Fig. A 2-3-4-1

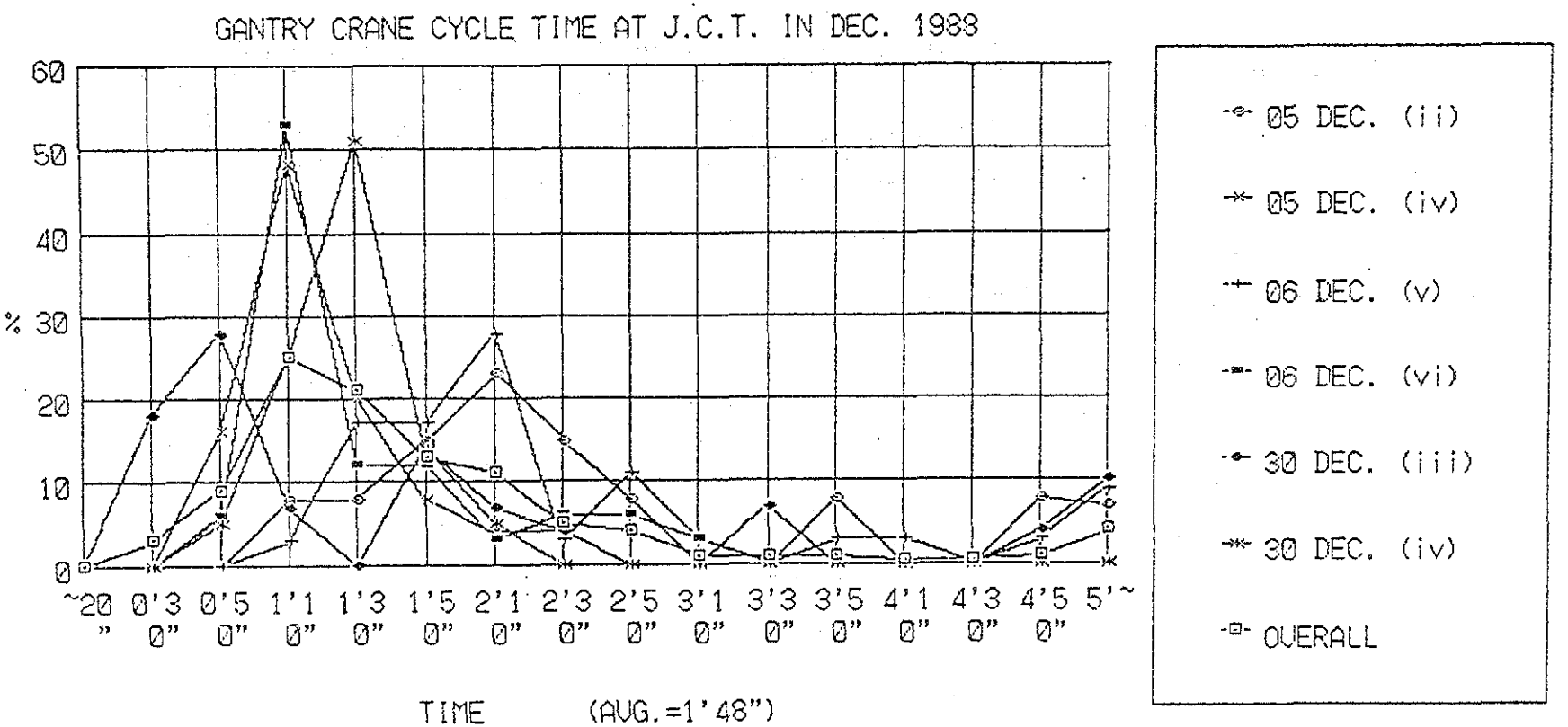

GANTRY CRANE CYCLE TIME AT J.C.T. IN DEC. 1983
60
50
40
% 30
20
10
0
~20" 0'30" 0'50" 1'10" 1'30" 1'50" 2'10" 2'30" 2'50" 3'10" 3'30" 3'50" 4'10" 4'30" 4'50" 5'~
TIME (AVG.=1'48")
05 DEC. (ii)
05 DEC. (iv)
06 DEC. (v)
06 DEC. (vi)
30 DEC. (iii)
30 DEC. (iv)
OVERALL

