II Port Capacity Analysis and Port Selection

2-1 Port Capacity Analysis

The container cargo volume for 1987/88 is estimated to be approx. 1.7×10^6 tonnes, and that for 1999/2000 approx. 5.9×10^6 tonnes and to handle these volumes a 2-berth container terminal and a 6-berth terminal will be necessary respectively. To guarantee a container terminal with the necessary scale two proposals are being considered: 1) to build the required number of berths from scratch and 2) to convert existing berths. Apart from necessary checks and other problems concerning the latter proposal, the decision of whether two berths be newly constructed or converted from exsisting berths must be made considering the total port capacity in Pakistan. In this case, the plan to construct new container berths from scratch will yield better results for the same investment. Note that a two berth container terminal is equivalent lengthwise to three existing berths so, the conversion of existing berths into container berths will mean, as compared to the construction of new berths, that from the start of construction the overall capacity of the port to handle cargo will be decreased, thus creating the need for extra conventional berths immediately or soon after the start of work.

In the case of Karachi, the conversion of existing berths is structurally problematic, but at Qasim, the wharves under construction at present, Marginal Wharf No. 5 – No. 7, have nearly the correct specification with regard to structure, length, depth, available quay space etc. to allow for conversion to full-fledged container berths envisaged in the Urgent Plan.

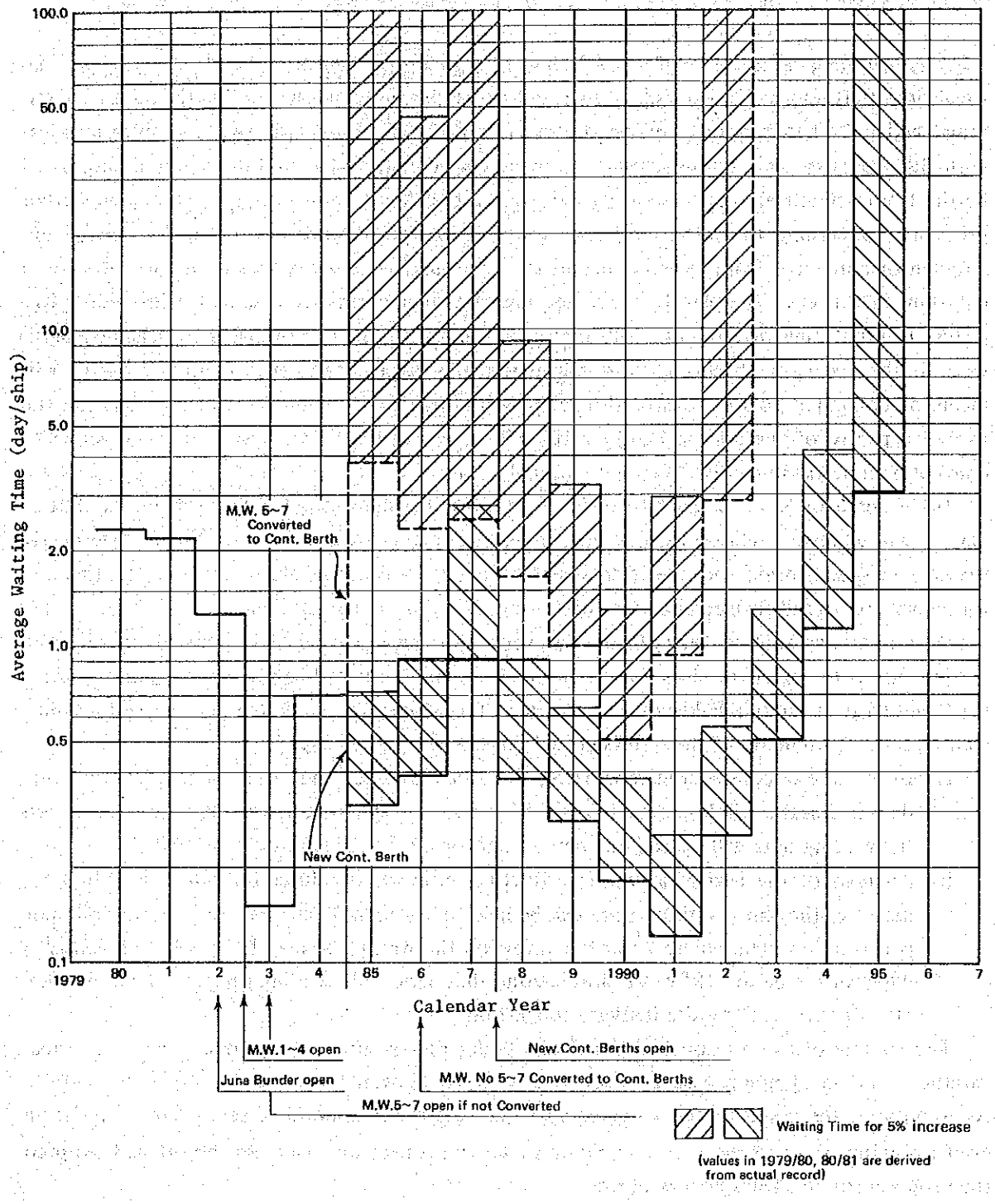
A comparative analysis for both of the proposals (new construction or conversion) had been carried out with regard to the relation between the dry cargo volume and the overall capacity for handling port cargo in Pakistan. The results of the analysis are evaluated in terms of the ships' waiting time. A summary of the results are set out below (refer to Fig. 8).

i) In the case of constructing new berths, the ships' waiting time can be held at less than one day during the whole period from 1983–1993, but on the other hand, under conversion the waiting time will exceed one day except for the 3 year period from 1989–91.

ii) Analysis of the berths, assuming a fluctuation in cargo volume indicate that with a 5% increase, the ships' waiting time can be held to less than 5 days until 1994 under the new construction plan, whereas under conversion the waiting time only be held to less than 5 days for the period 1989–91, and beyond that period the waiting time may be more than 10–50 days, with resultant severe congestion.

The volume of cargo in ports, in particular bulk cargo, is subject to great seasonal and annual variation, and in planning it seems necessary to make allowance for around a 10% fluctuation. As, therefore, the result of the above analysis indicate the likelihood of severe port congestion even assuming 5% increase in cargo volume under the conversion plan, this report had adopted the proposal for constructing new berths.

Fig. 8 Comparison of ship waiting Time



2-2 Port Selection

2-2-1 Outline

In considering whether the 2 berths to be built under the Urgent Plan would be better built at Karachi or Qasim, it must be said first of all that the results of independent studies show that it is both technically and economically feasible to build them at either port.

However, it is clearly disadvantageous to build one berth at each port, as compared to building them both at the same port, and so it is necessary to select one of the two ports.

For this a detailed comparison is necesary.

A port provides a space for various complicated activities involving miscellaneous agencies, functions etc., hence there are various viewpoints and corresponding decisions in port selection.

Among many relevant problems, the present report has selected the points shown below as key factors in assuring smooth and efficient containerization.

These key factors unanimously indicate the relative advantage of the Port of Karachi over the Port of Qasim. The key factors in this comparison are as follows:

i) Economic Profitability

Internal rate of return (IRR) can be taken as a basis for economic comparison, since the scale of the project is almost same at either port.

It has been found that the internal rate of return (IRR) at the Port of Karachi is 14.3% while that for the Port of Qasim is 12.2%. The former is 2.1% higher than the latter. This difference may appear small, yet it is a definite factor.

The difference stems mainly from such additional costs at Qasim as investment in miscellaneous port related infrastructures, expenditures for commutor traffic to/from Karachi, etc.

ii) Traffic Congestron in Karachi

In geographical terms, Qasim is cleary more advantageous. But container transport carrying mainly general cargo, is of purely commercial character, so there is a corresponding need for well-organized functions and facilities. A conclusion drawn from purely geographic consideration may be misleading.

As is explained in detail later, involved in the so called"roundabout transportation" in the two major ports in the Tokyo Bay Area, Yokohama and Tokyo, speak elonquently of the commercial character of container transport, and the relationship between Karachi and Qasim Ports bears a strong resemblance both in terms of history in port related investment and in terms of mutual position to that in Tokyo Bay. It follows that if Qasim were chosen, a considerable part of containers/container cargo going straight inland would do so via Karachi and the likelihood of this continuing in the long term is rather great.

In this situation, going from Qasim to Karachi and then from Karachi to inland, the container cargo has to pass through Karachi twice. Even if only half the container cargo were to do this, it comes to the same thing as if all the cargo were to be taken from Karachi in the first place. This will not only fail to relieve the traffic congestion in Karachi but will even bring about additional and otherwise unnecessary costs caused by this "roundabout transportation".

It is difficult to estimate what volume of traffic will follow this "roundabout transportation,"

and for how long a time. However the Port of Tokyo is, to some extent, equipped with commercial functions, whereas the situation appears much more serious in Karachi–Qasim than Yokohama–Tokyo. Thus, the actual statistics for Tokyo Bay, as given below, should be considered as a minimum possibility. According to these a figures, roughly 50% moves in a "roundabout" way, three years after having introducing full-fledged containerization in Tokyo Bay and roughly 30% seven years after.

From the above, it is difficult to concieve that the traffic congestion in Karachi will be in any way releaved by the selection of Qasim. On the other hand, if Karachi is chosen, as is shown in this report, the gate of the new terminal will be situated to the west of the gate to the present port, and it is possible that, bypassing the north of Karachi by taking the Maripur Road from the west of Karachi and going straight onto the Superhighway, there will only be a slight increase of congestion in the urban traffic. However, for this purpose it will be necessary to invest in the one "missing link" part of the by-pass.

In summary, it can not be concluded that Qasim Port has any advantages in relieving traffic congestion in Karachi at least in the short term. Further, in considering the nature of the two expenses namely additional and otherwise unnecessary cost for the "roundabout transportation" and the investment for completion of the bypass to the Super Highway, it may be said that it is better to select Karachi in the present circumstances.

iii) Regular Shipping Company Consideration

One factor that can not be determined internally is the question of the container carrier's port preference. Although their main concern is port charges, there are other factors such as the length, alignment, siltation etc. of the approach channel, and under free competition it can not be said that Qasim has sufficient attraction as a port of call for liner operators.

Therefore even if Karachi Port were to remain as it is and a full-fledged container terminal were built at Qasim, under free competition it is more than likely that containers transported by liners will still concentrate at Karachi.

It can not be overlooked that in these conditions the increase of full container vessels in number will be unexpectedly slowed down.

It must be pointed out here that the discussion so far has concerned liners which must follow a schedule in calling at a number of different ports. The situation is different, however, for trampers or bulkers which carries cargo on an individual contract, since should any of the problem raised above occur, they can be resolved under the terms of the contract.

2-2-2 Discussion on Various Aspects

1) Engineering Aspect

There is no substantial difference in scale and structure for the container terminal required for Karachi and Qasim Ports, but some of the surrounding conditions are different, bringing a slight difference in project cost. As shown in Table 4, the project cost of the Urgent Plan for Karachi amounts to about 115 million U.S. dollars, approximately 10% higher than that for Qasim, at about 103 million U.S. dollars. This is due mainly to the differences in cost for dredging/reclamation work and access rail/road. The bed soil in the project site at Karachi is classified medium to hard and this makes the cost of dredging/reclamation work higher than that for Qasim by about 4.9 million U.S. dollars. The other factor in the cost difference is the distance

of the container terminal site from the existing road/rail network. The terminal site in Karachi has been selected at a greater distance compared with that at Qasim in consideration of the soil balance in dredging/reclamation and the hardness of the sea bed material. The access road is aligned to meet Mauripur Road with a fly-over to avoid a level crossing with Karachi Circular Railway. The construction cost of an access rail/road and slope protection in Karachi is higher than that in Qasim by about 5.0 million U.S. dollars.

The quay wall work differs in the dimension of caissons, hardness of the bed soil, construction methods, etc. for both ports, but these cancell out giving nearly the same construction cost.

As for future land availability, both Karachi and Qasim Ports are favored by a spacious area and there is no hindrance to future port expansion in both Ports.

2) Operational Aspect

There is no comparison between the two ports from the viewpoint of operational experience. The modern development of Karachi Port started in 1854 with dredging of the main channel, and at present it has 24 multipurpose berths and 4 oil piers. In 1980, Karachi Port handled about 15 million tons of dry/wet cargoes, including more than 50,000 TEU of container cargo. In Qasim Port, however, there are, at Marginal Wharf, 4 berths completed and 3 berths under construction, and Iron Ore and Coal Berth. In 1980, the Iron Ore and Coal Berth started bulk cargo handling to feed raw material to Steel Mill but all the berths at Marginal Wharf are in operation.

Due to the difference in past experience described above, Qasim Port lags far behind Karachi Port in port operation.

3) Approach Channel

The approach channel in Karachi Port is much shorter and easier to maintaine than that in Qasim Port. The approach to the container terminal in Karachi Port is about 11 km long and almost straight in alignment, while the channel in Qasim Port is 42 km long and rather complicated along the reach of the inner creek. On the outer channel of Qasim Port, maintenance dredging of about 1.8 million m^3 per year is necessary to keep the required depth at an equilibrium stage, while about 1.0 million m^3 is calculated as necessary for Karachi Port.

4) Commercial Aspect

As mentioned in 2) Operational Aspect, Qasim Port started bulk cargo handling only in 1980 and port related infrastructure and functions have not been developed yet. Container transportation deals substantially with general cargo which can be smoothly transported only when fully supported by a well developed infrastructure and functions of a commercial nature. Therefore, the container terminal, if constructed in Qasim, will necessitate investment in port related infrastructure. In Karachi, this infrastructure has already been developed and little investment is required.

Next, the port users. As can be seen from the example the main factor is the difference in port charges. For comparison of the two ports' charges, the figures for an average size cargo vessel (5,900 GRT = 3,400 NRT) carrying general cargo and unloading over 7 days are given below.

	Karachi		Qasim		Ratio
Port Due	3 Rs/NRT	10,200 Rs	18.5 Rs/GRT	109,150 Rs	
Berthage	0.5 Rs/NRT/day	11,900	4.3 Rs/GRT/day	177,590	
Pilotage	1 Rs/NRT (in/out)	6,800	4 Rs/NRT (in/out)	27,200	
	Sub-Total	28,900	Sub-Total	313,940	
		(2,919 $)		(31,711 $)	10.9
Wharfage	16 Rs/t	80,000 Rs	48 Rs/t	240,000 Rs	
		(8,081 $)		(24,242 $)	3.0
	Grand Total	108,900 Rs	Grand Total	553,940 Rs	
		(11,000 $)		(55,954 $)	5.1

As can be seen from the above, the charges for Qasim are set much higher than for Karachi in all respects. Of these, the total of the port dues, berthage and pilotage costs which the shipping company must bear, is, compared with the total freight charge on a journey from Tokyo to Karachi ($95/t x 5,000 t = $475,000) 0.6% in the case of Karachi and 6.7% in the case of Qasim, a considerable difference. Charges for regular shipping carrying general cargo are usually fixed by individual conference, and if there in another nearby port the shipping company will naturally choose the cheaper one. On the other hand, this in never the case for irregular shipping, since the freight rates are not fixed. Furthermore since bulk cargo in usually government cargo, it can be directed to use a specific port in accordance with government policy. The difference in port charges for general cargo is particularly important to semi-container ships. In other words, even if a container terminal were built at Qasim, it is likely that semi-container shipping company would still go to Karachi, and it can be expected that there would be more semi-container ships using Karachi than full container ships using Qasim.

The construction of a container terminal at Qasim, with full container ships being handled at Qasim and semi-container ships separately at Karachi, would mean that it would be difficult to create a unified and highly effective container transport system.

5) City/Inland Traffic

Karachi City suffers from heavy traffic congestion particularly in the city area, while there is no traffic problem around the Qasim area with a newly constructed access road and National Highway nearby. According to a cargo flow analysis, about 40% of port cargo originates or is destined for the Karachi area and the remainder is transported to/from up-country. The traffic congestion in Karachi, in the case of constructing the container terminal in Qasim together with sufficient infrastructure, could be reduced by removing the through-traffic to/from up-country from Karachi City. While the traffic conditions in Karachi will remain almost the same for cargo to/from Karachi area alone, even if the container terminal is constructed in Qasim. Therefore, in the case of a container terminal constructed in Karachi, the Team has recommended an improvement of roads along the outskirts of Karachi City through Mauripur Road, Estate Avenue and up to the Super Highway in order to reduce the traffic congestion in the city. It should be noted that containerization does not necessarily put an additional traffic volume but is merely a conversion of traffic means.

In addition to the above, it is necessary to give sufficient consideration to the transport congestion that has followed the introduction of container transport in Japan, as will be explained in the following. As a devlopmental mode for this report, we may cite the example of the construction of container terminal at Tokyo and Yokohama Ports. The container terminal at Yokohama was built in 1969, and that at Tokyo 2 years later in 1971. Yokohama having a long history of handling general cargo, the infrastructure for supporting port activities was sufficiently developed in the surrounding area. On the other hand, general cargo has only recently begun to be handled at Tokyo, and in this sense the situation resembles that of Karachi and Qasim Ports.

As the result of container terminal being built at about the same time at ports with these characteristics, a unique phenomenon which has been termed "roundabout transportation" has occured in the flow of cargo through the area surrounding the ports, as will be explained below. This roundabout transportation occurs in the following manner. In the case of imports cargo unloaded at Tokyo is transported to Yokohama, some 25 km to the south, removed from its containes there, and then brought back to Tokyo again. For exports, the reverse happens; in either case because of the underdevelopment of port-related infrastructure in Tokyo there is a wasted journey from Tokyo – Yokohama (approx. 25 km). This follows the results of a survey into this roundabout transportation conducted for the month of October in 1974 and 1978.

Roundabout Transportation of Container Cargo in Tokyo (Unit, t)

		Oct. 1974			Oct. 1978		
		Import	Export	Total	Import	Export	Total
Volume of cargo subject to roundabout transportation	a	52,696	69,494	122,190	62,872	54,104	116,976
Total volume of cargo	b	138,590	130,931	269,521	217,861	193,174	411,035
Roundabout transporation rate a/b		38.0%	53.1%	45.3%	28.9%	28.0%	28.5%

From the above it can be seen that in Tokyo in 1974 3 years after the completion of the container terminal, approximately half of the total volume of cargo was subject to this roundabout transportation, and in 1978, 7 years after completion, the figure was 1/3. If a container terminal were constructed at Qasim the same type of phenomenon can be expected to occur, and moreover, since the infrastructure at Qasim is less developed than at Tokyo, the figures are likely to be greater. This not only means that a large part of the cargo going up-country from Qasim would pass through Karachi, but also that the traffic congestion in Karachi is likely to become much worse. Moreover, if roundabout transportation were to occur, a secondary transport system to cope with it would become necessary.

6) Economic Returns, IRR

This project has been evaluated as economically feasible in terms of IRR (internal rate of return) as shown in Table 4. IRR's calculated on a shadow price base are 14.3% for Karachi Port and 12.2% for Qasim Port.

The total measurable benefits to be evaluated in the present analysis, as mentioned in PART

VI, are considered to be almost the same for both ports. Thus, the above difference of IRRs is due to differences of capital and running costs in both ports.

Among the capital costs, the construction cost of port facilities in Karachi Port is about 115 million U.S. dollars and is about 10% higher than that for Qasim Port. However, in the case of Qasim Port, it is necessary to invest in various port supporting infrastructure to secure smooth container transportation. But here, in order to avoid overestimation of the benefits, we assume that all labourers related to container transportation will commute to Qasim from Karachi City, rather than constructing all the facilities, such as offices for stevedoring companies and agencies, labourers' houses and shops etc.

The investment to provide a minimum port supporting infrastructure is estimated to be 15.2 million U.S. dollars, excluding land acquisition costs. However, taking into account that these facilities could be also used for port activities other than container transportation, 7.6 million U.S. dollars, equivalent to 50% of the above estimate, has been finally adopted in the present analysis.

