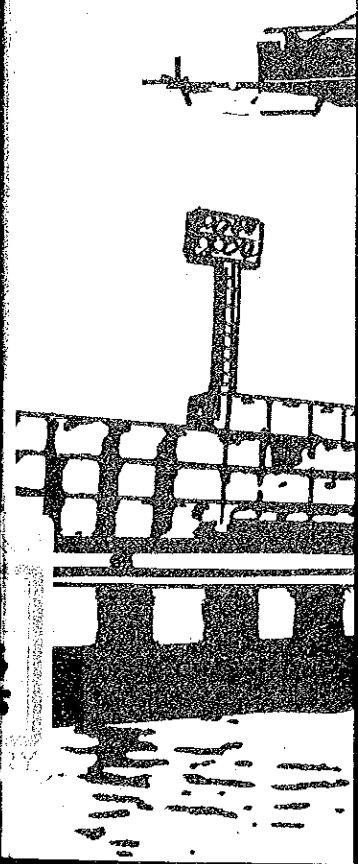


**FEASIBILITY STUDY REPORT
ON THE INTRODUCTION
OF CONTAINERIZATION
IN THE ISLAMIC REPUBLIC
OF PAKISTAN** FINAL REPORT VOL.1

MARCH 1982



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**FEASIBILITY STUDY REPORT
ON THE INTRODUCTION
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OF PAKISTAN** FINAL REPORT VOL.1

MARCH 1982

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PREFACE

In response to the request of the Government of the Islamic Republic of Pakistan, the Government of Japan decided to conduct a feasibility study on the Introduction of Containerization Project in the Islamic Republic of Pakistan and entrusted it to the Japan International Cooperation Agency (JICA).

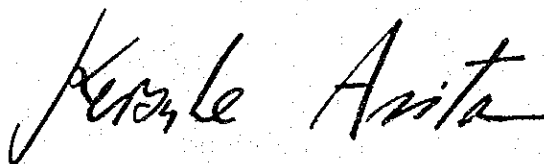
The JICA sent to Pakistan a survey team headed by Mr. Ikuhiko Yamashita several times in the period from November 1980 to January 1982.

The team exchanged views with the officials concerned of the Government of Pakistan over the Project and conducted a field survey in Karachi, Qasim, Lahore areas, etc. After the team returned to Japan, further studies were made and the present report has been prepared.

I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

I wish to express my deep appreciation to the officials concerned of the Government of Pakistan for their close cooperation extended to the team.

March, 1982



Keisuke Arita
President

Japan International Cooperation Agency

LETTER OF TRANSMITTAL

March , 1982

Mr. Keisuke Arita
President
Japan International Cooperation Agency

Dear Mr. Arita:

It is my great pleasure to submit herewith a report on the Introduction of Containerization in the Islamic Republic of Pakistan.

The Japanese study team, headed by myself, conducted a survey on the Project mainly in Pakistan for 42 days from November 17, 1980, at the request of the Japan International Cooperation Agency. The findings of the feasibility study and our proposition on the introduction of containerization are included in this report. The study shows that the importance and priority of the Project is very high so that I hope the Project be executed at the earliest opportunity.

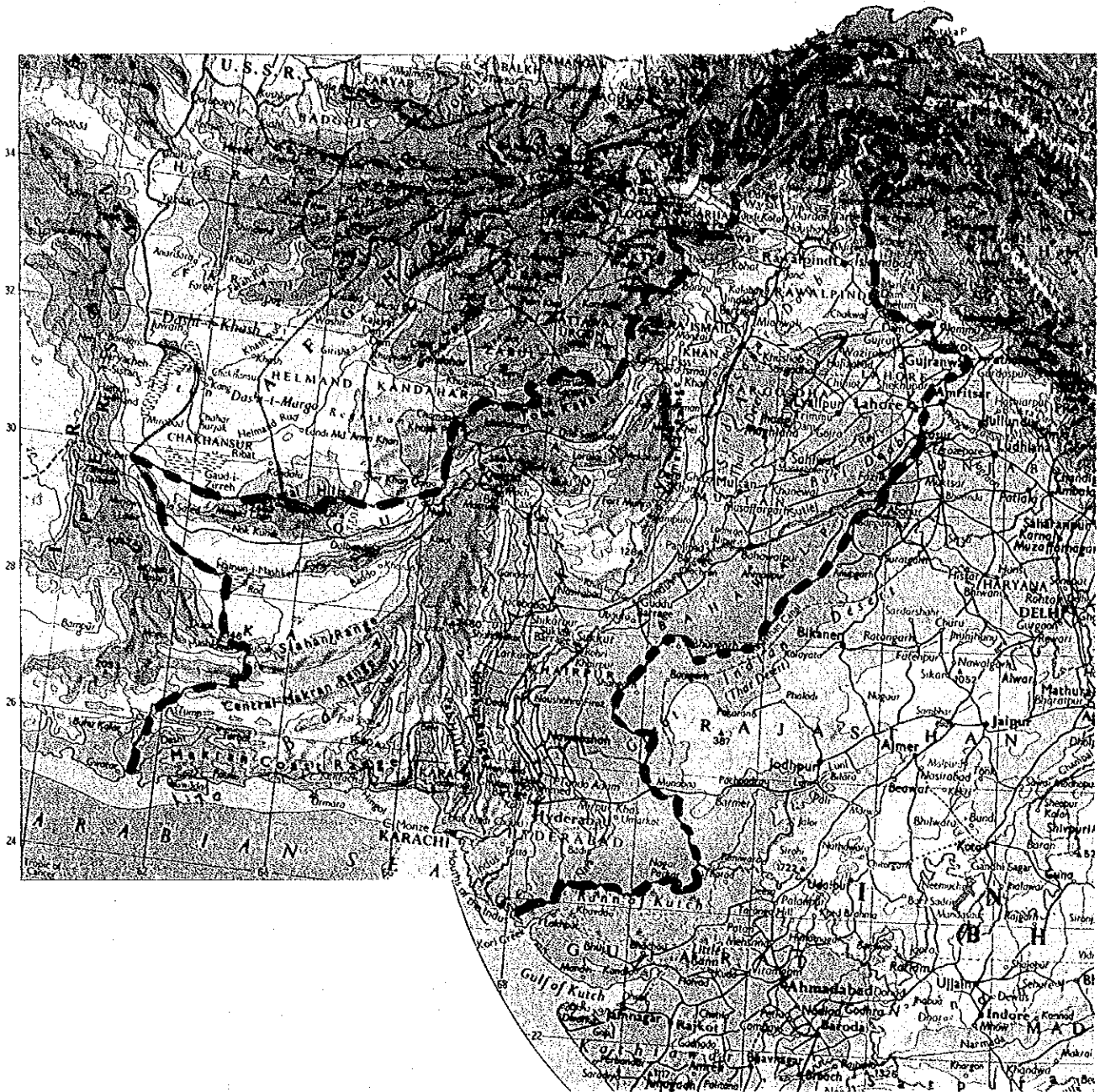
On behalf of the Japanese study team and myself, I would like to express my deepest appreciation to the Government of the Islamic Republic of Pakistan, the Ports and Shipping Wing Ministry of Communications and various organizations concerned the Project for their unlimited cooperation, assistance and warm hospitality extended to the team during our stay in Pakistan.

My indebtedness also is great to the Japan International Cooperation Agency, the Ministry of Transport, the Ministry of Foreign Affairs, the Japanese Embassy and the Japanese Consulate General in Pakistan for giving us valuable suggestions and assistance in the field study and in preparation of this report.