Fig. A 2-3-4-2

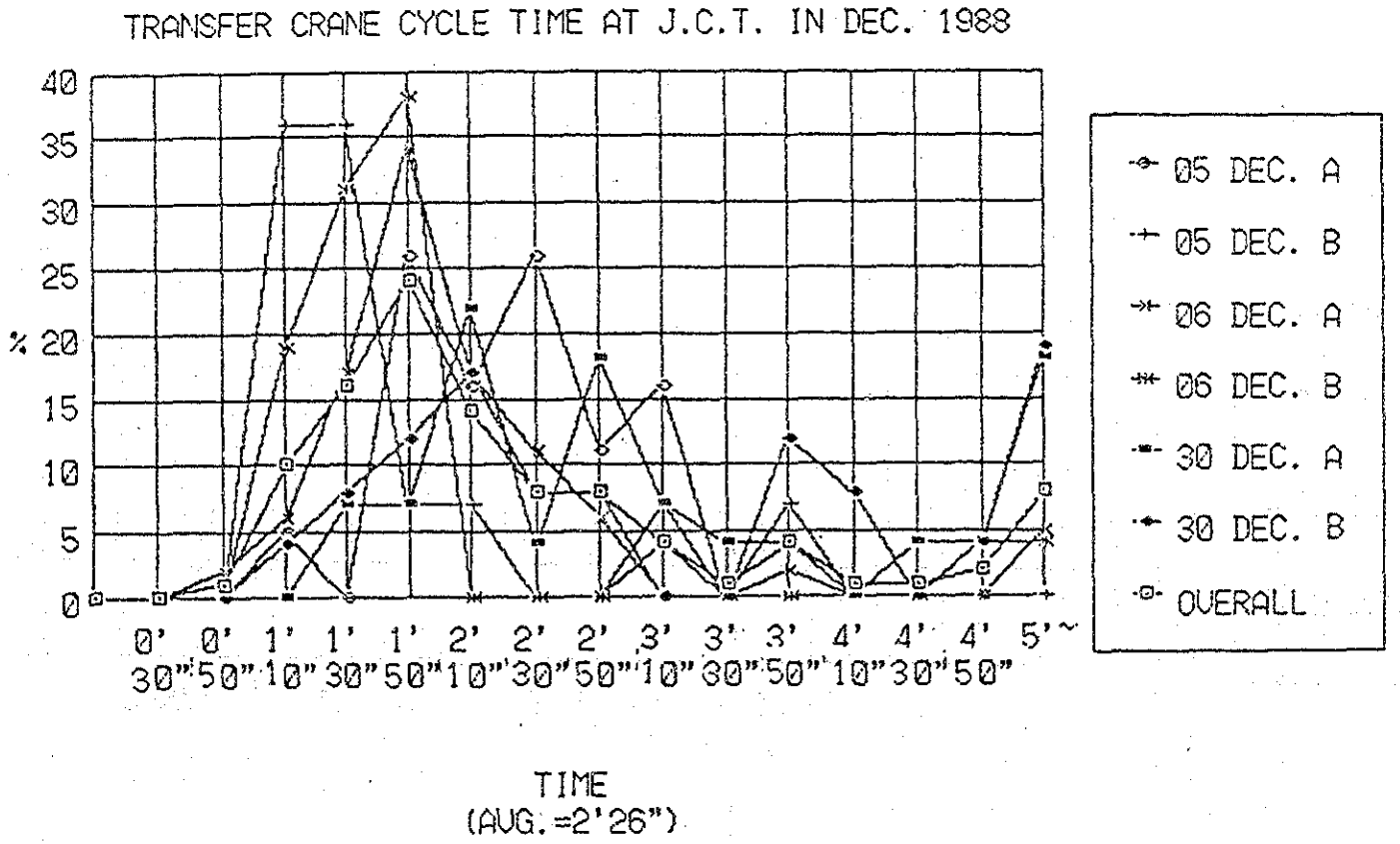

TRANSFER CRANE CYCLE TIME AT J.C.T. IN DEC. 1988
40
35
30
25
% 20
15
10
5
0
0' 0' 1' 1' 1' 2' 2' 2' 3' 3' 3' 4' 4' 4' 5'~
30" 50" 10" 30" 50" 10" 30" 50" 10" 30" 50" 10" 30" 50"
TIME
(AUG.=2'26")
05 DEC. A
05 DEC. B
06 DEC. A
06 DEC. B
30 DEC. A
30 DEC. B
OVERALL

