons) of Pakistan for this year.

Having those outlined figures on fleet and the cargo both in the past and the present were studied and an analysis performed to see if there are any problems/bottlenecks in the development of the shipping industry of this country. The surrounding situation is quite severe, as the shipping business is in the middle of world-wide depression presently.

In this sub-section, performance of Pakistan ships are studied and their share in the transport volume is discussed. And the containerization problem is also studied from the view point of Pakistan Shipping industry.

1.2 Carriers

1.2.1 Pakistan Shipping Companies

PNSC, with 75% of capital being owned by the Government, has a total of 26 vessels including one passenger boat, 410,234 DWT fleet, most of them handle dry cargo and they perform the following liner services.

a. Pakistan - UK - European Continent
b. Pakistan - USA East Coast - Canada
c. Pakistan - Far East - Japan
d. Pakistan - Mediterranean - Middle East Gulf
e. UK - Continent - Middle East Gulf
f. Far East - Middle East Gulf

They also have one passenger vessel which is so-called the "Haji Vessel", and mainly carry pilgrims.

PISC is a private company and owns 5 vessels of 48,958 DWT, 3 general cargo boats and 2 mixed passenger-cargo vessels. General cargo vessels are in the liner services between Pakistan and the neighbouring countries while the other two engage in carrying basically passenger (pilgrims) besides general cargo at times.

NTC was established in 1981 as a joint venture company of PNSC and an oil refinery company. They have one 89,941 DWT crude oil tanker and are carrying nearly half the amount of crude oil imported by Pakistan from the Middle East Gulf area.

1.2.2 Financial Status of the Three Shipping Companies

Summary of the financial condition of the three shipping companies are shown in Table 1.2.1.

From the table, the financial situation of the Pakistan's three Shipping Companies can be summarized as follows.

PNSC: Although the operating revenue increased by 16% during the fiscal year of 1985 and 1986 and the profit after taxes increased by 184% in 1986, still the amount of balance carried over in 1986 was minus 682,925 thousand Rupees which is in excess of the authorized capital amount of 500,000 thousand Rupees.

NTC: Operating revenues increased by 8.5% in 1986, however, expenses also increased, consequently the profit after taxation of 1986 was reduced by 66% from that of 1985. But the company could afford to pay a dividend.

PISC: Both operating revenue and expenses decreased a little bit, however, the profit after taxation was secured in 1986. There is still an outstanding loss carried forward which it seems will be off-set hopefully in the next year, 1987.

Table 1.2.1 Profit & Loss Account/Balance Sheet of Pakistan Shipping Organizations

(unit: Rupees in thousand)

		Pakistan National Shipping Co.			National Tanker Co. Ltd.			The Pan-Islamic Steamship Co. Ltd.		
		1986	1985	BAL	1986	1985	BAL	1986	1985	BAL
Profit & Loss Account	Operating Revenues	2,657,624	2,289,554	368,070	228,441	210,637	17,804	162,527	163,714	△1,187
	Operating Expenses	2,469,005	2,176,723	292,282	188,305	177,966	10,339	134,649	134,701	△ 52
	Other Income	96,304	161,341	△65,037	11,322	10,065	1,257	4,410	3,923	487
	Administrative Expenses	84,183	66,522	17,661	2,538	2,098	440	13,353	10,606	2,747
	Other Expenses	169,227	192,780	△23,553	46,053	30,436	15,617	2,878	3,869	△ 991
	(Worker's Participation Fund)	( )	( )	( )	(151)	(478)	(△ 327)	(803)	(923)	(△ 120)
	Profit before Taxation	31,513	14,870	16,643	2,867	10,202	△7,335	16,057	18,461	△2,404
	Taxation	6,008	5,880	128	1,309	5,643	△4,334	0	0	
	Profit after Taxation	25,505	8,990	16,515	1,558	4,559	△3,001	16,057	18,461	△2,404
	Accumulated P/L Brought Forward	△708,430	△717,420	8,990	243	884	△ 641	△34,479	△52,940	△18,461
	Unappropriated P/L Brought Forward	△682,925	△708,430	25,505	1,801	5,443	△3,642	△18,422	△34,479	△16,057
	Appropriations				1,454	5,200	△3,746			
	Balance Carried Forward	△682,925	△708,430	25,505	347	243	104	△18,422	△34,479	△16,057
Balance Sheet	Assets: Current Assets	777,597	716,884	60,713	123,892	113,971	9,921	36,843	30,960	5,883
	Assets: Fixed Assets	1,989,930	2,127,634	△137,704	76,424	95,976	△19,552	64,544	39,299	25,245
	Assets: Others	9,456	7,936	1,520	3,578		3,578	430	722	△ 292
	Assets: Total	2,776,983	2,852,454	△75,471	203,894	209,947	△ 6,053	101,817	70,981	30,836
	Liabilities: Current Liabilities and Provisions	1,483,702	1,463,055	20,647	62,392	51,163	11,229	76,807	63,028	13,779
	Liabilities: Long Term Loans and Deferred Liabilities	1,349,363	1,470,986	△121,623	110,585	127,971	△17,386	5,792	4,792	1,000
	Liabilities: Total	2,833,065	2,934,041	△100,976	172,977	179,134	△ 6,157	82,599	67,820	14,779
	Capital: Authorised Capital	500,000	500,000		7,270	5,020	2,250	32,885	32,885	
	Capital: Capital Reserve	126,843	126,843		23,300	25,550	△2,250	4,755	4,755	
	Capital: Adverse Balance on P/L Account	△682,925	△708,430	25,505	347	243	104	△18,422	△34,479	16,057
	Capital: Total	△ 56,082	△81,587	25,505	30,917	30,813	104	19,218	3,161	16,057

Source: from each firm

1.3 Traffic

1.3.1 Cargo Movement

Total Cargo movements by carriers are shown in Table 1.3.1[1/]. From the table, it is found that:

(a) Total Cargo Volume

In 1985-86, total volumes of approximately 20 million tons were moved both in imports and exports.

(1985-86)		
Dry Cargo	11,950 x 1,000 M.T.	(59.0%)
Liquid Cargo	8,289 x "	(41.0%)
Total	20,239 x "	(100.0%)

The total cargo volume has been increased gradually in the last 4 years at an average rate of approximately 7.7% per annum.

(b) Export/Import Ratio

There are two cargo types - dry cargo and liquid cargo - and in both dry and liquid, the portion of imports is much larger than that of exports, sharing nearly 77% of the total volume.

(1985-86)	Export	Import	(x 1,000 M.T.) Total
Dry Cargo	3,704 (31.0%)	8,246 (69.9%)	11,950 (100%)
Liquid "	994 (12.0%)	7,295 (88.0%)	8,289 (100%)
Total	4,698 (23.2%)	15,541 (76.8%)	20,239 (100%)

(c) Growth in Cargo Volume

We can see that the growth of dry cargo is remarkable both in exports and imports as follows.

		1982-83 (in 1,000 tons)	1985-86 (in 1,000 tons)	Growth in % for 4 Years	Average Growth Rate per Annum
Dry Cargo	Ex	2,395	3,704	54.7%	15.6%
"	Im	5,731	8,246	43.9%	12.9%
Liquid Cargo	Ex	1,152	994	-13.7%	-4.8%
"	Im	6,916	7,295	5.5%	1.8%
Total	Ex	3,547	4,698	32.4%	9.8%
"	Im	12,647	15,541	22.9%	7.1%

Note: 1/ There are some minor differences in statistical data between PSW and KPT/PQA. Differences are marginal. PSW data are mostly used as quoted in this chapter.

Table 1.3.1 Export and Import of Dry and Liquid Cargoes Handled at Karachi Port and Port Qasim by Pakistan and Foreign Flag Vessels during the Years 1982-83 to 1985-86 and July - December 1986

(Thousand Metric Ton)

Year	Export							Import							Total Export and Import						
	Total	Foreign Flag			Pakistan Flag			Total	Foreign Flag			Pakistan Flag			Total	Foreign Flag			Pakistan Flag		
		Handled by Ship Agents	Chartered by PNSC	Chartered by Pan Islamic	PNSC	Pan Islamic	National Tanker Co.		Handled by Ship Agents	Chartered by PNSC	Chartered by Pan Islamic	PNSC	Pan Islamic	National Tanker Co.		Handled by Ship Agents	Chartered by PNSC	Chartered by Pan Islamic	PNSC	Pan Islamic	National Tanker Co.
Dry and Liquid Cargoes																					
1982-83	3,547	2,870	28	-	591	58	-	12,647	9,778	111	24	457	95	2,182	16,194	12,648	139	24	1,048	153	2,182
1983-84	3,919	3,151	60	21	570	117	-	13,734	10,604	46	43	703	73	2,265	17,653	13,755	106	64	1,273	190	2,265
1984-85	3,358	2,737	77	34	437	73	-	14,538	11,167	429	37	772	62	2,071	17,896	13,904	506	71	1,209	135	2,071
1985-86	4,698	4,067	95	6	409	121	-	155,41	11,456	959	10	893	110	2,113	20,239	15,523	1,054	16	1,302	231	2,113
1986-87 (July-Dec.86)	1,879	1,596	86	-	115	82	-	8,116	6,224	457	-	350	20	1,065	9,995	7,820	543	-	465	102	1,065
Dry Cargo																					
1982-83	2,395	1,718	28	-	591	58	-	5,731	5,044	111	24	457	95	-	8,126	6,762	139	24	1,048	153	-
1983-84	3,260	2,492	60	21	570	117	-	6,334	5,469	46	43	703	73	-	9,594	7,961	106	64	1,273	190	-
1984-85	2,397	1,776	77	34	437	73	-	7,278	6,209	198	37	772	62	-	9,675	7,985	275	71	1,209	135	-
1985-86	3,704	3,077	91	6	409	121	-	8,246	6,647	586	10	893	110	-	11,950	9,724	677	16	1,302	231	-
1986-87 (July-Dec.86)	1,628	1,357	74	-	115	82	-	4,296	3,509	417	-	350	20	-	5,924	4,866	491	-	465	102	-
Liquid Cargo																					
1982-83	1,152	1,152	-	-	-	-	-	6,916	4,734	-	-	-	-	2,182	8,068	5,886	-	-	-	-	2,182
1983-84	659	659	-	-	-	-	-	7,400	5,135	-	-	-	-	2,265	8,059	5,794	-	-	-	-	2,265
1984-85	961	961	-	-	-	-	-	7,260	4,958	231	-	-	-	2,071	8,221	5,919	231	-	-	-	2,071
1985-86	994	990	4	-	-	-	-	7,295	4,809	373	-	-	-	2,113	8,289	5,799	377	-	-	-	2,113
1986-87 (July-Dec.86)	251	239	12	-	-	-	-	3,820	2,715	40	-	-	-	1,065	4,071	2,954	52	-	-	-	1,065

Source: PSW

(d) Cargo Shipping Volume by Carriers in 1985-86

PNSC carried approximately 11% of the dry cargo in 1985-86 while NTC shipped 26% of liquid cargo. However, the major portion (87% in Dry and 75% in Liquid) was shipped by foreign flag vessels, in other words, the shipments to and from Pakistan heavily depend on foreign flag fleets.

Table 1.3.2 Cargo Shipping Volume by Carriers in 1985-86

(x 1,000 M.T)

Carrier	Dry		Liquid		Total	
	Ex	Im	Ex	Im	Ex	Im
PNSC	409	893	0	0	409	893
	(10.9%)		(0.0%)		(6.4%)	
PISC	121	110	0	0	121	110
	(1.9%)		(0.0%)		(1.1%)	
NTC	0	0	0	2,113	0	2,113
	(0.0%)		(25.5%)		(10.5%)	
Foreign Flag	3,174	7,243	994	5,182	4,168	12,425
	(87.2%)		(74.5%)		(82.0%)	
Total	3,704	8,246	994	7,295	4,698	15,541
	(100%)		(100%)		(100%)	

Source: PSW

1.3.2 Passengers

Passengers carried by the vessels are shown in Table 1.3.3. It is found that regular passengers grew steadily in the last 4 years (81% increase in 1981 - 1985, average growth 21.9% per year) while the number of pilgrim passengers decreased by 32%, resulting in a total annual passenger almost in the level of 30,000 people in 1985-86.

A characteristic feature of ferry passengers is the concentration of pilgrim passengers in the Haji season of two months. It is shown in Table 1.3.4 hereunder.

Table 1.3.3 Passenger and Pilgrim Traffic for the Last Six Years

Year	Regular Passenger			Pilgrims			Passengers and Pilgrims		
	Dis-Embarked	Embarked	Total	Dis-Embarked	Embarked	Total	Dis-Embarked	Embarked	Total
1980-81	17,029	4,379	21,408	7,675	7,781	15,456	24,704	12,160	36,864
1981-82	14,087	2,996	17,083	11,121	11,121	22,242	25,208	14,117	39,325
1982-83	5,977	2,012	7,989	11,072	10,871	21,943	17,049	12,883	29,932
1983-84	4,373	3,825	8,198	11,062	11,606	22,668	15,435	15,431	30,866
1984-85	5,301	5,629	10,930	8,819	9,077	17,896	14,120	14,706	28,826
1985-86	8,319	6,166	14,485	6,333	8,513	14,846	14,652	14,679	29,331

Source: KPT

Table 1.3.4 Influence of Pilgrims at Port Karachi

	1984/85	1985-86
Total number of passengers:	28,826	29,331
Pilgrims	17,896	14,846
Regular Passengers	10,930	14,485
Monthly number of passengers:		
Pilgrimmage period	9,858	8,630
Other Months	910	1,207

Note: * Assuming 2-month duration for the pilgrimage

Source: KPT

1.4 Existing Vessels

1.4.1 Pakistan Cargo Vessel Fleet

The inventory of the each shipping company's fleet as of 1987 is shown in Table 1.4.1.