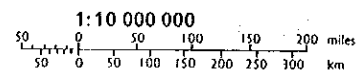
Sincerely yours,

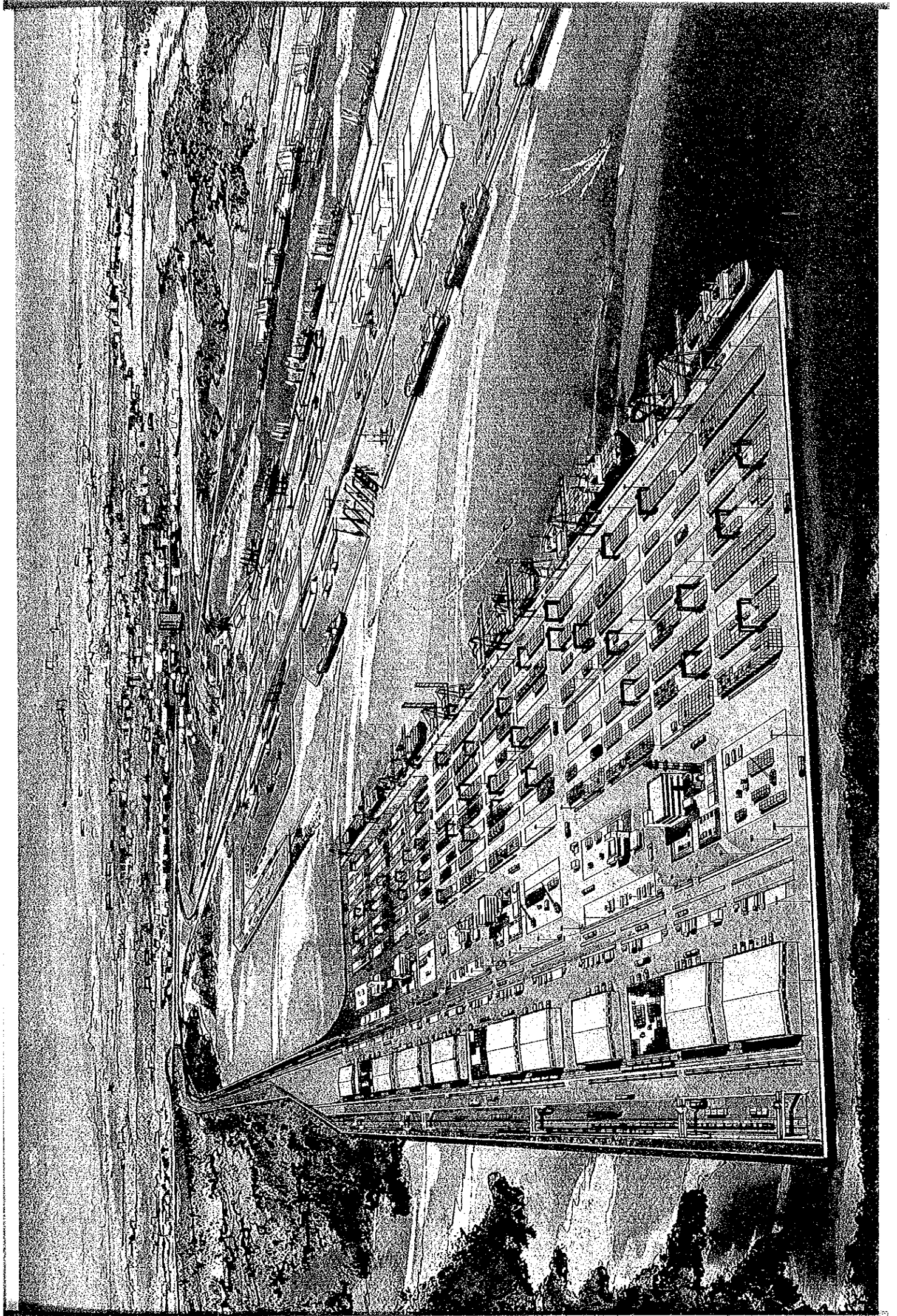


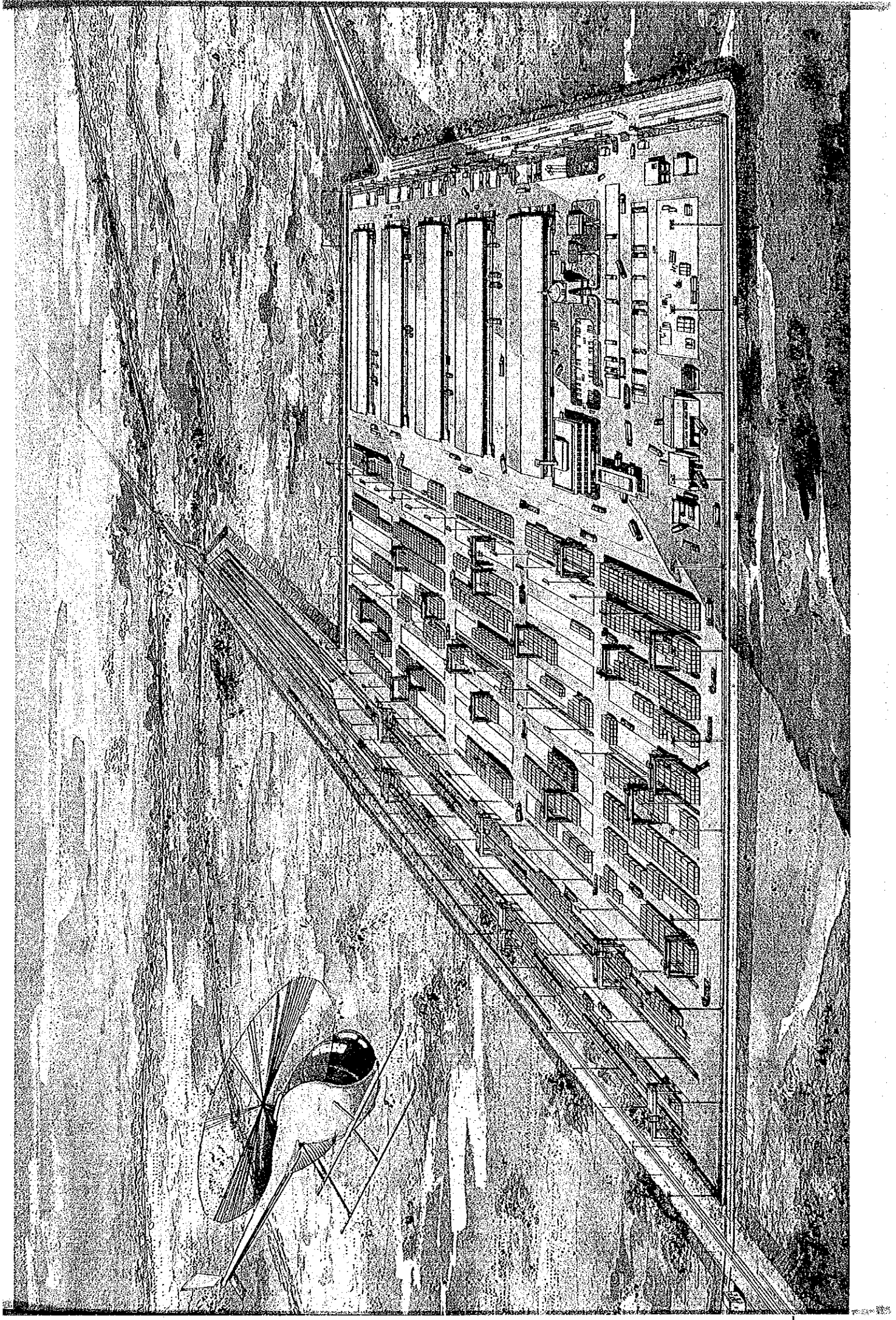
Ikuhiko Yamashita
Head
Japanese Study Team for the Introduction of
Containerization in the Islamic Republic
of Pakistan
(Director Planning, the Overseas Coastal Area
Development Institute of Japan)



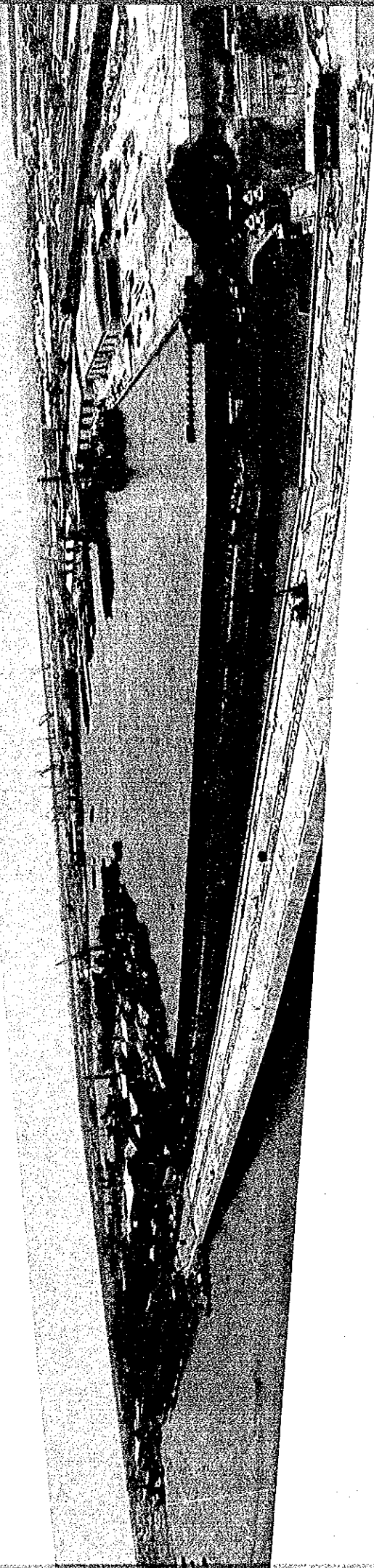
THE ISLAMIC REPUBLIC OF PAKISTAN







East Wharf and West Wharf, Karachi Port



Marginal Wharf, Casim Port



Construction Site, Inland Container Freight Station



Exchange Rate

US\$1.00 = Rupees 9.9 = Yen 210

ABBREVIATIONS

MOC	–	Ministry of Communications
PDD	–	Planning & Development Division
PC	–	Planning Commission
EAD	–	Economic Affairs Division
CBR	–	Central Board of Revenues
MOR	–	Ministry of Railway
PR	–	Pakistan Railway
RB	–	Railway Board
NTRC	–	National Transport Research Centre
PSW	–	Ports & Shipping Wing
KPT	–	Karachi Port Trust
PQA	–	Port Qasim Authority
PNSC	–	Pakistan National Shipping Corporation
NLC	–	National Logistic Cell
KDA	–	Karachi Development Authority
LDA	–	Lahore Development Authority
BDA	–	Baluchistan Development Authority
QDA	–	Quetta Development Authority
PDA	–	Peshawar Development Authority
KCCI	–	Karachi Chamber of Commerce and Industry
LCCI	–	Lahore Chamber of Commerce and Industry
EPB	–	Export Promotion Bureau