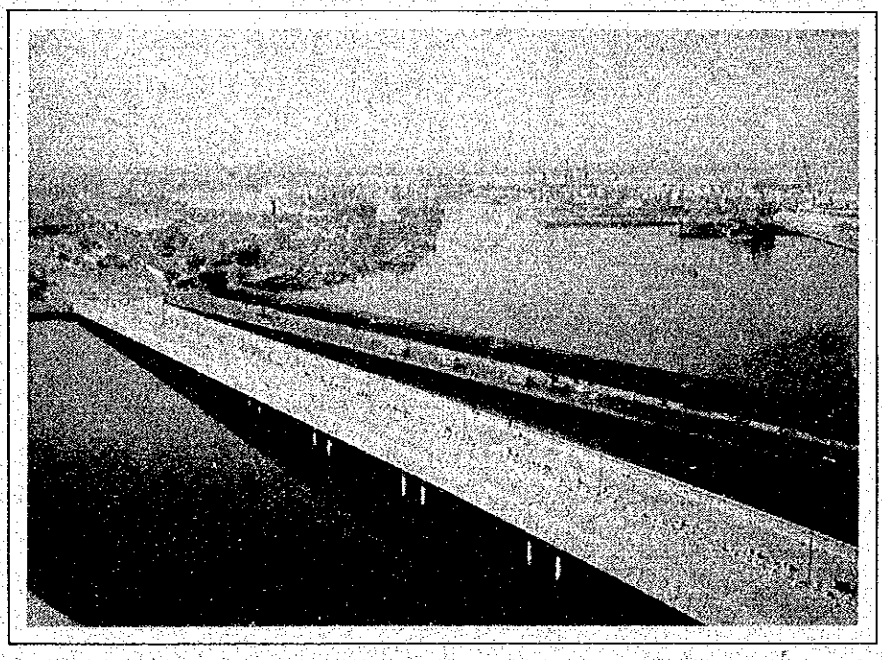
In addition to the above, the operation and maintenance costs for Qasim Port are higher than that for Karachi Port by about 5.0 million U.S. dollars, due mainly to a higher maintenance dredging cost and commuter traffic cost. The latter involves the operational costs for commuter traffic from Karachi to Qasim and for related business trips, and their cost.

The eventual IRR for Karachi Port will be about 2% higher than that for Qasim Port. There is no significant difference between shadow and market pricings, and this can be explained by the fact that nearly 80% of all the benefits are valued almost the same on both the shadow and the market price base.

Table 4 Comparison of Karachi and Qasim Port

	Karachi	Qasim
1) Engineering aspect		
Dredging work, bed soil	medium to hard	medium
Quay wall, crown height	+4.5 m	+5.2 m
Access road/rail, length	3.8 km	2.5 km
Future expansion, land	available	available
Project cost	115 mil. US$	103 mil. US$
2) Operational aspect		
Port operation	experienced	a little
Container handling	experienced	none
Semi/Full-cont. ship	unified handling	Separated handling
3) Navigational channel		
Approach channel, length	11 km	42 km
Maintenance dredging	1.0 mil. m^3	1.8 mil. m^3
4) Commercial aspect		
Port related function	exist	partly under construction
Port tariff, general cargo	1	: 5
bulk cargo	1	: 10
5) City/Inland traffic		
City traffic	to be bypassed	possible roundabout transportation
Inland traffic, port/up-country distance by rail	1,200 km	1,180 km
6) Economic return, IRR		
Shadow pricing	14.3%	12.2%
Market pricing	14.8%	12.7%

SUMMARY



SUMMARY

1. Container Traffic Forecast

A maritime container traffic forecast involves two steps. First, there must be the usual seaborne cargo forecast (total cargo forecast) not specific to container traffic. The second step is to estimate the quantity of container cargo out of the total seaborne cargo.

Traffic forecasts conducted in the past are reviewed, and assumed to comprise the entire volume of future port cargo. The volume of future container traffic is forecasted by considering containerizability of each commodity through analysis of past trends of containerization and whether the sea route is already containerized or not. The growth of containerization is approximated by a logistic curve in which the historical trend and ultimate containerizability are taken into account.

The target year for the Master Plan is set at 2000, while for the Urgent Plan, a possible completion year of 1987 has been set which allows sufficient time for various procedural steps such as a detail design, loan negotiations, tendering requirements, etc.

The volumes of container cargo in the above years are shown in Table 1 and summarized as below.

		1987–88	1999–2000
Volume of Container Cargo, ('000 ton)	Export	890	2,655
	Import	857	3,221
	Total	1,747	5,876

Table 1 Container Traffic Forecast

('000 M/T)

No.	Export	87/88	99/00	Import	87/88	99/00	Export/Import	87/88	99/00
1	Total	5,607	6,423	Total	10,836	21,851	Total	16,443	28,274
2	Total Liquid Cargo	1,167	643	Total Liquid Cargo	6,396	13,096	Total Liquid Cargo	7,563	13,739
21	Petroleum/Products	1,017	493	Petroleum/Crude	3,655	4,004			
22	Molasses	150	150	" /Products	2,361	8,337			
23				Edible Oils	380	755			
3	Total Dry Cargo	4,440	5,780	Total Dry Cargo	4,440	8,755	Total Dry Cargo	8,880	14,535
31	Rice	1,860	2,590	Wheat	370	1,120			
32	(Basmati)	(465)	(650)	Fertilizer	720	1,360			
33	(Coarse)	(1,395)	(1,940)	Phosphate Rock/Sulpher	530	780			
34	Fertilizer	870	570	Cement	-	-			
35	Sugar	200	200	Iron/Steel	-	550			
36	Cotton	300	300	Other Dry Cargo	2,820	4,945			
37	Other Dry Cargo	1,210	2,120						
4	Total Containerizable Cargo (31 + 35 + 36 + 37)	3,570	5,210	Total Containerizable Cargo (35 + 36)	2,820	5,495	Total Containerizable Cargo	6,390	10,705
	Containerized Routes			Containerized Routes			Containerized Routes		
41	(Share, %)	69.7	69.7	(Share, %)	64.3	64.3	(Share, %)	67.3	66.9
42	(Quantity) (4 x 41)	2,488	3,631	(Quantity) (4 x 41)	1,813	3,533	(Quantity) (42 / 4)	4,301	7,164
	Other Routes			Other Routes			Other Routes		
43	(Share, %)	30.3	30.3	(Share, %)	35.7	35.7	(Share, %)	32.7	33.1
44	(Quantity) (4 x 43)	1,082	1,579	(Quantity) (4 x 43)	1,007	1,962	(Quantity) (44 / 4)	2,089	3,541
5	Total Containerized Cargo (52 + 54)	890 (888)	2,655	Total Containerized Cargo (52 + 54)	857 (830)	3,221	Total Containerized Cargo	1,747 (1,718)	5,876
	Containerized Routes			Containerized Routes			Containerized Routes		
51	(Percentage of containerization)	33.6	60.6	(Percentage of containerization)	44.5	69.9	(Share, %) (52 / 42)	38.2	65.2
52	(Quantity (42 x 51)	836	2,200	(Quantity) (42 x 51)	807	2,470	(Quantity)	1,643	4,670
	Other Routes			Other Routes			Other Routes		
53	(Percentage of containerization)	5.0 (4.8)	28.8	(Percentage of containerization)	5.0 (2.3)	38.3	(Share, %) (54 / 44)	5.0 (3.6)	34.1
54	(Quantity) (44 x 53)	54 (52)	455	(Quantity) (44 x 53)	50 (23)	751	(Quantity)	104 (75)	1,206

2. Inland Container Transport

The main consumption centres in Pakistan, except Karachi and Hyderabad, are located in the Punjab province some 1,200 km away from Karachi Port. In order to transport seaborne containers safely, economically and quickly over such a long distance, various aspects of transportation are studied and summarized below.

Bottlenecks for inland container transport on existing railway and roads in Pakistan, and specially in Karachi City, were found through inventory studies in chapter 1 and 2.

Secondly, the present distribution pattern of seaborne containerizable cargoes between Karachi Port and up-countries was estimated in chapter 3 on the basis of NTRC Road O/D data and railway O/D Tables. In addition, future distribution of seaborne container cargoes in 1987/88 and 1999/2000 were also estimated for the uture demand of seaborne cargo traffic. The Results are summarized in Table 2.

Selection of an inland container transport system was made in chapter 4 by comparing the two alternatives shown in Fig. 1. As a result, the multimodal transport system was selected for the section between the port and the north regions, including Lahore, against the direct road transport system. Therefore, a unit train system is to be introduced between the port and the Inland Container Freight Station at Lahore.

According to the comparison studies, the present value for the multimodal transport system i.e. rail and road transport, is only about half that of the direct road transport system. Cost flows of alternatives for a project life of 20 years are shown in Table 3 and Table 4.

Finally, procurement of required railway container transport equipment and improvement of roads in Karachi for inland container transport were proposed by the team on the basis of the above studies. Those proposals for both urgent and master plans are shown in Table 5–6.

Table 2 Container Traffic by Area in 1987/88 and 1999/2000

Year: 1987/88 (Unit: ,000 tonnes)

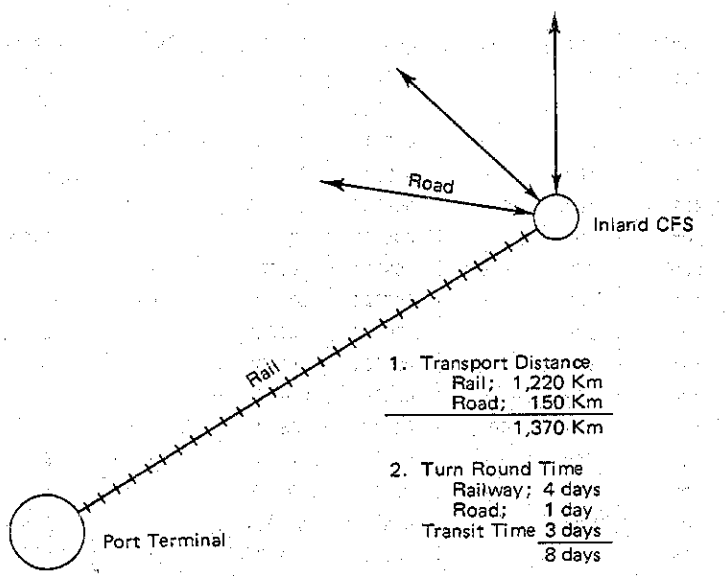
Area	Case I: Including Military Traffic			
	Import	Export	Total	Priority
1. Karachi	330	301	631	Karachi Port
2. Multan	66	176	242	2
3. Lahore	360	359	719	1
4. Peshawar	46	53	99	3
5. Quetta	55	1	56	4
Total	857	890	1,747	

Year: 1999/2000 (Unit: ,000 tonnes)

Area	Case I: Including Military Traffic			
	Import	Export	Total	Priority
1. Karachi	1,239	955	2,194	Karachi Port
2. Multan	250	453	703	2
3. Lahore	1,351	1,081	2,432	1
4. Peshawar	175	163	338	3
5. Quetta	206	3	209	4
Total	3,221	2,655	5,876	

Fig. 1 Comparison of Inland Transportation System

Case: Multimodel Transport System



1. Transport Distance
   Rail; 1,220 Km
   Road; 150 Km
   1,370 Km

2. Turn Round Time
   Railway; 4 days
   Road; 1 day
   Transit Time 3 days
   8 days

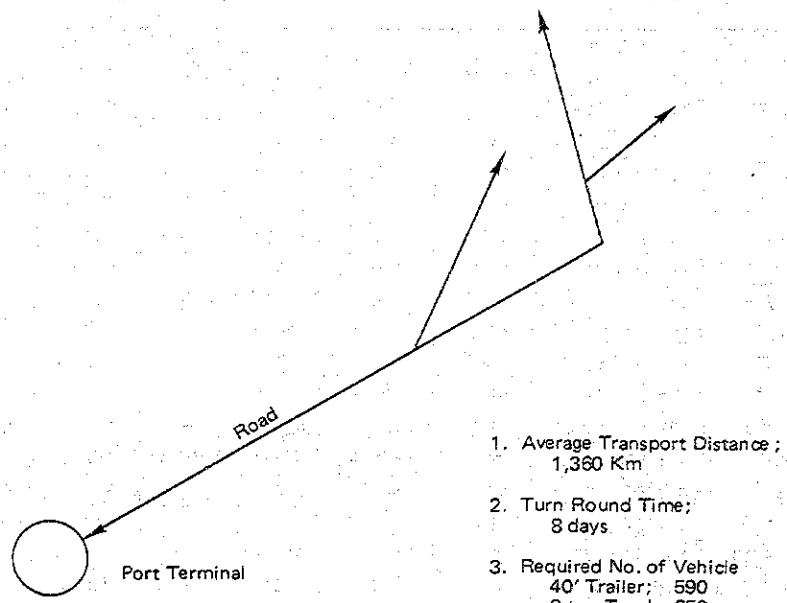
3. Required No. of Transport Equipment
   Railway Wagon; 200
   D.E. Loco; 8
   Shunting Loco; 2
   40' Trailer; 73
   8 ton Truck; 100

Import; 36,142 TEU
Export; 29,952 TEU

FcL; Import 21,685 TEU
Export 17,972 TEU

LcL; Import 14,457 TEU
Export 11,980 TEU

Case; Road Transport System



1. Average Transport Distance ;
   1,360 Km

2. Turn Round Time;
   8 days

3. Required No. of Vehicle
   40' Trailer; 590
   8 ton Truck; 650

Table 3 Cost Flow of Multimodal Transport System

	Year	Railway Transport Cost (1220 km)			Terminal Cost						Road Transport Cost (150 km) FCL + LCL			Road Cost (150 Km)	Railway Cost	Total Cost	Discanted at 12% p.a.
					Port Terminal			Inland CFS									
		Capital	W.E	S.Total	Capital	W.E	S.Total	Capital	W.E	S.Total	Capital	W.E	S.Total				
0	1987/88	22,400	12,500	34,900	7,086	407	7,493	12,250	1,274	13,524	4,850	4,049	8,899	2,010	1,430	68,256	68,256
1	8	-	12,500	12,500	-	407	407	-	1,274	1,274	-	4,049	4,049	64	70	18,364	16,396
2	9	-	12,500	12,500	-	407	407	-	1,274	1,274	-	4,049	4,049	64	70	18,364	14,640
3	1990	-	12,500	12,500	-	407	407	94	1,274	1,368	-	4,049	4,049	64	70	18,458	13,138
4	1	-	12,500	12,500	-	407	407	-	1,274	1,274	-	4,049	4,049	64	70	18,364	11,671
5	2	-	12,500	12,500	-	407	407	-	1,274	1,274	-	4,049	4,049	65	70	18,364	10,420
6	3	-	12,500	12,500	-	407	407	94	1,274	1,368	-	4,049	4,049	64	70	18,458	9,351
7	4	-	12,500	12,500	400	407	807	1,491	1,274	2,765	4,850	4,049	8,899	64	70	25,105	11,356
8	5	-	12,500	12,500	-	407	407	-	1,274	1,274	-	4,049	4,049	64	70	18,364	7,417
9	6	-	12,500	12,500	-	407	407	94	1,274	1,368	-	4,049	4,049	64	70	18,458	6,656
10	7	-	12,500	12,500	-	407	407	48	1,274	1,322	-	4,049	4,049	2,010	70	20,358	6,555
11	8	-	12,500	12,500	-	407	407	-	1,274	1,274	-	4,049	4,049	64	70	18,364	5,279
12	9	-	12,500	12,500	6,666	407	7,073	10,568	1,274	11,842	-	4,049	4,049	64	70	35,598	9,137
13	2000/1	-	12,500	12,500	-	407	407	-	1,274	1,274	-	4,049	4,049	64	70	18,364	4,209
14	1	-	12,500	12,500	400	407	807	1,491	1,274	2,765	4,850	4,049	8,899	64	70	25,105	5,137
15	2	-	12,500	12,500	-	407	407	94	1,274	1,368	-	4,049	4,049	64	70	18,458	3,372
16	3	-	12,500	12,500	-	407	407	-	1,274	1,274	-	4,049	4,049	64	70	18,364	2,996
17	4	-	12,500	12,500	-	407	407	-	1,274	1,274	-	4,049	4,049	64	70	18,364	2,675
18	5	-	12,500	12,500	-	407	407	94	1,274	1,368	-	4,049	4,049	64	70	18,458	2,400
19	2006/7	-6,840	12,500	5,660	-2,262	407	-1,855	-3,821	1,274	2,547	-693	4,049	3,356	64	70	4,748	551
																Total	211,612

E.E; Working Expense

Table 4 Cost Flow of Road Transport System

	Year	Terminal Cost Port Terminal Capital	W.E	S.Total	Road Transport Cost (1360 Km) FCL + LCL Capital	W.E	S.Total	Road Cost	Total Cost	Discounted at 12% p.a.
0	1987/8	5,164	869	6,033	37,300	33,997	71,297	18,224	95,554	95,554
1	8	-	869	869	-	33,997	33,997	577	35,443	31,646
2	9	-	869	869	-	33,997	33,997	577	35,443	28,255
3	1990	94	869	963	-	33,997	33,997	577	35,537	25,295
4	1	-	869	869	-	33,997	33,997	577	35,443	22,527
5	2	-	869	869	-	33,997	33,997	577	35,443	20,111
6	3	94	869	963	-	33,997	33,997	577	35,537	18,004
7	4	1,091	869	1,960	37,300	33,997	71,297	577	73,834	33,399
8	5	-	869	869	-	33,997	33,997	577	35,443	14,315
9	6	94	869	963	-	33,997	33,997	577	35,537	12,815
10	7	28	869	897	-	33,997	33,997	18,224	53,118	17,103
11	8	-	869	869	-	33,997	33,997	577	35,443	10,189
12	9	3,808	869	4,677	-	33,997	33,997	577	39,251	10,075
13	2000/1	-	869	869	-	33,997	33,997	577	35,443	8,123
14	1	1,091	869	1,960	37,300	33,997	71,297	577	73,834	15,108
15	2	94	869	963	-	33,997	33,997	577	35,537	6,492
16	3	-	869	869	-	33,997	33,997	577	35,443	5,782
17	4	-	869	869	-	33,997	33,997	577	35,443	5,162
18	5	94	869	963	-	33,997	33,997	577	35,537	4,621
19	2006/7	1,511	869	642	-5,329	33,997	28,668	577	28,603	3,321
									Total	387,897

WE; Working Expense

Table 5-1 Proposed Access Improvement and Cost

Case: Karachi Port

Unit; 1,000 US$

	Proposed Access Improvement by 1987/88	Share of the Generated Traffic (%)	Cost Shared for Urgent Plan	Proposed Access Improvement by 1999/2000	Share of the Generated Traffic (%)	Cost Shared by 1999	Cost Shared for Master Plan
Road	Mauripur Road			Mauripur Road			
	1) Widening of existing 2-lane bridges on Mauripur Road Length; 350 m Lane ; 6-lane divided	7.2%	252.0	1) Widening of 6-lane Mauripur Road Length; 4.8 km (Bridge; 350 m) Lane ; 6-lane⇒8-lane divided	7.2% for (2.0km + Bridge) 8.7% for 2.45km	169.2 63.9	
	*Mauripur Road will be widened by KPT and KDA by 1984.			Northern Bypass			
	Estate Avenue and Shahrah-e-Ibne Seena			2) Improvement of Khayaban-e-chishty junction	4.6%	4.4	
	2) Removement of obstruction on Estate Avenue near shershah Length; 1 km Lane ; 2 -lane⇒4-lane	4.6%	13.8	3) Widening and improvement of Manghopir Road from Estate Avenue up to Road 2000 Length; 7 km Lane ; 6-lane divided	1.0% for 2.5 km 2.5% for 4.5 km	7.5 67.5	
	3) Improvement of the round-abouts on shahrah-e-Ibne Seena as a signalized junction No of round about; 3	1.4%	4.0	4) Improvement, widening and extension of Road 2000 from Manghopir Road Length; 5.2 km Lane ; 6-lane divided	3.6%	112.3	
	Shahrah-e-Pakistan			5) Construction of the new road from Super Highway up to Road 2000 Length; 2 km (Bridge; 150 m) Lane ; 6-lane divided	6.6%	267.3	2,359.3 = 1,158.9 + 1,200.4
	4) Removement of garrages and encroachments located near junction with Rashid Minbas Road Length; 500 m Lane ; 2-lane⇒ 4-lane divided	2.0%	3.0	6) Construction of the clover-leaf junction on Super Highway near scheme No.33	6.6%	314.3	
	Maulvi Tamizuddin Khan Road			Southern Bypass			
	5) Widening of remaining portion of Mulvi Tamizuddin Khan Road Length; 1.6 km Lane ; 2-lane⇒ 4-lane divided	1.9%	9.1	7) Construction of the new road from Moulvi Tamizuddin Khan Road to clifton through China Creek Length; 2.4 km Lane ; 4-lane divided	2.1%	30.2	
	6) Widening of the bridge over railway near Dawood Centre Length; 100 m Lane ; 2-lane⇒4-lane divided	1.9%	9.5	8) Construction of the service road along with Sunset Boulevard Road Length; 4.4 km Lane ; 1 lane each side	2.7%	23.8	
	Other			9) Construction of two bridges over the Malir River Length; 700 m Lane ; 4-lane divided	2.0%	140.0	
	7) Improvement of the junction near Qamar House	10.9%	10.4				
Rail	Construction of new single railway line along with Circular Railway from entrance of New Terminal up to Karachi Bunder Length; 3 km	100.0%	857.1				
		Total	1,158.9		Total	1,200.4	

Table 5-2 Proposed Access Improvement and Cost -- Cont'd

Case: **Qasim Port**

Unit; 1,000 US$

	Proposed Access Improvement by 1987/88	Share of the Generated Traffic (%)	Cost Shared for Urgent Plan	Proposed Access Improvement in 1999/2000	Share of the Generated Traffic (%)	Cost Shared in 1990/2000	Cost Shared for Master Plan
Road	Southern Bypass			Port Qasim Access Road			
	1) Construction of the connecting road from Port Qusim Access Road up to Road 1600 in Korangi Length; 10.5 km Lane ; 2-lane	6.4%	201.6	1) Widening of the 2-lane access road and Construction of clover-leaf junction on National Highway Length; 12 km (Bridge; 20 m) Lane ; 2-lane=>4-lane divided	46.6%	3,943.2	3,943.2
				Southern Bypass			
				2) Widening the connecting road from the Access Road up to Road 1600 Length; 10.5 km Lane ; 2-lane =>4-lane divided	6.4%	201.6	403.2
				National Highway-Super Highway			
				3) Construction of the new road from National Highway up to Super Highway Length; 13.3 km (Bridge; 700 m) Lane ; 2-lane	9.6%	698.9	698.9
				Construction of passing lane Length; 1,000 m	100%	285.7	285.7
Rail							
		Total	201.6		Total	6,483.5	6,685.1

Table 6 Required No. of Equipment and Cost in 1987/88, 1999/2000

(Unit: 1,000 US$)

Equip.	Unit Price	1987/88		1999/2000	
		No. of Equip.	Cost	No. of Equip.	Cost
Wagon	57	200	11,400	800	45,600
Locomotive	1,200	8	9,600	32	38,400
Shunting Loco	700	2	1,400	2	1,400
		Total	22,400	Total	85,400

3. Development Plan

3-1. Current Port Condition

Pakistan has two Ports which are open to international seaborne trade. Karachi Port was and still is a main gate for seaborne cargo with 24 berths plus 4 berths under construction, while Qasim Port, having 7 berths at Marginal Wharf and IOC Berth, is expected to play an important role as the second international port, especially in bulk cargo handling.