The table can be summarized as follows:

- The latest constructed vessel in Pakistani Fleet is the M.V. Islamabad, a 18,204 DWT multi purpose vessel which was built in 1983, and this is the only vessel with an age less than 5 years.

- PNSC has a total of 25 cargo vessels of which the average age is 11.7 years, while PISC has 5 vessels with an average age 28.6 years. (NTC has one Tanker 12 years of age)

- In the case of replacement of the fleets of PNSC and PISC, for example, simply at the ratio of 3 vessels a year, it will take more than 10 years to renew all of them. Actually, from the economical view point, it is recommendable that the cargo vessels around/over age 20 should be replaced as soon as possible.

- The total tonnage of owned and chartered vessels as of April 1987 is shown below.

	Owned	Chartered	Total
PNSC	410,234	122,202	532,436
PISC	48,958	-	48,958
NTC	89,941	183,019	272,960
Total	549,133	305,221	854,354

- The capacity of Chartered Vessels amount to a total of 8 vessels (3 self geared container boats, 3 multi purpose and two crude oil tankers) with a tonnage of 305,221 DWT and nearly 1/3 of the gross Pakistani carrying capacity.

1.4.2 Pakistan Passenger Fleet

From Table 1.4.2, the following points are noted:

- PNSC has one passenger boat 27 years of age and PISC has two with ages of 37 years and 26 years, all pretty old in age.

- Size of those vessels are almost the same with a DWT of around 6,000 tons, each carrying passengers between 1,100 and 1,300.

Table 1.4.1 Pakistan Merchant Fleet (1)

PNSC Fleet — As of April, 1987

No.	Name of Ship	Year Built	DWT	Container Capacity (TEU)	Type of Vessels
a.	Ships less than 5 years old				
1.	ISLAMABAD	1983	18,204	428	Multi purpose vessel
		Total:	18,204	428	
b.	Ships 5 to 10 years old				
1.	SIBI	1981	16,436	381	Multi purpose vessel
2.	KHAIRPUR	"	16,430	381	"
3.	AYUBIA	"	18,050	496	"
4.	KAGHAN	"	18,050	496	"
5.	MURREE	"	18,050	496	"
6.	MULTAN	1980	18,257	390	"
7.	BOLAN	"	18,153	428	"
8.	CHITRAL	"	18,144	428	"
9.	HYDERABAD	"	18,257	390	"
10.	MALAKAND	"	18,224	390	"
11.	SARGODHA	"	18,242	390	"
12.	MAKRAN	1979	23,490	770	"
		Total:	219,783	5,436	
c.	Ships 10 to 15 years old				
1.	LALAZAR	1974	13,539	-	General cargo vessel
2.	HUNZA	1972	15,928	-	"
3.	HINGLAJ	"	15,928	-	"
4.	OCEAN ENVOY	"	15,215	-	"
		Total:	60,610	-	
d.	Ships over 15 years old				
1.	SHALAMAR	1970	13,391	-	General cargo vessel
2.	SUNDERBANS	1968	13,069	-	"
3.	MOENJODARO	"	13,069	-	"
4.	RANGAMATI	"	13,069	-	"
5.	TARBELA	"	13,330	80	"
6.	WARSAK	"	13,330	80	"
7.	KAPTAI	"	13,330	80	"
8.	OHRMAZD	"	13,277	-	"
9.	SHAMS	1960	5,772	-	Haji vessel (Passenger vessel)
		Total:	111,637	240	
		GRAND TOTAL:	410,234	6,104	

(Cont'd)

Table 1.4.1 Pakistan Merchant Fleet (2)

Vessels on time charter with PNSC — As of April, 1987

No.	Name of Ship	Date Hired	DWT	Container Capacity (TEU)	Type of Vessel
1.	COSMO OCEAN	Feb 1985	26,320	1,019	Container (Self-geared)
2.	GLORIOUS OCEAN	Apr 1985	26,320	1,019	"
3.	CARMEN ALBA	Mar 1987	21,357	904	"
4.	GANDA PERKASA	Nov 1985	13,437	421	Multi purpose Vessel
5.	TEAPING	May 1986	17,482	482	"
6.	TAIYUEN	Oct 1986	17,346	482	"
		Total:	122,202	4,327	

PISC Fleet — As of April, 1987

No.	Name of Ship	Year Built	DWT	Container Capacity (TEU)	Type of Vessel
1.	SAFINA-E-ARAB	1962	6,857	-	Passenger-cum-cargo vessel
2.	SAFINA-E-ABID	1951	5,240	-	"
3.	SAFINA-E-HAIDER	1963	12,655	-	General cargo vessel
4.	SAFINA-E-REHMAT	1958	12,313	-	"
5.	SAFINA-E-ISMAIL	1958	11,893	-	"
		Total:	48,958	-	

NTC Fleet — As of April, 1987

No.	Name of Ship	Year Built	DWT	Type of Vessel
1.	JOHAR	1975	89,941	Crude Oil Tanker
		Total:	89,941	

Vessels on Charter with NTC — As of April, 1987

No.	Name of Ship	Year Built	DWT	Type of Vessel
1.	NERAIDA	1972	96,961	Crude Oil Tanker
2.	ERATO	1974	86,058	"
		Total:	183,019	

- Referring again to Table 1.3.3, we note that the number of passengers throughout the years from 1980 to 1985 averaged 30,000 per year. The data with the percentage share of the Pakistani fleet and other countries in carrying passengers are not available.

Table 1.4.2 Pakistan Passenger Vessel Fleet

Name of Ship	Year Built	Speed (Kts)	DWT	Passenger Capacity
PNSC:				
Passenger cum Cargo Vessels				
mv SHAMS	1960	15.0	5,772	1,112
PISC:				
Passenger cum Cargo Vessels				
mv SAFINA-E-ARAB	1962	14.0	6,857	1,294
mv SAFINA-E-ABID	1951	14.0	5,240	1,186
Total			17,869	3,592

Source: PSW

1.4.3 Recent Changes in the Pakistani Fleet

Although the last Master Plan suggested the necessity of new vessel purchases, new acquisition and/or replacement of vessels by Pakistan shipping companies, they were hardly realized in the Sixth Five Year Plan, mostly because of the slump in the marine service market and non-recovered financial situation of the Pakistani shipping companies. Recently, PNSC made a change to their fleet.

M.V. "RANGAMATI" 13,069 DWT, 19 years old, was scrapped in August 1987, and M.V. "WARSAK" 13,330 DWT was also deleted from their fleet in July 1987.

PISC also made a change in their fleet:
M.V. "SAFINA-E-ISMAIL" 11,893 DWT, 39 years old, was scrapped while

M.V. "SAFINA-E-NAJAM" 11,381 DWT, built in 1976, was purchased in May, 1987 as a replacement.

Both of these replaced ships are general cargo vessels, and this was taken into account.

1.5 Share of Pakistan

1.5.1 Transport Share by Pakistani Ships

Tables 1.5.1 and 1.5.2 show the share of Pakistani owned, chartered and foreign flag vessels in the total yearly cargo volume of 1982-1986. From the tables the following points are interpreted:

- In the year 1985/86 about 3.6 million tons (18.0%) were carried by Pakistani vessels besides 1.1 million tons (5.3%) carried by time chartered vessel by Pakistan shipping companies.
- The total share of owned and chartered vessels both by Pakistan shipping companies, which is approx. 22-23%, is rather stable, however, in examining of those two shares, we can find that the chartered vessels share expanded considerably in the years of 1984/85 and 1985/86, at which time PNSC newly chartered the vessels to reinforce their fleet. (Also refer to the previous Table 1.4.1 showing the details of PNSC chartered fleet.)

Table 1.5.1 Share of Cargo Carried by Pakistan Shipping Companies (1)

(in 1,000 M.T.)

Year	Owned by Pakistan Shipping Companies	Chartered by Pakistan Shipping Companies	Handled Ship Agents (Foreign)	Total
1982-83	3,383	163	12,648	16,194
(% Share)	(20.9)	(1.0)	(78.1)	(100.0)
1983-84	3,728	170	13,755	17,653
(% Share)	(21.1)	(1.0)	(77.9)	(100.0)
1984-85	3,415	577	13,904	17,896
(% Share)	(19.1)	(3.2)	(77.7)	(100.0)
1985-86	3,646	1,070	15,523	20,239
(% Share)	(18.0)	(5.3)	(76.7)	(100.0)

Source: PSW

Table 1.5.2 Share of Cargo Carried by Pakistan Shipping Companies (2)

(in 1,000 M.T.)

	PNSC		PISC		NTC		TOTAL	
Year	Owned	Chartered	Owned	Chartered	Owned	Chartered	Owned	Chartered
1982-83	1,048	139	153	24	2,182	-	3,383	163
(% Share)	(6.5)	(0.9)	(0.0)	(0.1)	(13.5)	-	(20.9)	(1.0)
1983-84	1,273	106	190	64	2,265	-	3,728	170
(% Share)	(7.2)	(0.6)	(1.1)	(0.4)	(12.8)	-	(21.1)	(1.0)
1984-85	1,209	506	135	71	2,071	-	3,415	577
(% Share)	(6.7)	(2.8)	(0.8)	(0.4)	(11.6)	-	(19.1)	(3.2)
1985-86	1,302	1,504	231	16	2,113	-	3,646	1,070
(% Share)	(6.4)	(5.2)	(1.1)	(0.1)	(10.5)	-	(18.0)	(5.3)

Source: PSW

1.5.2 Share by Liner Service

In the liner service, there is a principle of so-called 40/40/20 sharing code which was established by UNCTAD of United Nations. This is just a guideline of cargo sharing in a certain conference, giving its 40 percent share to both of directly trading two countries and remaining 20% to the third one, which however is not meant to solve the problem of the outsiders in the main liner service routes of the world.

The shipping share of PNSC in the conference of Far East/Pakistan service, which is one of Pakistan's main liner trade, was 44.52% in the period of Apr. - Dec. 1986 as shown in Table 1.5.3, and this figure is above the standard of 40% in the said UNCTAD liner code.

Also Table 1.5.4 shows the PNSC's share in eastbound Europe/Pakistan Conference which is 52.5%, far above the target figure, while the share in westbound service is just 22.3% and under the code share, however, if we are to obtain the averaged share in east and westbound services, that figure would be 38.9% in these conference routes. Thus we can say PNSC is getting a fair share in two of Pakistan's major liner service routes.

Table 1.5.3 Far East Line Performance

		Conference Lifting	PNSC Lifting	PNSC %
Apr. 1984 to Mar. 1985	Dry Cargo (R.T.)	926,076	331,828	35.83
	Container (TEU)	5,845	1,615	27.63
Apr. 1985 to Mar. 1986	Dry Cargo (R.T.)	922,197	397,830	43.14
	Container (TEU)	5,858	1,087	18.55
Apr. 1986 to Dec. 1986	Dry Cargo (R.T.)	607,548	270,469	44.52
	Container (TEU)	4,645	763	16.43

Source: PNSC

Table 1.5.4 PNSC's Share in Europe/Pakistan Trade both in Eastbound and Westbound Services (Jan/Mar. '86)

	Eastbound			Westbound		
	Rev. tons	Share in Conf.	Total Share	Rev. tons	Share in Conf.	Total Share
Conference	88,057	100%	71.0	72,321	100%	61.0
(PNSC)	(46,204)	52.5%	(37.2)	(16,107)	22.3%	(13.6)
Non Conference	36,034	-	29.0	46,316	-	39.0
Total	124,091		100%	118,637		100%

Source: PNSC

Apart from the liner service, Table 1.5.5, which was derived from Table 1.3.1, shows cargo shipping share of PNSC in the dry cargo lifting. Including the 677 T.M.T. (thousand Metric tons) carried by PNSC chartered vessel, lifting of Pakistani fleet is 1,979 T.M.T., which is only 16.6% of the total Pakistan's Import/Export cargo movements of 11,950 T.M.T.

Those figures of getting low share in the total dry cargo liftings whereas rather a reasonable share in liner routes are found, allow us to conclude that:

(a) Major portion of voluminous cargo is carried by foreign flag vessels.

(b) Such a voluminous cargo is the iron ore/coal for Pakistan Steel Mill.

Table 1.5.5 Share of Dry Cargo Carried by PNSC in 1985-86

(in T.M.T.)

Dry Cargo Total	PNSC		
	Owned	Chartered	Total
11,950 (100%)	1,302 (10.9%)	677 (5.7%)	1,979 (16.6%)

Source: PSW

1.5.3 Containerization

As shown in Table 1.5.6 and Table 1.6.2 in Port Planning, the volume of container cargo handled at Karachi Port is rapidly increasing and it is forecasted that the number of the containers to be handled at the port in the year 2005-06 will be about five times larger than that of 1985-86.

Table 1.5.6 Containerized Cargo Movements at Karachi Port

Year	Total TEU's of containers handled at Karachi Port		Rate of increase against the previous year
1978-79	22,768		-
1979-80	40,137		76%
1980-81	60,170		50%
1981-82	89,512		59%
1982-83	124,229		39%
1983-84	140,370		13%
1984-85	169,415		21%
1985-86	244,086		44%
1986-87 (Feb.)	(186,135)	279,203*	14%*

Note: * Estimated

Source: KPT

Table 1.5.7 shows the container capacity of PNSC. There are 16 owned vessels which can handle containers and out of those 16, 13 are multi purpose vessels and most of them have container capacity of around 400/500 TEU (only M.V. MAKRAN has the capacity of 770 TEU) whereas the 3 are general cargo type, each having only 80 TEU container space. Besides owned vessels, 6 vessels being chartered by PNSC supplying a total of 4,327 TEU container space to complement any shortage in the owned fleet.