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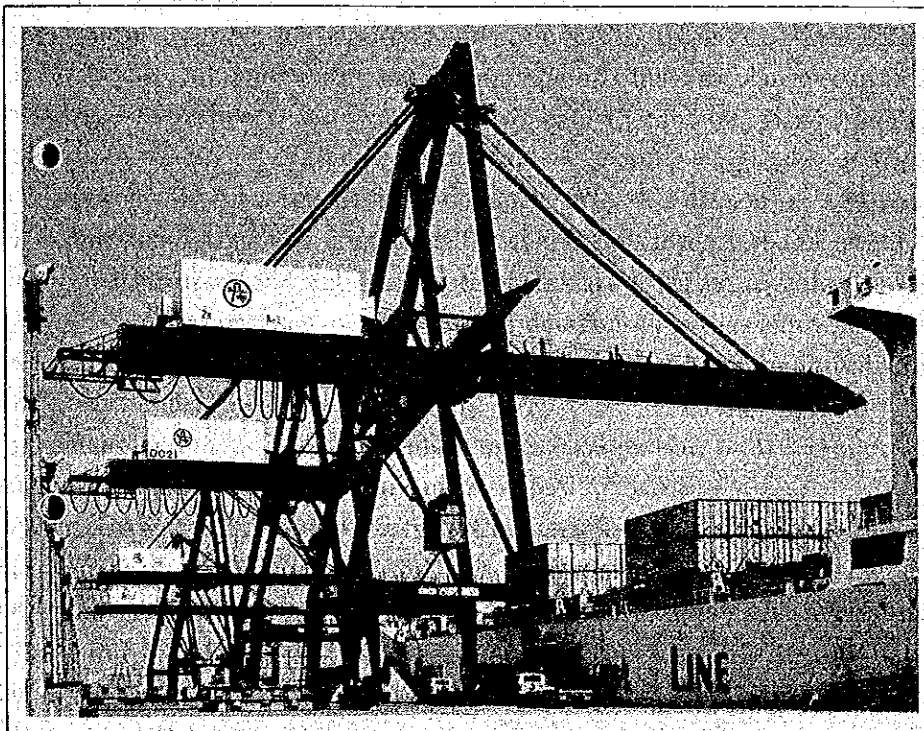
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LECTURE 1

1.1. THE SCALAR PRODUCT

1.2. THE VECTOR PRODUCT

1.3. THE GRADIENT

1.4. THE DIVERGENCE

1.5. THE CURL

1.6. THE LAPLACIAN

1.7. THE GAUSSIAN

1.8. THE STOKES

1.9. THE HELMHOLTZ

1.10. THE BIOT-SAVART

I CONCLUSIONS AND RECOMMENDATIONS

1-1 Conclusions

1-1-1 Introductory Comments

Based on the scope of work mutually agreed between the Japanese and the Pakistani Governments, a container terminal in port has been planned both for Karachi Port and Qasim Port as alternative possibilities, and an inland container freight station has also been planned at Lahore to establish a full-fledged container transport system in Pakistan.

The entire study consists of a master plan and an urgent plan. The master plan is to guarantee the sound development of a container transport system in the distant future (target year 1999/2000), and within the framework of this master plan, an urgent plan to cope with the recent rapid growth of containerization has been formulated to check the feasibility (target year 1987/88).

1-1-2 Master Plan

1) Port Container Terminal

a) Volume of Cargo and the Number of Berths Required.

The volume of container cargo for the target year of the Master Plan (1999/2000) is estimated to be approx. 5.9×10^6 tonnes, and a 6-berth container terminal will be necessary to handle this quantity.

b) Port Capacity Analysis

As a mean of securing the required number of berths, we may consider both renovating existing berths and constructing new ones. Among others the berths currently under construction at Qasim Port, Marginal Wharf No. 5-7 (2 container berths) are relatively suitable for conversion to container berths, and the depth, length etc. of these berths are mostly acceptable for a full-fledged container berth. A sufficient area can be secured for use behind the berths, and conditions for connection to both road and rail are good. It follows that the area for creating 2 of the necessary 6 berths by converting Marginal Wharf No. 5 ~ 7 to container berths is worth due consideration. However, the analysis of the total port capacity in Pakistan suggests that there will be a future shortage in Pakistan's overall port capacity to handle dry cargo.

The details of this analysis are shown in the comparison of the proposal for new construction and the proposal for conversion of existing berths.

c) Layout Plan and Construction Costs for Container Terminals.

The Karachi Port container terminal has been planned, as shown in Fig. 1, for the Western Backwater, and that for Qasim, as shown in Fig. 2, situated between the Marginal Wharf and the IOC berth. The necessary construction costs will be approx. US\$313 million in the case of a terminal in Karachi Port, and approx. US\$302 million for Qasim.

2) Inland Container Freight Station

a) Selection of site for Inland Container Freight Station

Lahore area has been revealed to be distinguished in the cargo handling demand among other areas such as Multan, Peshawar and Quetta. Therefore, the highest priority for the future site of Inland Container Freight Station is given to Lahore, whereas further study should be made for the other sites.

b) Cargo volume and Required Terminal Scale

The estimated volume of cargo for the target year (1999/2000) is approximately 2.8×10^6 tonnes. To handle this quantity an area of approximately 50 hectares will be necessary for the freight station.

c) Layout Plan for Freight Station and Construction Costs.

As shown in Fig. 3, the Inland Freight Station is planned for the southern part of Lahore City, southwest of Kahna Kacha railway station. Construction cost will be approx. US\$192 million.

1-1-3 Urgent Plan

1) Port Container Terminal

a) Cargo Volume and Required Number of Berths

The cargo volume for the target year of the Urgent Plan (1987/88) is estimated to approach approx. 1.7×10^6 tonnes, and to handle this cargo, a 2-berth container terminal will be necessary.

b) Selection of Port

As to whether the above-mentioned 2 berths should be constructed in Karachi or Qasim, either would be sufficiently feasible from an economic and technical point of view.

However, the construction of the 2 ports separately would be clearly disadvantageous, and it is highly desirable that either one of the two ports will be chosen and the 2 berths constructed next to one another.

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 which are fully described in "2-2 Port Selection", the present report has selected the four points shown below as key factors in assuring smooth and efficient containerization.

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

i) Economic Profitability of the Project

The internal rate of returns (IRRs) are 14.3% for the Port of Karachi and 12.2% for the Port of Qasim. The IRR for the Port of Karachi is higher than that for the Port of Qasim by 2.1%. This difference may appear small, yet it is well established. The factor contributing most to this difference is that an additional investment for port related infrastructures, such as offices for various commercial activities, etc.

would be required at Qasim.

ii) Road Congestion in Karachi

Geographically, Qasim Port is clearly advantageous in terms of direct transportation to the upcountry. However, almost all existing port related functions, facilities and know-how are situated in and around the Port of Karachi. Thus, the selection of the Port of Qasim for a container port would likely result in roundabout transportation of upcountry containers and container cargoes, as has been occurring for ten years around Tokyo Bay, in Japan (see 2-2 Port Selection). Selection of the Port of Qasim would thus not necessarily lead to the reduction of the road congestion in Karachi. Moreover, additional and otherwise unnecessary transportation costs would have to be paid, due to this roundabout route.

On the other hand, in the case of Karachi, if investment is made in filling in the gaps in a possible bypass, then worsening of road congestion could be avoided.

iii) Liner Operator's Viewpoint

Consideration must be given to the viewpoints of liner operators, since full-fledged containerization as formulated in the present report can only be realized if full container vessels call at port.

In view of the higher tariff levels and other disadvantageous points such as the length, the alignment and the siltation of the approach channel, and the lack of port related functions and facilities in and around the Port of Qasim, it is highly unlikely that liner operators will select the Port of Qasim rather than the Port of Karachi, under conditions of free competition. In other words, even if the Port of Qasim is selected as a container port, a substantial percentage of the containers will still go to the Port of Karachi so the full and efficient utilization of investments for containerization will not have been realized, at least during the first stage of full-fledged containerization.

iv) Current Cargo Allocation Policy of the Pakistan Government

This policy is exactly in line with the above discussions and is considered highly appropriate, at least for the time being.

The current port policy of the Pakistani Government, as can be seen in the allocation of port cargo between the two ports, is to assign the role of commercial port to Karachi Port, while assigning the role of bulk cargo port to Qasim Port.

c) Layout Plan and Construction Costs

The layout plan for the Urgent Plan for Karachi Port is as shown in Fig. 4. Among the 6 berths required under the Master Plan, the central 2 berths will be constructed under the Urgent Plan, in consideration of the balance between dredging and reclaiming soil volume, at a cost of approximately US\$115 million. The container terminal construction costs, yearly investment plan and construction plan are respectively shown in Tables 1, 2 and Fig. 5. For reference, the layout plan for the container terminal under the Urgent Plan for Qasim Port is shown in Fig. 6, and its construction costs in Table 3.