In 1980, Karachi Port handled about 7.2 million tons of dry cargo and received about 1600 ships.

Container transportation was first introduced to Pakistan in 1973 and in Karachi Port strenuous efforts have been made to handle container cargo by expanding container yards. In 1980, more than 50,000 TEUs were handled in Karachi Port and container cargo shows continuing increases in volume.

Karachi Port has wharves totaling 14,898 ft (4,540 m) in length with 24 berths raning in water depth from −28 ft (−8.5 m) to −34 ft (−10.4 m) and four newly constructed berths of −30 ft (−9.1 m) as well as three oil berths with a water depth of −32 ft and an oil berth designed for 75,000 DWT tankers. In addition, there are two ship repair

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Qasim Port has a channel of about 25 miles in length, providing access to the harbor. The mooring facilities of the port comprise four multipurpose "marginal wharf" berths, each with a water depth of −10 m and a length of 200 m, and an iron ore berth with a water depth of −12.4 m and a length of 279 m. In addition, three berths with a total length of 600 m are now being constructed as extensions to the marginal wharf.

3-2. Container Cargo Volume

A target year for the urgent plan has been set for the year 1987 by considering the expected completion year of the container terminal and expected increases of container cargo; and the target year for the master plan was chosen as the year of 2000. In those years, the seaborne cargo volume has been forecasted as below.

('000 t)

Year / Cargo	80/81	87/88	Growth Rate	99/2000
Dry Cargo Total	7,189	8,878	– 4.2% –	14,535
General Cargo	3,650	4,530	– 5.0% –	8,115
Bulk Cargo	3,539	4,348	– 3.3% –	6,420
Container Cargo		1,747	– 10.6% –	5,876

As shown above, dry cargo is forecasted to increase at a rate of about 4%. This can be broken down to a rate of 5% for general cargo and about 3% for a bulk cargo. And it is forecasted that the general cargo will be converted to container cargo at the high rate of about 11% per annum. This predicted marked trend of increase is a strong reason for introduction of container transportation to Pakistan.

3-3. Natural Conditions

In the Western Backwater Area of Karachi Port, the base formation appears at depths from −3 m to −20 m. This formation has an N value of more than 60 or is impenetrable. It contains various soils and Tertiary rocks and extends down to a considerable depth. It is topped by a layer of medium to high density sand ranging in N value from 4 to more than 60, or clay of medium to great hardness. This layer ranges in thickness from 1.5 m to 21 m. This, in turn, is topped by a weak layer of clay or sand, which accumulates to the surface of the ground.

At the site selected for a possible container terminal in Qasim Port, the base formation appears at a water depth of about −15 m and is distributed almost horizontally. From data gained from the test on this formation, which was conducted in only a part of the area, it can be presumed that the formation is a layer of hard clay with an S.P.T. of more than 50 blows/2 inches. It is topped by a layer of sand with medium compactness and clay with medium hardness, though with differences by place, which accumulates to the ground surface. But in the part of the shore-side half of the area proposed for the construction of the container terminal, near the iron ore berth, weak and soft clay accumulates to a thickness of about 12 m.

3-4. Scale and Layout of Container Terminal

The cargo handling capacity of a container berth is approximately one million tons per year. According to this empirically derived figure, the required numbers of container berths are thought to be two for the urgent plan and six for the master plan, and this is verified as

appropriate by queuing theory. The container terminal site has been selected for the Western Backwater Area in Karachi Port in consistence with past studies. For Qasim Port, the site selected is immediately downstream from the Marginal Wharf in consideration of the convenience of construction arrangements and construction costs, etc.

The layouts for these possible container terminals are shown in Fig. 2 and Fig. 3.

The alternative plan of converting Marginal Wharves No. 5–7 into a container terminal has been dropped, because port congestion will become a severe problem shortly after the completion of the container terminal, due to lack of berths as illustrated in Fig. 4.

From a structural point of view, these berths can be equipped with container cranes, but of the total length of 600 m, 75 m of berth No. 5 is designed for a berth water depth of −10 m; therefore, this berth is too shallow for use as a container berth.

For a structural type of container berth, the concrete caisson type has been adopted in consideration of the soil conditions of the project area, construction cost, construction period and the relative ease of construction. The stone-pitched type of sloping revetment was adopted for the bulkheads in consideration of the lower construction cost, ground conditions, water depth and the fact that the waters in front are calm. A reinforced concrete structure was chosen for the shed, office and other buildings in light of its durability and a pile foundation structure was recommended because of the great load on a site which is reclaimed land.

Fig. 2 (1) Container Berth Layout, Karachi (Master Plan)

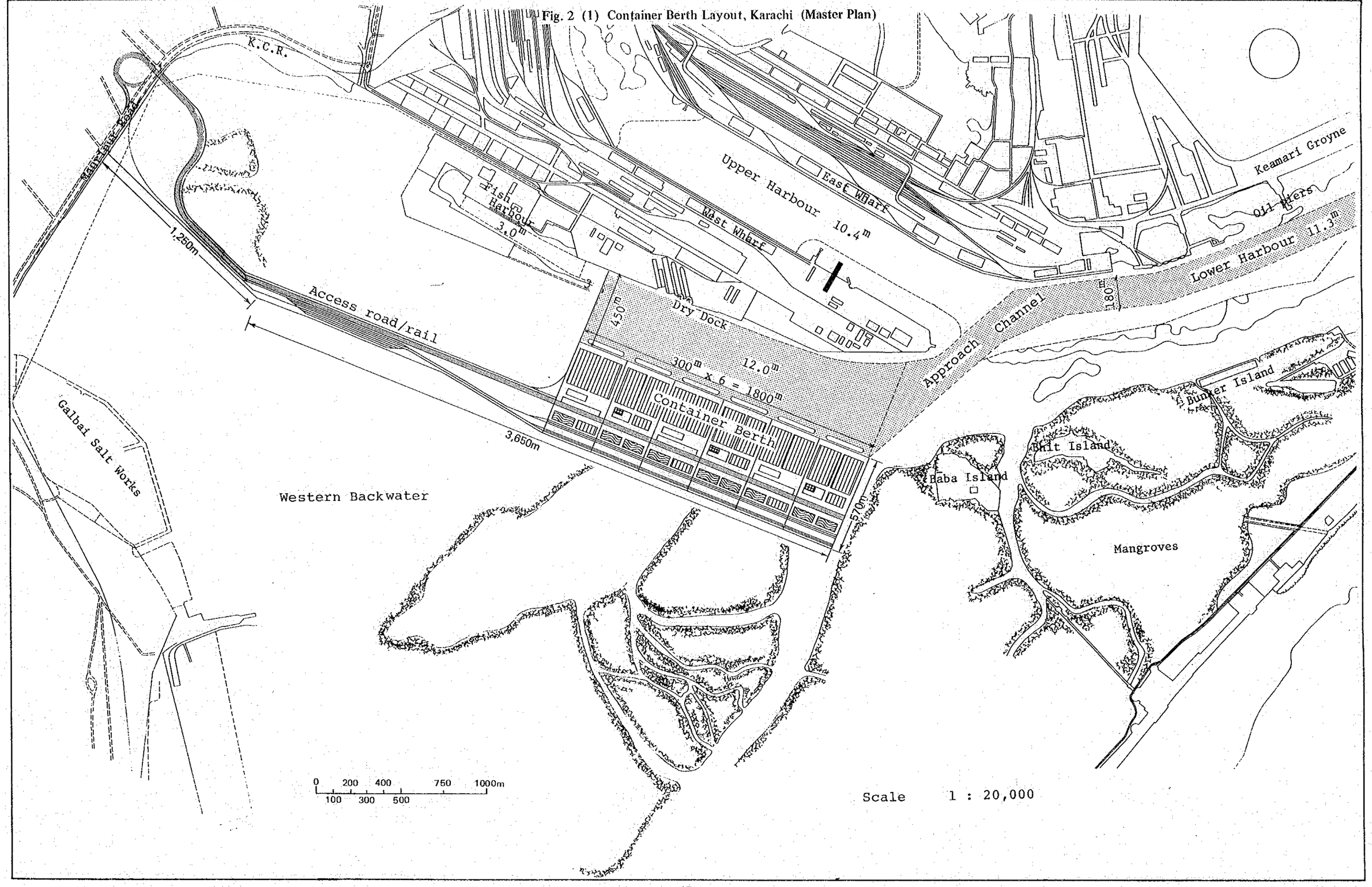


Fig. 2 (2) Container Berth Layout, Karachi (Urgent Plan)

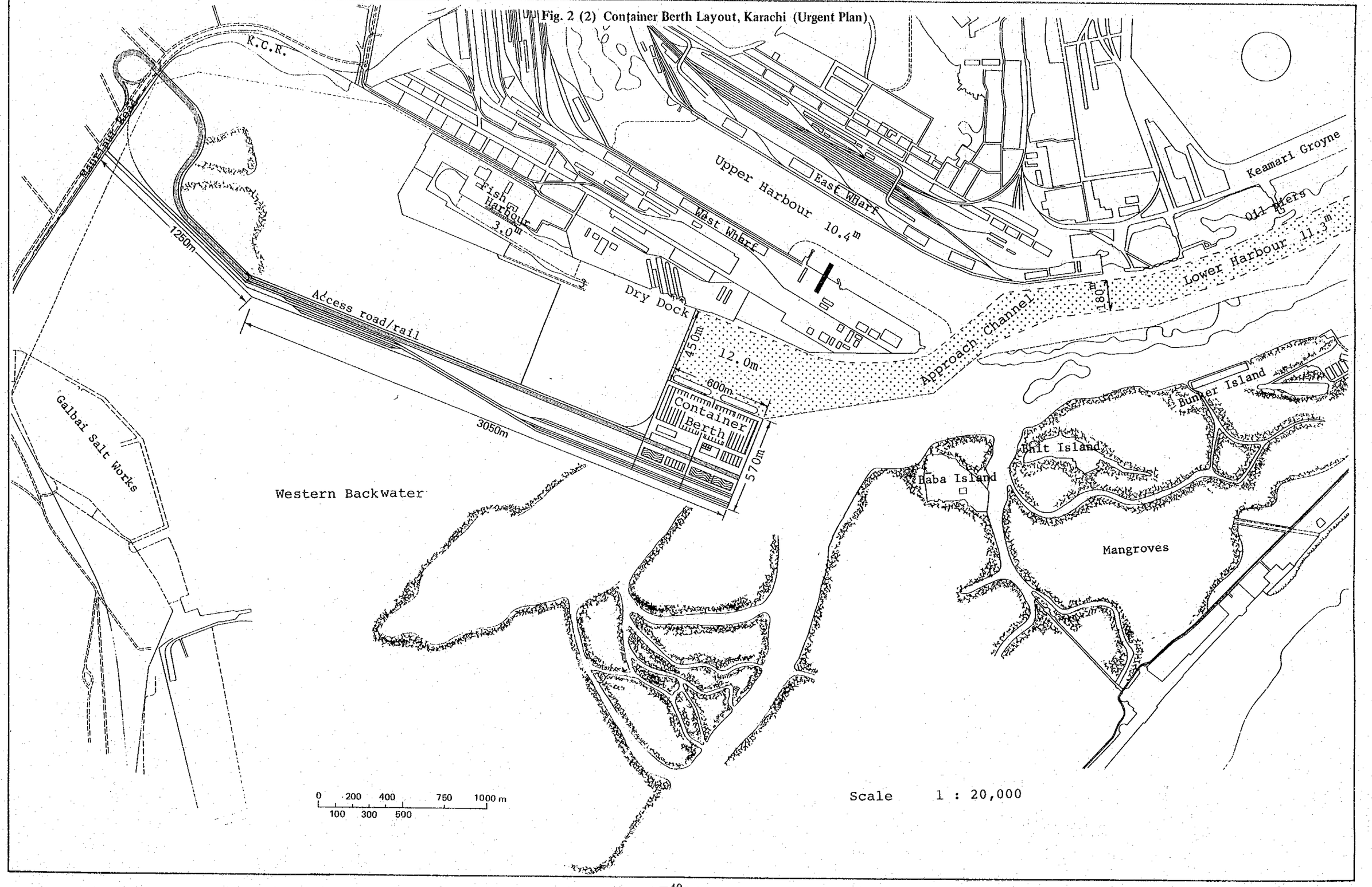


Fig. 3 (1) Container Berth Layout (Master Plan)

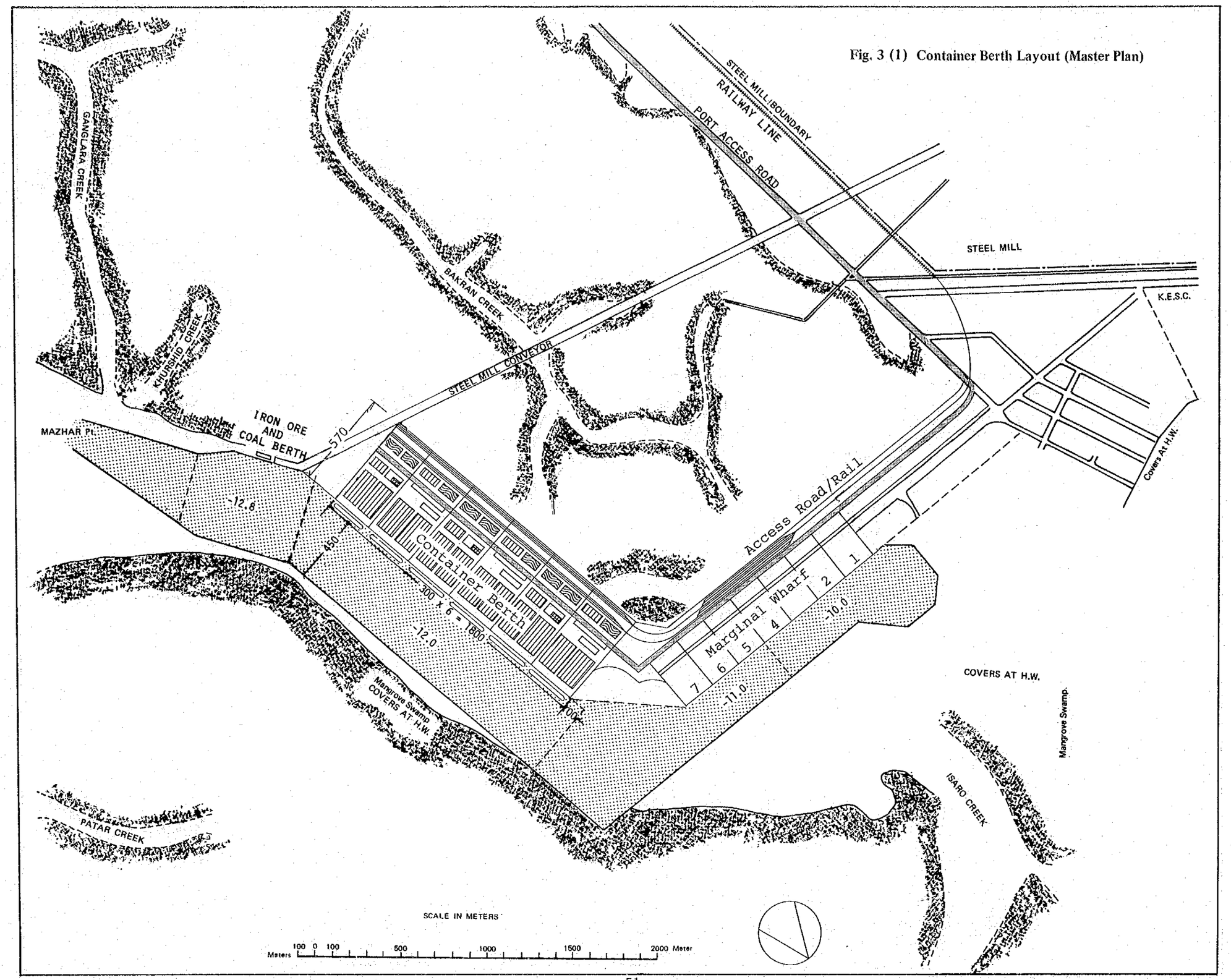
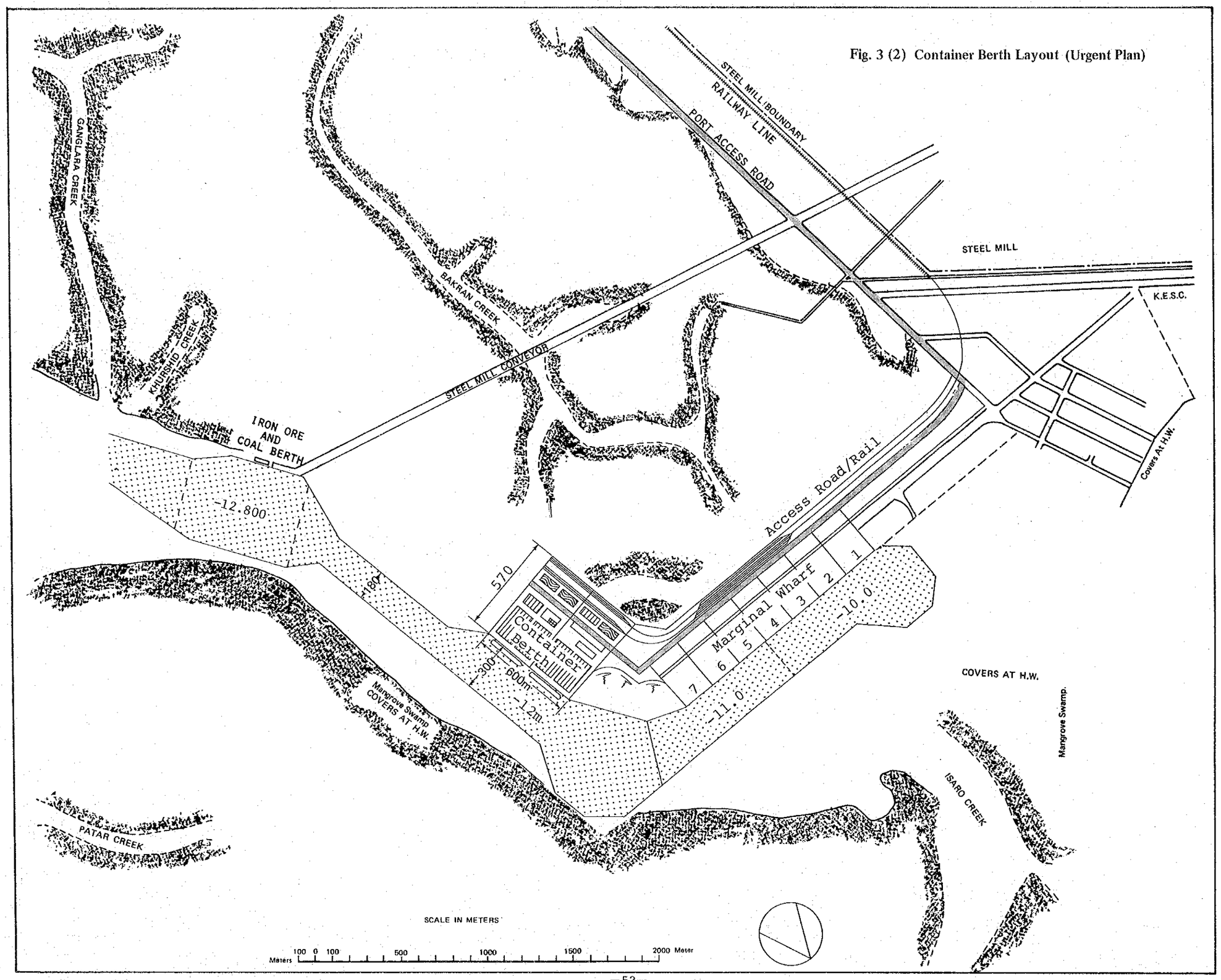