Table 1.5.7 Capacity of Containers Carried by PNSC

	PNSC		Total
	Owned	Chartered	
No. of Vessel	16	6	22
No. of TEU	6,104	4,327	10,431

Source: PSW

Looking back to Table 1.5.3, which shows the performance of PNSC in Far East/Pakistan Liner service, we note that PNSC, getting the share of 36 to 45% in dry cargo liftings, had a lower share of 16 to 28% in the container cargo liftings - this indicates that the container capacity of Pakistani fleet is smaller than it should be.

1.5.4 Tankers

Table 1.5.8 shows the lifting of crude oil by NTC and its share in the last 4 years. NTC carried more than 2 million tons of crude oil getting a share of approximately 50%.

Table 1.5.8 Share of Crude Oil Carried by NTC

(in 1,000 M.T.)

	1982-83	1983-84	1984-85	1985-86
Imported Liquid Cargo	6,916	7,400	7,260	7,295
Imported Crude Oil	4,332	4,340	4,088	3,726
Carried by NTC	2,182	2,265	2,071	2,113
Share of Crude Oil by NTC	50.4%	52.2%	50.7%	56.7%

Source: PSW

1.6 Problems

1.6.1 Share of Pakistan Ships

According to the estimation by the study team, the volume of containerizable cargo in 2005-06 will be approximately 10.5 million tons, about 5 times larger than at the present. Also it was noted in the foregoing sections that the major portion of raw materials required for Pakistan Steel Mill seems to be covered by the foreign flag vessels.

In order to maintain the fair share of 40% in the main liner conference even after the big expansion of container movements in the future, and also in order to secure a certain portion of transportation of important raw materials which deeply relates to the national industrial needs, the answer will be to have additional vessel by this country. (Even in the crude oil shipment where already it got more than 50% share, the acquisition of another tanker is to be sought if that is necessary from the economical or political view point).

However, in the strategy of improving the fleet, the following factors are to be considered:

(a) Financial circumstances

- Whether attractive loan terms can be available or not (fund and interest rate)

(b) Freight rate level in market at that time

(c) Price of new-building/second hand vessel

- for example, the price of new-building as of now is approximately 60% that of 1977-78.

As mentioned in the previous sectors (1.5.1), PNSC chartered 3 self-geared container vessels and 3 multi purpose vessels since 1985 and simultaneously their operating profits turned to be surplus in a single accounting year. This seems a good sample of purchase of the vessel is not the only way to reinforce the fleet: chartering is another way to obtain surplus.

1.6.2 Replacement of Aged Ships

Replacement of the aged ships is also important from the view point of efficiency. It should be realized that as far as the company's financial situation permits and the cargo volume increases together with a reasonable freight level.

Referring back again to Table 1.4.1, it is found that the latest vessel in the PNSC fleet is M.V. Islamabad which was constructed in 1983 and since then no new vessel was built. Further, in the PISC fleet, the newest one is age 24, constructed in 1963. The average age of PISC fleet (total 5) reaches 28.6 years while PNSC's (total 26) is 11.7 and NTC's is 12 (only one vessel). The

vessel age is not the only and solid index to consider replacement, however, generally speaking, aged vessel of more than 20 years costs/requires a large maintenance expenses.

1.6.3 Preparation for Containerization

Containerization is a general tendency in the field of transportation and is spreading rapidly all over the world, and it is so in Pakistan.

However, the container yard at Karachi Port and Port Qasim is not completed yet so the merit of fast handling in containerization at the port is not really enjoyed in this country, relying on the handling mainly on self-geared container vessels and crawler crane of APL. Following points are to be considered for accommodation and appreciation of containerization:

(a) Improve Container Carrying Capacity

As shown in previous section and Table 1.5.3, the PNSC's share in container cargo lifting is relatively low in the Far East Line conference liftings, and that figure is getting lower from 27.63% (1984/85) to 16.43% (1986) although the share of PNSC's share of dry cargo has increased during those years.

In Table 1.6.1, the ratio of container cargo capacity by tonnage on PNSC fleet is calculated: it was 29.8% in owned fleet and 70.8% in chartered fleet and in the total fleet, the ratio was 39.2%. These figures show the portion of tonnage capacity of container cargo on multi-purpose and container vessels, and the result of 39.2% exceeds the container cargo portion of 29.3% in the total dry cargo handled in 1985-86 as shown in Table 1.6.2 in Port Planning, although these tables are not exactly for the same year. At present, container capacity of PNSC seems to be sufficient to cover the requirements, however, in order to meet future container requirements which is believed to have increased 5 times higher, much more container capacity is to be increased.

Table 1.6.1 Container Capacity of PNSC Vessels (by TEU & Tonnage)

(As of April 1987)

	No. of Ships	Total DWT	Total TEU	20xTEU*/DWT %
PNSC owned	26	410,229	6,104	29.8
Chartered	6	122,202	4,327	70.8
Total	32	532,431	10,431	39.2

Source: PNSC

*Note: Container capacity by tonnage calculated on estimation of average 20 tons per TEU

(b) Procurement and Arrangement of Container Handling Equipment

For the purpose of making most effective use of containerization, it is necessary to prepare and procure equipment such as gantry cranes, portainers, straddle carriers, trailers and chassis to handle containers smoothly and quickly. Also as the containerization means the handling of so many containers efficiently, without missing or omitting any from the ledger, the computization of inventory system is inevitable.

(c) Custom Clearance System

All import and export cargoes to be checked and cleared by customs, which if it is performed thoroughly on every container, takes tremendous time and manpower.

It is recommended to induce a rather simplified clearance system similar to the ones in other countries of big sea-borne trade to save time and manpower.

(d) Efficient Transportation to/from the Inland

Containerization does not work well if it is designed only at the waterfront, but smooth transit system inland is also very important.

In Pakistan, where the shore line is rather short and hinterland is deep, an efficient traffic system to connect the waterfront with inland areas is especially required to get the entire merit of containerization. This, of course, is related deeply to other transportation modes especially of the Railways and the Trailer/Road system.

1.6.4 Efficiency by Cargo Preference

From Table 1.6.2 which shows PNSC's share in the Far East Line Conference, we can see their freight basis share in 1985-86 is 41.74% whereas that of revenue ton basis is 43.14% which eventually tells that the average freight rate of PNSC's lifting is lower than that of the entire conference's.

The results are also shown in the same Table that PNSC's average freight in 1985-86 is US$70.05 although that of Conference's is 72.40 and the same is true in other years also. If PNSC could take the average rated cargo in that year, they could earn an additional US$934,901 as follows

(72.40 - 70.05) US$ x 397,830 R.T = 934,901 US$

Table 1.6.3 shows the breakdown of Far East Line liftings by commodity and we can read PNSC's share is comparatively high in iron and steel, - relatively lower rate cargoes. To get higher performance for Pakistan's fleet, it is necessary to arrange efficient fleets, but also the effort to solicit higher rated cargo.

Table 1.6.2 Far East Line Performance PNSC Share in the Conference

	April 84 March 85	April 85 March 86	April 86 Dec. 86 (9 Months)
Conference Lifting (Revenue Tons)	926,076	922,197	607,548
PNSC Lifting (Revenue Tons)	331,828	397,830	270,469
PNSC's Share %	35.83	43.14	44.52
Conference Gross Freight ($.M)	69.760	66.770	43.884
PNSC Gross Freight ($.M)	23.877	27.868	18.409
PNSC's Share %	34.22	41.74	41.94
Conference Average Freight ($/RT)	75.33	72.40	72.23
PNSC's Average Freight ($/RT)	71.95	70.05	68.06

Source: PNSC

Table 1.6.3 Far East Line Performance Commodity-Wise Liftings by Conference vs. PNSC

Commodity	April, 1984 - March, 1985			April, 1985 - March, 1986			April, 1986 - December, 1986		
	Conf. Liftings	PNSC Liftings	PNSC %	Conf. Liftings	PNSC Liftings	PNSC %	Conf. Liftings	PNSC Liftings	PNSC %
Chemicals	13,069	3,153	24.13	17,335	6,657	38.40	15,080	4,715	31.26
Electric Goods	60,822	9,064	14.90	57,656	8,892	15.42	31,975	4,076	12.75
Iron and Steel	69,203	51,085	73.82	111,491	98,413	88.27	72,957	65,050	89.16
Machinery and Parts	51,301	18,089	32.26	62,111	31,355	50.48	29,383	12,715	43.27
Rubber Goods	31,917	5,252	16.45	22,996	3,717	16.16	21,133	4,102	19.41
Textiles	57,500	6,714	11.67	49,590	3,765	7.59	47,897	3,655	7.63
Vehicles (Unpacked)	328,447	92,890	28.28	317,951	46,825	14.72	205,562	47,162	22.94
Veh. Parts (Packed)	231,051	116,868	50.58	214,990	178,567	83.05	141,626	117,861	83.22
Other Cargo	82,766	28,713	34.69	68,077	19,639	28.84	41,935	11,133	26.55
Total:	926,076	331,828	35.83	922,197	397,830	43.14	607,548	270,469	44.52
No. of Container Carried (TEU)	5,845	1,615	27.63	5,858	1,087	18.55	4,645	763	16.43

Source: PNSC

1.7 Review of the Sixth Five Year Plan

1.7.1 Outline of the Sixth Five Year Plan (1983-88)

A schedule of ship procurement by the previous master plan study (1983) is shown in Table 1.7.1 and the schedule in the Sixth Five Year Plan is shown below. These two schedules are mostly the same although the timing might be different.

(i) Improvement in productivity from 3.7 tons per deadweight ton to 4.8 tons per deadweight ton.

(ii) Acquisition of four full container ships by the time container terminal comes into operation.

(iii) Acquisition of Five multi-purpose cargo "sister" ships (i.e. with identical design) by the PNSC.

(iv) Acquisition of Four 50,000 DWT bulk carriers to handle Pakistan Steel cargo.

(v) One special product tanker of about 15,000 DWT capacity for transporting edible oil.

(vi) One crude oil tanker of about 80,000 DWT for transporting crude oil.

(vii) Open shipping to private sector.

(viii) Programme of Financial Outlays for PNSC was 3,000 million Rupees.

Table 1.7.1 Investment Schedule by Mode --Non ADP--

(Million Rps, Financial, 1981 Price)

	Estimated Total	Cost Fec.	-- Allocation during 1983-88 --					Total 1983-88	Beyond 1987-88	Ranking
			1983-84	1984-85	1985-86	1986-87	1987-88			
1 Aquisition of Full Container Ships and Container Required for Operation	4402	4402	0	0	0	1216	0	1216	3186	A
2 Replacement of Multi Purpose Ships	5000	5000	200	200	200	200	200	1000	4000	A
Sub Total	9402	9402	200	200	200	1416	200	2216	7186	
3 Bulk Carrier for Steel Mill	920	920	0	230	230	230	230	920	0	B
4 Tanker (Crude Oil)	900	900	0	0	150	0	0	150	750	B
5 Tanker (Vegetable Oil)	300	300	0	0	100	0	0	100	200	B
Sub Total	2120	2120	0	230	480	230	230	1170	950	
Total	(11522)	(11522)	(200)	(430)	(680)	(1646)	(430)	(3386)	(8136)	

Note: The investment schedule for the item 3 is estimated as the pure calculation purpose with assumption of carrying fifty percent of cargoes.
(Re: Bulk Carrier for Steel Mill)

Source: National Transportation Plan (JICA, 1983)

1.7.2 Achievement of the Sixth Five Year Plan

New acquisition and replacement of vessels of Pakistan shipping companies were not realized in the beginning three years of the Sixth Plan. Following are found in the Mid-Plan Review.

(i) The effort to raise productivity has been materialized as from 3.7 tons per DWT in 1982-83 to 4.3 tons per DWT 1985-86.

For reference Table 1.7.2 is shown, which shows the average tons/DWT in the Japanese ships.

(ii) Acquisition of vessels in the Sixth Plan period have not been realized yet, but it is said negotiations to acquire some vessels are in progress:

- One second hand bulk carrier for shipment of rock phosphate has been approved. The carrier is expected to be acquired soon.

- One product tanker for edible oil has been submitted by PNSC to the government for approval.

- Purchase of a crude oil tanker which is 5 years old, 75,000 DWT, has been submitted by NTC in October, 1986 which is currently under consideration.

(iii) The opening up of shipping to the private sector has been a important strategy claimed in the Sixth Five Year Plan. Necessary legislative actions are under preparation.

Table 1.7.2 Productivity of Japanese Flag Vessels

	LINER[1]			TRAMPER[2]			OIL TANKER[3]		
	Volume of Transport (A) (x 1,000 MT)	DWT (B) (x 1,000)	Productivity (A) ÷ (B)	Volume of Transport (A) (x 1,000 MT)	DWT (B) (x 1,000)	Productivity (A) ÷ (B)	Volume of Transport (A) (x 1,000 MT)	DWT (B) (x 1,000)	Productivity (A) ÷ (B)
1983	12,080	2,576	4.7	157,938	22,928	6.9	117,312	14,863	7.9
1984	12,351	3,022	4.1	159,332	22,914	7.0	123,808	16,309	7.6
1985	11,583	2,426	4.8	164,858	24,524	6.7	118,099	13,806	8.6

Source: Statistic of Japan Shipowners Association, 1984-1986

Note: 1) : Including container vessel
2) : Including ore, coal, and other bulky carrier, also ore/oil carriers.
3) : Including crude and product oil carrier

CHAPTER 2 MASTER PLAN (FOR THE YEAR 2005-06)

2.1 Policies

The policy of Pakistan merchant fleet for further development is to realize a 40% share in liner service in accordance with the liner code of 40/40/20 established by UNCTAD. At the same time, increase in number of the owned fleet in other services than liner are targeted in order to secure Pakistani participation in major commodity transportation.

2.2 Demand for Shipping

2.2.1 Approaches

Seaborne cargo volumes in export/import were forecasted in PART II. The forecast volume of export/import are further divided into commodities and their regions of origin/destination, on assumption that the present pattern of 1985-86 will not change drastically even in the future.

