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FEASIBILITY STUDY REPORT ON THE INTRODUCTION OF CONTAINERIZATION IN THE ISLAMIC REPUBLIC OF PAKISTAN FINAL REPORT VOL.2

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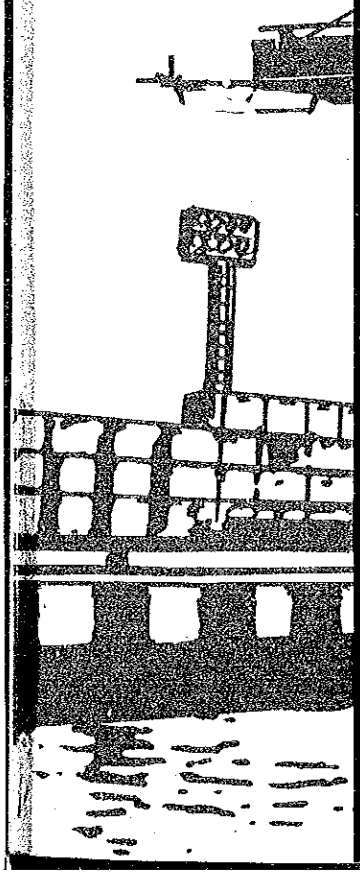

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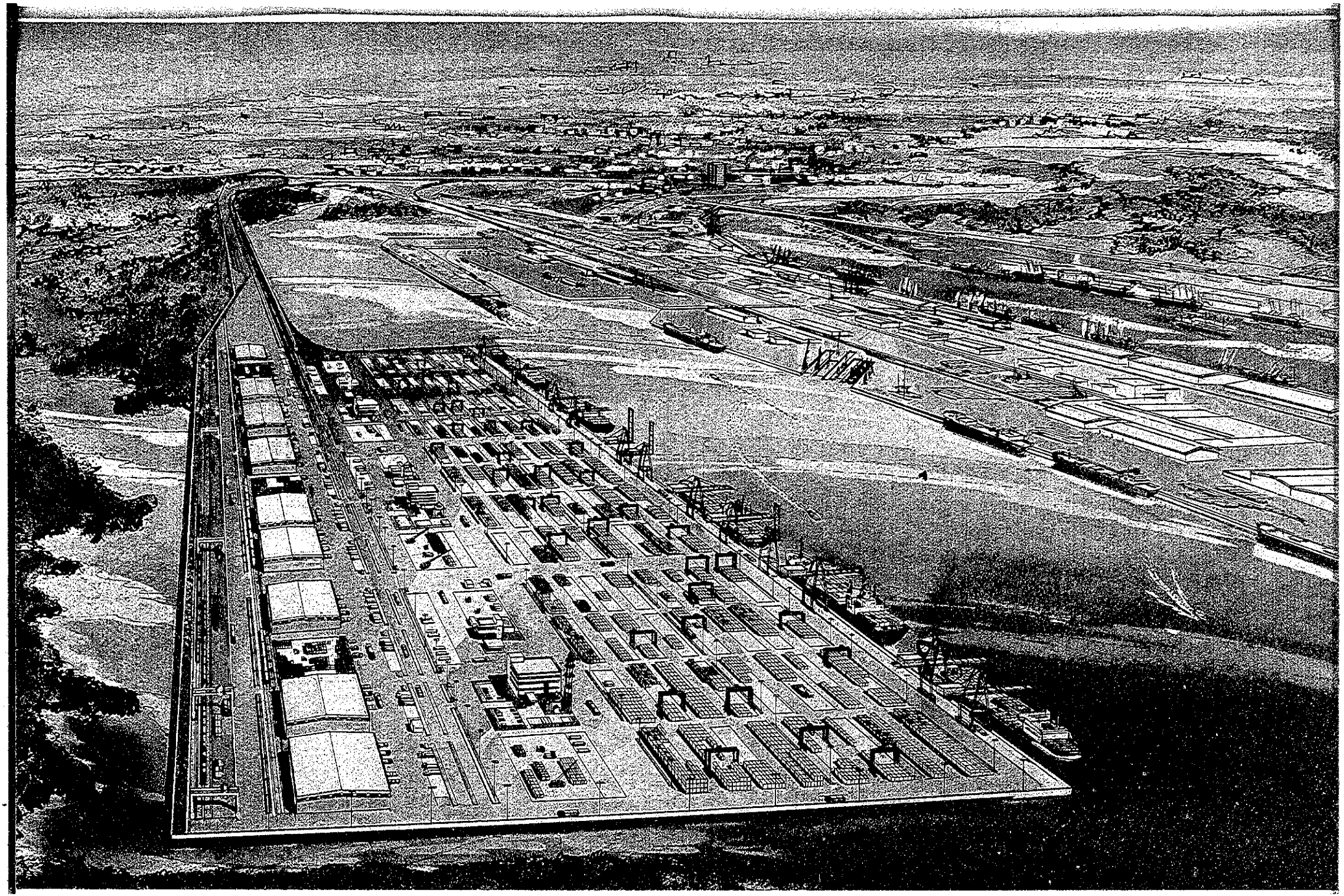