Fig. 3 (2) Container Berth Layout (Urgent Plan)



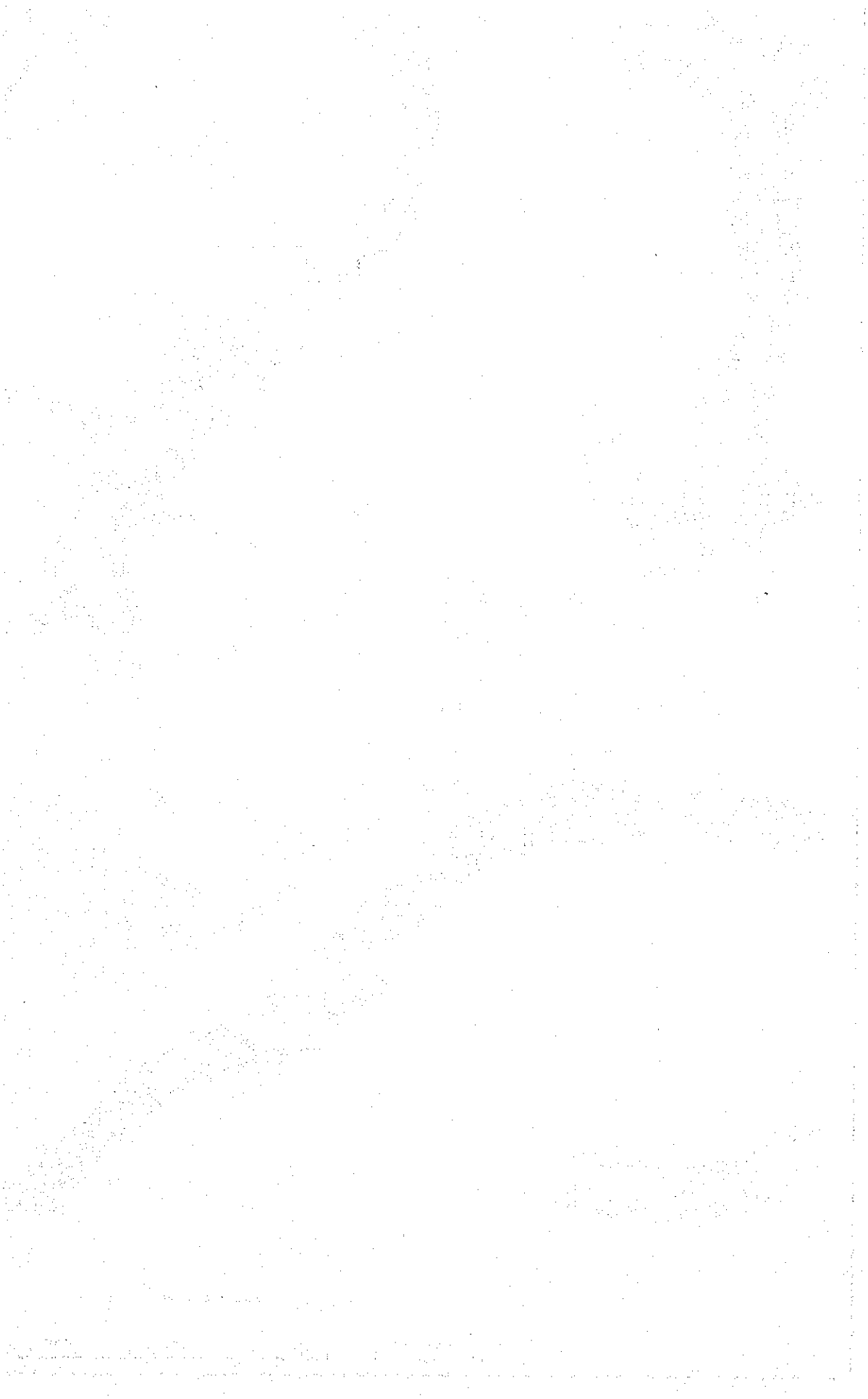
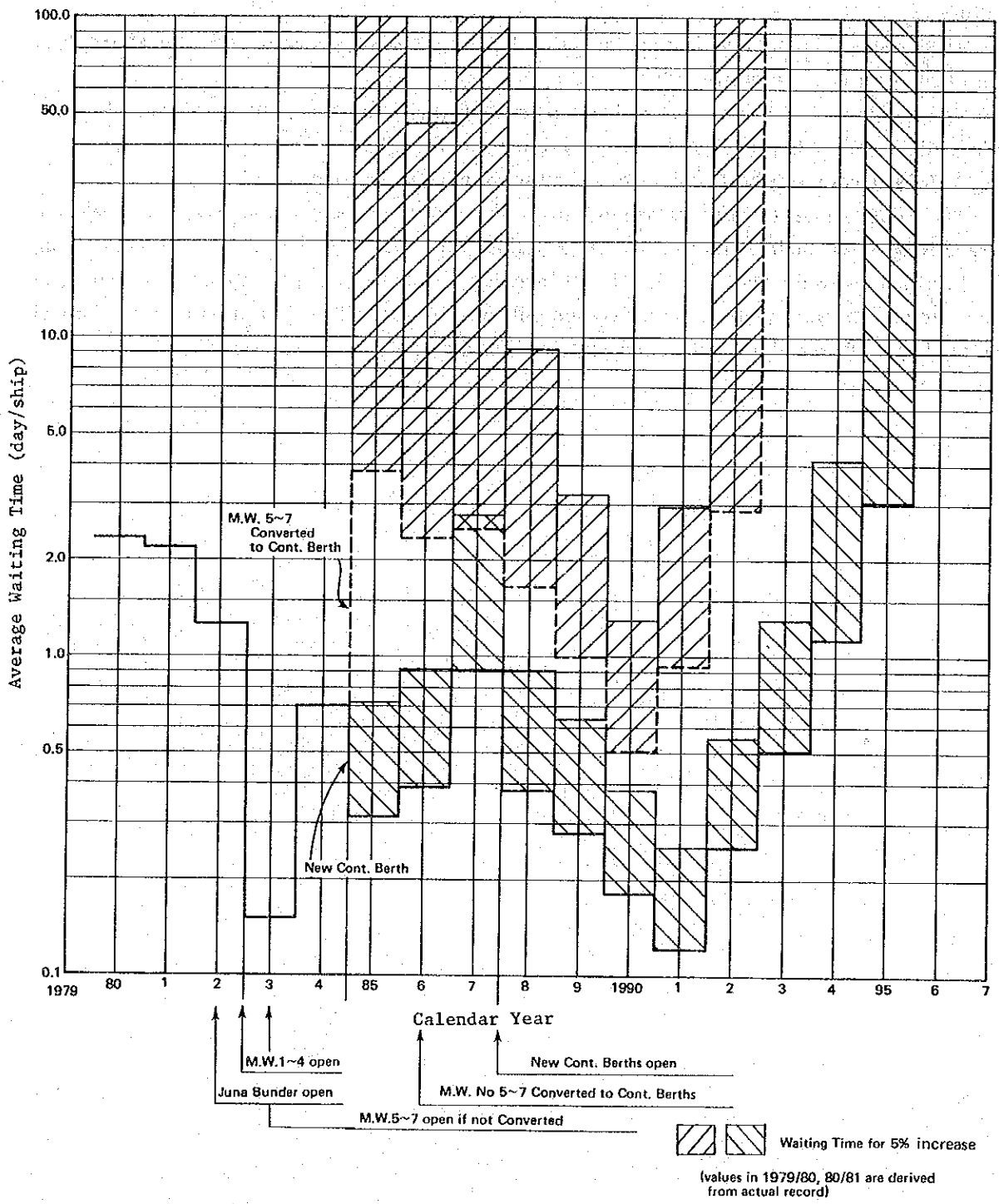


Fig. 4 Comparison of ship waiting Time



3-5 Port Container Terminal Plan

The results of the forecast for container and cargo movement for the Urgent Plan are shown in Fig. 5.

The proposed layouts of the main facilities in the port container terminal for the Master Plan and the Urgent Plan are shown in Fig. 6 and Fig. 7.

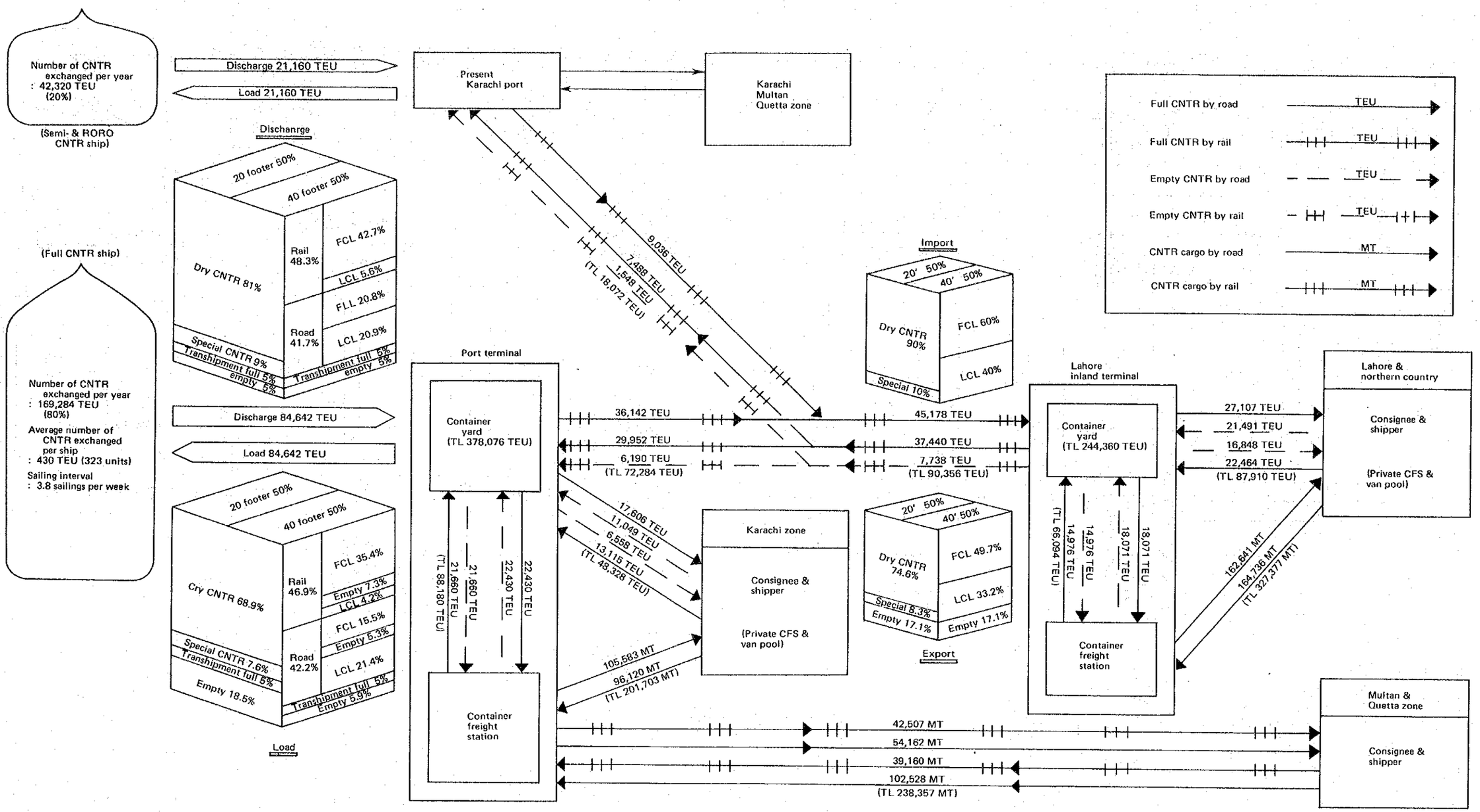
The required container and cargo handling equipment in the port container terminal for the Master Plan and the Urgent Plan is listed in Table 7 and Table 8.

A full size container berth will be equipped with two container cranes.

The rubber-tired transfer crane and the rail-mounted transfer crane have been selected respectively as the main equipment for the container yard operation and the unit train operation.

In order to ensure smooth and efficient inventory control of a large number of containers in the terminal, the yard plan computer system will be introduced into the port container terminal for the Urgent Plan and into the inland container freight station for the Master Plan.

Fig. 5 Forecast of Container & Cargo Movement (1987~1988)



- Share of CNTR stacked on CNTR yard of Port terminal
  - Import dry 31%
  - Export dry 27% { Over dimension 30%
  - Special 6% { Dangerous 40%
  - Empty 36% { Refrigerated 30%
- Percentage of empty CNTR stored at CNTR yard of port terminal
  - : 100% of export LCL CNTR
  - : 50% of export FCL CNTR

- Share of CNTR stacked on CNTR yard of Inland terminal
  - Import dry 28%
  - Export dry 20% { Over dimension 30%
  - Special 5% { Dangerous 40%
  - Empty 47% { Refrigerated 30%
- Percentage of empty CNTR stored at CNTR yard of inland Terminal
  - : 100% of export LCL CNTR
  - : 75% of export FCL CNTR

Fig. 6 Basic Layout of Port Terminal (Master plan)

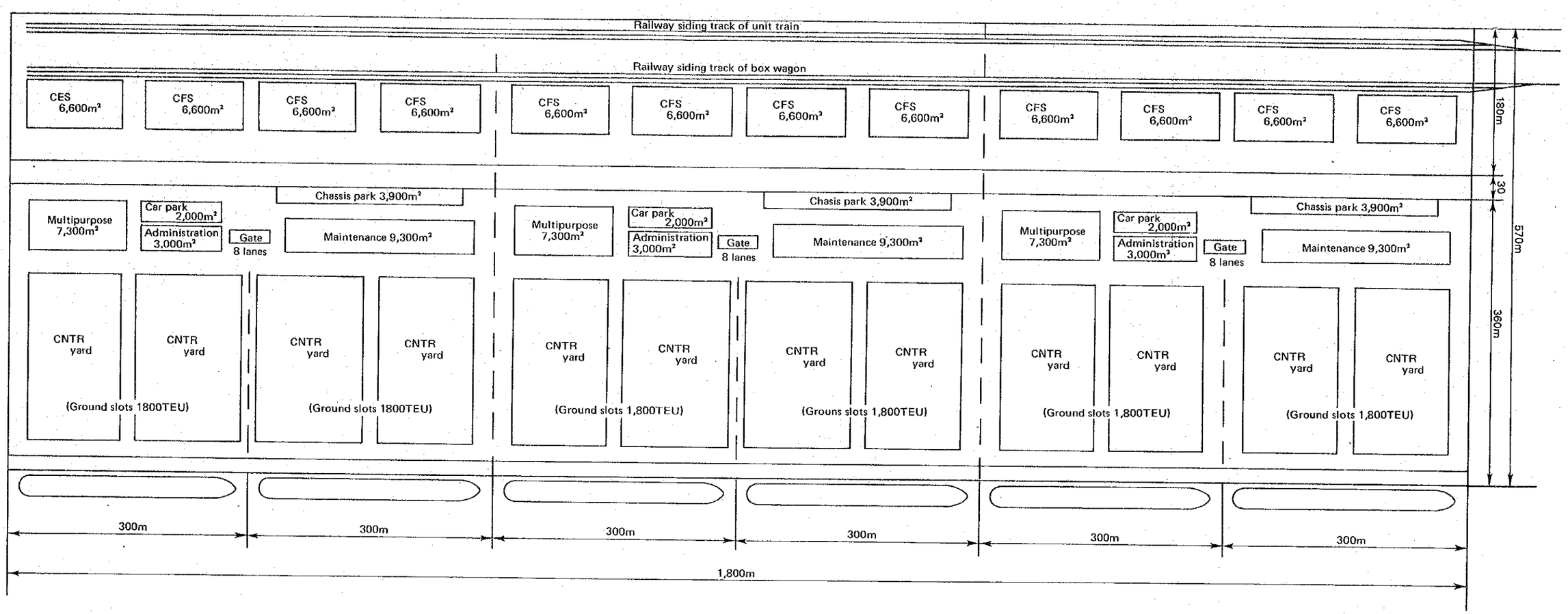


Fig. 7 Layout of Port Terminal (Urgent Plan)

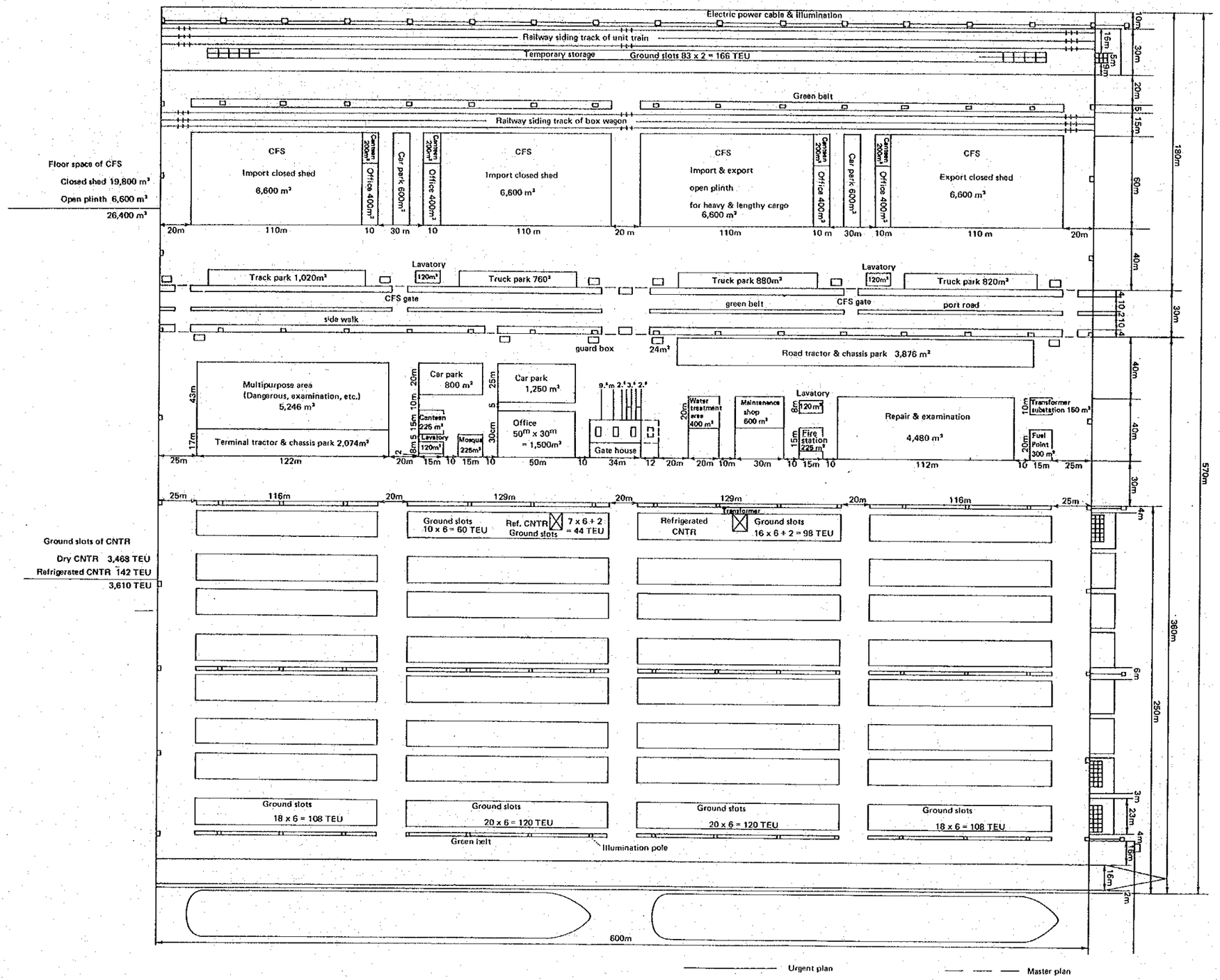


Table 7 Container Cargo Handling Equipments Required for Port Terminal (1999–2000)