In the case of passengers carried by vessels, it is assumed that they will be almost at the same level of 1985-86 in the future.

2.2.2 Forecast for Shipping

(1) Commodities

The forecasted volumes shown in the section of transport demand forecast, are analyzed by the areas of origin/destination and by commodities as shown in Tables 2.2.1 and 2.2.2. Tables 2.2.1 and 2.2.2 being divided in Tables 2.2.1 and 2.2.2 in Port Planning show that the total volume of imported cargo will increase 2.2 times in 2005-06 from that of 1985-86, and also exported cargo will increase 2.4 times in the same period.

Several items are combined into one such as the following in making the Tables.

(The Trade Matrix)

Fertilizer:	Fertilizer, Phosphate rock
Coal & Ores:	Coal, Coke, Iron ore
Others:	Sugar, Iron & steel, Other dry cargo

(2) Passengers

Passenger volumes for the future were also studied in the former Part. It is assumed that the volume of general passengers will not increase nor decrease, and will remain at the same level of 1985-86 in the years upto 2005-06.

General Passengers 15,000 per year

But the volume of pilgrims will be zero in the near future.

Table 2.2.1 Pakistan's Cargo Import by Area and Type of Cargo (1)

1985/86

(Unit: 1,000 M/T)

	1. Europe	2. Asia	3. Middle East	4. Africa	5. South America	6. North America	7. Oceania	(Total)
1. Wheat	511	0	0	0	0	1,188	210	1,909
2. Cement	80	137	0	0	0	0	0	217
3. Fertilizer	276	4	169	0	0	232	0	681
4. Rice	0	0	0	0	0	0	0	0
5. Coal & Ores	0	175	0	240	394	503	875	2,187
6. Petrols	65	49	6,223	0	0	3	0	6,340
7. Molasses	0	0	0	0	0	0	0	0
8. Edible & Tallow	45	347	2	0	116	315	0	825
9. Cotton	0	0	0	0	0	0	0	0
10. Others	1,123	1,808	18	75	58	15	127	3,224
(Total)	2,100	2,520	6,412	315	568	2,256	1,212	15,383

Table 2.2.1 Pakistan's Cargo Import by Area and Type of Cargo (2)

1992/93

(Unit: 1,000 M/T)

	1. Europe	2. Asia	3. Middle East	4. Africa	5. South America	6. North America	7. Oceania	(Total)
1. Wheat	0	0	0	0	0	0	0	0
2. Cement	0	0	0	0	0	0	0	0
3. Fertilizer	636	10	388	0	0	535	0	1,569
4. Rice	0	0	0	0	0	0	0	0
5. Coal & Ores	0	401	0	550	901	1,150	2,001	5,003
6. Petrols	91	71	8,780	0	0	3	0	8,945
7. Molasses	0	0	0	0	0	0	0	0
8. Edible & Tallow	60	460	4	0	153	419	0	1,096
9. Cotton	0	0	0	0	0	0	0	0
10. Others	1,146	1,845	18	76	59	15	130	3,289
(Total)	1,933	2,787	9,190	626	1,113	2,122	2,131	19,902

Table 2.2.1 Pakistan's Cargo Import by Area and Type of Cargo (3)

1997/98

(Unit: 1,000 M/T)

	1. Europe	2. Asia	3. Middle East	4. Africa	5. South America	6. North America	7. Oceania	(Total)
1. Wheat	0	0	0	0	0	0	0	0
2. Cement	0	0	0	0	0	0	0	0
3. Fertilizer	416	7	253	0	0	349	0	1,025
4. Rice	0	0	0	0	0	0	0	0
5. Coal & Ores	0	601	0	824	1,351	1,723	2,998	7,497
6. Petrols	112	86	10,778	0	0	5	0	10,981
7. Molasses	0	0	0	0	0	0	0	0
8. Edible & Tallow	61	470	4	0	156	427	0	1,118
9. Cotton	0	0	0	0	0	0	0	0
10. Others	1,422	2,291	23	95	73	20	160	4,084
(Total)	2,011	3,455	11,058	919	1,580	2,524	3,158	24,705

Table 2.2.1 Pakistan's Cargo Import by Area and Type of Cargo (4)

2005/06

(Unit: 1,000 M/T)

	1. Europe	2. Asia	3. Middle East	4. Africa	5. South America	6. North America	7. Oceania	(Total)
1. Wheat	0	0	0	0	0	0	0	0
2. Cement	0	0	0	0	0	0	0	0
3. Fertilizer	0	0	0	0	0	0	0	0
4. Rice	0	0	0	0	0	0	0	0
5. Coal & Ores	0	1,046	0	1,436	2,354	3,004	5,225	13,065
6. Petrols	148	115	14,260	0	0	6	0	14,529
7. Molasses	0	0	0	0	0	0	0	0
8. Edible & Tallow	56	422	4	0	140	384	0	1,006
9. Cotton	0	0	0	0	0	0	0	0
10. Others	1,986	3,199	32	132	102	27	223	5,701
(Total)	2,190	4,782	14,296	1,568	2,596	3,421	5,448	34,301

Source: JICA Study Team

Table 2.2.2 Pakistan's Cargo Export by Area and Type of Cargo (1)

1985/86 (Unit: 1,000 M/T)

	1. Europe	2. Asia	3. Middle East	4. Africa	5. South America	6. North America	7. Oceania	(Total)
1. Wheat	0	0	0	0	0	0	0	0
2. Cement	0	0	0	0	0	0	0	0
3. Fertilizer	155	89	134	0	0	0	0	378
4. Rice	25	108	449	570	163	1	0	1,316
5. Coal & Ores	0	6	22	0	0	0	0	28
6. Petrols	0	82	65	0	0	0	0	147
7. Molasses	725	9	2	0	0	0	0	736
8. Edible & Tallow	0	0	0	0	0	0	0	0
9. Cotton	19	616	2	0	2	0	0	639
10. Others	458	94	535	0	1	292	0	1,380
(Total)	1,382	1,004	1,209	570	166	293	0	4,624

Table 2.2.2 Pakistan's Cargo Export by Area and Type of Cargo (2)

1992/93 (Unit: 1,000 M/T)

	1. Europe	2. Asia	3. Middle East	4. Africa	5. South America	6. North America	7. Oceania	(Total)
1. Wheat	16	68	284	361	103	0	0	832
2. Cement	11	3	0	0	0	0	0	14
3. Fertilizer	0	0	0	0	0	0	0	0
4. Rice	20	84	352	447	127	1	0	1,031
5. Coal & Ores	0	0	0	0	0	0	0	0
6. Petrols	0	0	0	0	0	0	0	0
7. Molasses	832	10	2	0	0	0	0	844
8. Edible & Tallow	0	0	0	0	0	0	0	0
9. Cotton	18	586	2	0	2	0	0	608
10. Others	760	156	888	0	2	485	0	2,291
(Total)	1,657	907	1,528	808	234	486	0	5,620

Table 2.2.2 Pakistan's Cargo Export by Area and Type of Cargo (3)

1997/98 (Unit: 1,000 M/T)

	1. Europe	2. Asia	3. Middle East	4. Africa	5. South America	6. North America	7. Oceania	(Total)
1. Wheat	18	79	327	415	119	0	0	958
2. Cement	28	7	1	0	0	0	0	36
3. Fertilizer	0	0	0	0	0	0	0	0
4. Rice	19	83	343	436	125	0	0	1,006
5. Coal & Ores	0	0	0	0	0	0	0	0
6. Petrols	0	0	0	0	0	0	0	0
7. Molasses	1,177	14	3	0	0	0	0	1,194
8. Edible & Tallow	0	0	0	0	0	0	0	0
9. Cotton	16	519	2	0	2	0	0	539
10. Others	1,093	225	1,275	0	3	696	0	3,292
(Total)	2,351	927	1,951	851	249	696	0	7,025

Table 2.2.2 Pakistan's Cargo Export by Area and Type of Cargo (4)

2005/06 (Unit: 1,000 M/T)

	1. Europe	2. Asia	3. Middle East	4. Africa	5. South America	6. North America	7. Oceania	(Total)
1. Wheat	21	93	385	489	140	0	0	1,128
2. Cement	74	19	1	0	0	0	0	94
3. Fertilizer	288	163	250	0	0	0	0	701
4. Rice	20	85	352	447	128	0	0	1,032
5. Coal & Ores	0	0	0	0	0	0	0	0
6. Petrols	0	0	0	0	0	0	0	0
7. Molasses	1,859	22	5	0	0	0	0	1,886
8. Edible & Tallow	0	0	0	0	0	0	0	0
9. Cotton	14	405	3	0	3	0	0	425
10. Others	1,956	403	2,284	0	5	1,247	0	5,895
(Total)	4,232	1,190	3,280	936	276	1,247	0	11,161

Source: JICA Study Team

2.3 Planning Conditions

As already reviewed in the previous section, the total Pakistan trade volume in 2005-06 will be approximately 2.3 times higher than that of 1985-86. The share of Pakistani fleet in total cargo volume in these last 4 years were around 21 - 24%, so if it is necessary to keep this share at the time of the target year, it simply demands 2.3 times bigger carrying capacity than now. And it will require a large amount of investment.

Under these circumstances, the following factors are considered for planning:

-1. Development of container facilities at the Ports will be as scheduled.

-2. A long term production plan of Pakistan Steel Mill will be consistent with the demand forecast Chapter 6.

-3. A long term production plan of the oil refinery companie will be consistent with the demand forecast of Chapter 6.

-4. Rate of vessel chartering and freight level in the world will not fluctuate.

-5. Financial position of the shipping companies should be improved and funds will be available either in domestic or foreign source.

-6. Replacement of aged vessels will be considered.

-7. Shares of Pakistan fleet in the marine transport in the targeted year of 2005-06 will be as follows:

• Liner service	40%	from	40%	in 1985-86
• Bulker	25%	from	0%	"
• Tanker (crude oil)	50%	from	50%	"
• Tanker (edible oil)	50%	from	0%	"
• Ferry boats	100%	from	100%	"

2.4 Required Vessels upto 2005-06

As a result, the number of Pakistan vessels required is estimated as shown below.

	Existing		2005-06
• Liner service Multi.	28		14
Container	0		19*
• Bulkers (iron ore & coal)	0		10*
Bulker (phosphate)		(+1)	1
• Crude oil tankers	1	(+1)	3*
• Edible oil tankers	0	(+1)	1 + 1*
• Ferry boats (passengers)	3		3*
Total	32	(+3)	52

Purchase of 36 vessels

(+1) means the acquisition expected in 1987.

The total cost to acquire additional vessels and to replace the aged vessels is estimated at Rs. 13,046 million. The plan of purchase is summarized in Tables 2.4.1 and 2.4.2 and the detailed procedure of vessel purchase plan is described in the Appendix.

Table 2.4.1 Investment for Candidate Container Vessels

(Rs. million)

Year	1988/89	89/90	90/91	91/92	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	TOTAL
																			r x 2 + n x 2 / 4 (x 1,200 TEU)
Pakistan/Europe Line	r	n	r		n		N		R			N			N				R x 2 + N x 2 / 4 (x 1,800 TEU)
Price of Cont' Ves'ls	320	320	320		373		320		373			373			373				
Price of Containers		96	96		96		144					144			144				
Total Investment			1,568					890					1,034						3,492
																			r x 3 + n x 3 / 6 (x 1,200 TEU)
Pakistan/Far East Line	r	n	r	n	r	n		R		N		R	N			N		N	R x 1 + N x 4 / 5 (x 1,800 TEU)
Price of Cont' Ves'ls	320	320	320	320	320	320		373		373		373	373			373		373	
Price of Container		96		96		96				144			144			144		144	
Total Investment			2,208						890					1,924					5,022
TOTAL			3,776					1,780						2,958					8,514

Note: r : Replace of vessels (1,200 TEU)
n : New-building of vessels (1,200 TEU)
R : Replace of vessels (1,800 TEU)
N : New-building of vessels (1,800 TEU)

Source: JICA Study Team

Table 2.4.2 Investment for Other Candidate Vessels

(Rs. million)

Year	1988/89	89/90	90/91	91/92	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	TOTAL
Bulk Carrier	N	N	N		N	N		N		N		N			N			N	
Price of Vessel	213	213	213		213	213		213		213		213			213			213	
Total Investment			852					639							639				2,130
Crude Oil Tanker			R			N											R		
Price of Vessel			427			427											427		
Total Investment			427					427							427				1,281
Product Carrier													N						
Price of Vessel													320						
Total Investment															320				267
High Speed Passenger & Vehicle Ferry					N					R								N	
					267					267								267	
Total Investment			267					267							267				801
Total			1,546					1,333							1,653				4,532
																	+ Table 2.4.1		8,514
																	Grand Total		13,046

Note: R : Replace Vessels
N : New-building of Vessels

* Assuming that acquisition of crude oil tanker and product carrier was made in 1987.

Source: JICA Study Team

CHAPTER 3 THE SEVENTH FIVE YEAR PLAN

3.1 General

The strategies in the Master Plan 2005-06 are quoted again through which a plan for the Seventh Five Year Plan is proposed:

(1) Share of Pakistan Ships

In order to maintain the fair share of 40% in the main liner conference, and to secure a certain portion of transportation of important raw materials, Pakistan should increase the ratio of her own ships. A plan of purchase was discussed in Chapter 2.

(2) Replacement of the Aged Ships

Replacement of the aged ships is also important from the viewpoint of efficiency. This should be materialized as far as the shipping company's financial situation permits and the cargo volume increases at a reasonable freight level.