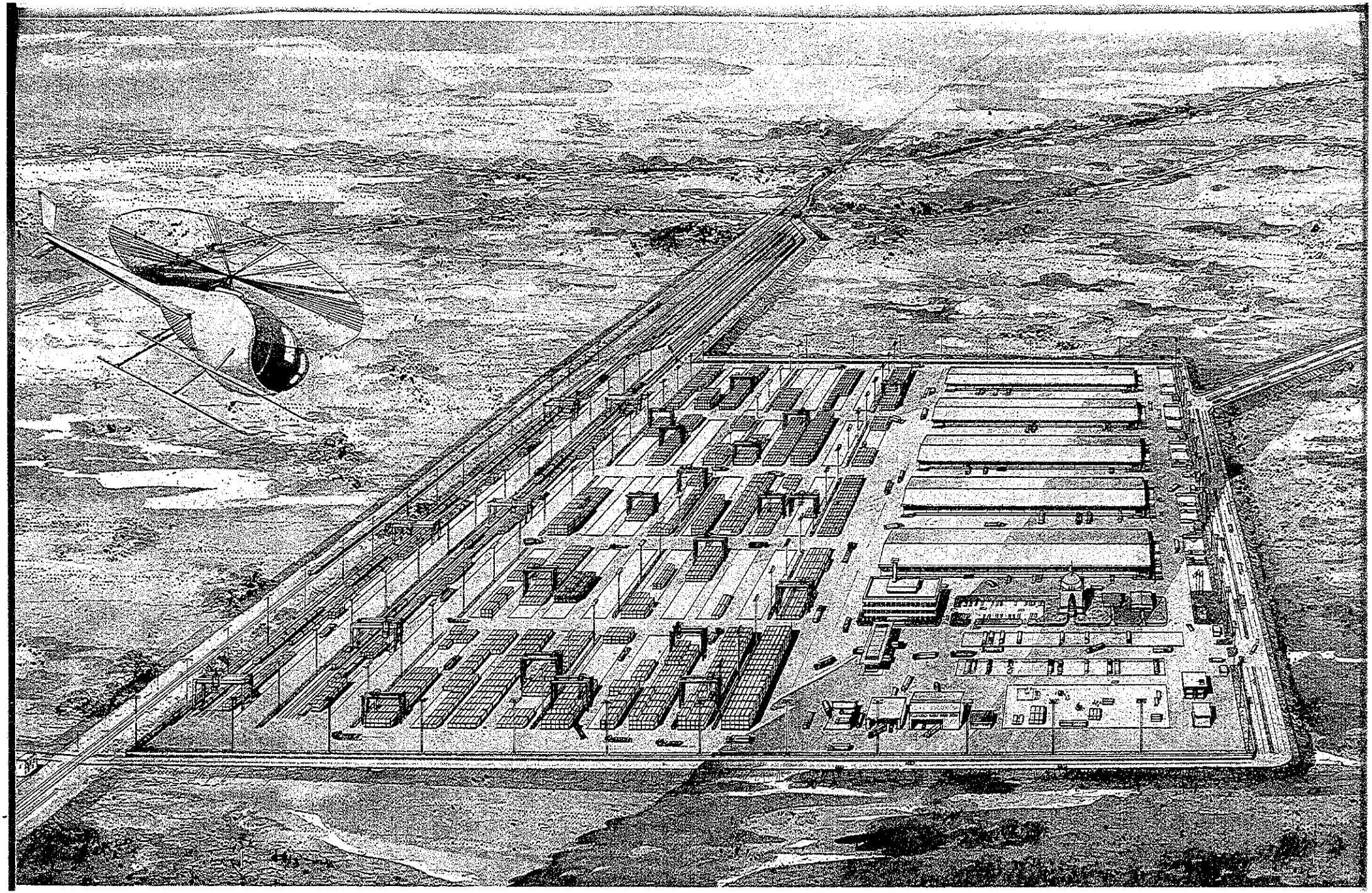

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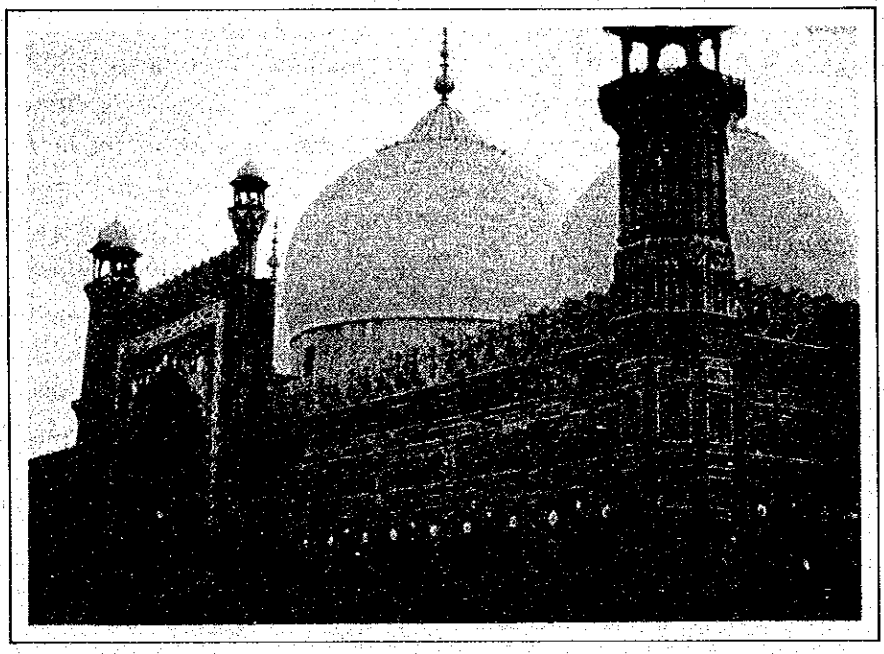
INTRODUCTION

1. Objectives and Scope of the Study ..... (1)
2. Field Investigation ..... (2)



INTRODUCTION

Containerization has been introduced in Pakistan since a semi-container ship was put into service in 1973 and a number of containers handled in the Port of Karachi is recently on a remarkable increase. This is a world-wide trend on sea transportation, and to be along with it, the Pakistani Government has requested the Japanese Government to carry out a feasilibility study for the introduction of containerization in Pakistan.

In response to the request, the Japan International Cooperation Agency (JICA) dispatched the Preliminary Study Team of five experts in June 1980 and then in November 1981 they organized the Study Team of eleven experts to carry out the in-depth field survey.

1. Objectives and Scope of the Study

The objectives and scope of this study are quoted from S/W signed in July 1980 as follows:

Objectives

1. The objective of this study is to formulate a long-term and an urgent port improvement plans for the containerization of sea-borne cargo traffic in Pakistan and to prepare a feasibility study of the urgent plan.
2. Container Freight Stations (CFS) in the up-country shall be considered with necessary consideration to the present and future situation of the inland transportation in Pakistan.

Scope of Study

1. Forecast of Cargo Movement
   (1) Estimation of general cargo traffic for target years to be fixed in accordance with the long-term and the urgent plan.
   (2) Analysis of current situation and outlook of containerizable Pakistani and regional liner routes.
   (3) Estimation of the containerizable cargo traffic for the target years.
2. Long-Term Port Improvement Plan
   (1) Site selection
   (2) Facility planning
   (3) Rough cost estimate
3. Urgent Port Improvement Plan
   (1) Facility planning and port layout
   (2) Engineering design
   (3) Construction program
   (4) Cost estimate
   (5) Economic analysis
   (6) Financial analysis.
4. Others

   Make the necessary recommendations to the Government of Pakistan concerning CFSs in the inland, by considering the present and future situation of the inland transportation in Pakistan.

2. Field Investigation

1) Organization concerned in Pakistan

To collect necessary data and exchange views study terms visited organizations as listed below:

Ministry of Communications
Planning & Development Division
National Transport Research Centre
Economic Affairs Division
Ports & Shipping Wing
Karachi Port Trust
Port Qasim Authority
Ministry of Railway
Pakistan Railways
National Logistic Cell
Pakistan National Shipping Corporation
Karachi Development Authority
Lahore Development Authority
Peshawar Development Authority
Karachi Chamber of Commerce and Industry
Lahore Chamber of Commerce and Industry

2) Study team

Following study terms were organized and dispatched by JICA at each stage of the study.

(1) Preliminary study team

The preliminary study team was organized as below:

Mr. Yoshiro HARAGUCHI (Head)
Managing Director,
Hanshin Port Development Authority

Mr. Ikuhiko YAMASHITA (Port Planning)
Deputy Director, Planning Div.
The Overseas Coastal Area Development
Institute of Japan

Mr. Akira KANEKO (Port Engineering)
Deputy Director, International Cooperation Div.
Bureau of Ports and Harbours
Ministry of Transport (MOT)

Mr. Masaharu SHINOHARA (Shipping)
Technical Staff, Overseas Div.
Shipping Bureau
MOT.

Mr. Takao KAIBARA (Coordination)
Coordinator, Social Development Cooperation Dept.
Japan International Cooperation Agency

The itinerary of the team is outlined in Table-1.

(2) Field survey team

According to S/W agreed, a field survey team of eleven members was organized as below:

Mr. Ikuhiko YAMASHITA
(Team Leader; Traffic Forecast)
Director Planning,
The Overseas Coastal Area Development
Institute of Japan (OCDI)

Mr. Hisanori KATO
(Co-Leader; Port Planning)
(Deputy Director, OCDI)

Capt. Hidemasa OKAMOTO
(Container Terminal Planning)
Operation Expert, OCDI

Mr. Noboru TANIGAWA
(Financial Analysis)
Senior Financialist, OCDI

Mr. Koichi FUJIKAWA
(Construction and Cost Estimate)
Civil Engineer, OCDI

Mr. Hiroaki OZASA
(Natural Condition)
Hydraulic Engineer, OCDI

Mr. Kunio OHASHI
(Transport Planning)
Transport Planner, OCDI

Mr. Makoto NAMATAME
(Structural Design)
Structural Engineer, OCDI

Mr. Mizuhiko TAMURA
(Economic Analysis)
Town Planner, OCDI

Mr. Katsuyuki NAKATSUBO
(Transport Policy Planning)
International Affairs Div.
Minister's Secretariat, MOT.

Mr. Takao KAIBARA
Project Officer
Japan International Cooperation Agency (JICA)

The team conducted a field survey as summarized in Table-2.

(3) Interim report mission

Following members were dispatched to explain an interim report:

Mr. Ikuhiko YAMASHITA
(Team Leader; Traffic Forecast)
Director Planning, The Overseas Coastal
Area Development Institute of Japan (OCDI)

Mr. Teizo IGARASHI
(Coordination)
Senior Staff, Japan International Cooperation
Agency (JICA)

Mr. Hisanori KATO
(Co-Leader; Port Planning)
Deputy Director, OCDI

Cept. Hidemasa OKAMOTO
(Container Terminal Planning)
Operation Expert, OCDI

Mr. Kunio OHASHI
(Transport Planning)
Transport Planner, OCDI

Mr. Koichi FUJIKAWA
(Construction and Cost Estimate)
Civil Engineer, OCDI.