Fig. A 2-3-4-3

DISTRIBUTION OF 'HANDLED UNITS/BERTHING HOUR' (41 SHIPS)
AT J.C.T. IN SEPTEMBER '88

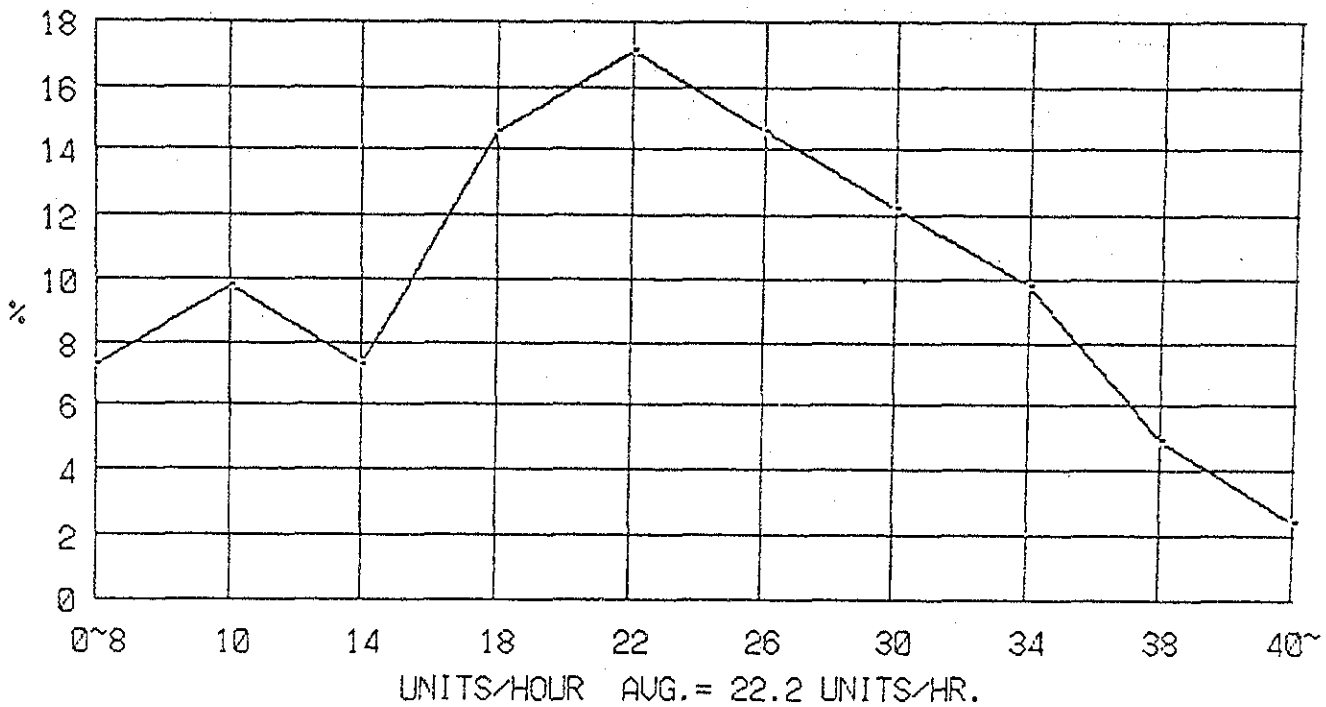