2) Inland Container Freight Station

a) Selection of Site for Inland Container Freight Station

Under the Urgent Plan, Lahore had been selected as the site for an inland container

freight station in view of its being situated in the area with the largest cargo handling demand.

b) Cargo Volume and the Terminal Scale

For the target year (1987/88) the volume of container cargo at the Inland Container Freight Station, including exports of cotton and rice (Basmati Rice) is estimated to be 0.8×10^6 tonnes. To handle this volume of cargo an area of approx. 30 hectares will be necessary.

c) Modes of transport

As far as the transport cost are concerned, rail is the best. The Urgent Plan has been formulated on the premise that rail will be the major carrier and road the minor.

d) Layout Plan for the Freight Station and its Construction Costs

The Inland Container Freight Station under the Urgent Plan is as shown in Fig. 7, and its construction costs will be approximately US\$66 million.

e) Feasibility of the Freight Station Plan

The economic return on the Freight Station will be 14%, which is considered to be sufficiently feasible.

f) Measure for the Practical Realisation of Inland Container Transport (1)

In the above discussion the export of cotton and rice (Basmati rice) was included in the estimation of cargo to be handled at the Freight Station. At present cotton and rice exports are transported mostly during their harvest periods by rail to Karachi/Karachi area where they are stored in warehouses for sometime, and then exported from Karachi Port throughout the year. This transport and storage system has not yet been adapted to a container transport system in which cargo can be containerised inland and then shipped directly from Karachi.

Apart from cotton and rice, the export cargo handled at the Inland Freight Station will amount to some 60% of the imports, meaning that about half of the Karachi-bound containers will be empty. In this case, the above-mentioned 14% IRR will drop to 4%, and so it will be hard to guarantee the project's feasibility.

Accordingly, to assure viable, full-fledged inland container transport, it will be necessary to convert conventional transport/storage systems for cotton and rice to systems compatible with the container transportation. This will also resolve the present shortage of rail transport capacity especially experienced during cotton and rice harvest periods.

g) Measure for the Practical Realisation of Inland Transport (2)

In 14% IRR calculations, the low economic cost of rail transportation was assumed. But with the reliability and speed of the present rail services leaving much to be improved, rail cannot predominate in container transport unless reliable services and reasonable tariff systems are provided.

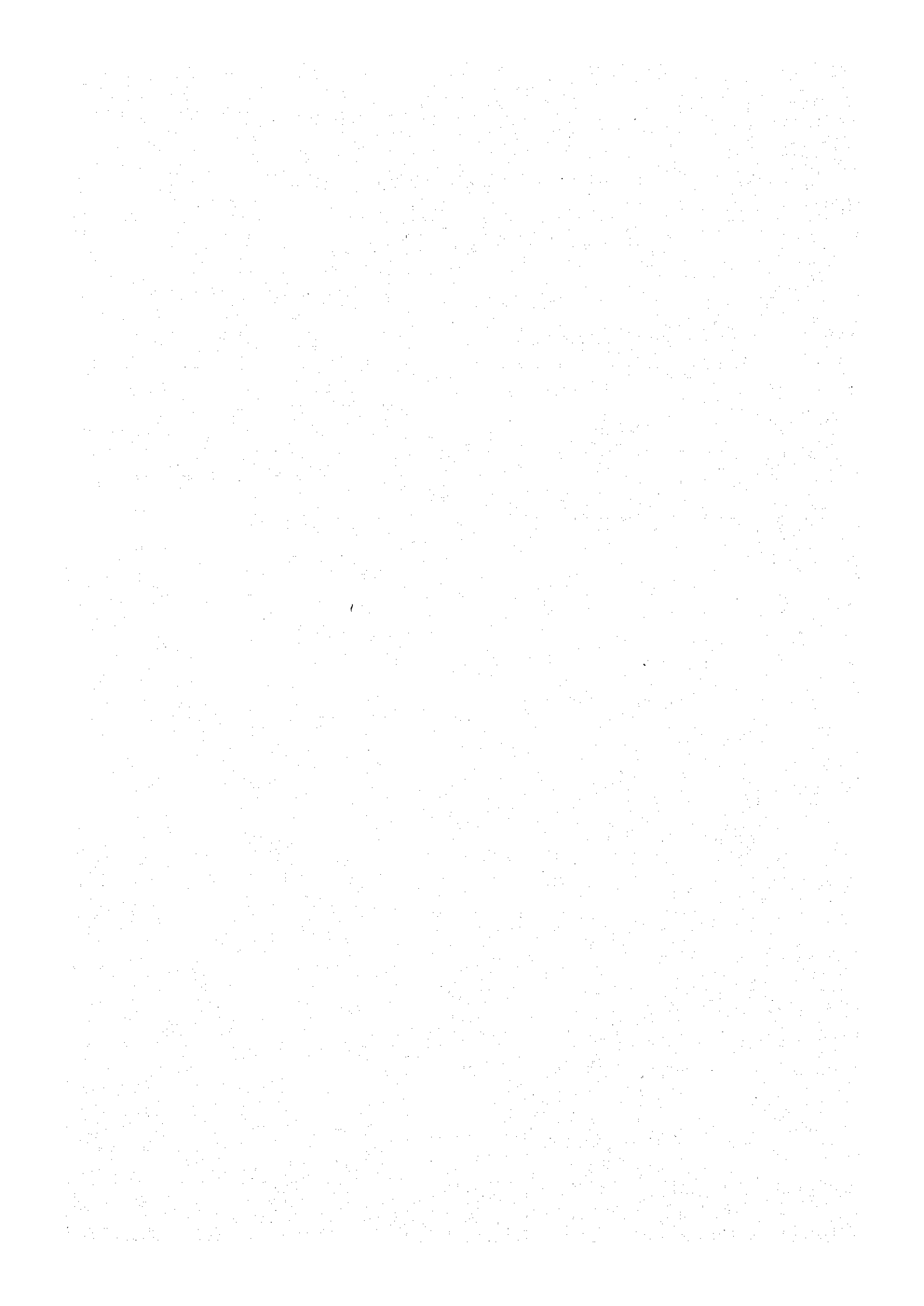
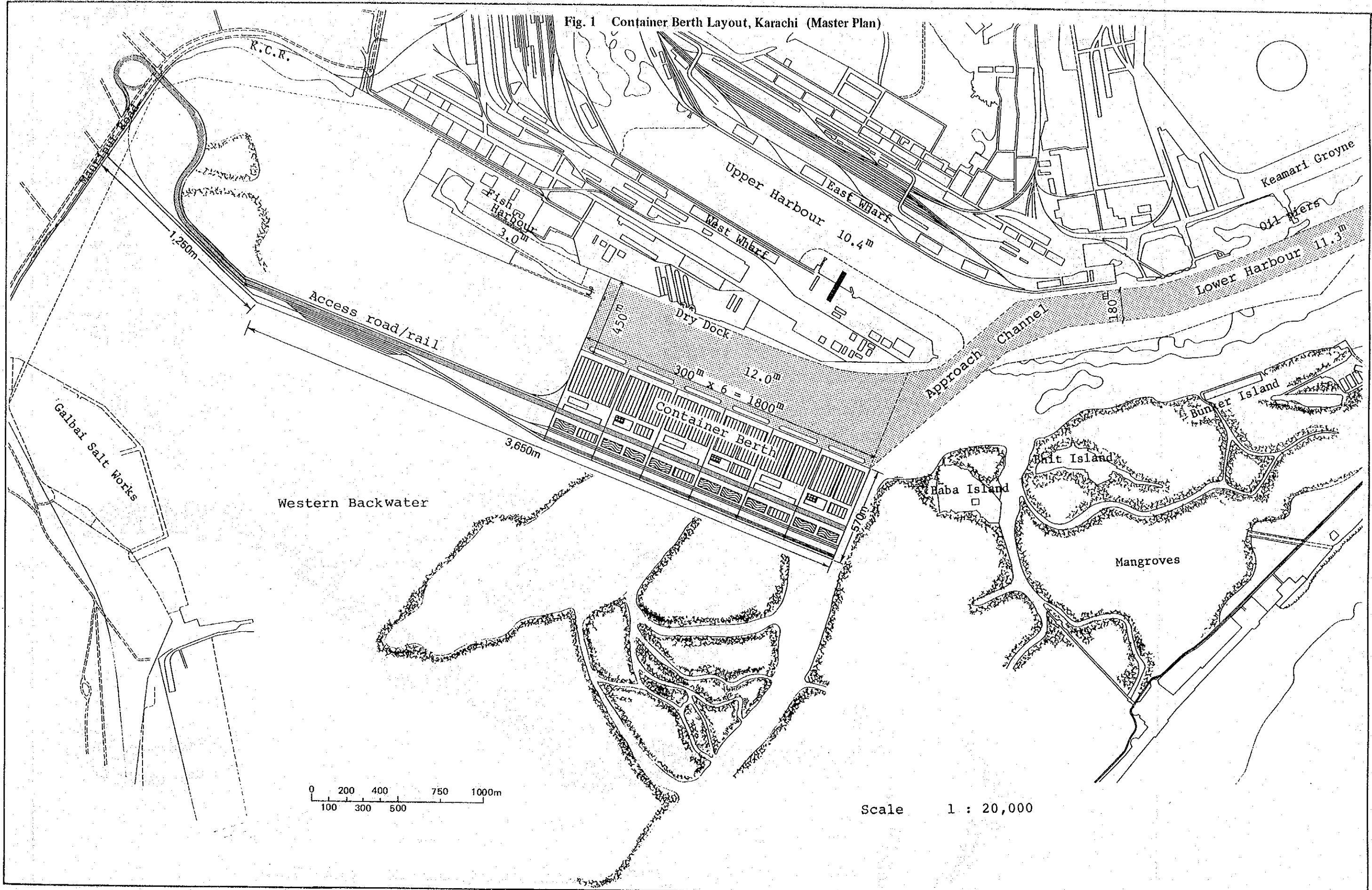