The itinery of the mission was as in Table-3.

Table 1 Itinerary of Preliminary Study Team

	Date	Itinerary
1	Jun. 29 Sun.	Tokyo→
2	30 Mon.	→Karachi. Courtesy call to the Japanese Consul General, Discussion with Capt. L. Jackson
3	Jul. 1 Tue.	Courtesy call to the Japanese Embassy, Visit to MOC, CBR, EAD.
4	2 Wed.	Visit to PDD
5	3 Thu.	Visit to RB, LDP, Lahore Station.
6	4 Fri.	Short tour by train and road.
7	5 Sat.	Discussion with Capt. L. Jackson, Visit to PR, KPT.
8	6 Sun.	Discussion with Capt. L. Jackson, Visit to NLC.
9	7 Mon.	Karachi Port tour.
10	8 Tue.	Visit to PQA, Qasim Port tour.
11	9 Wed.	Discussion with Capt. L. Jackson, Visit to PNSC.
12	10 Thu.	Signing of S/W and R/D, Visit to KPT.
13	11 Fri.	Move to Islamabad.
14	12 Sat.	Courtesy call to the Japanese Embassy, Visit to PDD, NLC.
15	13 Sun.	Discussion with Capt. L. Jackson, Karachi→
16	14 Mon.	→Tokyo

Table 2 Itinerary of Field Survey Team

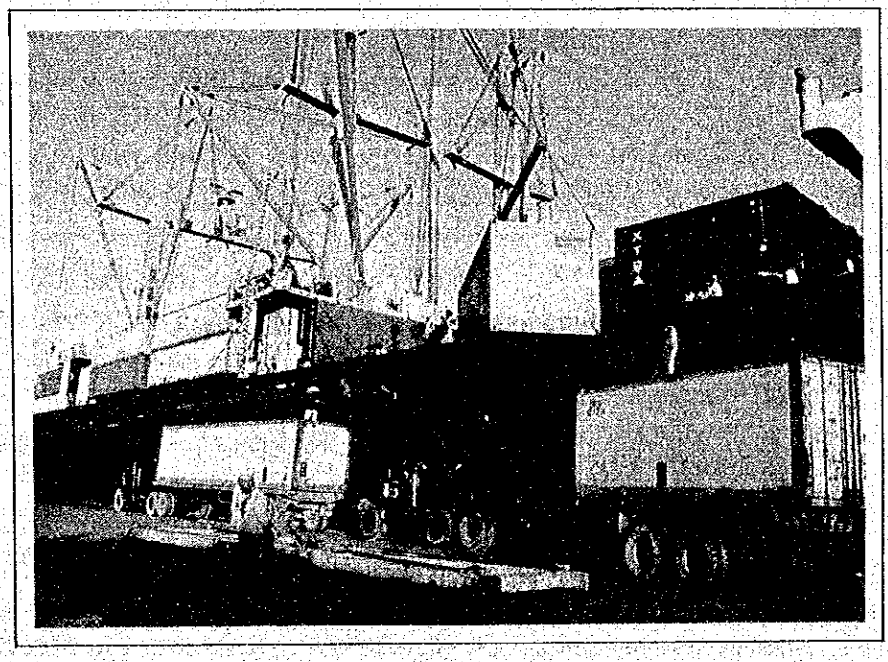
	Date		Itinerary
1	Nov. 20	Thu.	Tokyo
2	21	Fri.	→Karachi
3	22	Sat.	Courtesy call to the Japanese, Tour to Pipri Marshalling Yard.
4	23	Sun.	Discussion with Capt. L. Jackson, Tour to Pipri Marshalling Yard.
5	24	Mon.	Visit to KDA, NLC.
6	25	Tue.	Visit to PQA, port tour.
7	26	Wed.	Visit to KPT, Shipping agents.
8	27	Thu.	Visit to KPT, port tour.
9	28	Fri.	Inspection tour by road.
10	29	Sat.	Courtesy call to the Japanese Embassy, Visit to EAD, Visit to PQA (members in Karachi)
11	30	Sun.	Visit to MOC, MOR, PDD.
12	Dec. 1	Mon.	Move to Lahore.
13	2	Tue.	Visit to RB, workshop.
14	3	Wed.	Visit to LDP
15	4	Thu.	Visit to LDA, Discussion with staff of LCCI.
16	5	Fri.	Move to Karachi.
17	6	Sat.	Discussion with Capt. L. Jackson, Visit to KPT.
18	7	Sun.	Visit to KDA, KPT.
19	8	Mon.	Visit to KPT, data collection at Federal Publication Branch.
20	9	Tue.	Visit to CCI, PR, EPB (members in Quetta), Visit to KPT, NLC, KDA.
21	10	Wed.	Courtesy call to the Japanese Embassy (members in Islamabad), Visit to PQA.
22	11	Thu.	Visit to Peshawar Development Authority (members in Peshawar), Visit to KPT.
23	12	Fri.	Inspection tour by N-5 Highway (members in Peshawar).
24	13	Sat.	Visit to PQA, KPT.
25	14	Sun.	Visit to KPT, PQA, PR, PNSC.
26	15	Mon.	Visit to State Bank of Pakistan, Federal Publication Branch, Custom House, NLC.
27	16	Tue.	Visit to KPT, PR.
28	17	Wed.	Visit to PQA, PNSC, Inspection tour by rail.
29	18	Thu.	Visit to KPT, PQA.
30	19	Fri.	Inspection tour in Karachi Port
31	20	Sat.	Visit to PQA, JETRO.
32	21	Sun.	Courtesy call to the Japanese Consul General, Visit to PSW, KPT. Move to Lahore
33	22	Mon.	Visit to PR
34	23	Tue.	Visit to LDA, LCCI, LDP and alternative site for CFS.
35	24	Wed.	Visit to LDP, RB, LDA, LCCI.

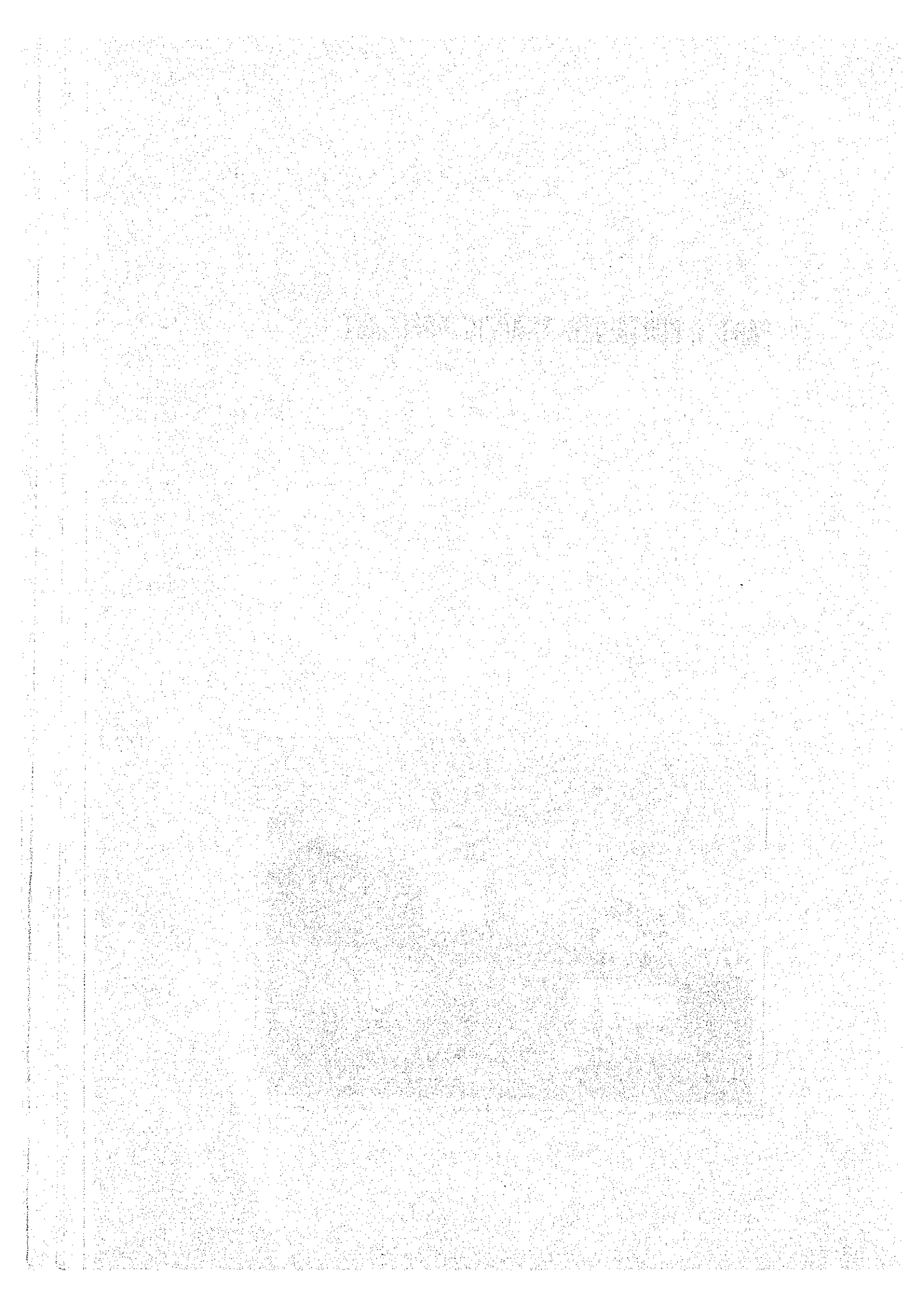
	Date		Itinerary
36	25	Thu.	Move to Islamabad.
37	26	Fri.	Inspection tour by National Highway
38	Dec. 27	Sat.	Courtesy call to the Japanese Embassy, Discussion with the staff of PDD.
39	28	Sun.	Islamabad → Tokyo