Fig. A 2-3-4-4

PRIME MOVER TURN ROUND PERIOD AT J.C.T. IN DEC. 1988

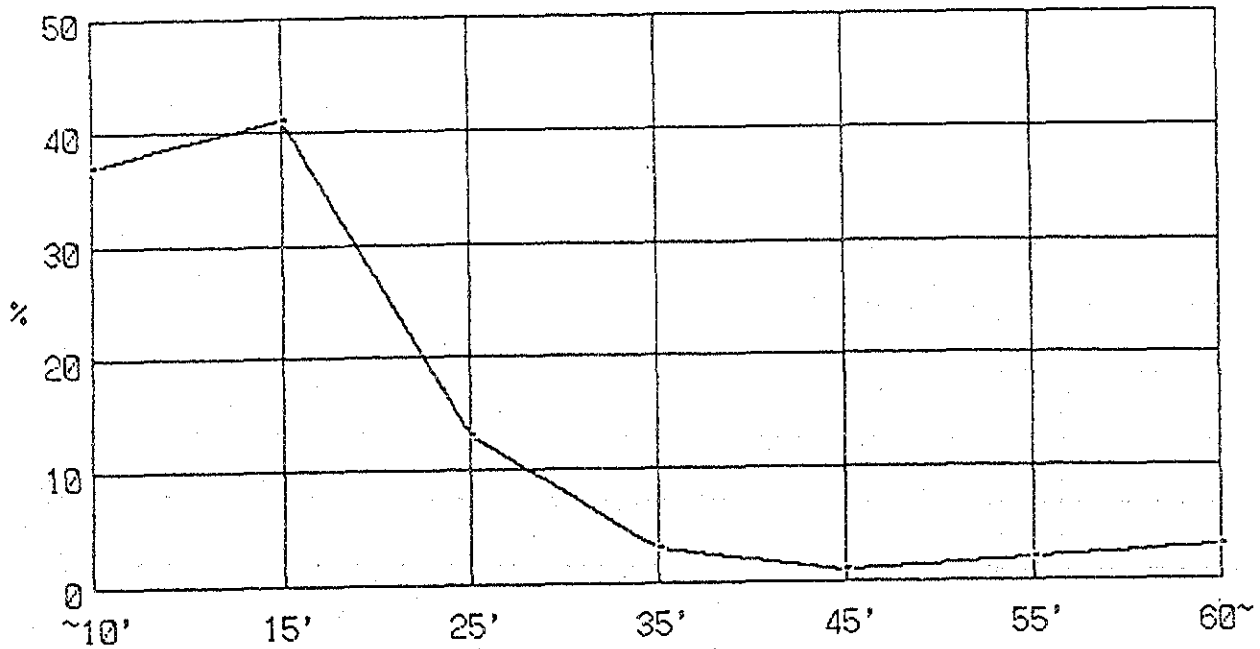
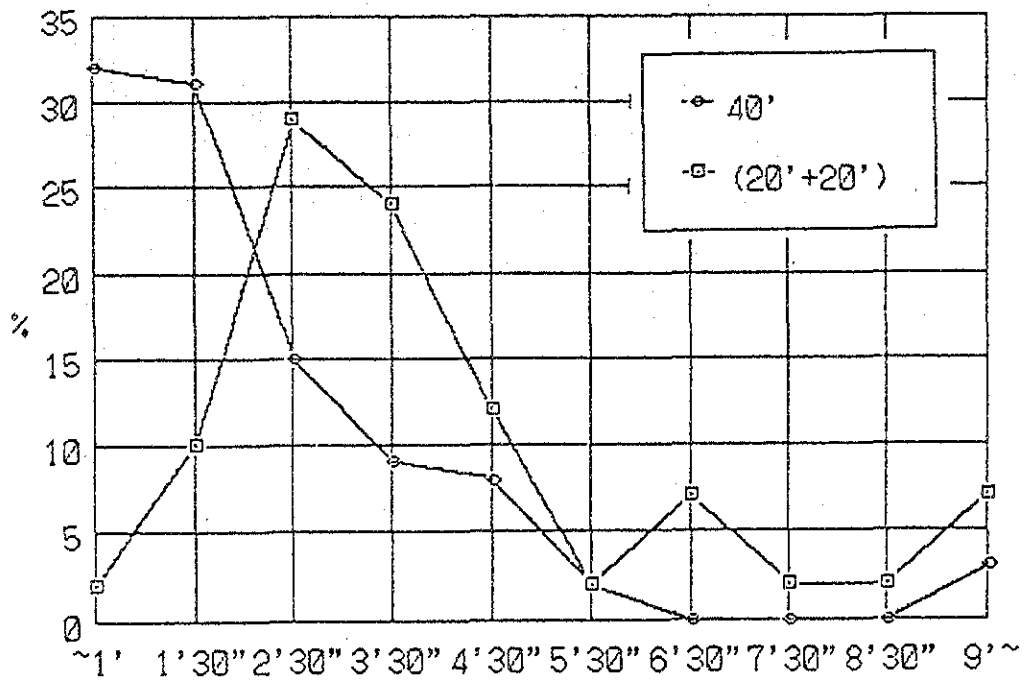