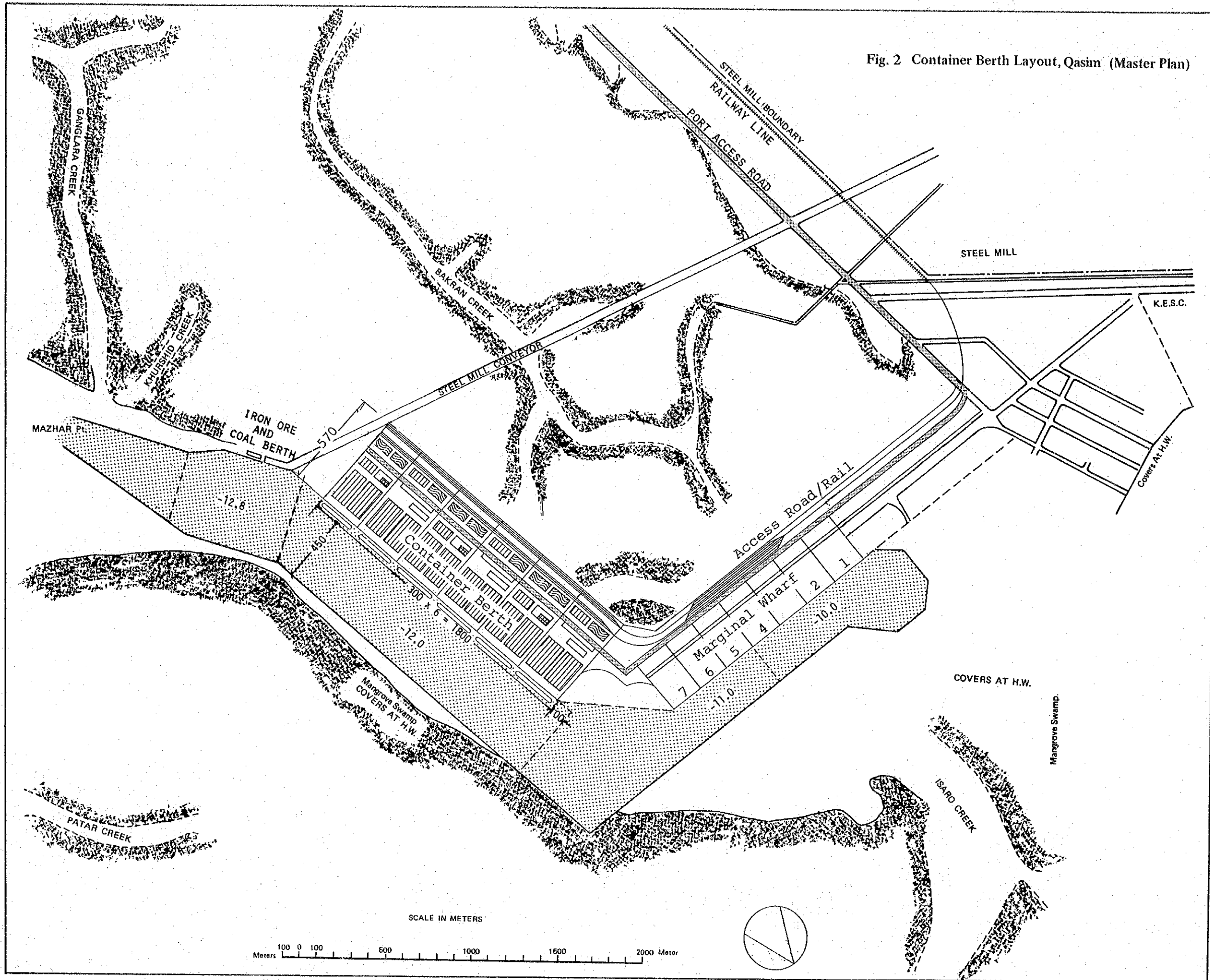
Fig. 1 Container Berth Layout, Karachi (Master Plan)



0 200 400 750 1000m
100 300 500

Scale 1 : 20,000

Fig. 2 Container Berth Layout, Qasim (Master Plan)



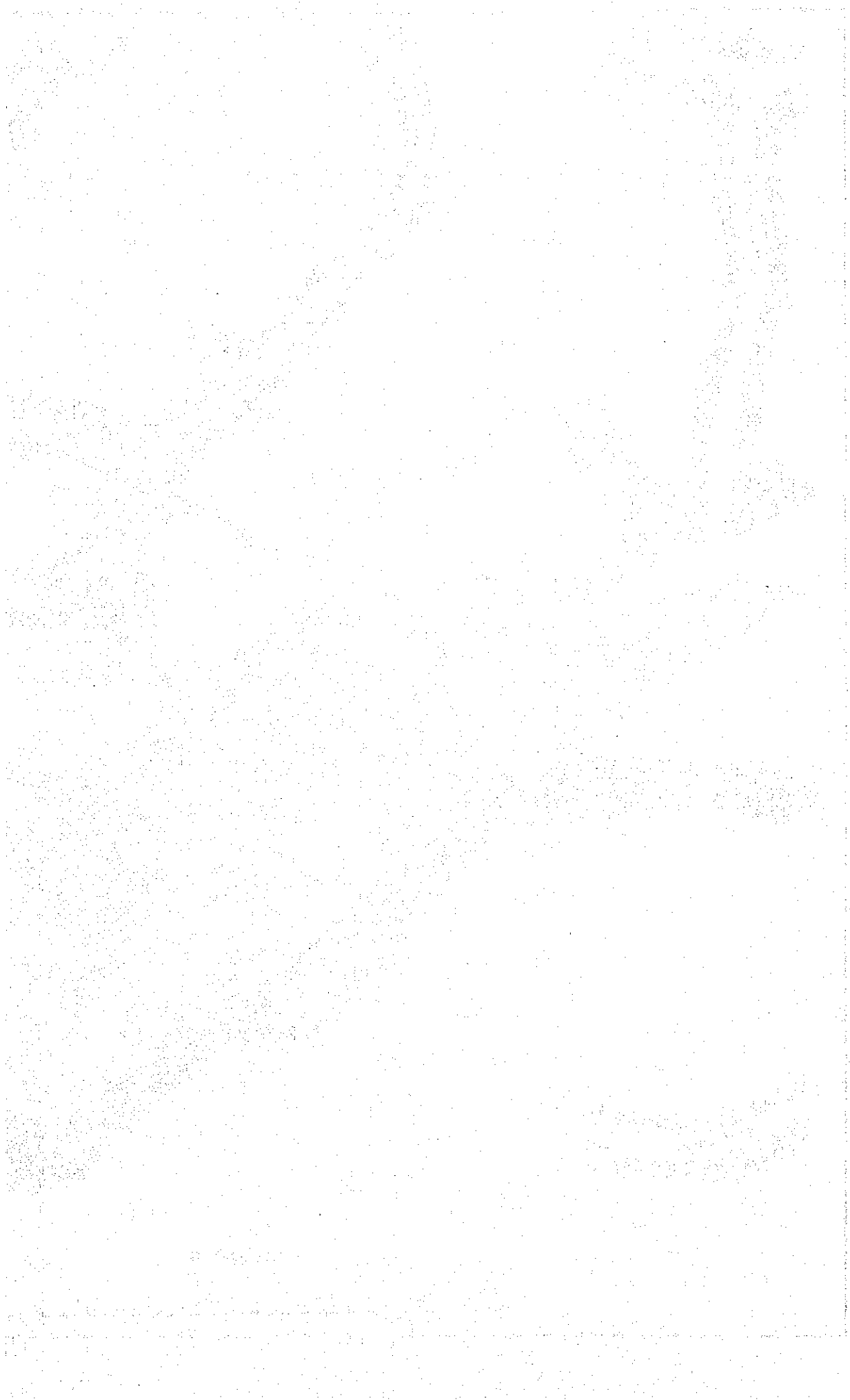


Fig. 3 Layout of Inland Container Freight Station (Master Plan)