Table 3 Itinerary of Interim Report Mission

	Date	Itinerary
1	Aug. 14 Fri.	Tokyo
2	15 Sat.	→ Karachi, Courtesy call to the Japanese Consul General, Discussion with Acting Jt. Secretary, Mr. Mohammad Ahmed Siddiqui.
3	16 Sun.	Visit to PNSC, Capt. L. Jackson.
4	17 Mon.	Visit to KDA, Traffic Engineering Bureau.
5	18 Tue.	Visit to PQA.
6	19 Wed.	Visit to NLC, KPT, KDA.
7	20 Thu.	Visit to KPT, port tour
8	21 Fri.	Move to Islamabad, Lahore
9	22 Sat.	Courtesy call to the Japanese Embassy (Members in Islamabad), Visit to LDP.
10	23 Sun.	Visit to PR, LCCI.
11	24 Mon.	Visit to LDA, Inspection tour to alternative sites.
12	25 Tue.	Data collection at LDA.
13	26 Wed.	Discussion with PR, LCCI, NLC, Visit to LDP, LDA.
14	27 Thu.	Visit to PR, Lahore Station.
15	28 Fri.	Move to Islamabad.
16	29 Sat.	Courtesy call to the Japanese Embassy, Visit to EAD, MOC, MOR.
17	30 Sun.	Visit to PDD, NLC, move to Karachi.
18	31 Mon.	Courtesy call to the Japanese Consul General, Visit to PSW.
19	Sept. 1 Tue.	Visit to EPB.
20	2 Wed.	Signing of R/D, Discussion with staff of PQA. Karachi
21	3 Thu.	→ Tokyo

PART I. CONTAINER TRAFFIC FORECAST





PART I CONTAINER TRAFFIC FORECAST

1. Total cargo forecast and container forecast

For a maritime container traffic forecast, two steps have to be cleared. The first step is a usual seaborne cargo forecast (total cargo forecast) not specific to container traffic. The second step is to estimate a quantity of container cargo out of total seaborne cargo.

2. Total cargo forecast

The following two comprehensive studies are adopted as a total seaborne cargo forecast:

a. Forecast of Seaborne Trade for Pakistan
   April 1978, Woods, Gordon & Co.

b. Bulk Terminal Feasibility Study, Final Report
   March 1980, Vol. 1 pp 3.1 – 3.27,
   Swan Wooster Engineering Co., Ltd.

The latter is a reviewing and updated version of the former. The result of these two studies are shown in Table I-1 (No. 1 – No. 37).

3. Container traffic forecast

The method of container traffic forecast employed in the present report is the slightly modified version of the one currently used by Port Authorities in Japan. The concept of the method is shown in Fig. I-1.

4. Factors to be taken into consideration

Maritime container traffic is dependent on many factors. The most important factor of these is whether the trade is export or import. So, the forecast must be done for export and import respectively.

Fig. I-1 is applicable for both export and import.

There are two other important factors. They are commodity and route. In the concept shown in Fig. I-1, commodity-wise and route-wise approaches are thus included.

5. Base cargoes for the container forecast

Base cargoes for the container traffic forecast are selected as shown in No. 4 in Table I-1. Wheat in import, fertilizer both in export and import, phosphate rock/sulpher in import and cement in import are excluded from the base cargoes. A positive reason for this exclusion is that in the historical trend in trade they have heavily fluctuated, and so if included, cause heavy fluctuation in the historical trend of the percentage of containerization. A negative reason for this is that the exclusion of these cargoes does not affect the container forecast, because these cargoes

will be, at least most of them, carried by bulk carriers which are cheaper than the transport by general cargo vessels.

Rice is included in the base cargoes, because it is already containerized. Basmati is suitable for container transport.

6. Source of commodity-wise and route-wise information

As the source of commodity-wise and route-wise information, the following two publications which are the latest available are employed in the present report:

Foreign Trade Statistics of Pakistan
Exports & Re-Exports, April–June 1974
Statistical Div., Gov. of Pakistan

Foreign Trade Statistics of Pakistan
Imports, April–June 1974
Statistical Div., Gov. of Pakistan

The acceptability of the above two publications is somewhat questionable due to their oldness. It is, to some extent, confirmed partly by comparing each commodity breakdown and partly by excluding heavily fluctuated commodities from the base cargoes for the forecast.

7. Sea route classification

All routes are classified into the following two groups:

"Containerized routes"
"Other routes"

A more detailed classification is desirable, however the reason of employing this simple classification is due solely to the data availability of the historical trend by route.

The "containerized routes" are shown in Table I-2.

8. Base cargo share by route

This is calculated from the statistics shown in "6. Source of commedity-wise and route-wise information".

The result is given in No. 41 for the "containerized routes" and No. 43 for the "other routes" in Table I-1.

9. Ultimate containerizability by commodity

The Table I-3 shows the assumed ultimate containerizabilities for each commodity. Since no other information is available, round numbers such as 0%, 50% and 100% are assumed for each commodty listed in the Table. 25% for rice means 100% of the ultimate containerizability for Basmati rice.

10. Ultimate containerizability by route

This is calculated by summing up for each commodity respectively the products of the ultimate containerizability for a commodity multiplied by the route-wise share of corresponding commodity for export and import seperately. The results of these calculations are shown in Table I-4.

11. Historical trend of container movement

The historical trend of container cargo for export and import are shown in Table I-5 and Fig. I-2.

12. Logistic curve forecast

The basic equation for logistic curve approximation of the growth of containerization is as follows:

$$P = \frac{Pm}{1 + C^{(t-t_0)}}$$

where,

- P : percentage of containerization by route at the year t
- Pm : ultimate containerizability by route which is defined as "percentage of containerization by route at fully containerized stage"
- C : a parameter
- t : year
- t_0 : time lag in year

13. Forecast for containerized routes

By making use of the historical trend and the ultimate containerizability by route, two parameters (C and t_0) in the basic equation described in 12, are calculated by the least square method. However, the parameter C thus obtained is very low compared to those of more advanced other world routes and the percentage of containerization reaches very rapidly to the fully containerized stage. Considering the historical trends of other world routes, this is, in all respects, unconceivable. The parameter C is dependent on the slope of a logistic curve as a whole.

But the steepest slope which best expresses the shape of a logistic curve is at around the half of the ultimate containerizability, so the historical trend which is a little more than 10% at most may not be adequate to determined the parameter C.