(Unit: 1,000 US$)

Description of Equipments	Q'ty	Unit Cost	Total Cost
(Ship's operation)			
Container cranes	12	3,095	37,140
Tractors	48	37	1,776
Chassis 40' (20' x 2)	48	13	624
(Unit train operation)			
Rail-mounted transfer cranes	6	2,381	14,286
Tractors	24	37	888
Chassis 40' (20' x 2)	24	13	312
(Container yard operation)			
Rubber-tired transfer cranes	36	952	34,272
(Gate operation)			
Weighing scales	6	62	372
(Maintenance)			
Forklift truck			
3.0 tons	6	17	102
15.0 tons with telescopic side spreader	6	126	756
(CFS operation)			
Forklift trucks			
3.0 tons	120	17	2,040
6.0 tons	12	35	420
Tractors	24	37	888
Chassis 20 footer	120	10	1,200
40 footer	60	10	600
Pallets	13,650	0.04	546
(Mulitipurpose)			
35 tons mobile cranes for emergency use	3	190	570
Forklift trucks			
3.0 tons	9	17	153
15.0 tons	3	105	315
35 tons top lifters with telescopic spreader	3	310	930
(Terminal office)			
Computers	3	952	2,856
Wireless telephones (VHE)	165	2	330
Total			101,376

Table 8 Container Cargo Handling Equipment Required for the Port Terminal (1987–1988)

(Unit: 1000 US$)

Description of Equipments	Q'ty	Unit Cost	Total Cost
(Ships operation)			
Container cranes	4	3,095	12,380
Yard tractor	16	37	592
Yard chassis 40' (20'x2)	16	13	208
(Unit train operation)			
Rail mounted transfer cranes	2	2,381	4,762
Road tractors	8	37	296
Road chassis 40' (20'x2)	8	13	104
(Container yard operation)			
Rubber tired transfer cranes	10	952	9,520
(Gate operation)			
Weighing scale	2	62	124
(Maintenance)			
Fork lift truck			
3.0 tons	2	17	34
15.0 tons with telescopic side spreader	2	126	252
(CFS operation)			
Fork lift trucks			
3.0 tons	36	17	612
6.0 tons	4	35	140
Road tractors	8	37	296
Road chassis			
20 footer	36	10	360
40 footer	18	10	180
Pellets	3,950	0.04	158
(Multipurpose)			
35 ton mobile cranes for emergency use	1	190	190
Fork lift truck			
3.0 tons	3	17	51
15.0 tons	1	105	105
Toplifter with telescopic spreader (35 tons)	1	310	310
(Terminal office)			
Computer	1	952	952
Wereless telephone (VHF)	53	2	106
Total			31,732

3-6. Inland Container Freight Station

Lahore has been selected as an appropriate location for the inland container terminal as the result of cargo flow analysis. However, the present Lahore Dry Port has been judged inadequate for development as a future inland container freight station due to i) shortage of land for future expansion, ii) difficulty of access to the port and iii) the serious effect upon city traffic congestion.

Two alternative sites have been taken up and examined as possible sites for an inland container freight station. One site, Muridke, lies north of the city beyond the Ravi River. The other site, Kahna Kacha is south of the city. The former site is more advantageous from the viewpoint of traffic, since being north of Lahore, it lies in the same direction as the destination/source of most through cargo. In this way, trucks transporting containers to/from the proposed container freight station need not pass through and congest the streets of Lahore.

On the other hand, the latter alternative of Kahna Kacha is free from the threaf of flood and has greater flexibility in terms of future expansin. Moreover, Kahna Kacha is more advantageous from the viewpoint of railway operation, as it is south of Lahore station, the major terminal station on the Karachi–Lahore line in Northern Pakistan. For containers to be transported past Lahore to a point further north (Muridke) would require considerable reorganization of the railway's current system of operations.

Therefore, the southern site has been selected in consideration of these various factors. The location and layout of the inland container freight station is shown in Fig. 8 and Fig. 9.

The layouts of the main facilities in the inland container freight station for the Master Plan and the Urgent Plan are shown in Fig. 10 and Fig. 11, and the required container cargo handling equipment are listed in Table 9 and Table 10.

The rubber-tired transfer crane and the rail-mounted transfer crane are selected respectively as the main equipment for the container yard operation and the unit train operation.

In order to ensure smooth and efficient inventory control of a large number of containers in the inland container freight station, the yard plan computor system is introduced for the Master Plan.

Fig. 8 Lahore Municipal Area

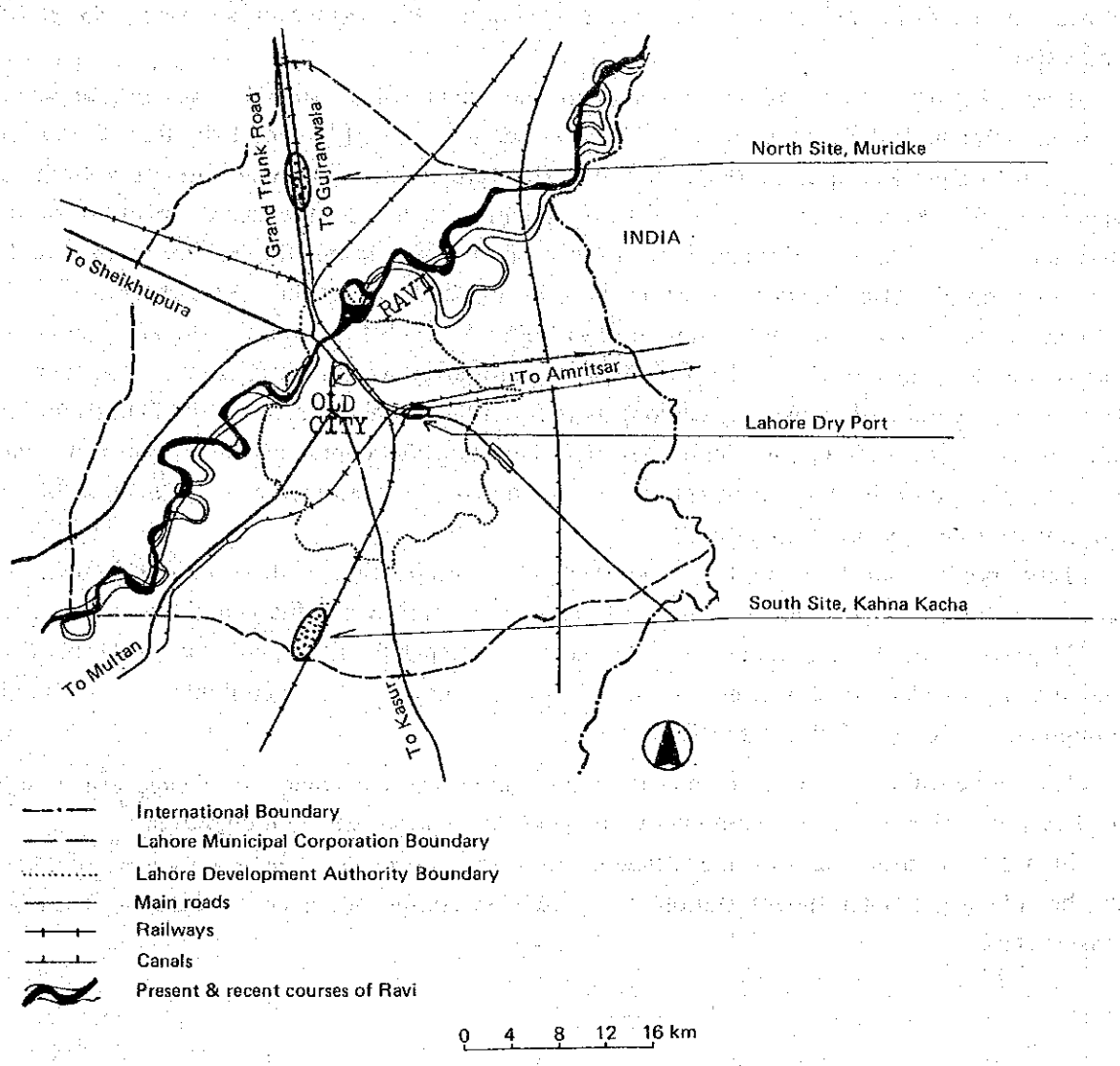


Fig. 9(1) Layout of Inland Container Freight Station (Master Plan)

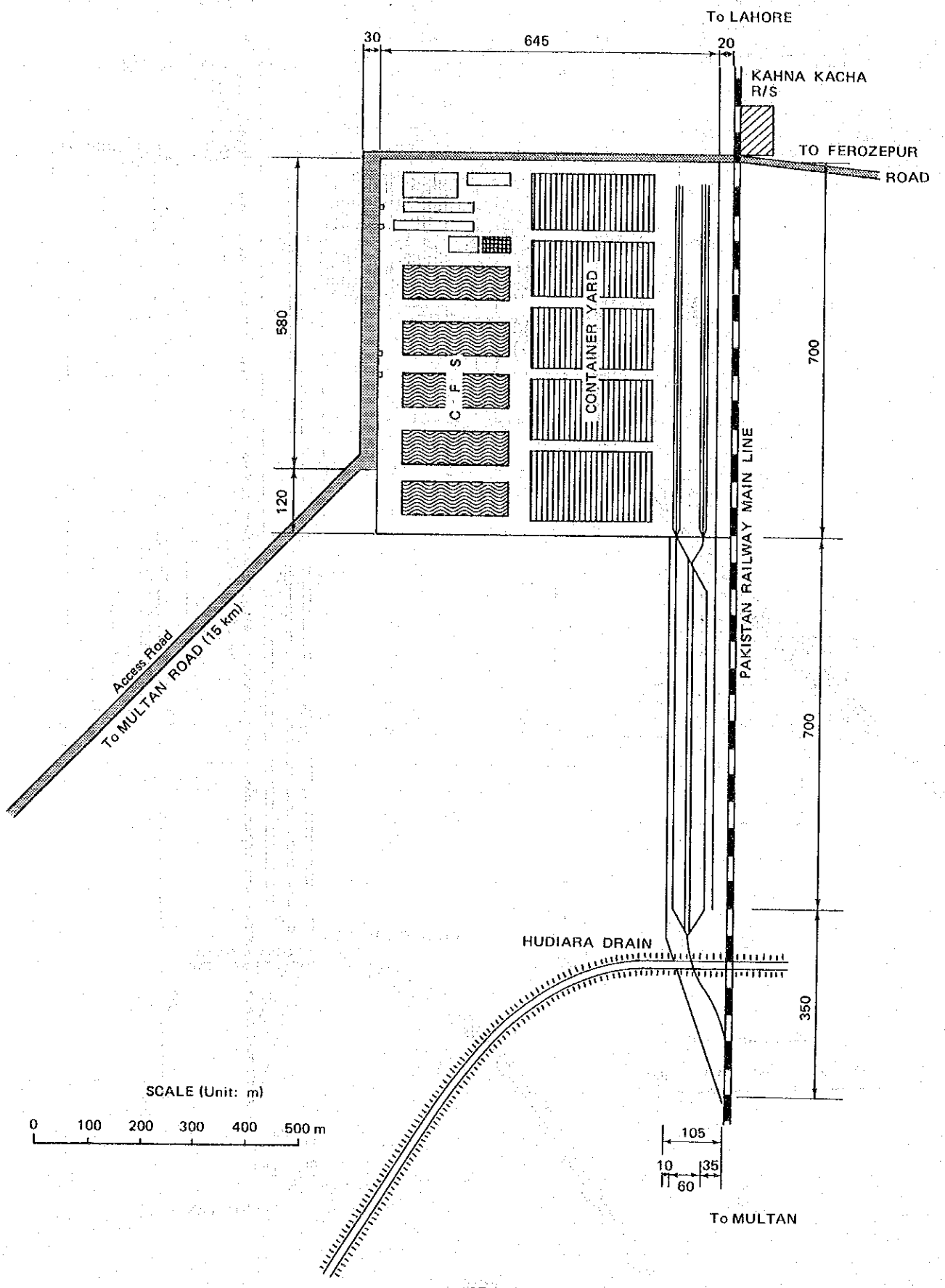


Fig. 9(2) Layout of Inland Container Freight Station (Urgent Plan)

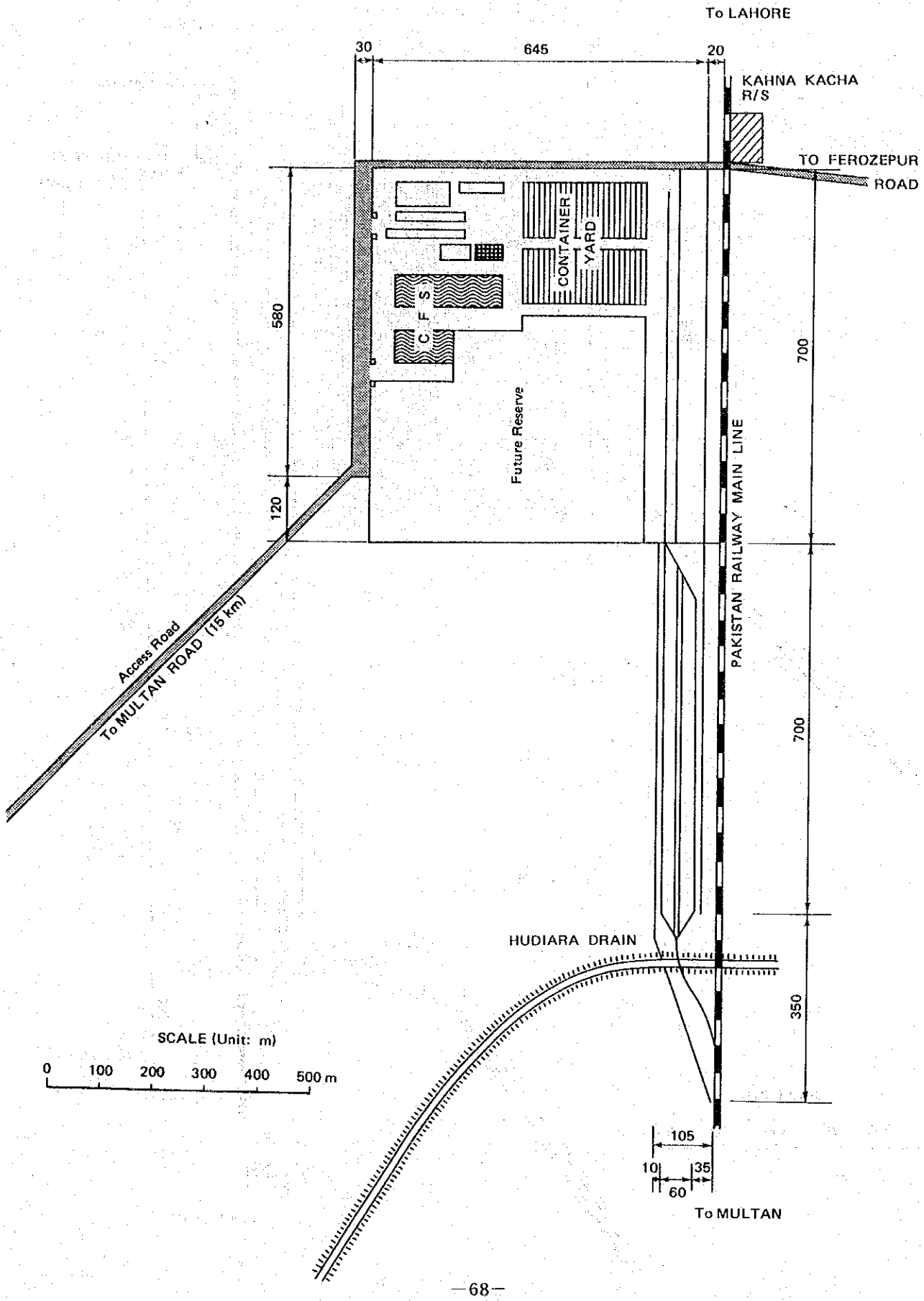


Fig. 10 Basic Layout of Inland Container Freight Station (Master plan)

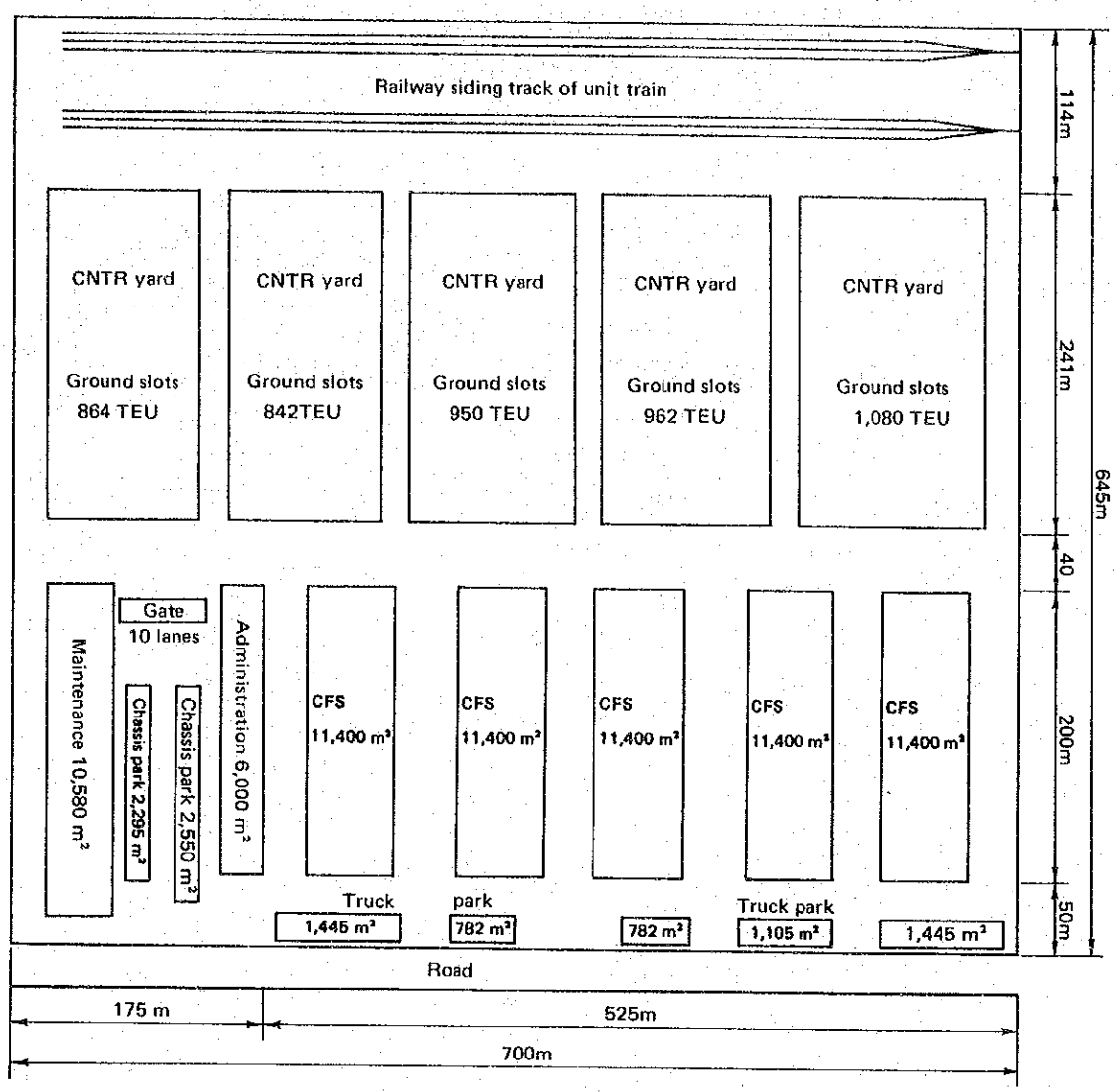


Fig. 11 Layout of Inland Container Freight Station (Urgent Plan)