(3) Preparation for Containerization

Containerization is a general tendency in the field of transportation and is spreading rapidly over the whole world, and so is in Pakistan. Following points are to be realized for accommodation and appreciation of the containerization:

(a) Improvement in container carrying capacity

(b) Procurement and arrangement of container handling equipment

(c) Efficient custom clearance system

(d) Efficient transportation to/from the inland area

(4) Efficiency by Cargo Preference

To get the higher performance for Pakistan fleet, it is necessary to arrange efficient fleet and fast scheduling, but also the effort to solicit the higher rated cargo is required.

3.2 Traffic Forecast by Area

The import/export projection for the year 1992-93 was broken down area-wise as presented in Table 2.2.1 (2) and Table 2.2.2 (2). General passenger traffic volume as of 1992-93 was assumed to be the same level as 1985-86, 15,000 per year, but the number of Pilgrim will gradually decrease.

3.3 Replacement and Acquisition of Pakistan Fleet

(1) Liner Service

As a first step, the volume of containerized cargo was estimated for the two major lines, Europe and Far East, as presented in Table 3.3.1.

Based on this volume, the requirement for container vessels was calculated for the year 1992-93 at 4 for the Europe line and 6 for the Far East line, as shown in Table 3.3.2. The capacity of container vessels was assumed at 1,200 and 1,800 TEUs, judging from general inclination of the world.

Based on this requirement, the investment schedule during the Seventh Five Year Plan for container vessels will be as shown in Table 3.3.3. The total amount needed in the Seventh Five Year Plan period is approximately Rs. 3.8 billion.

Table 3.3.3 Investment Requirement for Candidate Container Vessels

(Rs. million)

Year	1988-89	89-90	90-91	91-92	92-93
Pakistan/Europe Line	r	n	N		n
Price of Vessels	320	320	320		320
Price of Containers		96	96		96
Total Investment (1988-93)			1,568		
Pakistan/Far East Line	r	n	r	n	r	n
Price of Vessels	320	320	320	320	320	320
Price of Containers		96		96		96
Total Investment (1988-93)			2,208			
Total			3,776			

Note: r: Replace of vessels (1,200 TEU)
n: New building of vessels (1,200 TEU)
R: Replacement of vessels (1,800 TEU)
N: New-building of vessels (1,800 TEU)

Source: Study Team

(2) Other Vessels

As to bulk carriers for importing iron ore and coal, the number of vessels required for the year 1992-93 was calculated at 14.2 as shown in Table 3.3.4. This implies a purchase of four vessels during the Seventh Five Year Plan (ten vessels by 2005-06).

Table 3.3.1 Containerized Cargo Volume by Main Routes, 1992-93

EUROPE - PAKISTAN

Commodity	Import		Export	
	Containerized Cargo	Residual Cargo	Containerized Cargo	Residual Cargo
Rice:				
(A)	-		20,000	
(B)	-	-	17.7	82.5
(C)	-	-	3,540	16,460
(D)	-		236	
Cotton:				
(A)	-		18,000	
(B)	-	-	70.6	29.4
(C)	-	-	12,708	5,292
(D)	-	-	1,271	
Others:				
(A)	1,146,000		760,000	
(B)	67.8	32.2	76.6	23.4
(C)	776,988	369,012	582,160	177,840
(D)	81,789		36,385	
Total:	81,789 (TEU)	369,012 (M.T)	37,892 (TEU)	199,592 (M.T)

FAR EAST - PAKISTAN

Rice:				
(A)	-		84,000	
(B)	-	-	17.7	82.3
(C)	-	-	14,868	69,132
(D)	-		992	
Cotton:				
(A)	-		586,000	
(B)	-	-	70.6	29.4
(C)	-	-	413,716	172,284
(D)	-		41,372	
Others:				
(A)	1,845,000		156,000	
(B)	67.8	32.2	76.6	23.4
(C)	1,250,910	594,090	119,496	36,504
(D)	131,675		7,469	
Total:	131,675 (TEU)	637,776 (M.T)	49,833 (TE)	277,920 (M.T)

(A) Total Cargo Movement (M.T)
(B) Containerized/Residual Cargo Ratio (%)
(C) Cargo Movement (M.T)
(D) Container (TEU)

Table 3.3.2 Capacity Analysis of Container Ships, 1992-93

Trade	Import/ Export	Cargo Movement	(A) PNSC's 40% Share	(B) Turn Round	(C) Required Space	No. of Vessels
Europe/Pakistan	Import	81,789 TEU	32,716 TEU	50 Days	4,674 TEU	1,200 TEU x 4
Far East/Pakistan	"	131,675 TEU	52,670 "	45 "	6,772 "	" x 6

Note: (A) x (B) / 350 Days = (C)

Table 3.3.4 Estimated Number of Bulk Carriers (1992-93)

50,000 DWT Bulk Vessels

Ship Speed : 13.2 Knots
DFT : 11.1 M
Discharging Port : Port Qasim

IRON ORE: 2,240,000 tons/year

Source	%	Quantity	Voyage	Dist' (Mile)	Running Day	Reserve	Loading	Discharging	Reserve	Total Turn Round	Voyage per Year x Turn Round
Brazil (Septiba)	30	672,000	13.4	7,897x2	49.9	2	1	4	1	57.6	772
Australia (Port Hedland)	25	560,000	11.2	4,157x2	26.2	1	1	4	1	33.2	372
Liberia (Buchanan)	20	448,000	9.0	7,601x2	48.0	2	1	4	1	56.0	504
Canada (Sept Iles)	15	336,000	6.7	7,739x2	48.9	1	1	4	1	55.9	375
India (Karwar)	10	224,000	4.5	688x2	4.3	0.5	7	4	1	16.8	76
Sub-Total (1)	100	2,240,000	44.8	-	-	-	-	-	-	-	2,099

Coal: 2,763,000 tons/year

Source	%	Quantity	Voyage	Dist' (Mile)	Running Day	Reserve	Loading	Discharging	Reserve	Total Turn Round	Voyage per Year x Turn Round
Australia (New Castle)	65	1,795,950	35.9	6,524x2	41.2	2	1	4	1	49.2	1,766
Canada (Robert Bank)	25	690,750	13.8	9,965x2	63.0	2	1	4	1	71.0	980
USA (Philadelphia)	10	276,300	5.5	8,301x2	52.4	3	2	4	1	62.4	343
Sub Total (2)	100	2,763,000	55.2	-	-	-	-	-	-	-	3,089
G. Total (1) + (2)	-	5,003,000	100.0	-	-	-	-	-	-	-	5,188

5,188 ÷ 365 = 14.2
(No. of Vessels)

The volume of crude oil imported to Pakistan is projected to increase from 3.7 million tons in 1985-86 to 4.3 million tons in 1992-93. In view of this, NTC is at present planning to purchase a 75,000 DWT second-hand tanker. This purchase was initially planned in 1987, but it is likely to be postponed to the Seventh Five Year Plan period. The existing NTC tanker "JOHAR" which is already 12 years old needs to be replaced in the Seventh Plan period.

With regard to product carrier (edible oil tanker), PNSC is reportedly planning to purchase a 25,000 DWT vessel shortly. However, this is again likely to be postponed to the Seventh Five Year Plan period. Considering the future import of edible oil which is projected to increase from 0.8 million tons in 1985-86 to 1.1 million tons in 1992-93, it is desirable to own a product carrier.

As to high-speed ferry boats, the future demand is projected to be fluctuating. However, it is considered important to acquire modern and high-speed ferry boats in order to absorb more potential passengers and cargoes to be expected expanding in the long run.

Based on the above discussions, the investment schedule of other vessels than container ships was prepared as shown in Table 3.3.5.

(3) Summary

The total investments required during the Seventh Five Year Plan amount to a total of 5,322 million rupees. Out of the total, 71% is for purchasing container ships, 16% for bulk carriers and 13% for other vessels.

Table 3.3.5 Investment Number of Other Candidate Vessels

(Rs. million)

Year	1988-89	89-90	90-91	91-92	92-93
Bulk Carrier	N	N	N		N
Price of Vessels	213	213	213		213
Total Investment			852		
Crude Oil Tanker			R		
Price of Vessels			427		
Total Investment			427		
High Speed Passenger & Vehicle Ferry					R
Price of Vessels					267
Total Investment			267		
Total			1,546		

Note: R: Replacement of Vessels
N: New-building of Vessels

Source: JICA Study Team

3.4 Economic Assessment

3.4.1 General

The plan to expand the Pakistani fleet is based on a national policy to have a certain share by national flag vessels in the transportation of trade commodities. Implementation of the plan is influenced by various factors and can be postponed even if it can be economically justified. Some factors are listed below.

- Foreign currency position
- World shipping market
- Management/Crew
- Funding sources
- Political consideration, etc.

An extensive study is necessary to obtain a conclusion in economic assessment of the fleet expansion plan, where the risk and uncertainly analysis of the above factors in the long term should be fully considered. However in this study for the transportation plan, a preliminary assessment will be conducted. This is based on the assumption that the influential factors would maintain the present status and no drastic change/fluctuation will happen as recorded since 1974 (See Fig. 3.4.1).

In this preliminary economic assessment, a project of purchasing a new container ship was taken up.

3.4.2 Preliminary Economic Assessment

The following cases are taken up for the economic assessment and various cost items to be studied.

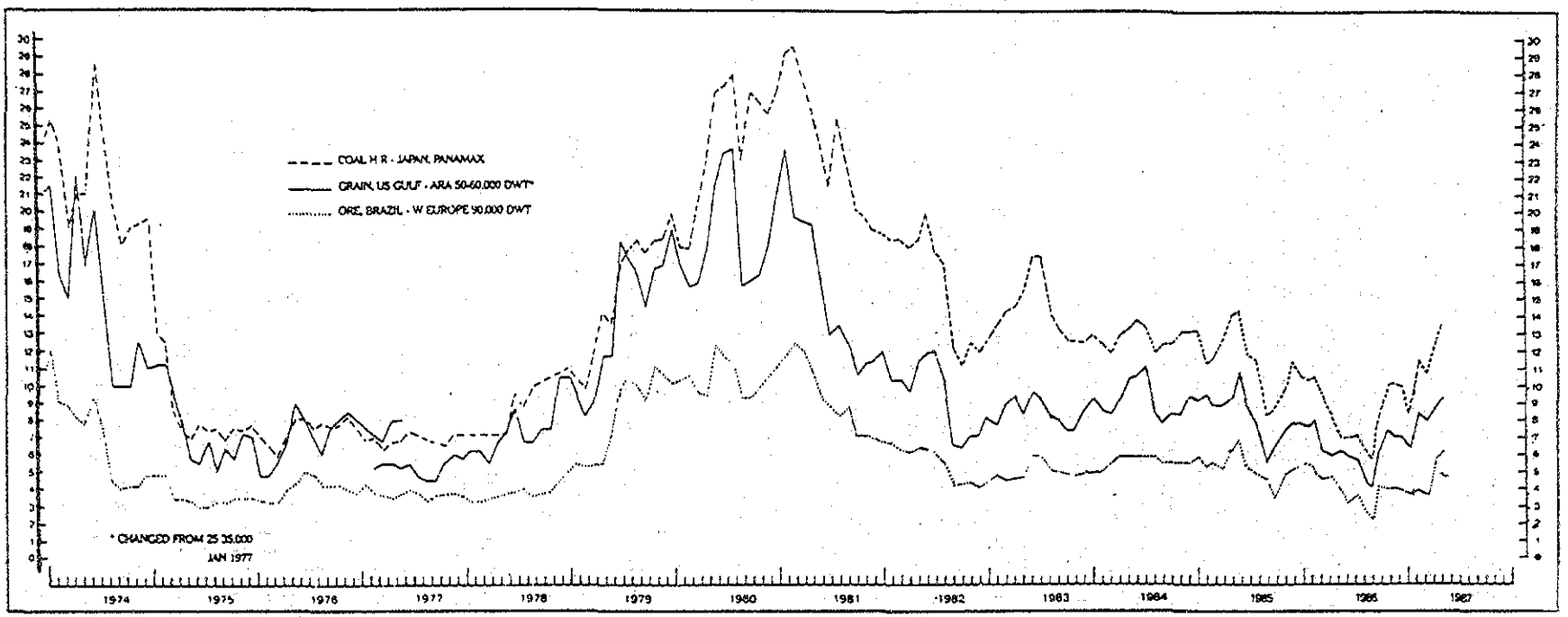
A. A new container ship vs. an existing ship
B. A new container ship vs. a chartered ship

Firstly, based on the cost information listed in Table 3.4.1, economic operation cost was estimated as shown in Table 3.4.2.

It is generally said that a ship with an age of more than 20 years is better to be replaced because after being used for more than 20 years in ocean transportation, the costs and expenses for operation and maintenance of the ship will usually rise sharply and in most cases the replacement will be more economical than keeping on the old vessel.

A cost comparison is conducted under a simplified condition for the following two cases.

Fig. 3.4.1 Shipping Market Indicators, Dry-Cargo-Voyage Charter Rates



Source: Eagger Forrester Shipping Commentary (London April 1987)

Table 3.4.1 New Ship Building, Old Existing Ships and Chartered Vessels

	A	B	C
	New Container Ship (1,200 TEU) (21,000 DWT)	Existing Ship (677 TEU)* (M.V. "LALAZAR: 13,539 DWT)	Chartered Container Ship (COSMO OCEAN: 1,019 TEU)
	Expected operating cost in the first year	Operating cost in the last year, 1986	
1. Wages (Number of Crew)	2.4 Rs. million 23 Persons	3.6 Rs. million 34 Persons	
2. Insurance	5.9 Rs. million	1.5 Rs. million	
3. Repair & Maintenance	1.73 Rs. million	2.3 Rs. million	
4. Lubricating Oil	0.78 Rs. million	0.6 Rs. million	
5. Storage	0.6 Rs. million	0.8 Rs. million	
6. Tax	-	-	
Total:	11.41 Rs. million	8.8 Rs. million	(Time Chartered fee per year) 32.4 Rs. million
(Without insurance)	5.51 Rs. million	7.30 Rs. million	(75%) 24.3 Rs. million
	Expected capital cost in the first year	Capital cost per year (Repayment already completed)	
1. Rate of Interest	14%	-	
2. Repayment	320 Rs. million	-	
	New Building Cost: 320 Rs. million		
	Others		
1. Ship's Speed	15 knots	13 knots	
2. Fuel Oil Consumption per day	F.O. 30 Tons D.O. 2.5 Tons	F.O. 21 Tons D.O. 2.0 Tons	

Note: * Conversion factor is assumed as 20 DWT = 1 TEU
Source: PNSC, Study Team

Case 1. A New Container Ship vs. an Existing Ship

(1) A New Ship:

a. A ship is built and used for 15 years

b. Residual value is assumed at 20% of the initial cost

c. Annual operation cost is assumed to increase 5% p.a. after
5 years because of increasing inefficiency.

d. Insurance fee is excluded from the economic cost.