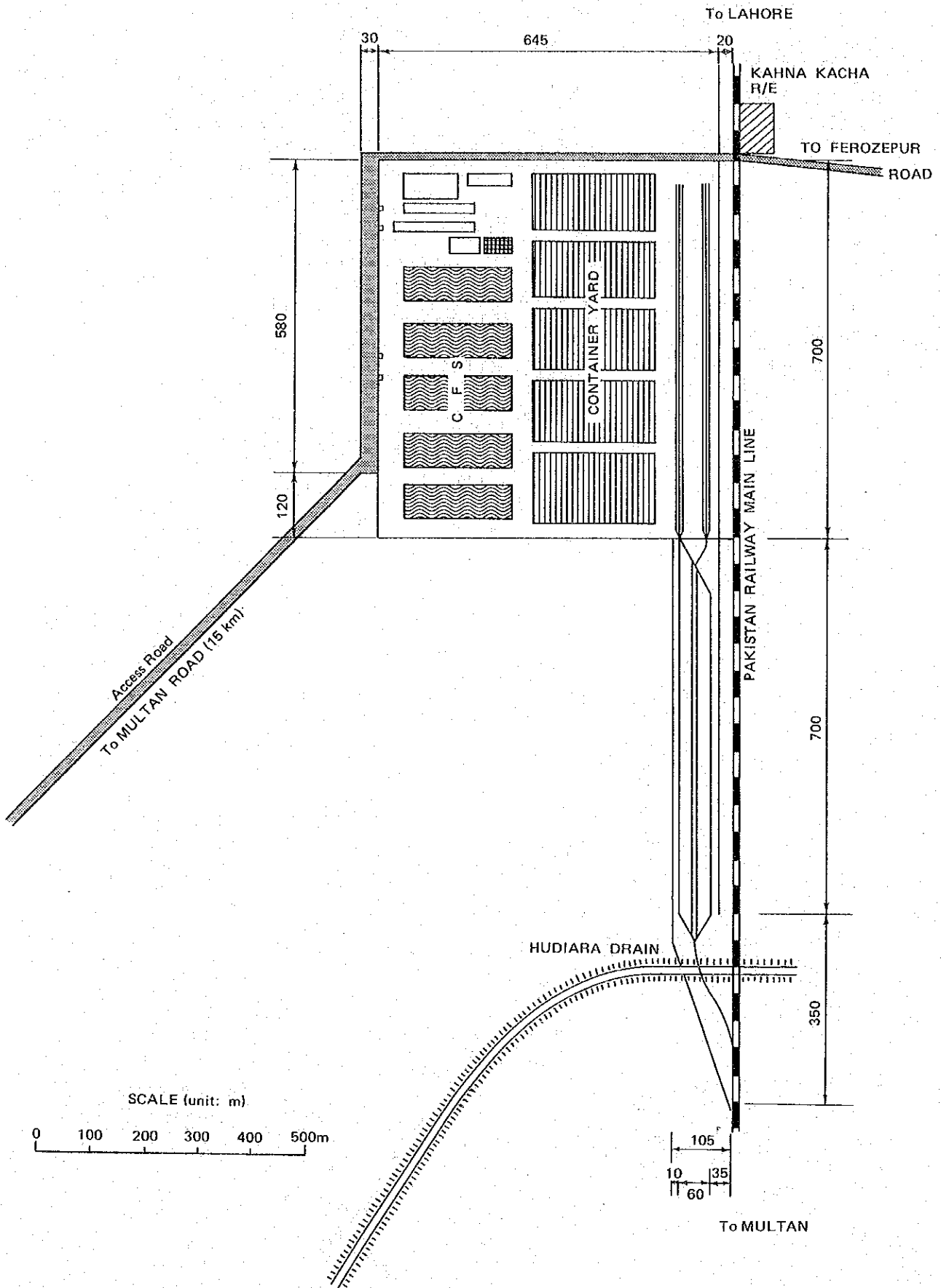
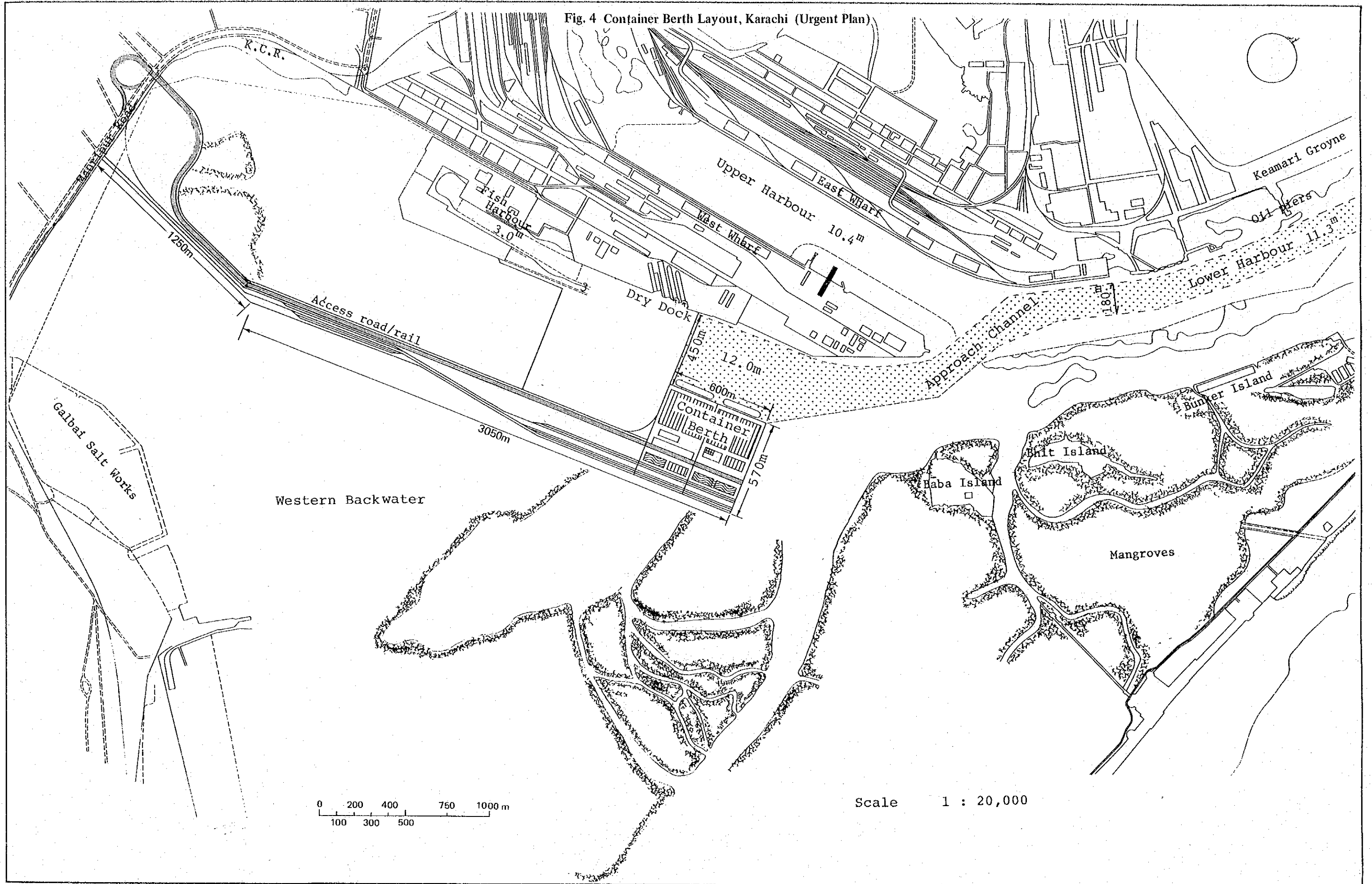


Fig. 4 Container Berth Layout, Karachi (Urgent Plan)



0 200 400 750 1000 m
100 300 500

Scale 1 : 20,000

Table 1 Construction Cost for Karachi Port (Urgent Plan)

Unit: 1000 US\$

ITEM	PARTICULARS	UNIT	QUANTITY	AMOUNT		TOTAL
				LOCAL	FOREIGN	
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
5	Retaining Wall	m	72	447	239	686
	Access Railway and Road					
5	Railway	m	11,700	315	1,785	2,100
	Road	m	4,100	1,327	332	1,659
6	Interchange	Nos	1	1,334	333	1,667
	Container Terminal					
6	Pavement	m ₂	282,400	9,682	2,421	12,103
	CFS	m ₂	19,800	4,024	1,006	5,030
6	Office & Other Buildings	m ₂	9,881	1,851	463	2,314
	Railway	m	3,600	77	437	514
6	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
8	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 2 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				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										635	635	1,270	635	635	1,270	1,270	1,270	2,540
	Mounted Transfer Crane										1,001	428	1,429	1,000	429	1,429	2,001	857	2,858
	Utilities																		
7	Mobilization & Demobilization																		
8	Equipments																		
	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	82,929	99,713
9	Engineering Study & Supervision				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