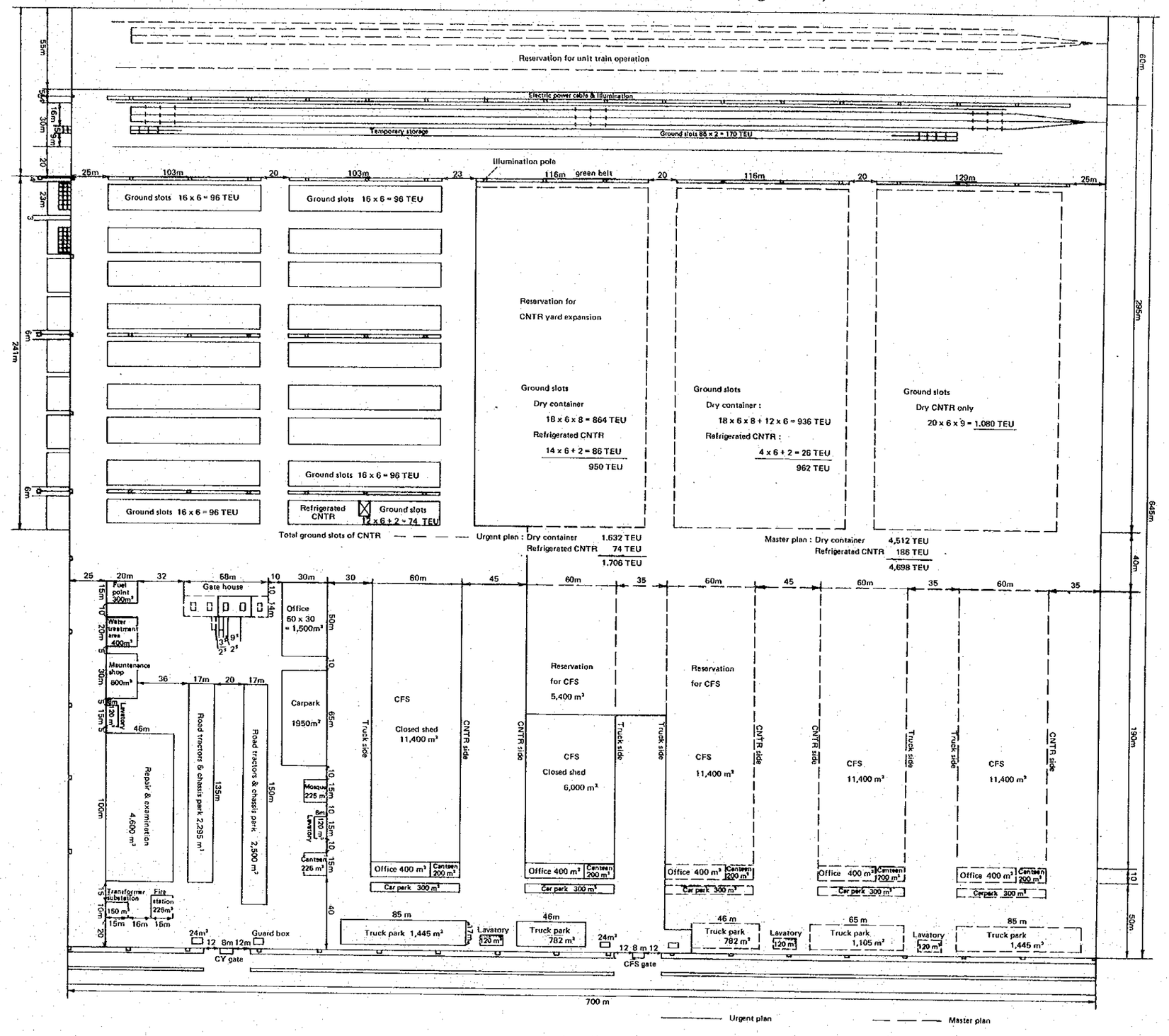


Table 9 Container Cargo Handling Equipments Required for Inland Container Freight Station (1999–2000)

(Unit: 1,000 US$)

Description of Equipments	Q'ty	Unit Cost	Total Cost
(Unit train operation)			
Railmounted transfer cranes	6	2,381	14,286
Tractors	24	37	888
Chassis 40' (20' x 2)	24	13	312
(Container yard operation)			
Rubber-tired transfer cranes	18	952	17,136
(Gate operation)			
Weighing scales	2	62	124
(Maintenance)			
Fork lift trucks			
3.0 tons	2	17	34
15.0 tons with telescopic side spreader	2	126	252
(CFS operation)			
Fork lift trucks			
3.0 tons	44	17	748
6.0 tons	5	35	175
Tractors	12	37	444
Chassis 20 footer	44	10	440
40 footer	22	10	220
Pallets	9,945	0.00	398
(Multipurpose)			
35 tons mobile cranes for emergency use	2	190	380
Fork lift trucks			
3.0 tons	4	17	68
15.0 tons	2	105	210
(Terminal office)			
Computer	1	952	952
Wireless telephones (VHF)	64	2	128
Total			37,195

Table 10 Container Cargo Handling Equipments Required for The Inland Container Freight Station (1987–1988)

(Unit: 1,000 US$)

Description of equipment	Q'ty	Unit Cost	Total Cost
(Unit train operation)			
Rail mounted transfer cranes	2	2,381	4,762
Yard tractor	8	37	296
Yard chassis 40' (20' x 2)	8	13	104
(Container yard operation)			
Rubble tired transfer crane	6	952	5,712
(Gate operation)			
Weighing scale	1	62	62
(Maintenance)			
Forklift truck			
3.0 tons	1	17	17
15.0 tons with telescopic side spreader	1	126	126
(CFS operation)			
Forklift truck			
3.0 tons	14	17	238
6.0 tons	2	35	70
Yard tractor	4	37	148
Yard chassis 20 footer	14	10	140
40 footer	7	10	70
Pallets	2,938	0.04	118
(Multipurpose)			
Forklift truck			
3.0 tons	2	17	34
15.0 tons	1	105	105
Mobile crane for emergency use and CFS operation 35 tons	1	190	190
(Communication)			
Wireless telephone (VHF)	24	2	48
Total			12,240

3-7. Rough Estimates of Construction Cost

3-7-1 Conditions of cost estimates

Construction cost is estimated based on the following conditons:

(1) Exchange rates between Pakistan Rupee, Japanese Yen and US Dollar are assumed to be as follows: US$1.00 = Rs 9.9 = ¥210

(2) Estimates are based on unit prices in the year 1980.

(3) Unit prices of construction materials and labour wages are based on the NESPAK PRICE INDEX and the data obtained through the site survey.

(4) Construction vessels are assumed to be brought from and returned to Singapore and its vicinity after completion.
Thus, round-trip transportation expenses and insurances are included in the estimate.
Equipment and construction materials domestically unavailable will be transported from Japan and are expressed in CIF prices.

(5) Taxes such as import duties and sales tax on both domestic and imported goods are excluded because of transfer cost.

3-7-2 Construction cost

The construction schedule for the container terminals is shown in Fig. 12-1, 12-2, 12-3.

The construction costs for the Master Plan and Urgent Plan are shown in Table 11-1, 11-2, 11-3 and Table 12-1, 12-2, 12-3, respectively.

And the total construction cost for the Master Plan and Urgent Plan are shown in Table 12-4, 12-5.

Also, the yearly investment plan is shown in Table 13-1, 13-2, 13-3.

Fig. 12-1 Construction Schedule for Karachi Port

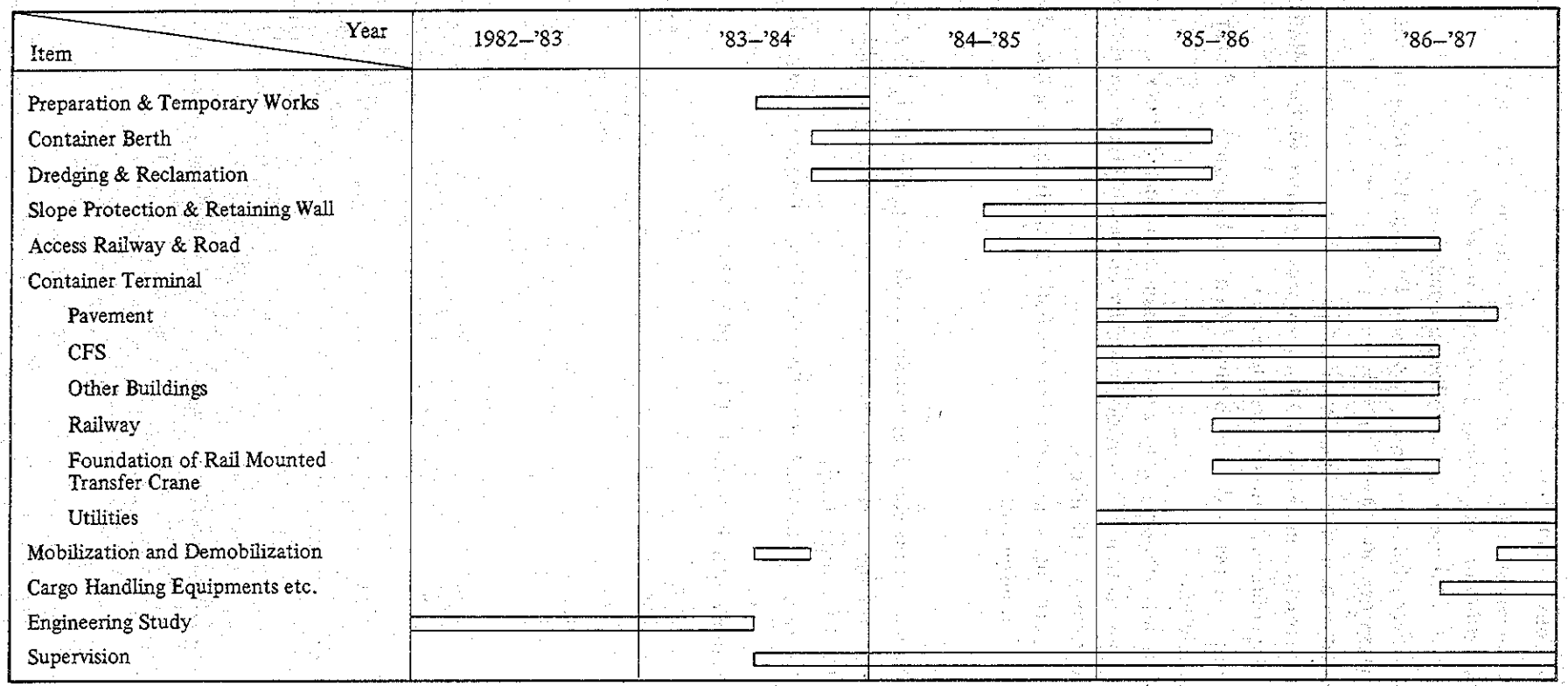


Fig. 12-2 Construction Schedule for Qasim Port

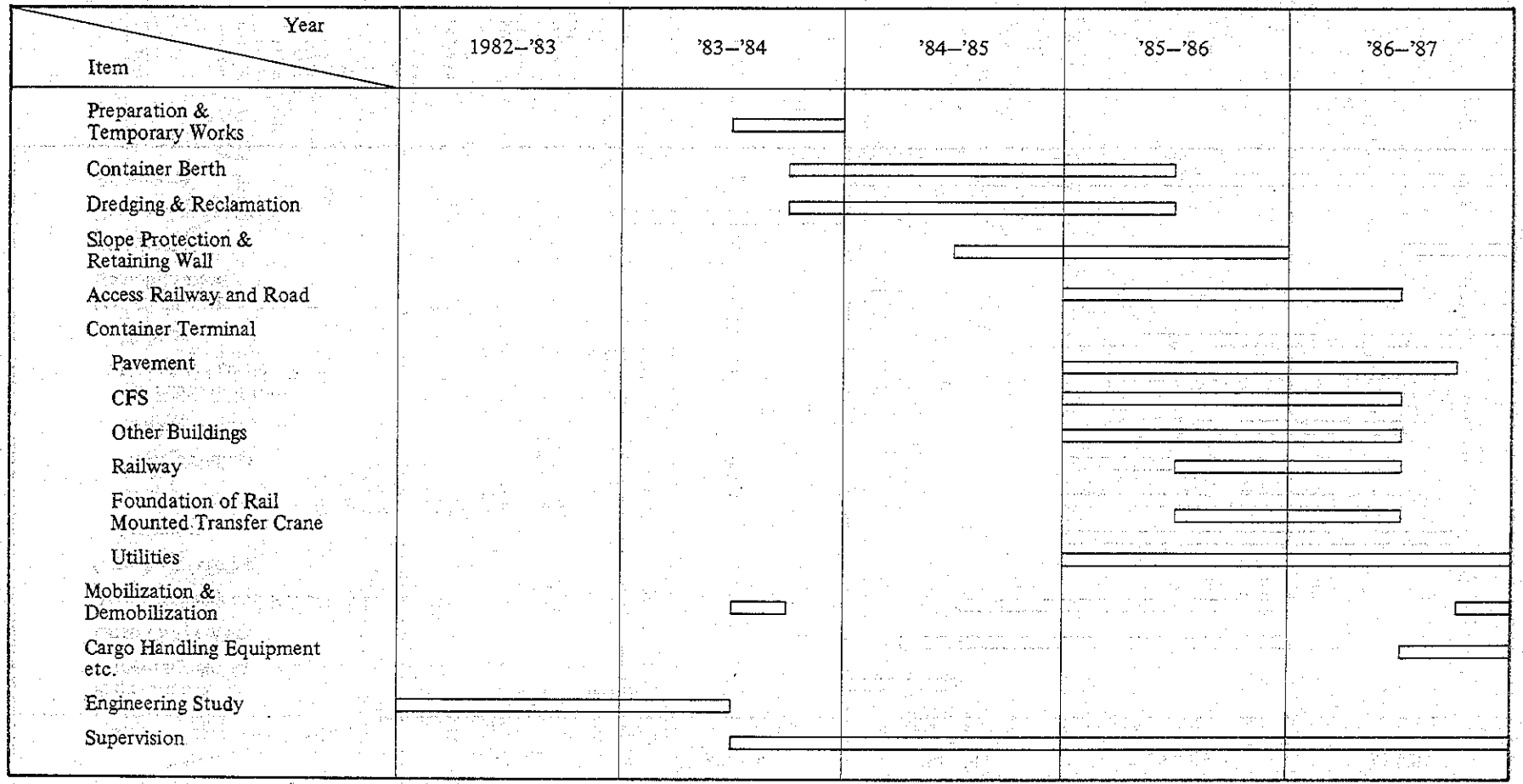


Fig. 12-3 Construction Schedule for Inland Container Terminal

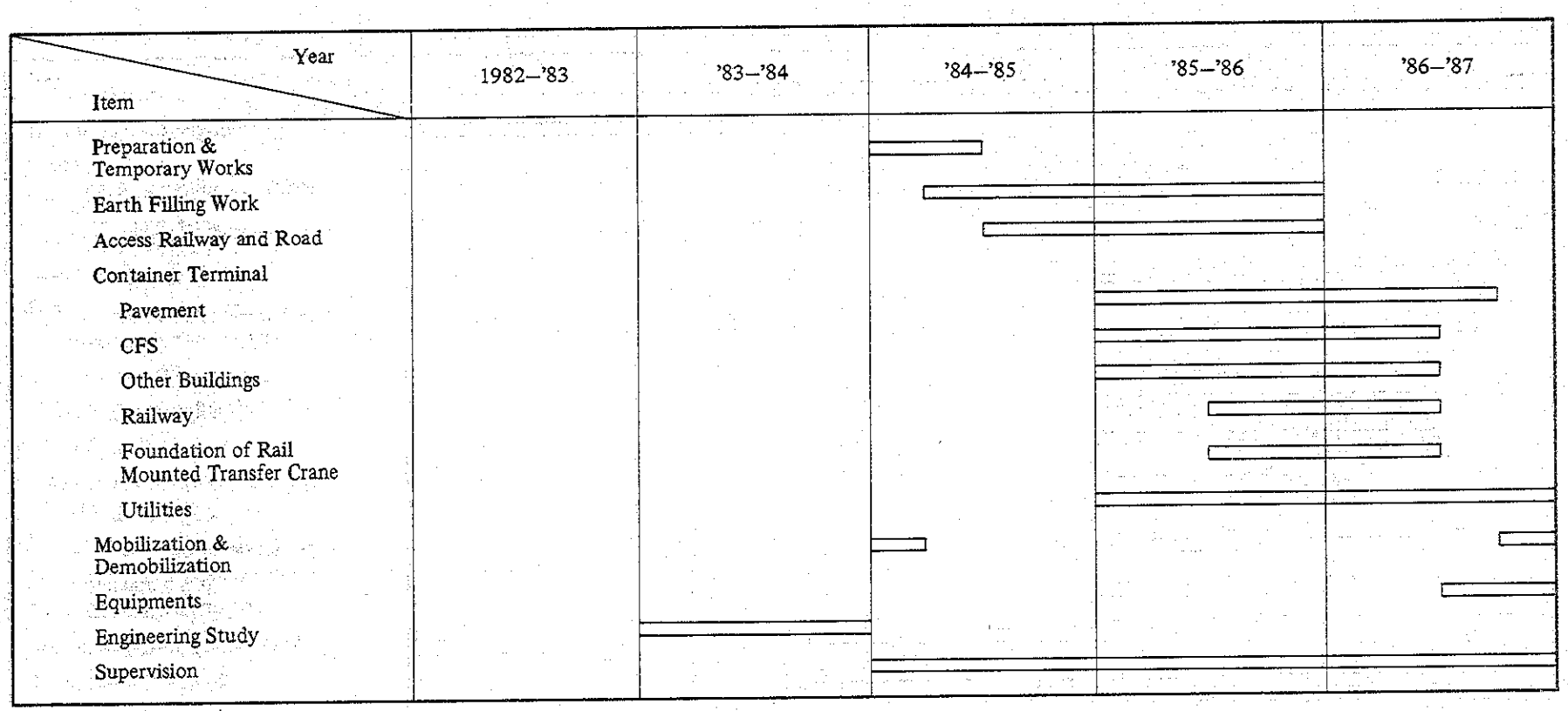


Table 11-1 Construction Cost for Karachi Port (Master Plan)

Unit: 1000 US$

ITEM	PARTICULARS	UNIT	QUANTITY	AMOUNT		
				LOCAL	FOREIGN	TOTAL
1	Preparation & Temporary Works	L.S		1,104	395	1,499
2	Container Berth	m_3	1,800	22,911	23,523	46,434
3	Dredging & Reclamation	m^3	8,950,000	8,052	20,710	28,762
4	Slope Protection & Retaining Wall					
	Slope Protection	m	9,300	1,860	797	2,657
	Retaining Wall	m	144	206	1,165	1,371
5	Access Railway and Road					
	Railway	m	14,000	365	2,064	2,429
	Road	m	4,100	2,312	578	2,890
	Interchange	Nos	1	2,286	571	2,857
6	Container Terminal					
	Pavement	m^2	846,750	29,030	7,259	36,289
	CFS	m^2	59,400	12,067	3,017	15,084
	Office & Other Buildings	m^2	30,147	5,610	1,403	7,013
	Railway	m	10,800	231	1,312	1,543
	Foundation of Rail Mounted Transfer Crane	m	1,800	3,810	3,810	7,620
	Utilities	L.S		6,002	2,572	8,574
7	Mobilization & Demobilization	L.S		-	2,857	2,857
8	Equipments					
	Cargo Handling Equipments	L.S		-	101,376	101,376
	Navigational Aids	L.S		-	143	143
	Sub Total			95,846	173,552	269,398
9	Engineering Study & Supervision	L.S		2,694	8,082	10,776
10	Physical Contingency		15% of Item 1-7 + 5% of Item 8	14,377	18,881	33,258
Total				112,917	200,515	313,432