Fig. A 2-3-4-5

PRIME MOVER (TAIL-TAIL) AT J.C.T. IN DEC. 1988



AVG(40')=2'04"
AVG(20'+20')=3'47"

Fig. A 2-3-4-6

HANDLED UNITS / BERTHING HOUR

AT JCT SEPT '88

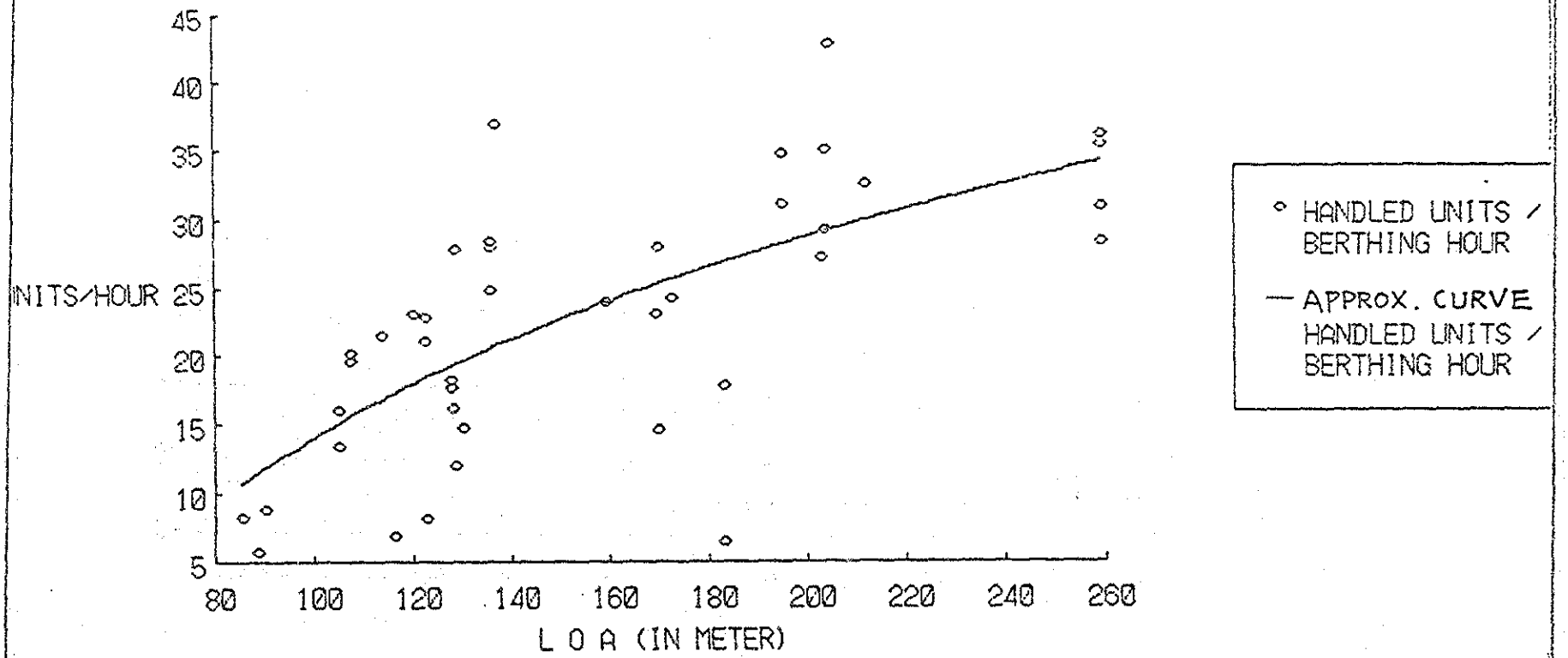
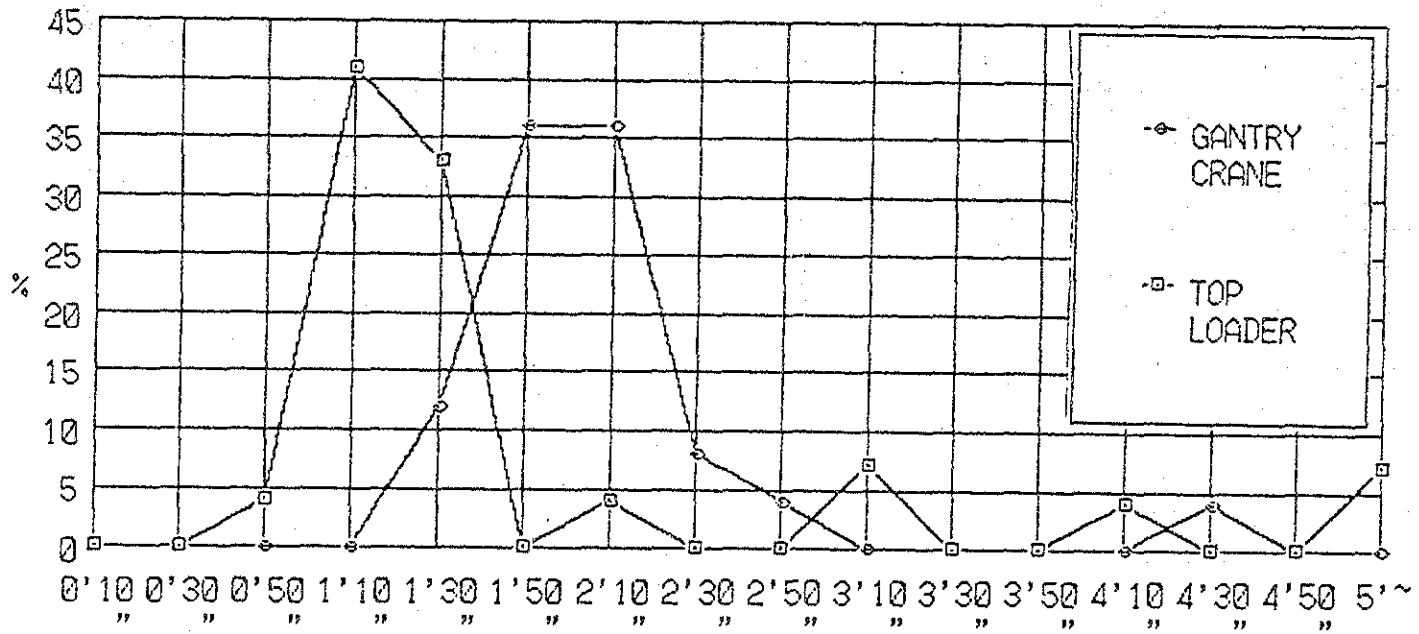