Fig. 5 Construction Schedule for Qasim Port

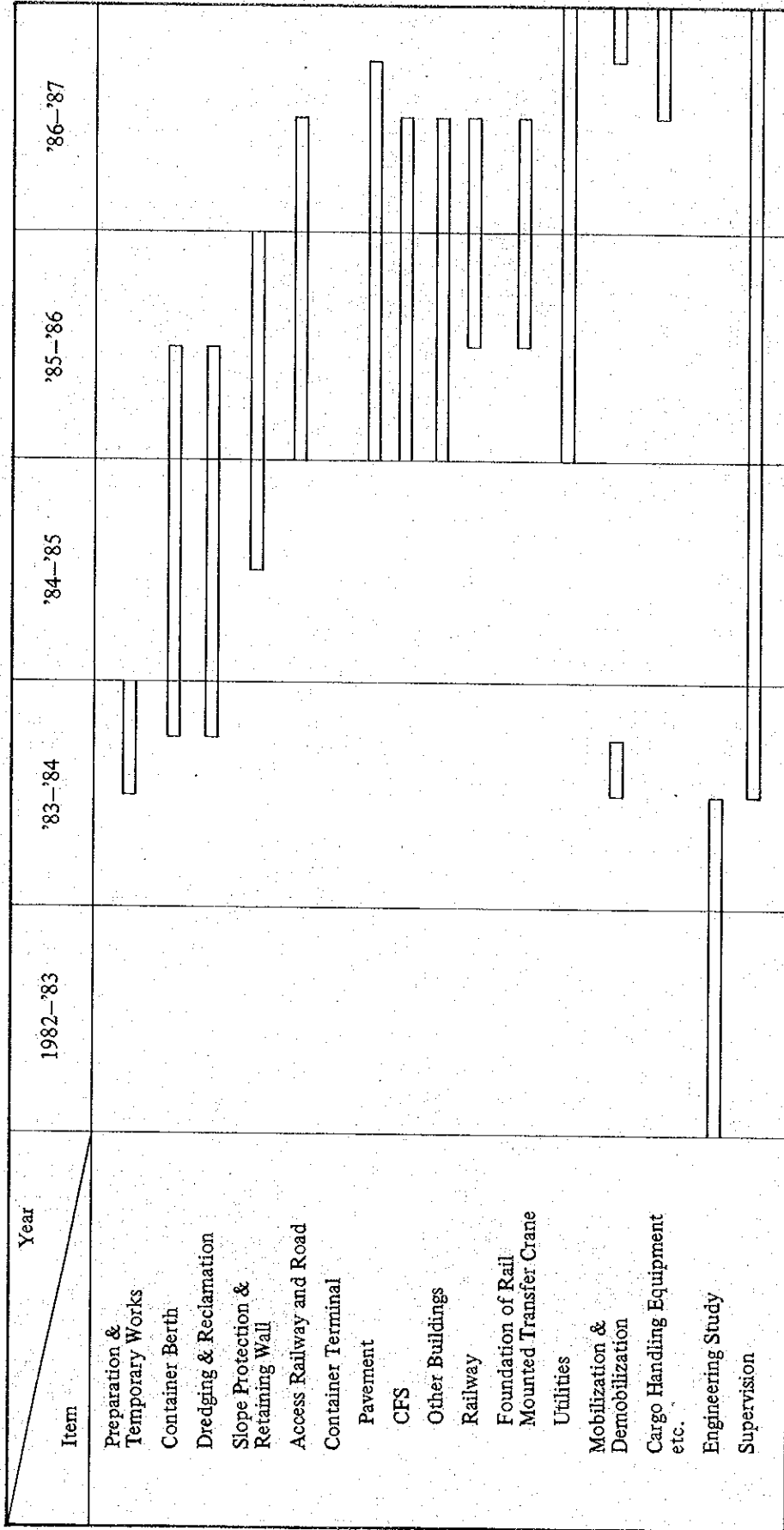
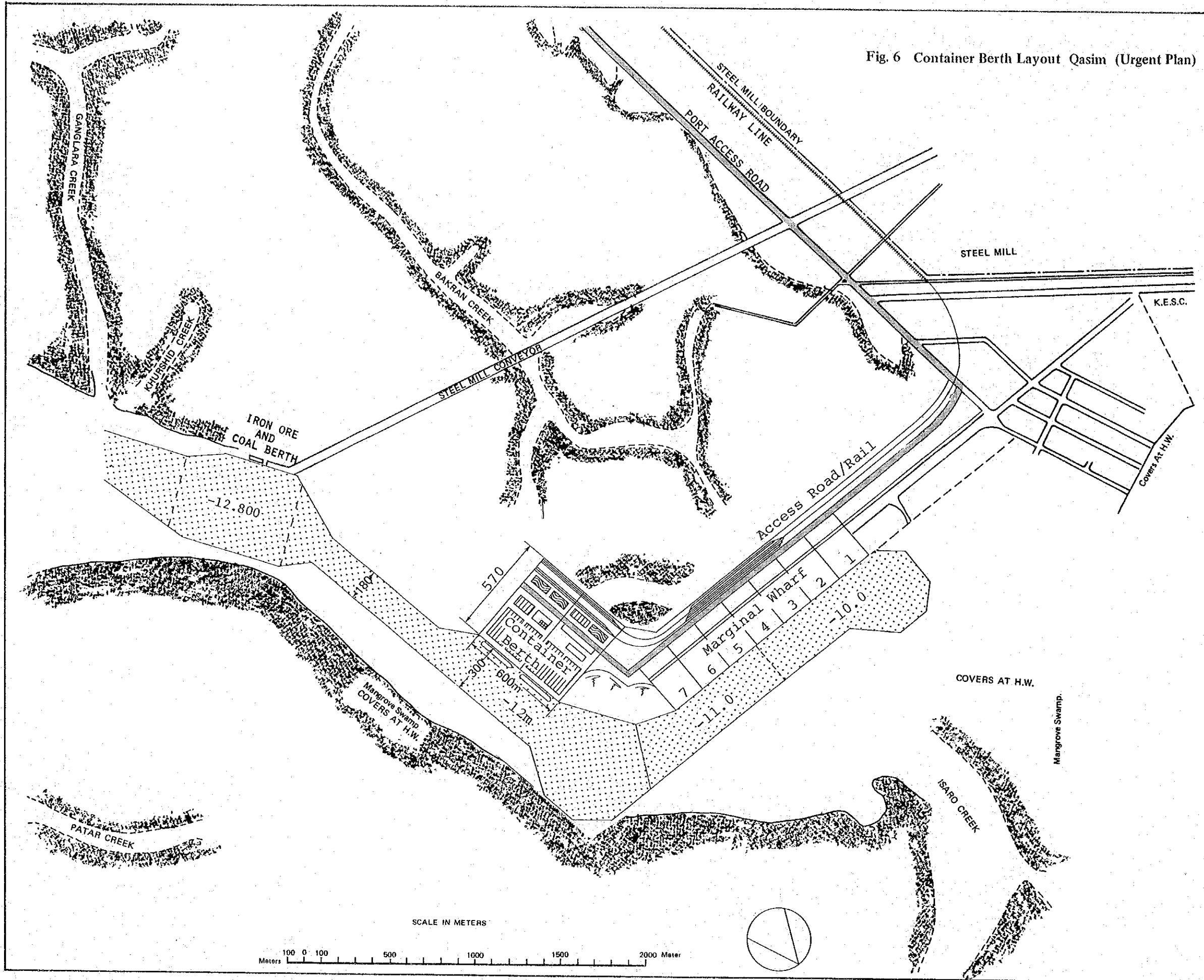


Fig. 6 Container Berth Layout Qasim (Urgent Plan)