The averages of Cs for some of the other more advanced world routes are finally employed as the parameter Cs for export and import. It should be noted that C for export in developed countries is employed as C for import in Pakistan and vice versa. They are shown in Table I-6 together with the parameter t_0s.

The percentages of containerization for both target years are given in Table I-7 and Table I-1 (No. 51). The growing feature of containerization is shown in Fig. I-2.

14. Forecast for other routes

Since no historical trend is available for the "other routes", the parameter Cs for export and import are assumed same as those for the "containerized routes" for export and import respectively.

As for the parameter t_0, ten years more than that for the "containerized routes" is assumed. Ten years time lag is the average of those between some of the early containerized world routes and some of the lately containerized world routes. The parameter Cs and t_0s are shown in Table I-6.

The percentages of containerization for both target years are given in Table I-7 and Table I-1 (No. 53). The growing feature of containerization is shown in Fig. I-2.

15. Rouding-off of low percentage of containerization

Since the logistic curve approximation at low percentage is less reliable than at higher percentage, percentages of containerization less than five percent are rounded off to five percent.

Table I-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

Table I-2 List of Containerized Routes

Shipping Co.	Routes
American President Lines	West Coast USA, Japan, Singapore (Transhipment Service)
Compagnie General Maritime	North Continental/French Port
Hansa Lines	Mediterranean/Continent
Contship Deutschland GMBH (Conship Saudinational Lines)	UK/Continent
Gulf Shipping Lines	Singapore/Australia
Farrel Lines (American Export)	USA/Gulf/East Coast Canada
Jugolinija	Red Sea/Mediterranean/Adriatic Ports, South America (Transhipment Service)
Hellenic Line (Ro-Ro)	East Coast USA
Megario	UK/Continent/Mediterranean, PG
Mid East Cargo (O.T. Express Line & O.Y. Finnlines Ltd.)	North Continent, West Africa (Transhipment Service)
PNSC	USA/Canada, UK/Continent, Far East
P & O	Far East, Australia, UK
Maersk Line	Far East, USA
Lloyd Triestino & Anchor Line	UK/Continent, Italy
USSR Line (Black Sea Shipping ...)	UK/Continent
Lauro	Adriatic/Western Italy, Far East/Japan

Table I-3 Ultimate Containerizability by Commodity

No.	Commodity	Ultimate Containerizability
0	[FOOD/LIVE ANIMALS]	
00	LIVE ANIMALS	0
01	MEAT/PREPS	100
02	DAIRY PRODUCTS/EGGS	100
03	FISH/PREPS	100
04	CEREALS/PREPS	
	Wheat	*
	Rice	25
	Barley Unmilled	0
	Others	100
05	FRUITS/VEGETABLES	100
06	SUGAR/PREPS./HONEY	
	Sugar	100
	Molasses	*
	Others	100
07	COFFEE/TEA/COCOA/SPICES	100
08	ANIMAL FEEDING STUFF	50
09	MISC. FOOD PREPS	100
1	[BEVERAGES/TOBACCO]	
11	BEVERAGES	100
12	TOBACCO	100
2	[CRUDE MATERIALS EXCL. FUELS]	
21	HIDES/SKINS/FURS. UNDRSSD	100
22	OIL SEEDS/NUTS/KERNELS	100
23	RUBBER CRUDE/SYNTHETIC	100
24	WOOD/LUMBER/CORK	
	Logs	0
	Others	100
25	PULP/WASTE PAPERS	100
26	TEXTILE FIBRES	100
27	CRUDE FERTLZR/MINRLS, NES	0
28	METALLIFEROUS ORES/SCRAP	0
29	CRUDE ANIMAL/VEGETABLES, NES	100
3	[MINERAL FUEL, ETC.]	
32	COAL/COAK/BRIQUETTES	0
33	PETROLEUM/PRODUCTS	*
34	GAS NATURAL/MANFCTRD	*
4	[ANIMAL/VEGETABLE OIL/FAT]	
41	ANIMAL OILS/FATS	*

No.	Commodity	Ultimate Containerizability
42	FIXED VEGETABLE OIL/FAT	*
43	PROCESSED ANML/VEG. OIL, ETC.	*
5	[CHEMICALS]	
51	CHEM. ELEMENT COMPOUNDS	100
52	COAL/PETROLEUM, ETC. CHEM.	100
53	DYES/TANNING/COLOUR PROD.	100
54	MEDICINAL, ETC. PROD.	100
55	PERFUME/CLEANING, ETC. PROD.	100
56	FERTLZERS MANFCTRD	*
57	EXPLOSIVES/PYROTECH. PROD.	100
58	PLASTIC MATERIALS, ETC.	100
59	CHEMICALS, NES	100
6	[BASIC MANUFACTURES]	
61	LEATHER DRESSD/FUR, ETC.	100
62	RUBBER MANFCTRS, NES	100
63	WOOD/CORK MANFCTRS, NES	100
64	PAPER/PAPERBOARD MFRS.	100
65	TEXTILE YARN/FABRIC, ETC.	100
66	NONMETAL MINRL MFRS. NES	100
	Cement	
	Others	
67	IRON/STEEL	50
68	NON FERROUS METALS	100
69	METAL MFRS, NES	100
7	[MACHINES/TRANSPORT EQUIPMENT]	
71	MACHINERY NON ELECTRIC	100
72	ELECTRIC MACHINERY	100
73	TRANSPORT EQUIPMENT	
	Cars	50
	Parts	100
8	[MISC. MANUFACTURED GOODS]	
81	PLUMBG/HEATING/LIGHTNING EQUIPMENT	100
82	FURNITURE	100
83	TRAVEL GOODS/BAGS	100
84	CLOTHING	100
85	FOOTWEAR	100
86	INSTRUMENT/WATCHES/CLOCKS	100
89	MISC. MANFCTRD GOODS, NES	100
9	[GOODS NOT CLASSED BY KIND]	

Note: *Not included in base cargo for container forecast

Table I-4 Ultimate Containerizability by Route

(unit: %)

Route	Export	Import
Containerized Routes	64.4	70.5
Other Routes	45.7	49.3

Table I-5 Percentage of Containerization (1976/77–1979/80)

('000 M/T)

	76/77	77	77/78	78	78/79	79	79/80	80
1 Export Dry Cargo, Total (Base Cargo)	1,700	1,663*3	1,625	1,683*3	1,741	1,919*3	2,096	
11 Rice	910		806		1,008		1,106	
12 Other Cargo	790		819		733		990	
13 Container		46*1		102*1	177*2	241*1	302*2	
Percentage of Containerization (%) (13/1)		2.8		6.1	10.2	12.6	14.4	
2 Import Dry Cargo, Total	3,106		3,930		6,539		5,212	
21 Wheat	394		967		2,161		653	
22 Fertilizer	501		578		1,400		1,237	
23 Cement	–		34		630		611	
24 Other Cargo (Base Cargo)	2,211	1,281*3	2,351	2,350*3	2,348	2,530*3	2,711	
25 Container		42*1		73*1	104*2	178*1	230*2	
Percentage of Containerization (%) (25/24)		1.8		3.1	4.4	7.0	8.5	
3 Selected Im./Ex. Dry Cargo, Total (Base Cargo) (1 + 24)		3,944		4,033	4,089	4,449	4,807	
31 Container		88		175	281	419	532	
Percentage of Containerization (%) (31/3)		2.2		4.3	6.9	9.4	11.1	

Notes: *1. Dept of Shipping Control
*2. KPT
*3. Average of Two Fiscal Years

Table I-6 C and t_o

Route	Export	Import
Containerized Routes		
C	0.8	0.7
t_o	10.6	9.5
Other Route		
C	0.8	0.7
t_o	20.6	19.5

Table I-7 Percentage of Containerization

Route	Export		Import	
	1987/88	1999/2000	1987/88	1999/2000
Containerized Routes	33.6	60.6	44.5	69.9
Other Routes	4.8	28.8	2.3	38.3