Fig. A 2-3-4-7

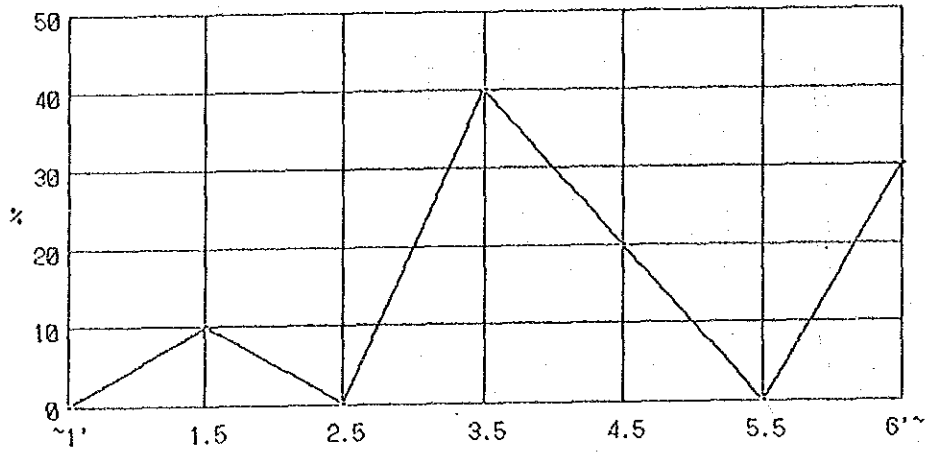
CYCLE TIME OBSERVED ON 27th DEC.'88 AT Q.C.T.