(2) An Existing Ship:

M.V. "LALAZAR" is taken up for example.

a. The ship (built in 1974) can be used another 7 years, then replaced by a newly built ship.

b. Residual value of the LALAZAR is zero at the end of 7 years. That of a new ship, 40% after 8 years.

c. M.V. LALAZAR's economic cost of annual operation is calculated at 11.38, after adjusted to the equivalent size of an A-ship as shown in Table 3.4.2. In addition to the above, the following elements must be considered.

- Technology of ship building has advanced so much in these last 13 years, which resulted in an enormous improvement in speed and fuel consumption for a new ship. In other words, the LALAZAR would require much more time than a new ship for a certain voyage with a larger fuel cost resulting less efficiency in vessel operation. It is assumed that LALAZAR would cost 30% more in terms of economic cost in 1987.

d. LALAZAR's annual cost is assumed to increase by 10% upto 1989 and by 15% upto 1994.

(3) Cost Streams

Comparison of cost streams are shown in Table 3.4.3. Column A means the new ship is bought in 1987 and used for 15 years, and column B means the saving of the LALAZAR cost in the same period, where the saving is realized by the acquisition of a new ship.

The resultant benefit/cost ratio was calculated at 0.72 when discounted by 12% annually. The economic internal rate of return was 3.61.

(4) Sensitivity Test

If the LALAZAR is assumed to be used upto 1999 with an increasing annual cost, the benefit/cost ratio is calculated at 0.82 when discounted by 12% annually. The economic internal rate of return was increased to 8.77%. (See Table 3.4.4)

Table 3.4.2 Adjusted Operation Cost

A	B	C
New Container Ship (1,200 TEU) (21,000 DWT)	Existing Ship (677 TEU)[1] (M.V. "LALAZAR": 13,539 DWT)	Chartered Container Vessel (COSMO OCEAN: 1,019 TEU)
Same	To be adjusted to a size of 1,200 TEU/21,000 DWT.	To be adjusted to a size of 1,200 TEU/21,000 DWT.
Same	When the cost increases in proportion to the size, $\frac{21,000}{13,539} = 1.55$ to be factored	When the cost increases in proportion to the size, $\frac{1,200}{1,019} = 1.18$ to be factored
Same	When the scale of economy is assumed[2], a factor of 1.55 is used.	When the scale of economy is assumed, a factor of 1.18 is calculated[2] and used.
Total: 11.41 Rs. million/Y	8.8 x 1.55 = 13.64 Rs. million/Y	32.4 x 1.18 = 38.23 Rs. million/Y
Economic Total 5.51 Rs. million/Y	7.3 x 1.55 = 32 Rs. million/Y	24.3 x 1.18 = 28.67 Rs. million/Y

Note: 1) 20 DWT = 1 TEU
2) The cost does not increase in proportion to the size. By referring to charter rate quoted from GMBH, an adjustment factor is determined.

Gearless Container Ship (November, 1986)

Balandra	1,253 TEU	21,600 DW	18.0 knots	6 mos	6,500 US$/day
Artimon	1,172 TEU	20,500 DW	18.0 knots	9 mos	6,500 US$/day
Westertal	962 TEU	14,120 DW	16.5 knots	12 mos	5,200 US$/day
Sinofa	480 TEU	8,725 DW	15.0 knots	3 mos	3,500 US$/day

Source: Shipping & Chartering GMBH (Jork, West Germany)

o From the above GMBH figures, a Ship of 1,200 TEU is assumed at US$6,500/day, and ship-TEU 677 is calculated to be equivalent by multiplying the factor calculated below:

962 - 480 = 482, 677 - 480 = 197, 197 ÷ 482 = 0.41,
0.41 x (5,200 - 3,500) = 695, 695 + 3,500 = 4,195, 6,500 ÷ 4,195 = 1.55

A factor of 1.55 is estimated and used for adjustment.

o A chartered ship of 1,019 TEU is between Artimon and Westertal. A factor is estimated by finding a proportional relationship.

1,200 - 962 = 238, 1,019 - 962 = 57, 57 ÷ 238 = 0.24,
0.24 x (6,500 - 5,200) = 312, 312 + 5,200 = 5,512, 6,500 ÷ 5,512 = 1.18

A factor of 1.18 is determined.

Table 3.4.3 New Ships vs. Existing Ships

(000 Rs)

Year	(B) Total Benefit	Discounted Benefit	(A) Total Cost	Discounted Cost
1988/89	16,260	11,574	320,000	227,770
1989/90	17,880	11,363	5,500	3,495
1990/91	20,560	11,666	5,500	3,121
1991/92	23,640	11,977	5,500	2,786
1992/93	27,180	12,295	5,500	2,488
1993/94	31,250	12,621	5,500	2,221
1994/95	35,930	12,957	5,770	2,081
1995/96	320,000	103,032	6,050	1,948
1996/97	5,500	1,581	6,350	1,825
1997/98	5,500	1,412	6,660	1,709
1998/99	5,500	1,260	6,990	1,602
1999/00	5,500	1,125	7,680	1,571
2000/01	5,500	1,005	8,440	1,542
2001/01	5,770	941	9,280	1,514
2002/03	6,050	881	10,200	1,486
2003/04	-128,000	-16,645	-64,000	-8,323
Total	404,020	179,045	350,920	248,837

B/C Ratio at a Discount Rate of 12 %/year: 0.72
Internal Rate of Return: 3.61 %/year

Table 3.4.4 New Ships vs. Existing Ships
(Sensitivity Test)

(000 Rs)

Year	Total Benefit	Discounted Benefit	Total Cost	Discounted Cost
1988/89	16,260	11,574	320,000	227,770
1989/90	17,880	11,363	5,500	3,495
1990/91	20,560	11,666	5,500	3,121
1991/92	23,640	11,977	5,500	2,786
1992/93	27,180	12,295	5,500	2,488
1993/94	31,250	12,621	5,500	2,221
1994/95	35,930	12,957	5,770	2,081
1995/96	43,110	13,880	6,050	1,948
1996/97	51,730	14,871	6,350	1,825
1997/98	62,070	15,932	6,660	1,709
1998/99	74,480	17,069	6,990	1,602
1999/00	89,370	18,287	7,680	1,571
2000/01	320,000	58,463	8,440	1,542
2001/01	5,500	897	9,280	1,514
2002/03	5,500	801	10,200	1,486
2003/04	-160,000	-20,806	-64,000	-8,323
Total	664,460	203,846	350,920	248,837

B/C Ratio at a Discount Rate of 12 %/year: 0.82
Internal Rate of Return: 8.77 %/year

(5) Conclusion

These cost streams are crudely estimated and subject to a systematic and intensive study. However, it indicates that the existing fleet might be used for 20 - 25 years, if they travel at their own efficient operations. Using the existing ship for a total period of less than 20 years before being replaced by a new ship would not be an economical solution.

Case 2. New Container Ship vs. Chartered Ship

(1) A New Ship

Assumptions used in the comparison is same as the Case 1.

(2) Chartered Ship:

a. COSMO OCEAN is taken

b. The economic charter cost per year is 28.67 M.Rs and will not change over the coming 15 years.

c. No residual value

d. Insurance pleminum is estimated at 25% and excluded in the case of economic analysis.

(3) Cost Stream

The streams of cost (new ship building and operation over 15 years) and savings (no need to keep and operate the chartered ship because of a new ship) are shown in Table 3.4.5.

It shows that the economic return will be 3.72%.

(4) Sensitivity Test

If the savings (foreign currency payment of chartering) is weighed at 1.20 because of shadow priced foreign currency savings, the savings stream becomes as shown in Table 3.4.6. The economic return will be 6.73%.

(5) Conclusion

Just as in the case 1, these cost streams are a crude approximation. A systematic and intensive study should be conducted to find an exact solution. However, the above study (1) - (4) shows that:

a. Viability of new ship building in order to replace the chartered vessel depends on the forecast fluctuating charter rate (See Fig. 3.4.1).

b. Economic value of foreign exchange savings (realized by the cancellation of charter fee) will also affect the rate of return.

Table 3.4.5 New Ships vs. Chartered Ships

(000 Rs)

Year	Total Benefit	Discounted Benefit	Total Cost	Discounted Cost
1988/89	28,670	20,407	320,000	227,770
1989/90	28,670	18,220	5,500	3,495
1990/91	28,670	16,268	5,500	3,121
1991/92	28,670	14,525	5,500	2,786
1992/93	28,670	12,969	5,500	2,488
1993/94	28,670	11,579	5,500	2,221
1994/95	28,670	10,339	5,770	2,081
1995/96	28,670	9,231	6,050	1,948
1996/97	28,670	8,242	6,350	1,825
1997/98	28,670	7,359	6,660	1,709
1998/99	28,670	6,570	6,990	1,602
1999/00	28,670	5,866	7,680	1,571
2000/01	28,670	5,238	8,440	1,542
2001/01	28,670	4,677	9,280	1,514
2002/03	28,670	4,176	10,200	1,486
2003/04	28,670	3,728	-64,000	-8,323
Total	458,720	159,394	350,920	248,837

B/C Ratio at a Discount Rate of 12 %/year: 0.64
Internal Rate of Return: 3.72 %/year

Table 3.4.6 New Ships vs. Chartered Ships
(Sensitivity Test)

(000 Rs)

Year	Total Benefit	Discounted Benefit	Total Cost	Discounted Cost
1988/89	34,404	24,488	320,000	227,770
1989/90	34,404	21,864	5,500	3,495
1990/91	34,404	19,522	5,500	3,121
1991/92	34,404	17,430	5,500	2,786
1992/93	34,404	15,563	5,500	2,488
1993/94	34,404	13,895	5,500	2,221
1994/95	34,404	12,406	5,770	2,081
1995/96	34,404	11,077	6,050	1,948
1996/97	34,404	9,890	6,350	1,825
1997/98	34,404	8,831	6,660	1,709
1998/99	34,404	7,885	6,990	1,602
1999/00	34,404	7,040	7,680	1,571
2000/01	34,404	6,285	8,440	1,542
2001/01	34,404	5,612	9,280	1,514
2002/03	34,404	5,011	10,200	1,486
2003/04	34,404	4,474	-64,000	-8,323
Total	550,464	191,273	350,920	248,837

B/C Ratio at a Discount Rate of 12 %/year: 0.77
Internal Rate of Return: 6.73 %/year

3.5 Recommendations

Economic viability of the policy to replace the existing aged vessels is found when the ship becomes older, say 25 years or more. Existing ships should be used at its maximum efficiency state of operation.

While the economic study indicates that the use of existing ships of more than 25 years is an economical solution, the real condition of the market should be considered. It is the demand/selection by shippers and consignees for the type and facilities of the aged ship.

World markets propose availability of new modern facility ships as well as those of aged old ships. It has been a general tendency for shippers to use new ships rather than using the old ones. To meet this tendency, it is said most of American, European and Japanese shipping companies try to change vessels more than 10 years old with new ones. Aged vessels can travel efficiently, but loadings are less in the market. Considering this situation, the study proposes the use of 20 years as a target point of replacement, not 25 years or 30 years.

Accordingly, the plan to replace vessels in the 7th Plan period is consistent with the above economic principle because these targeted replacements are posted when the ship reaches an age of more than 20 years.

Replacement of chartered ships by newly built ships is hard to justify with a reasonable economic return. It depends on various uncertain factors outside the country and the Government policy as well.

A gradual increase of the Pakistan fleet along with the forecasted developing trade volume is consistent with the national policy and security programs to have a certain share carried by the national carriers in the transportation of essential commodities.

The economic and financial viabilities of the plan is again influenced by uncertain factors which are difficult to define and forecast in the cost streams of over 15-20 years. However, the plan is reasonable and recommendable as it is within a gradual fleet increase principle, not a radical increase plan.

APPENDIX FOR

SHIPPING

TABLE OF CONTENTS

SHIPPING

Vessel Purchase Plan

(1) Full Containers

(a) Necessity:

Containerization is now a general and world-wide trend in liner services and that trend is also emerging widely in this country. In order to accommodate this movement, the acquisition of full container vessels is considered.

(b) Calculation of the number of container vessels required. Calculation flow chart is shown in Appendix Table 1. The premises for calculation is as follows.