Fig. 1-1 Flow of Container Cargo Forecast

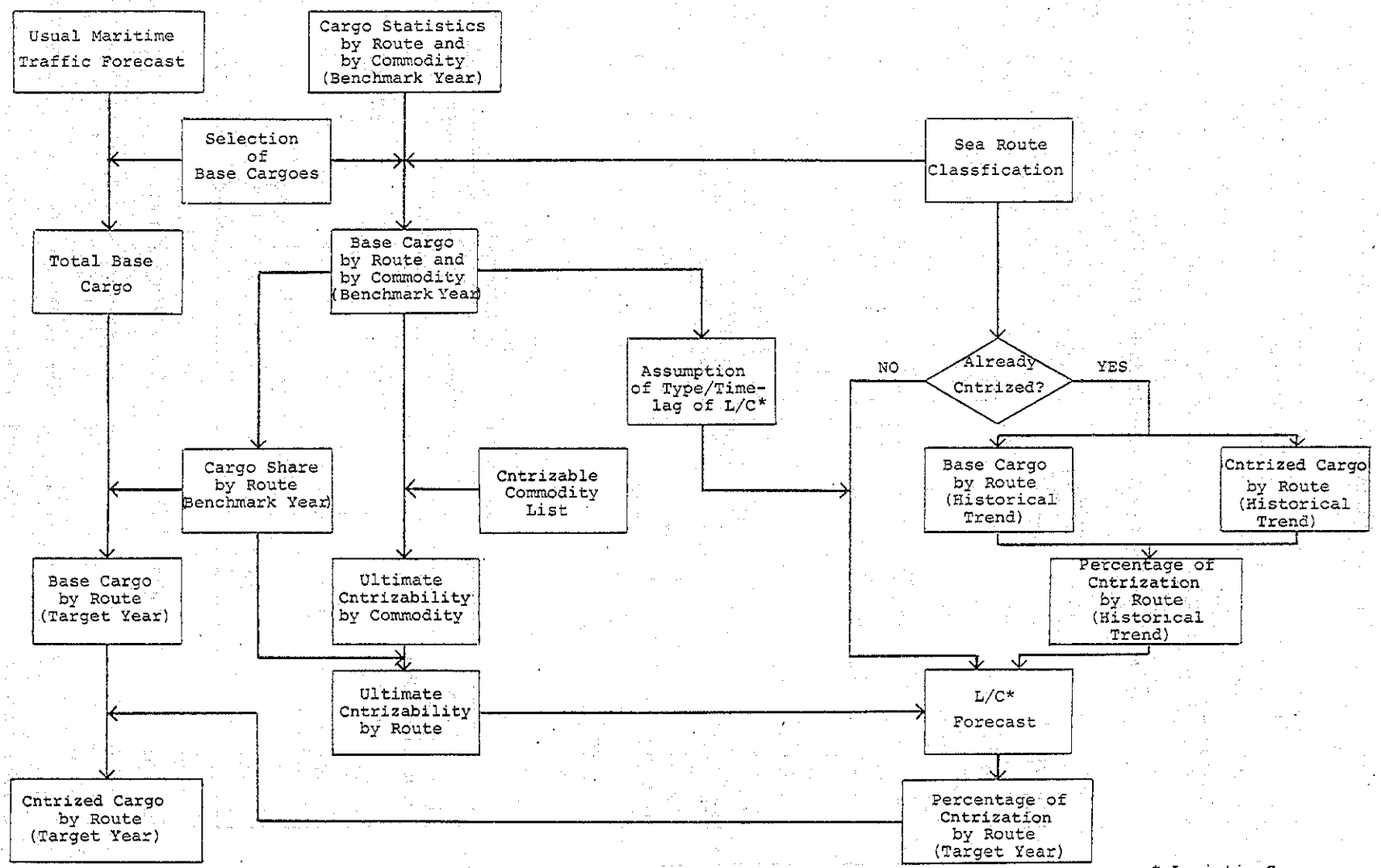
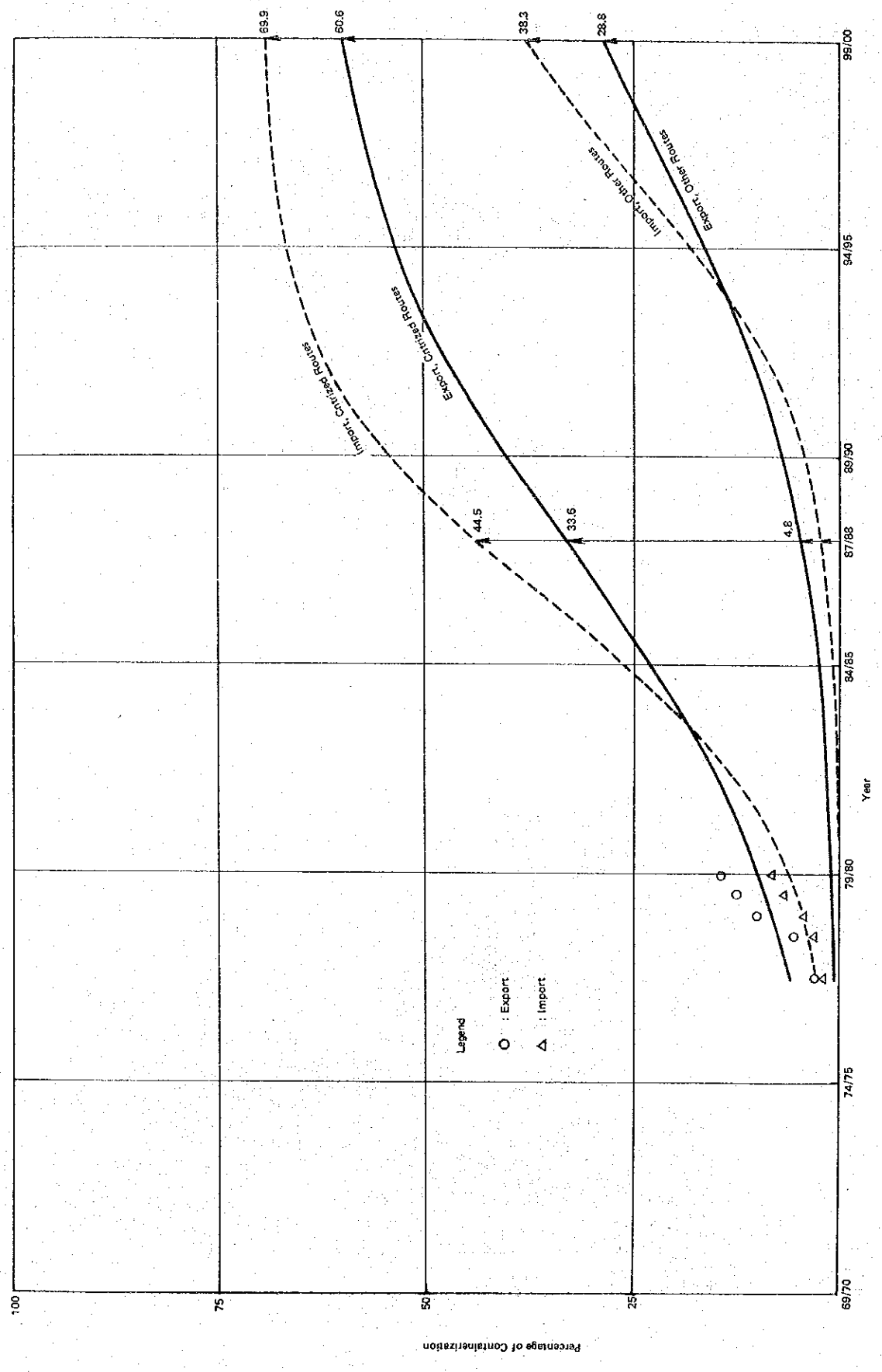