Table 11-2 Construction Cost for Qasim Port (Master Plan)

Unit: 1000 US$

ITEM	PARTICULARS	UNIT	QUANTITY	AMOUNT		
				LOCAL	FOREIGN	TOTAL
1	Preparation & Temporary Works	L.S		969	224	1,193
2	Container Berth	m	1,800	24,882	21,537	46,419
3	Dredging & Reclamation					
	Dredging	m^3	4,300,000	2,867	7,371	10,238
	Reclamation	m^3	7,200,000	5,223	12,731	17,954
4	Slope Protection & Retaining Wall					
	Slope Protection	m	5,992	1,198	514	1,712
	Retaining Wall	m	108	309	720	1,029
5	Access Railway & Road					
	Railway	m	9,000	193	1,093	1,286
	Road	m	2,500	1,410	352	1,762
6	Container Terminal					
	Pavement	m^2	846,750	29,030	7,259	36,289
	CFS	m^2	59,400	12,440	3,110	15,550
	Office & Other Buildings	m^2	30,147	5,784	1,446	7,230
	Railway	m	10,800	231	1,312	1,543
	Foundation of Rail Mounted Transfer Crane	m	1,800	3,810	3,810	7,620
	Utilities	L.S		6,002	2,572	8,574
7	Mobilization & Demobilization	L.S		-	2,381	2,381
8	Equipments					
	Cargo Handling Equipment	L.S		-	101,376	101,376
	Navigational Aids	L.S		-	143	143
	Sub Total			94,348	167,951	262,299
9	Engineering Study & Supervision	L.S		2,623	7,869	10,492
10	Physical Contingency		15% of Item 1-7 +5% of Item 8	10,501	18,692	29,193
Total				107,472	194,512	301,984

Table 11-3 Construction Cost for Inland Container Terminal (Master Plan)

Unit: 1000 US$

ITEM	PARTICULARS	UNIT	QUANTITY	AMOUNT		
				LOCAL	FOREIGN	TOTAL
1	Preparation & Temporary Works	L.S		382	95	477
2	Access Railway & Road					
	Railway	m	7,250	155	881	1,036
	Road	m_3	15,000	6,000	1,500	7,500
3	Earth Filling Work	m^3	874,000	1,665	1,665	3,330
4	Container Terminal					
	Pavement	m^2	366,900	12,579	3,145	15,724
	CFS	m^2	57,000	12,301	3,075	15,376
	Office & Other Buildings	m^2	6,960	1,713	428	2,141
	Railway	m	4,000	86	486	572
	Foundation of Rail Mounted Transfer Crane	m	600	720	720	1,440
	Utilities	L.S		1,667	714	2,381
5	Land Acquisition Cost	m^2	770,000	1,540		1,540
6	Mobilization & Demobilization	L.S		-	333	333
7	Equipments					
	Cargo Handling Equipments	L.S		666	37,195	37,861
	Locomotives & Flat Cars	L.S		-	85,400	85,400
	Sub Total			39,474	135,637	175,111
8	Engineering Study & Supervision	L.S		1,313	3,940	5,253
9	Physical Contingency		10% of Item 1-6 + 5% of Item 7	3,914	7,434	11,348
	Total			44,701	147,011	191,712

Table 12-1 Construction Cost for Karachi Port (Urgent Plan)

Unit: 1000 US$

ITEM	PARTICULARS	UNIT	QUANTITY	AMOUNT		
				LOCAL	FOREIGN	TOTAL
1	Preparation & Temporary Works	L.S		638	255	893
2	Container Berth	m_3	600	7,637	7,841	15,478
3	Dredging & Reclamation	m^3	4,700,000	4,321	11,113	15,434
4	Slope Protection & Retaining Wall					
	Slope Protection	m	9,300	1,860	797	2,657
	Retaining Wall	m	72	447	239	686
5	Acess Railway and Road					
	Railway	m	11,700	315	1,785	2,100
	Road	m	4,100	1,327	332	1,659
	Interchange	Nos	1	1,334	333	1,667
6	Container Terminal					
	Pavement	m^2	282,400	9,682	2,421	12,103
	CFS	m^2	19,800	4,024	1,006	5,030
	Office & Other Buildings	m^2	9,881	1,851	463	2,314
	Railway	m	3,600	77	437	514
	Foundation of Rail Mounted Transfer Crane	m	600	1,270	1,270	2,540
	Utilities	L.S		2,001	857	2,858
7	Mobilization & Demobilization	L.S		-	1,905	1,905
8	Equipments					
	Cargo Handling Equipments	L.S		-	31,732	31,732
	Navigational Aids	L.S		-	143	143
	Sub Total			36,784	62,929	99,713
9	Engineering Study & Supervision	L.S		997	2,992	3,989
10	Physical Contingency		15% of Item 1-7 +5% of Item 8	5,518	6,252	11,770
	Total			43,299	72,173	115,472

Table 12-2 Construction Cost for Qasim Port (Urgent Plan)

Unit: 1000 US$

ITEM	PARTICULARS	UNIT	QUANTITY	AMOUNT		
				LOCAL	FOREIGN	TOTAL
1	Preparation & Temporary Works	L.S		514	126	640
2	Container Berth	m	600	8,294	7,179	15,473
3	Dredging & Reclamation					
	Dredging	m^3	1,920,000	1,280	3,291	4,571
	Reclamation	m^3	2,400,000	1,736	4,249	5,985
4	Slope Protection & Rotaining Wall					
	Slope Protection	m	4,258	851	363	1,216
	Retaining Wall	m	72	103	583	686
5	Access Railway & Road					
	Railway	m	5,500	118	668	786
	Road	m	2,500	800	200	1,000
6	Container Terminal					
	Pavement	m^2	282,400	9,682	2,421	12,103
	CFS	m^2	19,800	4,149	1,037	5,186
	Office & Other Buildings	m^2	9,881	1,909	477	2,386
	Railway	m	3,600	77	437	514
	Foundation of Rail Mounted Transfer Crane	m	600	1,270	1,270	2,540
	Utilities	L.S		2,001	857	2,858
7	Mobilization & Demobilization	L.S		-	1,429	1,429
8	Equipments					
	Cargo Handling Equipments	L.S		-	31,732	31,732
	Navigational Aids	L.S		-	143	143
	Sub Total			32,784	56,464	89,248
9	Engineering Study & Supervision	L.S		892	2,678	3,570
10	Physical Contingency		15% of Item 1-7 +5 % of Item 8	4,918	5,282	10,200
	Total			38,594	64,424	103,018

Table 12-3 Construction Cost for Inland Container Terminal (Urgent Plan)

Unit: 1000 US$

ITEM	PARTICULARS	UNIT	QUANTITY	AMOUNT		
				LOCAL	FOREIGN	TOTAL
1	Preparation & Temporary Works	L.S		217	55	272
2	Access Railway & Road					
	Railway	m	4,450	96	538	634
	Road	m_3	15,000	2,400	600	3,000
3	Earth Filling Work	m^3	674,000	1,284	1,284	2,568
4	Container Terminal					
	Pavement	m^2	180,500	6,189	1,547	7,736
	CFS	m^2	17,400	3,755	939	4,694
	Office & Other Buildings	m^2	4,450	1,260	315	1,575
	Railway	m	2,000	43	243	286
	Foundation of Rail Mounted Transfer Crane	m	600	720	720	1,440
	Utilities	L_2S		1,169	501	1,670
5	Land Acquisition Cost	m^2	466,000	932	-	932
6	Mobilization & Demobilization	L.S		-	190	190
7	Equipments					
	Cargo Handling Equipments	L.S		228	12,240	12,468
	Locomotives & Flat Cars	L.S		-	22,400	22,400
	Sub Total			18,293	41,572	59,865
8	Engineering Study & Supervision	L.S		449	1,347	1,796
9	Physical Contingency		10% of Item 1-6 +5% of Item 7	1,818	2,425	4,243
	Total			20,560	45,344	65,904

Table 12-4 Estimate of Investment Cost (Master Plan)

Karachi Port + Inland C/T (Unit: million US$)

	Total	I		II	
		Civil Works	Equip-ment	Local	Foreign
Two berths + C/T	269.4	167.9	101.5	95.8	173.6
Inland C/T	175.1	51.8	123.3	39.5	135.6
Sub Total	444.5	219.7	224.8	135.3	309.2
Consultant Fee	16.0			4.0	12.0
Physical Contingency	44.6			18.3	26.3
Total	505.1			157.6	347.5

Qasim Port + Inland C/T

	Total	I		II	
		Civil Works	Equip-ment	Local	Foreign
Two berth + C/T	262.3	160.8	101.5	94.3	168.0
Inland C/T	175.1	51.8	123.3	39.5	135.6
Sub Total	437.4	212.6	224.8	133.8	303.6
Consultant Fee	15.8			4.0	11.8
Physical Contingency	40.5			14.4	26.1
Total	493.7			152.2	341.5

Table 12-5 Estimate of Investment Cost (Urgent Plan)

Karachi Port + Inland C/T

(Unit: million US$)

	Total	I		II	
		Civil Works	Equip-ment	Local	Foreign
Two berths + C/T	99.7	67.8	31.9	36.8	62.9
Inland C/T	59.9	25.0	34.9	18.3	41.6
Sub Total	159.6	92.8	66.8	55.1	104.5
Consultant Fee	5.8			1.5	4.3
Physical Contingency	16.0			7.3	8.7
Total	181.4			63.9	117.5

Qasim Port + Inland C/T

	Total	I		II	
		Civil Works	Equip-ment	Local	Foreign
Two berths + C/T	89.2	57.3	31.9	32.8	56.4
Inland C/T	59.9	25.0	34.9	18.3	41.6
Sub Total	149.1	82.3	66.8	51.1	98.0
Consultant Fee	5.4			1.4	4.0
Physical Contingency	14.4			6.7	7.7
Total	168.9			59.2	109.7

Table 13-1 Yearly Investment Plan (Karachi Port)

Unit: 1,000 US$

Item	Particulars	1982 - '83			'83 - '84			'84 - '85			'85 - '86			'86 - '87			Total		
		L/C	F/C	Sub Total	L/C	F/C	Sub Total	L/C	F/C	Sub Total	L/C	F/C	Sub Total	L/C	F/C	Sub Total	L/C	F/C	Total
1	Preparation & Temporary Work				638	255	893										638	255	893
2	Container Berth				1,091	1,120	2,211	4,364	4,481	8,845	2,182	2,240	4,422				7,637	7,841	15,478
3	Dredging & Reclamation																		
	Dredging				309	794	1,103	1,235	3,175	4,410	618	1,587	2,205				2,162	5,556	7,718
	Reclamation				308	794	1,102	1,234	3,175	4,409	617	1,588	2,205				2,159	5,557	7,716
4	Slope Protection & Retaining Wall							769	345	1,114	1,538	691	2,229				2,307	1,036	3,343
5	Access Railway & Road							744	612	1,356	1,488	1,225	2,713	744	613	1,357	2,976	2,450	5,426
6	Container Terminal																		
	Pavement										5,533	1,383	6,916	4,149	1,038	5,187	9,682	2,421	12,103
	CFS										2,683	671	3,354	1,341	335	1,676	4,024	1,006	5,030
	Other Buildings										1,234	309	1,543	617	154	771	1,851	463	2,314
	Railway										39	218	257	38	219	257	77	437	514
	Foundation of Rail Mounted Transfer Crane										635	635	1,270	635	635	1,270	1,270	1,270	2,540
	Utilities										1,001	428	1,429	1,000	429	1,429	2,001	857	2,858
7	Mobilization & Demobilization				-	953	953							-	952	952	-	1,905	1,905
8	Equipments													-	31,875	31,875	-	31,875	31,875
	Sub Total				2,346	3,916	6,262	8,346	11,788	20,134	17,568	10,975	28,543	8,524	36,250	44,774	36,784	62,929	99,713
9	Engineering Study & Supervision	305	922	1,227	230	690	920	154	460	614	154	460	614	154	460	614	997	2,992	3,989
10	Physical Contingency				352	587	939	1,252	1,768	3,020	2,635	1,647	4,282	1,279	2,250	3,529	5,518	6,252	11,770
	Total	305	922	1,227	2,928	5,193	8,121	9,752	14,016	23,768	20,357	13,082	33,439	9,957	38,960	48,917	43,299	72,173	115,472

Table 13-2 Yearly Investment Plan (Qasim Port)

Unit: 1,000 US$

Item	Particulars	1982 - '83			'83 - '84			'84 - '85			'85 - '86			'86 - '87			Total		
		L/C	F/C	Sub Total	L/C	F/C	Sub Total	L/C	F/C	Sub Total	L/C	F/C	Sub Total	L/C	F/C	Sub Total	L/C	F/C	Total
1	Preparation & Temporary Work				514	126	640										514	126	640
2	Container Berth				1,185	1,026	2,211	4,739	4,102	8,841	2,370	2,051	4,421				8,294	7,179	15,473
3	Dredging & Reclamation																		
	Dredging				171	441	612	686	1,763	2,449	343	881	1,224				1,200	3,085	4,285
	Reclamation				260	636	896	1,037	2,546	3,583	519	1,273	1,792				1,816	4,455	6,271
4	Slope Protection & Retaining Wall							318	316	634	636	632	1,268				954	948	1,902
5	Access Railway & Road										612	579	1,191	306	289	595	918	868	1,786
6	Container Terminal																		
	Pavement										5,533	1,383	6,916	4,149	1,038	5,187	9,682	2,421	12,103
	CFS										2,766	691	3,457	1,383	346	1,729	4,149	1,037	5,186
	Other Buildings										1,273	318	1,591	636	159	795	1,909	477	2,386
	Railway										39	218	257	38	219	257	77	437	514
	Foundation of Rail Mounted Transfer Crane										635	635	1,270	635	635	1,270	1,270	1,270	2,540
	Utilities										1,001	428	1,429	1,000	429	1,429	2,001	857	2,858
7	Mobilization & Demobilization				-	715	715							-	714	714	-	1,429	1,429
8	Equipments													-	31,875	31,875	-	31,875	31,875
	Sub Total				2,130	2,944	5,074	6,780	8,727	15,507	15,727	9,089	24,816	8,147	35,704	43,851	32,784	56,464	89,248
9	Engineering Study & Supervision	275	824	1,099	206	618	824	137	412	549	137	412	549	137	412	549	892	2,678	3,570
10	Physical Contingency				320	441	761	1,017	1,309	2,326	2,359	1,363	3,722	1,222	2,169	3,391	4,918	5,282	10,200
	Total	275	824	1,099	2,656	4,003	6,659	7,934	10,448	18,382	18,223	10,864	29,087	9,506	38,285	47,791	38,594	64,424	103,018

Table 13-3 Yearly Investment Plan (Inland Container Terminal)

Unit: 1,000 US$

Item	Particulars	1982 - '83			'83 - '84			'84 - '85			'85 - '86			'86 - '87			Total		
		L/C	F/C	Sub Total	L/C	F/C	Sub Total	L/C	F/C	Sub Total	L/C	F/C	Sub Total	L/C	F/C	Sub Total	L/C	F/C	Total
1	Preparation & Temporary Work							217	55	272							217	55	272
2	Access Railway and Road							832	379	1,211	1,664	759	2,423				2,496	1,138	3,634
3	Earth Filling Work							550	550	1,100	734	734	1,468				1,284	1,284	2,568
4	Container Terminal																		
	Pavement										3,537	884	4,421	2,652	663	3,315	6,189	1,547	7,736
	CFS										2,503	626	3,129	1,252	313	1,565	3,755	939	4,694
	Other Buildings										840	210	1,050	420	105	525	1,260	315	1,575
	Railway										21	122	143	22	121	143	43	243	286
	Foundation of Rail Mounted Transfer Crane										360	360	720	360	360	720	720	720	1,440
	Utilities										585	250	835	584	251	835	1,169	501	1,670
5	Land Acquisition Cost							932	-	932							932	-	932
6	Mobilization & Demobilization							-	95	95				-	95	95	-	190	190
7	Equipments													228	34,640	34,868	228	34,640	34,868
	Sub Total							2,531	1,079	3,610	10,244	3,945	14,189	5,518	36,548	42,066	18,293	41,572	59,865
8	Engineering Study & Supervision				179	540	719	90	269	359	90	269	359	90	269	359	449	1,347	1,796
9	Physical Contingency							253	108	361	1,024	395	1,419	541	1,922	2,463	1,818	2,425	4,243
	Total				179	540	719	2,874	1,456	4,330	11,358	4,609	15,967	6,149	38,739	44,888	20,560	45,344	65,904

4. Economic Analysis

4-1. Method of Economic Analysis

The method of economic analysis is as follows

(1) Both shadow pricing and market pricing are employed to evaluate all costs and benefits.

(2) As an alternative to be considered for the sake of comparison, the case without investment, called the WITHOUT case, is employed in the cases of both the Port Terminal and Inland Terminal.

(3) The economic returns are evaluated according to the internal rate of return (IRR).

(4) IRR is calculated separately for Karachi Port, Qasim Port and the Inland Container Terminal (Lahore). At the same time, it is calculated for Karachi Port + Inland Container Terminal and Qasim Port + Inland Container Terminal. Thereby, their economic returns are comparatively evaluated.

(5) The periods of IRR calculation are set in consideration of the average service life of facilities and equipment as follows:

Development Site Proposed	Average Service Life	Period of IRR Calculation
Karachi Port	22.7	29 years 1982/'83–2010/'11
Qasim Port	22.1	28 years 1982/'83–2009/'10
Inland CNTR Terminal	21.7	27 years 1983/'84–2009/'10
Karachi Port + Inland CNTR Terminal	22.0	28 years 1982/'83–2009/'10
Qasim Port + Inland CNTR Terminal	22.0	28 years 1982/'83–2009/'10

4-2. Benefits

The benefits of the Urgent Plan are as follows:

(1) Contribution to the economic development of the country by strengthening the foundations of the nation's economy through modernization of the Port.

(2) Reduction in cargo handling costs by raising cargo handling productivity through mechanization and containerization.

(3) Reduction of damage to cargo through containerization and mechanization.

(4) Reduction in packing costs through containerization.

(5) Increase of the rate of storage through modulization.

(6) Reduction in ship costs for berth waiting time and for loading/unloading cargo, mainly through increases in cargo handling capacity and productivity.

(7) Reduction of transport period, inland transport period, and port area freight accumulation through the increase of efficiency of inland transportation.

(8) Reduction in container rental fees through the shortening of transport periods.

(9) Possible function as a center for entrepot trade, handling transhipment cargo and providing container feeder services to neighbouring countries.
(10) Prompt control of accurate information through introduction of a computer system.

Among the above mentioned benefits, numbers 2, 6, 7, and 8 are quantitatively measurable, so are evaluated and considered in the economic analysis. As for #6 (reduction in ship's staying cost), since the benefits of this will not entirely accrue to Pakistan, 30% is assumed as the percentage of benefits that Pakistan will enjoy both directly and indirectly (feedback ratio).

Additionally, an analysis assuming a feedback ratio of 50% has been undertaken as well, considering that an increased ratio is likely in the next 30 years. At the same time, this serves the function of a sensitivity analysis. In regards to (7): reduction in transport cost, the method of evaluating the transport cost by using the existing modal split is perhaps valid, but here 50% by railway and by road is adopted as the modal split for the following two reasons. One reason is that in the future, a shift should be made to railway transport, which is advantageous to the national economy. The other reason is that overestimation of the benefits should be avoided. Calculation of the existing modal split (36.3% by railway and 63.7% by road) is also made by means of sensitivity analysis.

4-3 Costs

The costs of the Urgent Plan are as follows:
(1) Cost of constructing civil engineering facilities.
(2) Cost of purchasing cargo handling equipment.
(3) Operation and maintenance cost for equipment and various other facilities.

If a container terminal is to be constructed at Qasim Port, it will be necessary to invest in various port supporting infrastructures in order to assure smooth container transportation – for example, facilities such as the offices and storehouses of stevedoring companies, cargo transport companies and warehousing companies, and the offices of agencies, banks and insurance companies etc.. It would be ideal if a new town including houses, schools, mosques and shops could be constructed there. But here, in order to avoid overestimation of the benefits that will derive from the project, we assume that the various functions necessary for container transportation are already sufficiently in place in Karachi City. Also assumed is that all the labourers, whose work is related to container transportation, commute from Karachi City to Qasim. Therefore, the following costs are added separately in the analysis for Qasim Port:

Construction cost of infrastructures:

The investment to provide minimum port supporting infrastructures such as the above mentioned facilities. However, taking into consideration that these facilities could be used for port activities other than container transportation as well, 50% of all the investment is finally adopted in present analysis.