- o Estimated cargo volumes up to the year 2005-06 are based on the forecast study shown Table 2.2.1 and 2.2.2.
- o This calculation is made on two major liner services of Pakistan, Europe/Pakistan and Far East/Pakistan.
- o Containerizability of each commodity is estimated in Appendix Table 2.
- o The volume of containerizable commodity is as shown in Appendix Table 3.
- o Operation patterns of the vessels are shown in Appendix Table 4 and based on the pattern, days required for the round voyage which are:

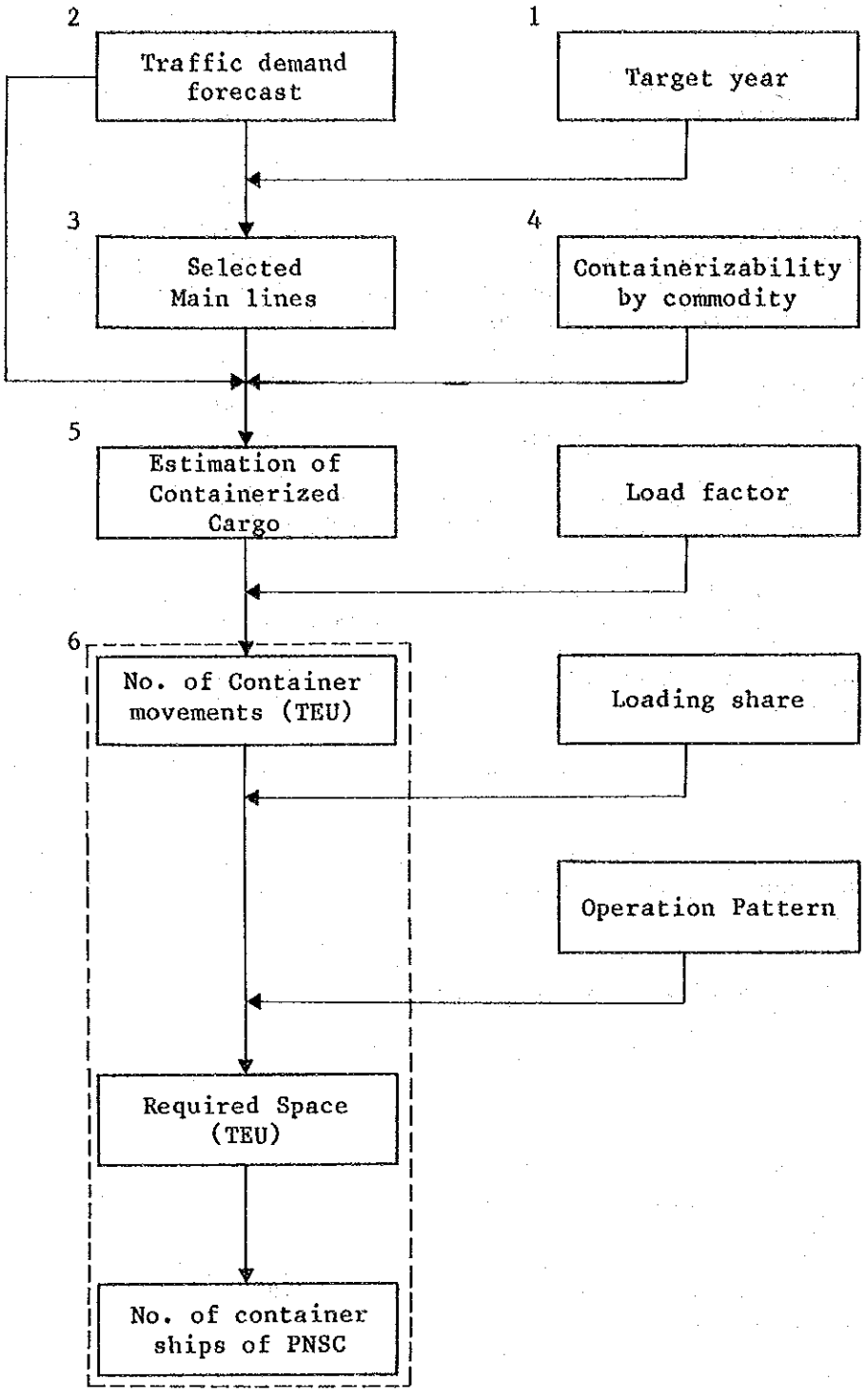
Europe/Pakistan	50.0 days
Far East/Pakistan	47.0 days

- o PNSC's cargo share was assumed to be 40%.

(c) Results of Calculation

- o Based on the load factors (loadable tonnage per 20' container) hereunder, the necessary numbers of full container vessels as 10 ships x 1,200 TEU size and 4 ships x 1,800 TEU size by the year 1997-98 and 10 ships x 1,200 TEU size ships x 1,800 TEU size in 2005-06 was used. (Refer to Appendix Table 5 and 9 for further details).
- o Load Factor

Rice		15 metric ton per TEU
Cotton		10 metric ton per TEU
Others	- Export	16 metric ton per TEU
	- Import	9.5 metric ton per TEU



App. Table 1 Required No. of Container Ships

App. Table 2 Estimated Ratio of Commodity-wise Containerizability

Commodity	Ultimate Containerizability	1985/ 1986	1992/ 1993	1997/ 1998	2005/ 2006
1. Wheat	*		0	0	0
2. Cement	-		0	0	0
3. Fertilizer	*		0	0	0
4. Rice	25%	13.5%	17.7%	19.9%	21.1%
5. Coal and Iron Ore	0		0	0	0
6. Petrols	0		0	0	0
7. Molasses	*		0	0	0
8. Edible Oil and Tallow	*		0	0	0
9. Cotton	100%	53.9%	70.6%	79.6%	84.2%
10. Others - Import	-	30.8%	67.8%	79.6%	86.8%
- Export	-	64.2%	76.6%	84.2%	87.0%
Total - Import		33.0%	68.5%	85.5%	97.5%
- Export		53.9%	70.6%	79.6%	84.2%

Note: Others: Sugar, Iron & steel, Other dry cargo

App. Table 3 Containerized Cargo Volume of Main Routes (1)

EUROPE/PAKISTAN

1992-1993

Commodity	Import		Export	
	Containerized Cargo	Residual Cargo	Containerized Cargo	Residual Cargo
Rice:				
(A)	-		20,000	
(B)	-	-	17.7	82.3
(C)	-	-	3,540	16,460
(D)	-		236	
Cotton:				
(A)	-		18,000	
(B)	-	-	70.6	29.4
(C)	-	-	12,708	5,292
(D)	-		1,271	
Others:				
(A)	1,146,000		760,000	
(B)	67.8	32.2	76.6	23.4
(C)	776,988	369,012	582,160	177,840
(D)	81,789		36,385	
Total	81,789 (TEU)	369,012 (M/T)	37,892 (TEU)	199,592 (M/T)

1997-98

Rice:				
(A)	-		19,000	
(B)	-	-	19.9	80.1
(C)	-	-	3,781	15,219
(D)	-		253	
Cotton:				
(A)	-		16,000	
(B)	-	-	79.6	20.4
(C)	-	-	12,736	3,264
(D)	-		1,274	
Others:				
(A)	1,422,000		1,093,000	
(B)	79.6	20.4	84.2	15.8
(C)	1,131,912	290,088	920,306	172,694
(D)	119,149		55,777	
Total	119,149 (TEU)	290,088 (M/T)	57,304 (TEU)	191,177 (M/T)

2005-06

Rice:				
(A)	-		20,000	
(B)	-	-	21.1	78.9
(C)	-	-	4,220	15,780
(D)	-		282	
Cotton:				
(A)	-		14,000	
(B)	-	-	84.2	15.8
(C)	-	-	11,788	2,212
(D)	-		1,179	
Others:				
(A)	1,986,000		1,956,000	
(B)	86.8	13.2	87.0	13.0
(C)	1,723,848	262,152	1,701,720	254,280
(D)	181,458		106,358	
Total	181,458 (TEU)	262,152 (M/T)	107,819 (TEU)	254,280 (M/T)

Remarks (A) Total Cargo Movement (M/T)
(B) Containerized/Residual Cargo Ratio (%)
(C) Cargo Movement (M/T)
(D) Container (TEU)

App. Table 3 Containerized Cargo Volume of Main Routes (2)

FAR EAST/PAKISTAN

1992-1993

Commodity	Import		Export	
	Containerized Cargo	Residual Cargo	Containerized Cargo	Residual Cargo
Rice:				
(A)	-		84,000	
(B)	-	-	17.7	82.3
(C)	-	-	14,868	69,132
(D)	-		992	
Cotton:				
(A)	-		586,000	
(B)	-	-	70.6	29.4
(C)	-	-	413,716	172,284
(D)	-		41,372	
Others:				
(A)	1,845,000		156,000	
(B)	67.8	32.2	76.6	23.4
(C)	1,250,910	594,090	119,496	36,504
(D)	131,675		7,469	
Total	131,675 (TEU)	594,090 (M/T)	49,833 (TEU)	277,920 (M/T)

1997-1998

Rice:				
(A)	-		83,000	
(B)	-	-	19.9	80.1
(C)	-	-	16,517	66,483
(D)	-		1,102	
Cotton:				
(A)	-		519,000	
(B)	-	-	79.6	20.4
(C)	-	-	413,124	105,876
(D)	-		41,313	
Others:				
(A)	2,291,000		225,000	
(B)	79.6	20.4	84.2	15.8
(C)	1,823,636	467,364	189,450	35,550
(D)	191,962		11,841	
Total	191,962 (TEU)	467,364 (M/T)	54,256 (TEU)	207,909 (M/T)

2005-2006

Rice:				
(A)	-		85,000	
(B)	-	-	21.1	78.9
(C)	-	-	17,935	67,065
(D)	-		1,196	
Cotton:				
(A)	-		405,000	
(B)	-	-	84.2	15.8
(C)	-	-	341,010	63,990
(D)	-		34,101	
Others:				
(A)	3,199,000		403,000	
(B)	86.8	13.2	87.0	13.0
(C)	2,776,732	422,268	350,610	52,390
(D)	292,288		21,914	
Total	292,288 (TEU)	422,268 (M/T)	57,210 (TEU)	183,445 (M/T)

Remarks (A) Total Cargo Movement (M/T)
(B) Containerized/Residual Cargo Ratio (%)
(C) Cargo Movement (M/T)
(D) Container (TEU)

App. Table 4 Pattern of Operations

	EUROPE/PAKISTAN FAR EAST/PAKISTAN	Speed of Ship 18 Knots 18 Knots	Turn Round 50 days 45 days
EUROPE/PAKISTAN	MILAGE	RUN (days)	STAY (days)
Southampton	495	1.1	1.5
Hamburg	151	0.3	1.5
Bremenhaven	327	0.8	1
Rotterdam	247	0.6	1.5
Le Havre	1,712	4.0	1.5
Barcelona	185	0.4	1.5
Fos	201	0.5	1.5
Genoa	1,419	3.3	2
Suez	2,770	6.4	1
Karachi	2,770	6.4	1
Suez	3,054	7.1	
Southampton			
Reserve		1.1	2
Total		32.0	18.0

FAR EAST/PAKISTAN	MILAGE	RUN (Days)	STAY (days)
Yokohama	210	0.5	1.0
Nagoya	240	0.6	0.5
Kobe	363	0.8	1.5
Busan	913	2.1	1.0
Kaohsiung	342	0.8	1.0
Hongkong	1,445	3.3	1.0
Singapore	2,882	6.7	2.0
Karachi	4,313	10.0	1.0
Hongkong	1,582	3.7	1.0
Yokohama			
Reserve		1.0	5.5
Total		29.5	15.5

App. Table 5 Capacity Analysis of Container Ships

Year	Trade	Import/ Export	Cargo Movement	(A) PNSC's 40% Share	(B) Turn Round	(C) Required Space	Vessels
1992-93	Europe/Pakistan	Import	81,789 TEU	32,716 TEU	50 Days	4,674 TEU	1,200 TEU x 4
"	Far East/Pakistan	"	131,675 "	52,670 "	45 "	6,772 "	1,200 TEU x 6
1997-98	Europe/Pakistan	"	119,149 "	47,660 "	50 "	6,809 "	1,200 TEU x 4 1,800 TEU x 2
"	Far East/Pakistan	"	191,962 "	76,785 "	45 "	9,873 "	1,200 TEU x 6 1,800 TEU x 2
2005-06	Europe/Pakistan	"	181,458 "	72,584 "	50 "	10,370 "	1,200 TEU x 4 1,800 TEU x 4
"	Far East/Pakistan	"	292,288 "	116,916 "	45 "	15,032 "	1,200 TEU x 6 1,800 TEU x 5

Remark: (A) x (B) / 350 Days = (C)

(2) Bunkers for PSM

(a) Necessity

As previously pointed out the present share of Pakistani fleet for so called bulk cargo is relatively low. It is not so simple to say that acquisition of the bulk carrier will positively help Pakistan's economy as it depends on the market in the bulk carrier business. However, from the viewpoint of maintaining stable supply of materials, a plan of purchase should be studied.

(b) Required Numbers of Bulk Carrier

It is projected that Pakistan will have to import approximately 2.76 million tons of coking coal and 2.24 million tons of iron ore in the year 1992-93. Also according to the demand forecast in the previous chapter, approximately 6.41 million tons of coal and 6.66 million tons of iron ore will be required and imported to this country.

Based on these expected volumes at each target year, the draft limitation at Port Qasim which is 12.0 m in the fair season and 10 -11.0 m in monsoon season allowing only up to 50,000 DWT vessels, and the trade pattern model shown hereunder, the required number of bulk carriers worked out is as follows.

o Required number of bulk carriers:

1992-93	50,000 DWT x 14.2 vessels
2005-06	50,000 DWT x 36.7 vessels

For further details, refer to Appendix Tables 6 (for the year of 1992-93) and 7 (for the year of 2005-06).

o Trade Pattern model for the calculation.

(a) Iron Ore

Country	Port	Share in %
BRAZIL	SEPETIBA	30
AUSTRALIA	PORT HEDLAND	25
LIBERIA	BUCHANAN	20
CANADA	SEPT ISLES	15
INDIA	KARWAR	10

(b) Coal

Country	Port	Share in %
AUSTRALIA	NEWCASTLE	65
CANADA	ROBERTS BANK	25
U.S.A.	PHILADELPHIA	10

(3) Crude Oil Tankers

Pakistan's annual import volume of crude oil is approximately 4 million tons and about a half of them, 2 million tons were carried by NTC's tanker "JOHAR" of 89,951 DWT. It is said that NTC is now planning to purchase another second hand tanker of 75,000 DWT size. If this project is materialized, NTC can cover all of its crude oil import by these two vessels.