Fig. I-2 Logistic Curve Estimation



PART II. TRANSPORTATION SYSTEM

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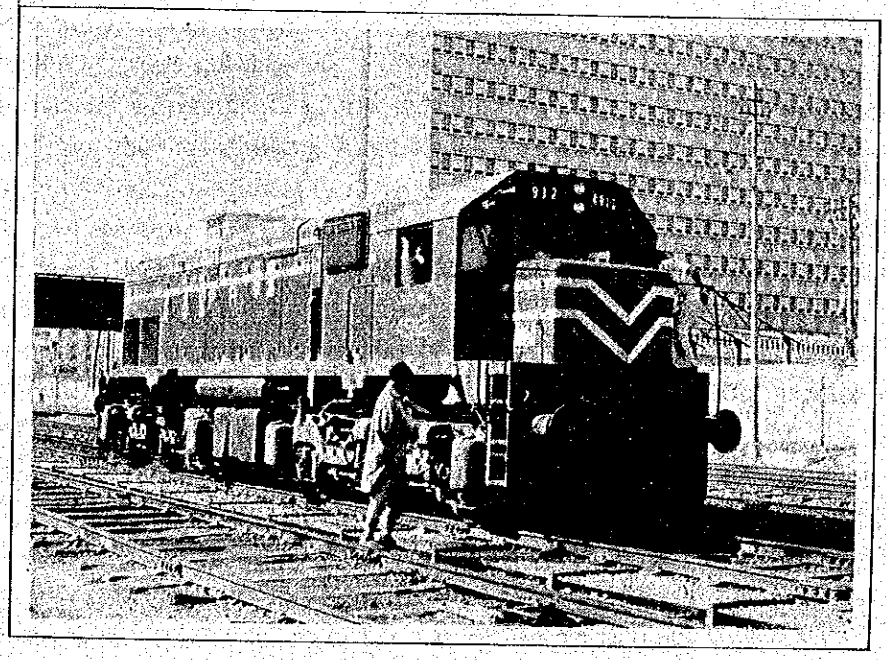

PART II. INLAND CONTAINER TRANSPORTATION

Objective

Objectives of this Part II are as follows;

1) Determination of the bottlenecks on railway and road transport,
2) Determination of present distribution pattern of seaborne containerizable traffic between Karachi Port and up-countries.
3) Estimate of the future distribution pattern and volume of seaborne container traffic between the port and up-countries.
4) Determination of the inland transportation mode between port and up-countries.
5) Proposal on introduction of transport equipment and improvement of infrastructure for inland container transport.

CHAPTER 1. INLAND TRANSPORT SYSTEM

1-1 Transport sector

The transport sector in Pakistan has a number of services ranging from the traditional animal drawn to the modern jet airplanes. The principal transportation system is composed of 8,800 km of railways, 40,000 km of national and provincial roads, four international air ports, two major ports and 854 km of gas pipelines. Pakistan's transport network is shown in Fig. II-1-1.

The Ministry of Railways and Pakistan Railways are responsible for the construction, maintenance and operation of the railways and the Ministry of Communications is responsible for national highways, ports and shipping. The rest of the road network is under the control of either of four provincial Governments or Districts Councils. And the Planning Commission of the Government has the coordinating function through its preparation and decision of major investment in the transportation sector.

Handling of seaborne cargo to up-country has been fully controlled by the National Logistic Cell (NCL) since 1978. NLC has also full responsibility for the emergency movement of wheat and fertilizer from Karachi Port to up-country.

NLC now has more than 1,000 trucks of which 500 trucks Mercedez Benz L 1921/52 and 53 Hino Truck Trailers have specifications as a container trailer. The inventory of the trucks owned by NLC is shown in Table II-1-13.

NLC carried more than one million tonnes in 1979 between the port and up-country markets using NLC trucks. However, the Government has a policy to give the first priority to the Pakistan Railways for carrying import cargoes to the main inland markets in order to utilize efficiently the railways as well as the road systems.

The main consumption markets of Pakistan besides Karachi and Hyderabad are located in the Punjab Province and those populated towns are located close to Lahore, some 1,200 km away from Karachi Port.

Consequently, the vital traffic flow of the country has developed between the densely populated area in the northeast with Lahore as the Center and Karachi Port with the surrounding industrial area.

In the case of the transport of general cargo, the locations of storages, processing facilities and marketing organizations within Karachi city, especially in the vicinity of Karachi Port, indicate most of the cargo move first between the port and these locations, and are transported afterwards to the markets which disperse then all over the country.

When the Karachi-Multan pipeline is completed, the oil traffic equivalent to 500 Wagons per day will divert from the railway to the pipeline to the extent of its full capacity. A significant component of the capacity of the former system will become available for carrying containers.

The Pakistan Railways is the sole bonded carrier of cargo between Karachi Port and Lahore Dry Port at the moment.

After the increase of oil prices, railways could become far more economical than road for medium to long distance traffic. Accordingly it is desirable to utilize railway capacity to the full extent by improving in efficiency.

The growth rate in the domestic traffic in the transport sector has been faster than that in real GDP. Domestic freight transport during the period of 1970 to 1975, grew at rate of 5.4% annually while GDP in constant prices increased at 4.3%.

In the country as a whole, the road transport is clearly the dominant mode of transport, for example its share was 62% in 1977/78.

In Pakistan, the overall transport capacity has generally kept up with the increases in demand and there have been critical bottlenecks except for the seasonal peak problem generated at Karachi Port and on the Pakistan Railway's network.

Diversion of the freight traffic from railway to roads has been seen due to the misallocation of resources and inefficient management in the transport sector in the past.

The fifth five year plan (1978 – 83) presents the transport policy and investment as follows:

- o Improvement of the operational efficiency and/or modernization of existing facilities in order to increase capacity.
- o Give high priority to the completion of the ongoing programmes.

Allocation of the funds among the various programmes are proposed as mentioned in Table II-1-1.

1-2 Pakistan railways

1-2-1 Railway network

Most of the major cities in Pakistan are connected by the railway and have rail connection with India, Iran and rail-road connection with Afghanistan.

The railway network is as shown in Fig. II-1-2. The total route kilometerage of the Pakistan Railways is 8,815 km and its details are as follows:

Broad gauge	(1.676 m)	:	7,758.10 km
Metre gauge	(1.000 m)	:	445.58 km
Narrow gauge	(0.760 m)	:	611.35 km

The line from Karachi to Bahawalpur is double track, and there are small sections of double track near Lahore, Rawalpindi and Quetta.

Route km by type of gauge for the last five years is shown in Table II-1-2.

As can be seen from Table II-1-3, the capacity of part of the Karachi-Lahore main line is still partly insufficient.

However, newly constructed second Kotri Bridge over the Indus has removed a main bottleneck on the main Karachi-Lahore line which was opened to traffic in February 1980. The main line between Karachi Cantonment and Lala Musa of 1,500 km in length is being improved and old 90-lb rails are being replaced with new 100-lb rails. 1,534 km of track has been replaced with 100-lb rails on main line. In addition to the above works, the welding of the rail joints on main line was almost completed by welding 13 m-long rail into 800 m length on the newly laid 100-lb track.

Lahore to Khanewal main line of 288 km long has already been electrified with 25 kV single phase overhead system. The other section of Khanewal – Samasatta is being electrified.

1-2-2 Permissible speeds and axle loads

At the moment, speeds of train vary from 32 to 105 km per hour on broad gauge. Maximum axle loads allowed on broad gauge vary from 13 to 22.5 tonnes for locomotives and 16.5 tonnes for other rolling stocks.

Maximum permissible axle loads are determined by the strength of bridges.

Newly replaced 100-lb rails on main line will enable the maximum permissible speed to be raised from 96 to 120 km per hour.

Permissible speeds and engine axle loads by section are shown as follows.

Section	Permissible speed (km/hr)	Engine axle load (tonne)
Karachi – Lahore	105	22.5
Lahore – Lalamusa	96	22.5
Lalamusa – Nowshera	65	22.5
Nowshera – Landi Kotal	65 – 26	17.5
Rohri – Sibi	80	17.5
Sibi – Kolpur	40 – 29	17.5
Kolpur – Quetta	65	17.5
Quetta – Chaman	65 – 40	17.5

1-2-3 Motive power and rolling stock

Locomotives and wagons owned by the Pakistan Railways are shown in Table II-1-4.

At the moment, 350 locomotives are already outdated but will be retained in service.

Steam locomotives, of which 95% are over 45 years old, carried 8.67% of the gross tonne-km in 1978/79.

There are 474 diesel electric locomotives. These locomotives carried 83.5% of the gross tonne-km in 1978/79. In 1979/80, thirty diesel electric locomotives were procured to replace 45 old age locomotives. Again at the end of 1980, 30 diesel electric locomotives were procured.