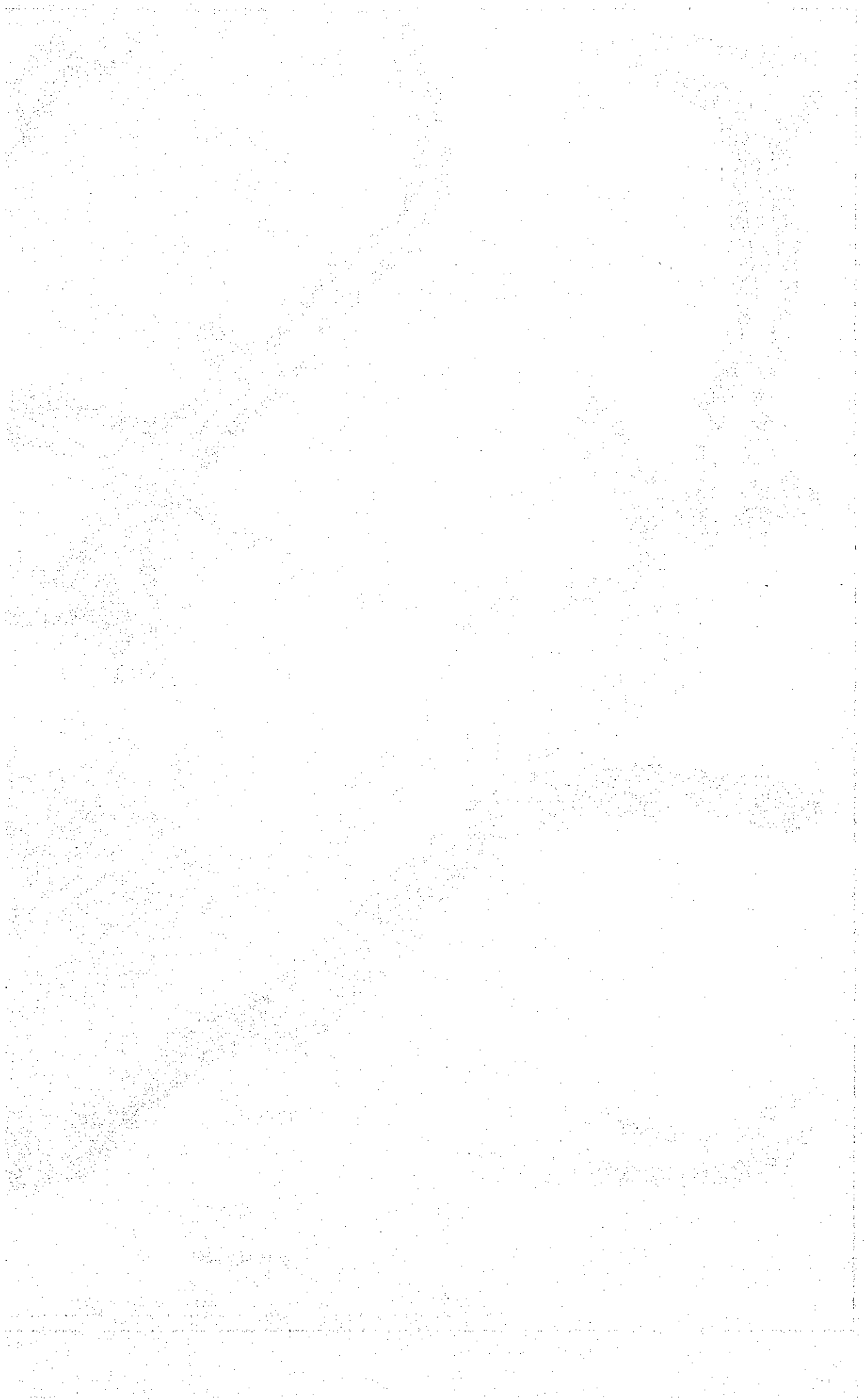
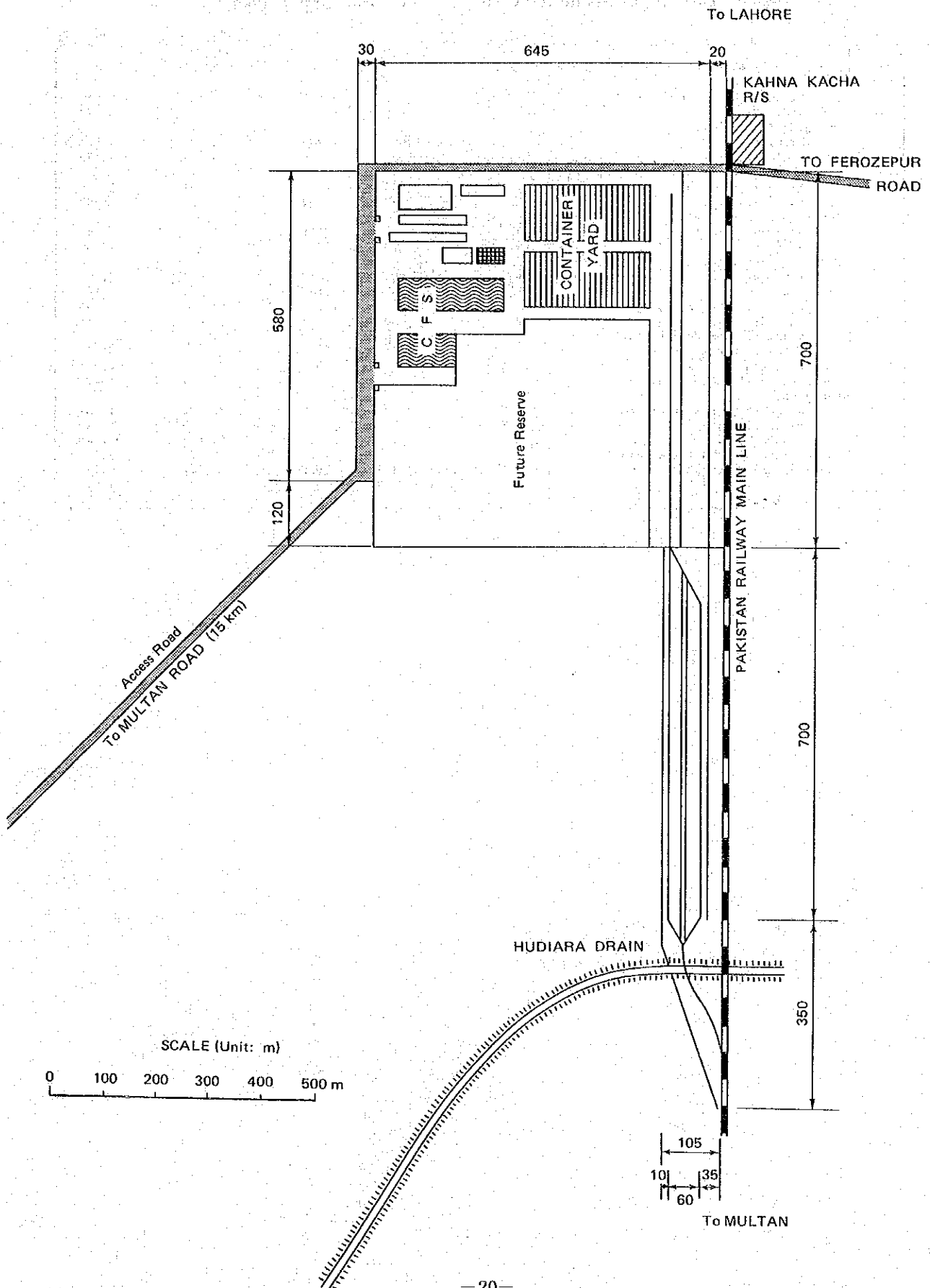


Table 3 Construction Cost for Qasim Port (Urgent Plan)

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 & Retaining 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

Fig. 7 Layout of Inland Container Freight Station (Urgent Plan)



1-2 Recommendations

1-2-1 Construction of Container Terminal

- 1) Under the present situation of containerisation in Pakistan, especially with regard to the existing container handling in port, we recommend that the highest priority be given to construction of a full-fledged container terminal (two berths).
- 2) As the result of comparing both Karachi and Qasim Ports, it is considered best that the 2 berths under the Urgent Plan be constructed at Karachi. We therefore recommended that the Urgent Plan for Karachi Port in this report be implemented.
- 3) Following the opening of the proposed container terminal, we recommend that the port tariff for containers handled both in the new terminal and the conventional berths be raised to obtain a 25% increase in total port revenue.

1-2-2 Promotion of Inland Container Transportation

- 1) In consideration of the geographical, social and economic conditions in Pakistan, we recommended that the following measures be carried out urgently in order to realise a smooth and efficient inland container transport system.
 - a) To improve services and transportation systems relating to the railway which must be the major future carrier of containers.
 - b) To improve roads and the road network which will supplement container transportation to/from the upcountry, and which will play a major role in short range transportation.
 - c) To convert the current cotton and rice transportation/storage system to a system compatible with inland container transportation so as to guarantee the export of containers, which are forecast to be substantially less than those for import.
- 2) As well as the above recommendations, we recommend the construction of a new Inland Container Freight Station at Lahore as shown in the Urgent Plan in this report. It is desirable that this Freight Station be open for use at more or less the same time at opening of the Karachi Port terminal.

1-2-3 Terminal Management

- 1) The most desirable management and operation system at the container terminal would have a single organization, directly employing the required number of experienced and well trained personnel, thus providing terminal users with a through and complete service covering the entire container movement. An acceptable alternative to the above is to set up a corporate body empowered to entrust part of the terminal duties to one or at most two well established contractor(s). This corporate body should be answerable to the claims of all terminal users.
- 2) It is recommended that a reliable operation and management system be set up to train and retain the minimum numbers of permanent staff and steady workers required at all

levels of terminal operation.

- 3) The plans include a large degree of mechanization in cargo handling. It is recommended that a reliable operation and management system, including training/retaining of equipment repair staff, parts supply/storage, maintenance and repair facilities for equipment, be established to ensure the smooth operation of the equipment.
- 4) It is recommended that the relevant laws and regulations be altered to simplify the various procedures for customs clearance, etc., related to container and cargo transportation. In order to fully enjoy the merits of the door-to-door transportation of goods by container, it is recommended that expansion of the container handling facilities in the shipper's and consignee's premises be encouraged.