In the meantime, according to the forecast by our study team, the volume of Pakistan's oil imports will increase only upto 4.36 million tons by the year 2005-06 with a very low increase rate.

Taking into account of the age of "JOHAR" which is 12 years old and the predicted increase of crude oil import in the future, 3 vessels are required to meet the demand of forecast, including two replacements.

(4) Edible Oil Tankers

In 1985/86, Pakistan imported a total 825,000 tons of Edible oil and it is estimated by our study team that the amount of the import will go up to 1,006,000 tons, approx. 1.2 times higher than the present volume in the year 2005-06.

For the purpose of taking an appropriate share by national fleet, it is desirable to have a product carrier, for example, the size of 25,000 DWT. (We understand PNSC is now planning to materialize this acquisition of product carrier in 1987).

App. Table 6 Estimated No. of Bulk Carriers (1992-93)

50,000 DWT Bulk Carriers

Ships Speed : 13.2 Knots
Draft : 11.1 M
Discharging Port: Port Qasim

ORE: 2,240,000 tons/year

Source		%	Quantity	Voyage	Dist' (Mile)	Running Day	Reserve	Loading	Discharging	Reserve	Total Turn Round	Voyage per Year x Turn Round
Brazil	(Septiba)	30	672,000	13.4	7,897x2	49.9	2	1	4	1	57.6	772
Australia	(Port Hedland)	25	560,000	11.2	4,157x2	26.2	1	1	4	1	33.2	372
Liberia	(Buchanan)	20	448,000	9.0	7,601x2	48.0	2	1	4	1	56.0	504
Canada	(Sept Iles)	15	336,000	6.7	7,739x2	48.9	1	1	4	1	55.9	375
India	(Karwar)	10	224,000	4.5	688x2	4.3	0.5	7	4	1	16.8	76
Sub Total (1)		100	2,240,000	44.8	-	-	-	-	-	-	-	2,099

Coal: 2,763,000 tons/year

Source		%	Quantity	Voyage	Dist' (Mile)	Running Day	Reserve	Loading	Discharging	Reserve	Total Turn Round	Voyage per Year x Turn Round
Australia	(New Castle)	65	1,795,950	35.9	6,524x2	41.2	2	1	4	1	49.2	1,766
Canada	(Robert Bank)	25	690,750	13.8	9,965x2	63.0	2	1	4	1	71.0	980
USA	(Philadelphia)	10	276,300	5.5	8,301x2	52.4	3	2	4	1	62.4	343
Sub Total (2)		100	2,763,000	55.2	-	-	-	-	-	-	-	3,089
G. Total (1) + (2)		-	5,003,000	100.0	-	-	-	-	-	-	-	5,188

5,188 ÷ 365 ≒ 14.2
(No. of Vessels)

App. Table 7 Estimated No, of Bulk Carriers (2005-06)

50,000 DWT Bulk Carriers

Ships Speed : 13.2 Knots
Draft : 11.1 M
Discharging Port: Port Qasim

ORE: 6,656,000 tons/year

Source	%	Quantity	Voyage	Dist (Mile)	Running Day	Reserve	Loading	Discharging	Reserve	Total Turn Round	Voyage per Year x Turn Round
Brazil (Septiba)	30	1,996,800	39.9	7,897x2	49.9	2	1	4	1	57.6	2,298
Australia (Port Hedland)	25	1,664,000	33.3	4,157x2	26.2	1	1	4	1	33.2	1,106
Liberia (Buchanan)	20	1,331,200	26.6	7,601x2	48.0	2	1	4	1	56.0	1,490
Canada (Sept Iles)	15	998,400	20.0	7,739x2	48.9	1	1	4	1	55.9	1,118
India (Karwar)	10	665,600	13.3	688x2	4.3	0.5	7	4	1	16.8	223
Sub Total (1)	100	6,656,000	133.1	-	-	-	-	-	-	-	6,235

Coal: 6,409,000 tons/year

Source	%	Quantity	Voyage	Dist (Mile)	Running Day	Reserve	Loading	Discharging	Reserve	Total Turn Round	Voyage per Year x Turn Round
Australia (New Castle)	65	4,165,850	83.3	6,524x2	41.2	2	1	4	1	49.2	4,098
Canada (Robert Bank)	25	1,602,250	32.0	9,965x2	63.0	2	1	4	1	71.0	2,272
USA (Philadelphia)	10	640,900	12.8	8,301x2	52.4	3	2	4	1	62.4	799
Sub Total (2)	100	6,409,000	128.1	-	-	-	-	-	-	-	7,169
G. Total (1) + (2)	-	13,065,000	261.2	-	-	-	-	-	-	-	13,404

13,404 ÷ 365 ≒ 36.7
(No. of Vessels)

(5) High-speed Ferry Boats

(a) Appendix Table 8 shows the detailed cargo movements among Middle East Area by country and in summary, a total of 600,000 tons export and 4,980,000 tons import was recorded in the year 1984-85. These figures mean this the Mid East Trade share is 19.7% in total of Pakistan exports, and 51.3% in total imports, (excluding 4,090,000 ton of oil movements in import, import dry cargo's volume and share of this area is 890,000 tons, of 9.2%)

That Appendix Table also shows the fluctuation of volume by country by year and it is rather difficult to find a certain trend in the trade liftings, however, as studied in Tables 2.2.1 and 2.2.2, total trade volume in this Middle East Gulf is expected to be active and expand in the long run.

(b) Passenger Traffic

It is forecasted that the total numbers of general passengers will be maintained at the present level of approx. 15,000 a year in the year 2005-06. In the passenger traffic, key points are speed and fare charge including passengers luggage fee. There seems to be ample room to expand passenger numbers if the present old passenger fleets of average age over 29 years are replaced with new and high-speed ferry at moderate fares.

(c) Merits of Building New Ferry Boats

o By launching high-speed ferry with speeds of about 20 knot, we can expect to induce the export/import of fresh vegetables and other perishable cargoes to/from Middle East Gulf area, simultaneously with passengers. The present 3 vessels will be replaced.

(6) Cost Calculations

(a) Full Container Vessel

Total investments required for new-building of full container ships are shown in the Appendix Table 9, which are calculated based on the following assumptions and estimated figures.

- Building Cost of a Vessel

  Price on delivery as of 1987 basis

  1,200 TEU Rs. 320 million (US$20.0 mil; yen 3,000 million)

  1,800 TEU Rs. 373 million (US$23.3 mil; yen 3,500 million)

  (Exchange rate US1$ = Yen 150 = Rs 16)

- Cost of Containers

  US$2,000/unit (20'), 1 set = 1,200 or 1,800 units

  Required Nos.: 2.5 sets/ship

App. Table 8 Direction of Pakistan's Middle East Trade

			Bahrain	Iran	Iraq	Kuwait	Oman	Qatar	Saudi Arabia	U.A.E.	Yemen Arab Rep.	Yemen Dem. Rep.	Total (A)	Pak Total (B)	(A)/(B)%
1980-1981	IMPORT	In Million Rs	942.4	25.3	1,569.5	4,276.2	11.9	77.0	6,868.7	3,012.5	-	0.5	16,784.0	53,547.5	31.3%
		Metric Tons	5,790	4,017	191,224	188,108	6,175	32,396	2,206,348	972,822	-	26	4,606,906	7,874,562	58.5%
	EXPORT	M. Rs	112.0	2,300.3	397.5	519.7	90.6	152.2	1,746.4	1,545.9	56.2	108.0	7,028.8	29,565.3	23.8%
		M. Tons	15,140	73,127	54,636	55,490	13,047	51,381	191,801	384,372	18,332	20,882	878,208	3,536,742	24.8%
1981-1982	IMPORT	M. Rs	7.5	22.5	817.2	5,765.8	32.8	59.9	8,486.7	3,946.0	0.1	0.5	19,139.0	59,490.0	32.2%
		M. Tons	18,839	40,816	9,438	90,928	2,488	13,642	2,409,301	1,249,367	57,575	-	3,892,394	10,843,948	35.9%
	EXPORT	M. Rs	118.0	849.4	539.7	535.0	474.8	163.0	1,943.5	1,700.6	10.5	597.6	6,932.1	26,684.5	26.0%
		M. Tons	18,900	47,238	43,388	140,200	108,750	21,948	271,060	357,722	57,032	2,954	1,069,192	3,760,562	28.4%
1982-1983	IMPORT	M. Rs	24.0	1,144.6	6.0	6,386.0	287.0	79.7	9,098.1	3,784.4	-	-	20,809.8	68,163.7	30.5%
		M. Tons	1,164	517,666	1,286	197,104	625	10,654	3,375,016	1,166,500	1,596	5	5,271,616	11,709,270	45.0%
	EXPORT	M. Rs	216.8	4,237.1	292.6	475.1	359.4	257.9	3,212.2	2,888.6	16.8	532.7	12,489.2	34,675.1	36.0%
		M. Tons	11,832	16,998	9,288	75,509	10,714	27,256	223,825	37,039	73,804	3,411	489,676	3,339,530	14.7%
1983-1984	IMPORT	M. Rs	92.4	1,202.0	4.0	6,197.3	1.5	72.1	7,596.9	4,393.1	0.3	0.8	19,560.4	76,717.6	25.5%
		M. Tons	7,535	270,482	1,240	38,257	28,794	7,516	2,352,904	753,023	16,917	65	3,476,733	8,442,475	41.2%
	EXPORT	M. Rs	192.9	5,991.2	163.0	703.0	348.9	217.6	2,929.4	2,814.7	336.3	10.3	13,707.3	37,627.2	36.4%
		M. Tons	15,257	201,029	3,780	91,753	4,851	18,813	103,596	244,636	148,346	215	832,276	3,428.921	24.3%
1984-1985	IMPORT	M. Rs	51.7	1,061.2	11.7	7,104.7	195.3	66.3	9,570.5	4,611.6	3.8	4.0	22,680.8	89,799.7	25.3%
		M. Tons	7,440	336,116	2,766	15,645	79	6,449	2,526,575	2,080,668	4,627	-	4,980,365	9,712,291	51.3%
	EXPORT	M. Rs	182.7	1,074.7	166.1	392.8	718.0	91.0	2,629.2	1,930.8	8.8	207.5	7,401.6	38,414.7	19.3%
		M. Tons	15,928	69,536	2,301	34,921	36,215	11,611	66,337	339,930	250	23,844	600,873	3,056,845	19.7%

Source: Pattern of Foreign Trade of Pakistan
(Chamber of Commerce & Industry Karachi)

: PSW

App. Table 9 Total Investment for Newly-Built Container Ships

1992-1993	Ship		Container	G. Total
		million		
Europe	1,200 TEU x 4	Rs 320 x 4 = 1,280	Rs 576 million	Rs 3,776 million
Far East	1,200 TEU x 6	Rs 320 x 6 = 1,920	(6 Ships')	
		S.Total Rs 3,200 million		

1997-1998	Ship		Container	G. Total
		million		
Europe	1,200 TEU x 4	Rs 320 x 4 = 1,280	Rs 864 million	Rs 5,556 million
	1,800 TEU x 2	Rs 373 x 2 = 746		
Far East	1,200 TEU x 6	Rs 320 x 6 = 1,920	(8 Ships')	
	1,800 TEU x 2	Rs 373 x 2 = 746		
		S.Total Rs 4,692 million		

2005-2006	Ship		Container	G. Total
		million		
Europe	1,200 TEU x 4	Rs 320 x 4 = Rs 1,280	Rs 1,584 million	Rs 8,141 million
	1,800 TEU x 4	Rs 373 x 4 = Rs 1,492		
Far East	1,200 TEU x 6	Rs 320 x 6 = Rs 1,920	(13 Ships')	
	1,800 TEU x 5	Rs 373 x 5 = Rs 1,865		
		S.Total Rs 6,557 million		

(b) Bulk Carriers (50,000 DWT size)

Investment for new-building of bulk carriers is shown in App. Table 2, which is calculated based on the following assumptions and estimated figures.

- Price of Newly-Built Carrier (as of 1987)

  Rs. 213 millions
  (US$ 13.3 mil.; Yen 2,00 mil.)
  (Ex ¥150/1US$; Rs. 16/1US$)

- Total Investments

Year	Pakistan's Share in Trade	Vessels Required	Investments Required
1992-93	25%	4 x 50,000 DWT	Rs. 852 million
2005-06	25%	10 x 50,000 DWT	Rs.2,130 million

(c) Crude Oil Tankers

Investment for new-building of crude oil tankers is shown in App. Table 2 which is calculated based on the following assumptions and estimated figures.

Price of new-building of 80,000 DWT tanker as of 1987 is as follows:

Rs. 427 million
(US$ 26.7 mil.; Yen 4,000 mil.)
(Ex ¥150/1US$; Rs. 16/1US$)

(d) Product Carrier (Edible Oil Tanker)

Investment for new-building of Product Carriers is shown in App. Table 2, which is calculated based on following assumptions and estimated figures.

25,000 DWT Product Carrier's price (as of 1987) is as follows.

Rs. 320 million
(US$ 20.0 mil. ; Yen 3,000 mil.)
(Ex ¥150/1US$; Rs. 16/1US$)

(e) High-Speed Passenger & Vehicle Ferry

Investments for new-building of High-Speed Passenger & Vehicle Ferry are shown in App. Table 2, which is calculated based on following assumptions and estimated figures.

Price of about 3,200 DWT High-Speed Ferry (new-building) as of 1987 is almost the same as the product carrier as follows.

Rs. 267 million
(US$ 16.7 mil.; Yen 2,500 mil.)
(Ex ¥150 = 1US$, Rs. 16/US$1)