Operation and maintenance cost:

The operation and maintenance cost for commuter traffic from Karachi to Qasim and for related business trips, and their time costs.

4-4 Evaluation of Economic Returns

IRRs having a feedback ratio of 30% and a modal split of 50% by railway, are calculated and the results are as follows.

Further, figures in parentheses show IRRs that are calculated respectively where the costs related to railway facilities are subtracted from the construction costs of the port terminal, and then, where the same costs are added to the construction costs of the Inland Terminal.

Development Site Proposed	IRR	
	Shadow Pricing	Market Pricing
Karachi Port	14.3% (16.2%)	14.8% (16.8%)
Qasim Port	12.2% (13.9%)	12.7% (14.4%)
Inland CNTR Terminal	14.0% (*1 10.5%) (*2 11.0%)	15.2% (*1 11.5%) (*2 12.0%)
Karachi Port + Inland CNTR Terminal	14.1%	14.9%
Qasim Port + Inland CNTR Terminal	12.8%	13.5%

*1 assuming construction of a Port Terminal in Karachi Port

*2 assuming construction of a Port Terminal in Qasim Port

In addition to the above evaluation, excluding rice (basmati) and cotton for export, IRRs are also calculated with the following results:

Development Site Proposed	IRR	
	Shadow Pricing	Market Pricing
Inland CNTR Terminal	4.0%	4.5%
Karachi Port + Inland CNTR Terminal	11.5%	12.0%
Qasim Port + Inland CNTR Terminal	9.8%	10.3%

In port or inland transport investment projects, IRRs usually range from 10% to 20%. It is generally considered that a project with an IRR of more than around 10% is economically feasible. Thus, it can be concluded that the present plan has sufficient economic feasibility. However, the difference in IRR between Karachi Port and Qasim Port, though not especially large, is a well established figure. Therefore, from the point of view of the national economy, Karachi Port is more feasible and advantageous for port development than Qasim Port.

Excluding figures for rice/cotton, the IRR shows extremely low feasibility which can be explained by the fact that the benefits will decrease in proportion to container volumes (excluding rice and cotton), thus increased empty containers will entail wasteful transport costs. Empty containers will come to comprise approximately 50% of export containers.

Containerization will achieve its full benefits only when Port and Inland Terminals are operated in a integrated system. Accordingly, to assure viable full-fledged inland container transport, it will be necessary to convert the conventional cotton and rice transport/storage system to a system compatible with container transportation.

5. Financial Analysis

5-1 Karachi Port

(1) Premises

a. Karachi Port will employ a self-supporting accounting system.

b. The financial analysis shall encompass the whole Karachi Port as well as the entire Project, and the soundness of finances in regards to profitability, sources, and applications of funds shall be reviewed as the Project is carried out.

c. The project alone is considered as an independent enterprise whose profitability will be judged based on its financial rate of return (FRR).

d. Tariffs on containers will be reviewed.

(2) Review of Financial Statements and Tariff

Financial statements for the period from 1977–78 to 2005–06 were prepared assuming the 6 cases shown in Table 5-2 setting the project life at 19 years, counting from 1987–88 when project use commences, with consideration to procurement of investment funds (Table 5-1) and tariff standards.

Table 5-3 delineates their outline.

a. Upon considering profitability, fund sources, and applications in terms of financial soundness, and upon considering the profitability of the project in terms of FRR, it seems that none of the possible cases for carrying out this project will succeed unless the current tariff is increased.

b. In order to gain over 7% of the return on net fixed assets by the investment of the Project, the current tarrif should be raised by 25% and 15% for the interest rates of 11.6% and 2.75% of the loans respectively. As for FRR, interest rate of the loan will be considered to be a criteria for judgement consisting of the following 4 cases.

(Investment funds) Foreign currency portion: 53.9%
Local currency portion 46.1%

Case 1. Loan interest: foreign currency portion 11.6%
local currency portion
self-finance:
FRR 6.3%

Case 2. Loan interest: foreign currency portion 2.75%
local currency portion
self-finance:
FRR 1.5%

Case 3. Loan interest: foreign currency portion 11.6%
local currency portion 11.6%:
FRR 11.6%

Case 4. Loan interest: foreign currency portion 2.75%
local currency portion 11.6%;
FRR 6.8%

c. If the current tariff is raised from 1987–88, after the Project has begun operation, it will be necessary to obtain a local loan during the construction period. If the tariff is raised from 1982–83, when Project construction is started, then a local loan will be unnecessary.

d. Cases E and F envision a raise in the current tariff by 25% and 15% respectively, from 1987–88 when the Project begins operation. As the local currency portion of the invested fund is obtained by loan (at 11.6% interest), there will be no difficulties pertaining to fund sources and applications. Although profitability during the period of construction will not be to high, it will likely increase from 1989–90. In the case of E, the return on net fixed assets will rise over 8.9% for 1989–90 and thereafter. FRR obtained in this case is 11.2%. For case F, the return on net fixed assets will rise over 6.2% for the year 1989–90 and thereafter. FRR is 6.1%. FRR of both Cases E and F will be almost reasonable since these correspond to FRR of Case 3 and Case 4 in the above mentioned b.

e. Cases C and D indicate respectively the situations where the current tariff is raised by 25% and 15% from 1982–83, when the Project commences. For both cases, there are no difficulties pertaining to profitability, fund sources and applications. For Case C, the return on net fixed assets will change from 6.4% to 8.9% between 1982–83 and 1989–90 and FRR is 11.2%. For case D, the return on net fixed assets will change from 3.8% to 6.2% and FRR is 6.1%. Both cases have a problem in the timing of raise in the tariff.

We recommend either Case E or Case F, both of which propose a raise in the current tariff from 1987–88, when the benifits envisioned in the Project begin being realized and the financial soundness and FRR profitability of the project are assured. Detailed financial statements for Case E are shown in Table VII-1-5 to 7, Part VII.

(3) Financial Rate of Return (FRR)

The financial rate of return (FRR) on the Project is 11.2% (Case E). Table 5-4 shows the internal rate of returns corresponding to the raises in tariff.

(4) Tariff on Containers

It is necessary to determine the tariff for containers before the container terminal is completed. Assuming that the operation costs, interest, and depreciation costs are to be recovered through Project revenue alone, a study was made of possible container tariffs with results as shown in Table 5-5.

5-2 Inland Container Terminal

(1) Premises

a. The terminal shall assume a self-supporting accounting system under the organization of Pakistan Railways.

b. The financial analysis shall be made limited to the Project, and wherein the financial soundness of profitability, sources and applications of funds, and financial statements will be reviewed as the project is actually carried out.

c. The profitability is judged based on the internal rate of returns (FRR).

d. Container tariffs will be reviewed.

(2) Review on Financial Statements and Tariff

Financial statements for the period starting from 1983–84 to 2006–07 were prepared based on 6 imaginary cases as shown in Table 5-7, assuming a project life of 20 years starting from 1987–88 when project use commences, with consideration to the procurement of investment funds (Table 5-6) and the tariff standard. An outline of this is shown in Table 5-8. According to the current container tariff, the profitability and the status of fund sources and applications will be satisfactory, with the operating ratio and the return on net fixed assets fluctuating below 45% and above 19% respectively. (Cases A to D).

After 1987–88 when the port at sea and the inland container terminal are completed, the current high tariff will be reviewed and reduced to more reasonable level. The financial statements, based on the tariff reduced by 20% from the current rate, are shown as cases E and F. In these cases, there are no foreseeable problems concerning the financial status, fund sources and applications. The operating ratio and the return on net fixed assets will fluctuate below 56% and above 9% respectively.

(3) Financial Rate of Returns (FRR)

FRR is 34.7% under the current tariff, and will be 25.0% if the tariff is lowered by 20%. FRR corresponding to the tariff reductions are shown in Table 5-9. Based on the premise that operating costs, the interest and depreciation costs will be recovered, an FRR of at least 17% will be necessary.

(4) Tariff on Container

Based on the premise that all costs limited to the Project are to be recovered, the tariff on containers was reviewed. Table 5-10 shows the results of this review.

Table 5-1 Finance Schedule of Karachi Container Terminal

(Unit: 1,000 US$)

Item	Construction Year	1982–82			1983–83			1984–85			1985–86			1986–87			Total		
		L/C	F/C	Sub-total	L/C	F/C	Sub-total	L/C	F/C	Sub-total	L/C	F/C	Sub-total	L/C	F/C	Sub-total	L/C	F/C	Total
Civil Engineering Facilities	Container Berth				1,389	1,120	2,509	5,557	4,481	10,038	2,778	2,240	5,018				9,724	7,841	17,565
	Reclamation				308	794	1,102	1,234	3,175	4,409	617	1,588	2,205				2,159	5,557	7,716
	Slope Protection & Retaining Wall							769	345	1,114	1,538	691	2,229				2,307	1,036	3,343
	Access Railway & Road							1,010	612	1,622	2,022	1,225	3,247	1,011	613	1,624	4,043	2,450	6,493
	Container Terminal																		
	Pavement										5,533	1,383	6,916	4,149	1,038	5,187	9,682	2,421	12,103
	CFS										2,683	671	3,354	1,341	335	1,676	4,024	1,006	5,030
	Other Buildings										1,234	309	1,543	617	154	771	1,851	463	2,314
	Railway										166	218	384	166	219	385	332	437	769
	Foundation										1,042	635	1,677	1,043	635	1,678	2,085	1,270	3,355
	Utilities										1,134	428	1,562	1,134	429	1,563	2,268	857	3,125
	Sub-total (1)				1,697	1,914	3,611	8,570	8,613	17,183	18,747	9,388	28,135	9,461	3,423	12,884	38,475	23,338	61,813
	Preliminery & Temporary Works				661	255	916										661	255	916
	Dredging				309	794	1,103	1,235	3,175	4,410	618	1,587	2,205				2,162	5,556	7,718
	Transportation of Constr. Equip. & Craft					953	953								952	952		1,905	1,905
	Sub-total (2)				970	2,002	2,972	1,235	3,175	4,410	618	1,587	2,205		952	952	2,823	7,716	10,539
	Total [(1) + (2)]				2,667	3,916	6,583	9,805	11,788	21,593	19,365	10,975	30,340	9,461	4,375	13,836	41,298	31,054	72,352
Equip., etc.	Sub-total (3)													14,012	31,875	45,887	14,012	31,875	45,887
Engineering	Sub-total (4)	305	922	1,227	230	690	920	154	460	614	154	460	614	154	460	614	997	2,992	3,989
Physical Contingency	Sub-total (5) [15% of (1) + (2)] [5% of (3)]				352	587	939	1,252	1,768	3,020	2,635	1,647	4,282	1,279	2,250	3,529	5,518	6,252	11,770
	Grand Total (1)–(5)	305	922	1,227	3,249	5,193	8,442	11,211	14,016	25,227	22,154	13,082	35,236	24,906	38,960	63,866	61,825	72,173	133,998

Table 5-2 Case Study

Case	Foreign Currency	Local Currency	Tariff Rate
A	Foreign Loan Interest Rate: 11.6% Term: 20 years after 5 years grace period	Own Budget	Current Tariff
B	Interest Rate: 2.75% Term: 20 years after 10 years grace period	Same as above	Same as above
C	Interest Rate: 11.6% Term: 20 years after 5 years grace period	Same as above	Raising current tariff by 25% on and after 1982–83
D	Interest Rate: 2.75% Term: 20 years after 10 years grace period	Same as above	Raising current tariff by 15% on and after 1982–83
E	Interest Rate: 11.6% Term: 20 years after 5 years grace period	Local Loan: Interest Rate: 11.6% Term: 20 years after 5 year grace period	Raising current tariff by 25% on and after 1987–88
F	Interest Rate: 2.75% Term: 20 years after 10 years grace period	Same as above	Raising current tariff by 15% on and after 1987–88

Table 5-3 Financial Statement

(Unit: million RS)

	Case	1977 –78	1982 –83	1984 –85	1986 –87	1987 –88	1988 –89	1991 –92 1995 –96	1996 –97 2000 –01	2001 –02 2005 –06
Revenue	A	325	488	509	538	571	606	3,489	3,498	3,495
	B	〃	〃	〃	〃	〃	〃	〃	〃	〃
	C	〃	610	636	673	714	758	4,361	4,372	4,369
	D	〃	561	585	619	657	697	4,012	4,023	4,019
	E	〃	488	509	538	714	758	4,361	4,372	4,369
	F	〃	〃	〃	〃	657	697	4,012	4,023	4,019
Profit after depreciation	A	52	–35	–23	–40	–120	–85	82	217	412
	B	〃	–34	–11	6	–57	–26	279	332	450
	C	〃	87	104	95	23	67	954	1,091	1,286
	D	〃	39	65	87	29	65	802	857	974
	E	〃	–35	–34	–97	–48	0	705	931	1,148
	F	〃	–34	–22	–51	–42	–2	553	697	903
Fixed assets		1,157	1,876	2,042	2,855	2,710	2,565	1,550	825	183
Long-term loan	A	353	500	633	1,082	1,012	941	564	319	106
	B	〃	〃	〃	〃	1,048	1,013	744	499	286
	C	〃	〃	〃	〃	1,012	941	564	319	106
	D	〃	〃	〃	〃	1,048	1,013	744	499	286
	E	〃	503	780	1,694	1,593	1,491	897	497	129
	F	〃	〃	〃	〃	1,629	1,563	1,077	677	309
Net current assets	A	123	–18	–21	–376	–382	–354	593	1,485	2,521
	B	〃	–17	–5	–291	–198	–75	1,282	2,289	3,363
	C	〃	104	357	265	402	582	2,738	4,504	6,414
	D	〃	56	221	93	272	486	2,568	4,100	5,698
	E	〃	–15	113	136	171	253	1,819	3,270	4,887
	F	〃	–14	129	221	298	414	1,906	3,123	4,495
Reserves	A	1,243	1,560	1,590	1,599	1,518	1,472	1,781	2,193	2,800
	B	〃	1,561	1,606	1,684	1,666	1,679	2,290	2,817	3,462
	C	〃	1,682	1,968	2,240	2,302	2,408	3,926	5,212	6,693
	D	〃	1,634	1,832	2,068	2,136	2,240	3,576	4,628	5,797
	E	〃	1,560	1,577	1,499	1,490	1,529	2,674	3,800	5,143
	F	〃	1,561	1,593	1,584	1,581	1,618	2,581	3,473	4,571

Table 5-4 FRR

Percentage of Tariff Raise	FRR
0%	less than 0.1%
10%	3.0%
15%	6.1%
17%	7.2%
20%	8.8%
25%	11.2%
26%	11.7%
30%	13.5%

Table 5-5 Container Tariff (per Unit)

(Unit: Rs)

Container	Interest Rate 11.6%		Interest Rate 2.75%	
	20 ft	40 ft	20 ft	40 ft
FCL	1,060	1,590	910	1,370
LCL	1,590	2,390	1,370	2,050
Transhipment	800	1,200	690	1,030
Empty	1,060	1,590	910	1,370
Storage	65	130	55	110

Table 5-6 Finance Schedule of Inland CFS

(Unit: 1,000 US$)

Item	Construction Year	1983-84			1984-85			1985-86			1986-87			Total		
		L/C	F/C	sub-total	L/C	F/C	sub-total	L/C	F/C	sub-total	L/C	F/C	sub total	L/C	F/C	Total
Civil Engineering Facilities	Land Acquisition Cost				932		932							932		932
	Reclamation				550	550	1,100	734	734	1,468				1,284	1,284	2,568
	Access Railway & Road				937	379	1,316	1,873	759	2,632				2,810	1,138	3,948
	Container Terminal															
	Pavement							3,537	884	4,421	2,652	663	3,315	6,189	1,547	7,736
	CFS							2,503	626	3,129	1,252	313	1,565	3,755	939	4,694
	Other Building							840	210	1,050	420	105	525	1,260	315	1,575
	Railway							92	122	214	94	121	215	186	243	429
	Foundation							536	360	896	537	360	897	1,073	720	1,793
	Utilities							664	250	914	662	251	913	1,326	501	1,827
	Sub-Total (1)				2,419	929	3,348	10,779	3,945	14,724	5,617	1,813	7,430	18,815	6,687	25,502
	Preliminary & Temporary Work				217	55	272							217	55	272
	Transportation of Constr. Equip.					95	95					95	95		190	190
	Sub-Total (2)				217	150	367					95	95	217	245	462
	Total (1) + (2)				2,636	1,079	3,715	10,779	3,945	14,724	5,617	1,908	7,525	19,032	6,932	25,964
Equipment etc	Sub-Total (3)										14,574	34,640	49,214	14,574	34,640	49,214
Engineering	Sub-Total (4)	179	540	719	90	269	359	90	269	359	90	269	359	449	1,347	1,796
Physical Contingency	Sub-Total (5) 15% of (1) + (2) 5% of (3)				253	108	361	1,024	395	1,419	541	1,922	2,463	1,818	2,425	4,243
Grand Total	(1) - (5)	179	540	719	2,979	1,456	4,435	11,893	4,609	16,502	20,822	38,739	59,561	35,873	45,344	81,217

Table 5-7 Case Study

Case	Foreign Currency	Local Currency	Tariff Rate
A	Foreign Loan Interest Rate: 11.6% Term: 20 years after 5 years grace period	PR or Government Investment Dividend: 6.25% per year	Current Tariff
B	Interest Rate: 2.75% Term: 20 years after 10 years grace period	Same as above	Same as above
C	Interest Rate: 11.6% Term: 20 years after 5 years grace period	Local Loan: Interest rate 11.6% Term: 20 years after 5 years grace period	Same as above
D	Interest Rate: 2.75% Term: 20 years after 10 years grace period	Same as above	Same as above
E	Interest Rate: 11.6% Term: 20 years after 5 years grace period	PR or Government Investment Dividend: 6.25% per year	Reducing current tariff by 20% on and after 1987-88
F	Interest Rate: 2.75% Term: 20 years after 10 years grace period	Same as above	Same as above

Table 5-8 Financial Statement

(Unit: Million Rs)

	Case	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93 – 1996-97	1997-98 – 2001-02	2002-03 – 2006-07
Revenue	A	396	462	553	627	627	3135	3135	3135
	B	"	"	"	"	"	"	"	"
	C	"	"	"	"	"	"	"	"
	D	"	"	"	"	"	"	"	"
	E	317	370	442	502	502	2510	2510	2510
	F	"	"	"	"	"	"	"	"
Profit before Depreciation & Improvement Fund	A	42	88	151	202	205	1063	1128	1193
	B	82	128	188	237	237	1187	1202	1217
	C	56	104	172	229	234	1238	1355	1473
	D	96	144	209	264	266	1363	1429	1497
	E	-37	-4	40	77	80	438	503	568
	F	3	36	77	112	112	562	577	592
Fixed Assets		766	728	690	652	614	424	234	44
Net Current Assets	A	76	215	421	680	942	2290	3703	5181
	B	144	345	610	926	1242	2736	4223	5725
	C	49	186	395	663	936	2369	3919	5587
	D	117	316	584	909	1236	2816	4440	6132
	E	34	44	139	273	410	1133	1921	2774
	F	65	174	328	519	710	1579	2441	3318
Reserves	A	5	93	244	446	651	1714	2842	4035
	B	73	201	389	626	863	2050	3252	4469
	C	-22	82	254	483	717	1955	3310	4783
	D	46	190	399	663	929	2292	3721	5218
	E	-74	-78	-38	39	119	557	1060	1628
	F	-6	30	107	219	331	893	1470	2062

Table 5-9 FRR

Tariff Reduction	FRR
0%	34.7%
5%	32.5%
10%	30.0%
15%	27.6%
20%	25.0%
25%	22.3%
30%	19.5%
35%	16.6%
40%	13.3%

Table 5-10 Tariff on Container

(in the case of no profit no loss – (F/C) Interest rate 11.6%
(L/C) PR or Government Investment Dividend 6.25%)

Tariff on Freight

(Unit: RS)

	20 ft	40 ft
Import Loaded	3,000	6,000
Export Loaded	1,900	3,800
Empty	900	1,800

Tariff on Cargo handling storage

	20 ft	40 ft
FCL	570	860
LCL	860	1,290
Empty	570	860
Storage	35	70