7.82% of the gross tonne-km in 1978/79 was carried by electric locomotives.

The Pakistan Railways having 34,749 wagons consisting of four-wheel and bogie wagons in the year 1979/80.

The diesel locomotive workshops are located in Rawalpindi and Karachi. Rawalpindi workshop has been expanded for overhauling of 300 locomotives. Diesel workshop in Karachi Cantonment has overhauling capacity of 100 diesel electric locomotives.

There are normal maintenance facilities at Karachi Cantonment, Rawalpindi, Samasata, Kundian, Lahore, Sibi, Rohri and Quetta.

Wagons are manufactured in the Central Mechanical Workshops, Moghalpura.

1-2-4 Freight traffic

Principal freight is composed of petroleum products, wheat, cement, fertilizer and rice. The freight traffic by commodity over the 1975/76 – 1979/80 period is summarized in Table II-1-5.

Freight traffic increased from 1975/76 to 1978/79 by 10% per annum. In 1978/79 freight traffic reached 10,136 million tonne-km. The average haul increased from 554 km in 1976/77 to 793 km in 1978/79. In 1979/80, freight ton was increased but tonne-km and the average haul were decreased as opposed to the year 1978/79.

Traffic density is the highest on the Karachi-Lahore main line which carries bulk and military commodities from the port area to up-country.

An imbalance of commodity flow is observed in the above section, with the ratio of tonnage between up and down directions.

Sectional cargo traffic in 1978/79 which divided into four commodities of containerizable cargo, rice, non-containerizable cargo and oil products are summerized in Table II-1-6. And diagram of traffic volume by section is shown inFig. II-1-6 and II-1-3.

More than 20% of railway freight traffic between Karachi and Khanewal is shared by petrol products.

The oil pipeline of 854 km in length between Karachi and Mahmud Kot, north of Multan has been completed and will be put into operation in 1981.

With the diversion of the oil traffic from railway to pipeline, the container train will be able to take the place of oil train.

1-2-5 The fifth five year plan

The plan is formulated to eliminate physical bottlenecks, mainly on the main Karachi-Rawalpindi line and to provide the basis such as plants, equipment and materials so as to improve the operational performance.

The main items of the project consist of truck rehabilitation, marshalling yards including completion of the Pipri marshalling yard, line capacity works and terminal facilities including completion of the second Kotri Bridge, rehabilitation of bridges, changeover to airbrakes and central couplers, etc.

The summary of railway programme is shown in Table II-1-7.

1-2-6 Bottlenecks for container transportation by railway

(1) Shortage of locomotives

The P.R. has an acute shortage of locomotives. As mentioned before, 350 locomotives are already over age and their transport efficiency has sharply declined.

Locomotives for container unit trains are, therefore, required to be procured for inland container transportation.

(2) Goods wagons

Sea-born containers carried by four wheel wagons exceed the vehicle gauge of P.R.

For this reason, P.R. used to have a speed limit and special charges for overdimension.

The relation between general overdimension and vehicle gauge is shown in Fig. II-1-4.

Therefore, special container flat cars as illustrated in Fig. II-1-5 should be introduced for container transport.

(3) Lahore Station

At present, 2,000 wagons nearly yard capacity are daily handled at Lahore Station. The station was planned according to the transportation pattern before the independence and the number of departure and arrival lines are insufficient for through goods trains. As for passenger trains only five nearly railway capacity are operated as through passenger trains against the present demand of seven.

There is no room for expansion around Lahore Station because the vicinity has already been fully developed. The Pakistan Railways gave up double-tracking the section between Lahore Station and the Ravi River 20 years ago. Therefore, providing a dry port between the Ravi River and Murid-Ke is technically difficult due to insufficient railway capacity.

(4) Topography

Topographically, the country is divided into the plains of Punjab and Sind Provinces and the mountainous terrains of the Northwest Frontier and Baluchistan Provinces.

Both permissible speed and load are greatly restricted by the mountainous terrain in Rawalpindi, Peshawar and Quetta because of steep gradient.

(5) Railway capacity

As indicated in Table II-1-3, railway traffic in part of the Karachi-Lahore section has already reached capacity. However, the problem of insufficient railway capacity will be solved by the increase in railway capacity proposed in the 5th Five-Year Plan.

1-3 Road transport

1-3-1 Road network

The main road network consists of about 25,000 km of paved roads and 15,000 km of up-paved roads. 47% of paved road in Pakistan has been constructed in Punjab.

Most of the major highways have been built as one-lane or two-lane highways.

Pavement structural strength on major highways is insufficient to carry a heavy traffic load.

There are some 40,000 – 60,000 km of earth roads in addition to the main road network.

Total length of major roads in Pakistan by type of surface for last five-years is shown in Table II-1-8 and National Highway Network is shown in Fig. II-1-6.

The construction schedule of the Indus Super Highway of 1,200 km to link Karachi to Peshawar along the west bank of the Indus River will be delayed.

N-5

This is main highway running from Karachi to Torkham of Afghanistan border. The sections of Karachi – Rohri, Rohri – Lahore and Lahore – Torkham correspond to Asian Highway Route A-73, A-2 and A-1.

Construction of a new carriageway from Shahdara to Muridke and Gujranwala Bypass has been completed. Construction of the dual carriageway from Nowshera to Peshawar has been started.

In addition, the improvement works of N-5 have also been taken in hand to remove bottlenecks and ensure speedy movement of essential commodities from Karachi Port to up-country.

N-25

This highway is the so-called RCD highway and corresponds to Asian Highway Route A-74.

RCD highway is now under construction and there are no restaurants and filling stations along this highway.

RCD highway will be able to reduce a distance of about 200 km between Karachi and Quetta from the existing route.

Therefore this highway will have a potential of diverting traffic from the National Highway.

N-35

Karakoram Highway N-35 is being constructed by the Chinese and Pakistani military engineers to link Islamabad to China.

N-65

This route corresponds to Asian Highway Route A-2.

1-3-2 Traffic volume on major highways

The team has obtained traffic count data in 1972 from the Punjab Highway Department at Lahore. Punjab traffic counts are generally reliable since Lahore was the center for the West Pakistan Highway Department, and traffic counts have been taken not only in Punjab but also in other provinces.

On the other hand, the team has also obtained the latest traffic counts data from the National Transport Research Center which were taken in conjunction with the NTRC O-D survey in February 1980.

Daily traffic volumes on major highways in 1980 together with pavement width and peak hourly traffic volumes with volume-capacity ratios are shown in Tables II-1-9 and II-1-10.

On the main highway, traffic volumes vary from about 2,500 – 5,000 daily traffic in the rural areas to 7,000 – 13,000 daily traffic near the urban areas.

About 70% of the traffic volume on major highway is shared by trucks between Karachi and Multan. On other highways, traffic volumes vary from 500 to 2,000 p.c.u. per day.

There is still space capacity on major roads in the terms of service level of "C".

Sectional daily traffic volumes in terms of p.c.u. on major highways in 1980 are shown in Fig. II-1-7.

Hourly variations of traffic volumes on major highways are shown in Fig. II-1-8.

Hourly variations on Super Highway show the characteristics of traffic flow from/to Karachi.

Inbound traffic to Karachi is mainly observed during night and outbound traffic appears up to midnight.

1-3-3 Registration number of vehicles

It is difficult to obtain the trends of traffic growth rate from limited number of traffic count data.

Vehicle registration data mentioned in Table II-1-11 indicate 4.65 and 10.86% of growth rates for trucks and all vehicles. However, scrapped vehicles have not been deducted from registration numbers.

Number of motor vehicles on road by type for the last five years have been compiled by NTRC as mentioned in Table II-1-12 indicates 8 and 18% of growth rates for trucks and all vehicles as opposed to the above data.

There are many small truck industries each of which owns one or two trucks.

The 8 ton capacity Bedford truck is a commonly used truck and is assembled in Pakistan.

Tandem-axle trucks are rarely found in Pakistan except some trucks which belong to the National Logistic Cell. NLC owned trucks are listed in Table II-1-13 of which Mercedez Benz L 1921/52, Hino truck tractor and Fiat truck tractor of 20-tonne are originally designed for container transportation.