AVG. (GANT) =2'06"
AVG. (TOP) =1'50"

Fig. A 2-3-4-8

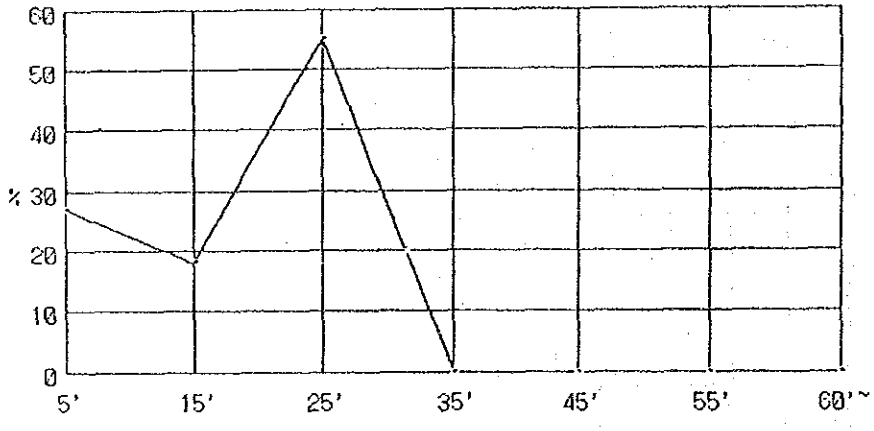
PRIME MOVER (TAIL-TAIL,20'+20') AT Q.C.T. IN DEC.1988



TIME
AVG.=4'15"

Fig. A 2-3-4-9

PRIME MOVER TURN ROUND PERIOD AT Q.C.T. OBSERVED ON 27th DEC. '88



TIME
AVG.=17'48"

Table A 2-3-4-1 Gantry Crane Production

Cycle Time	Handling Units/ Hour	Berth Occupancy %	Operational %	Actual Handling %	Units/Crane /Year ('000)	TEUs/Crane/Year ('000)	
						40' 50%	40' 15%
3'00	20	65	90	0.7	70	106	81
		75	90	0.7	81	122	94
2'24	25	65	90	0.7	88	132	101
		75	90	0.7	102	153	117
2'00	30	65	90	0.7	106	159	122
		75	90	0.7	122	183	140
1'42	35	65	90	0.7	123	185	142
		75	90	0.7	142	214	164
1'30	40	65	90	0.7	141	212	162
		75	90	0.7	163	244	187
1'20	45	65	90	0.7	159	283	183
		75	90	0.7	183	275	211
1'12	50	65	90	0.7	176	265	203
		75	90	0.7	204	306	234

Table A 2-3-4-2 Distance and Time Table

Place	Distance(km)	Speed(km/hr.)	hour
QCT#6	1.5	20	0.075
Road(inside Port)	3.0	20	0.15
Road(outside Port)	1.0	40	0.025
Crownland	1.0	20	0.05
Total			0.300

JCT#3	0.5	20	0.025
Road(inside Port)	1.5	20	0.075
Road(outside Port)	1.0	40	0.025
Crownland	1.0	20	0.05
Total			0.175

Table A 2-3-4-3

(1) TURN ROUND TIME (J.C.T. ~ J.C.T.)

JCT#3 at Gantry	0.025
" on Road	0.025
" at Yard crane	0.025
" on Road	0.025
Information & Communication	0.100
Total	0.200 (=12'00")

(2) TURN ROUND TIME (Q.C.T. ~ Q.C.T.)

QCT at Crane	0.025
" on Road	0.075
" at Top loader	0.025
" on Road	0.075
Information & Communication	0.100
Total	0.300 (=18'00")

(3) TURN ROUND TIME (J.C.T. ~ CROWNLAND)

JCT at Gantry	0.025
JCT ~ Crownland	0.175
Crownland Yard crane	0.025
Crownland ~J.C.T.	0.175
Information & Communication.	0.100
Total	0.500 (=30'00")

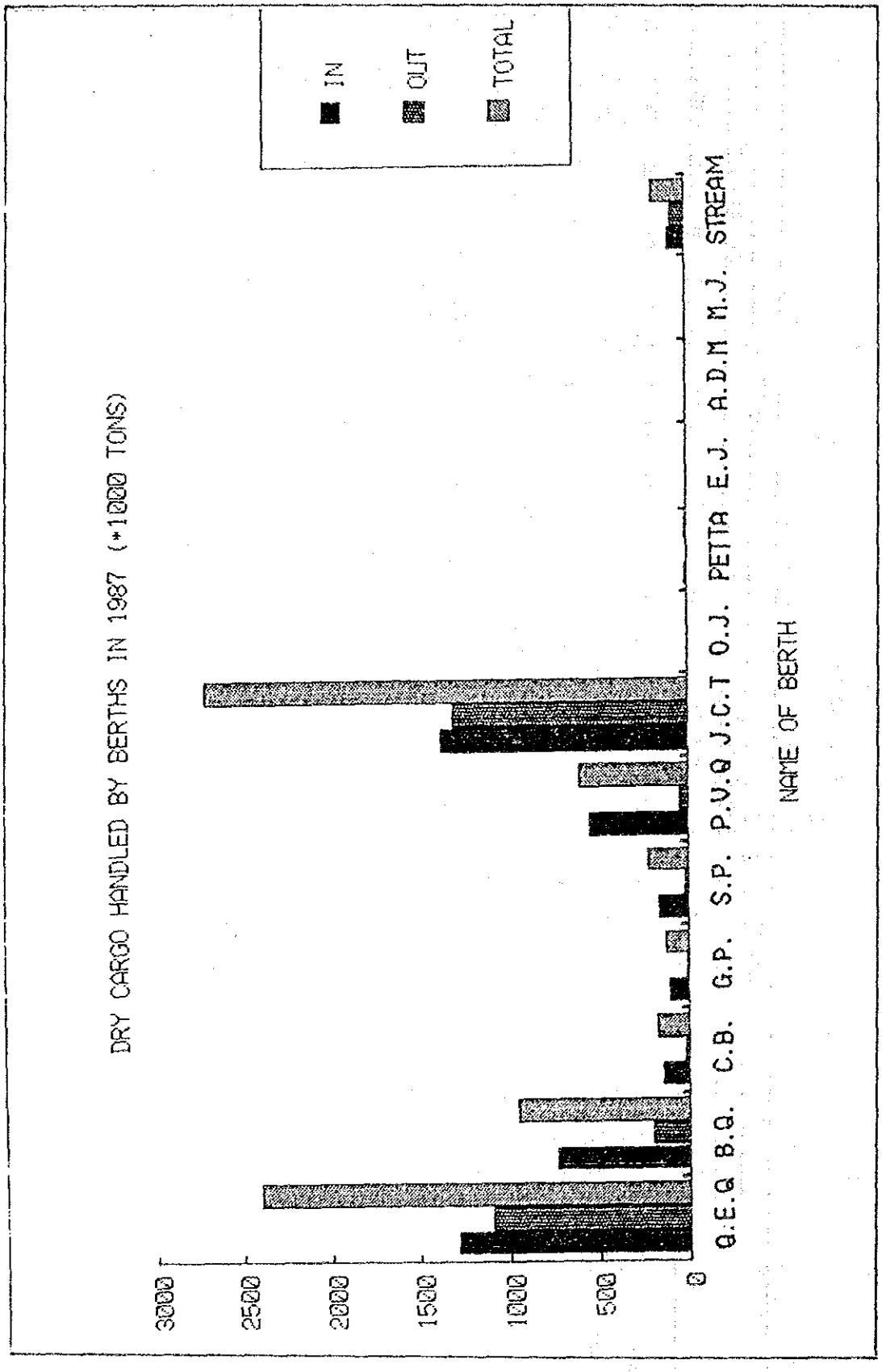
(4) TURN TOUND TIME (Q.C.T. ~ CROWNLAND)

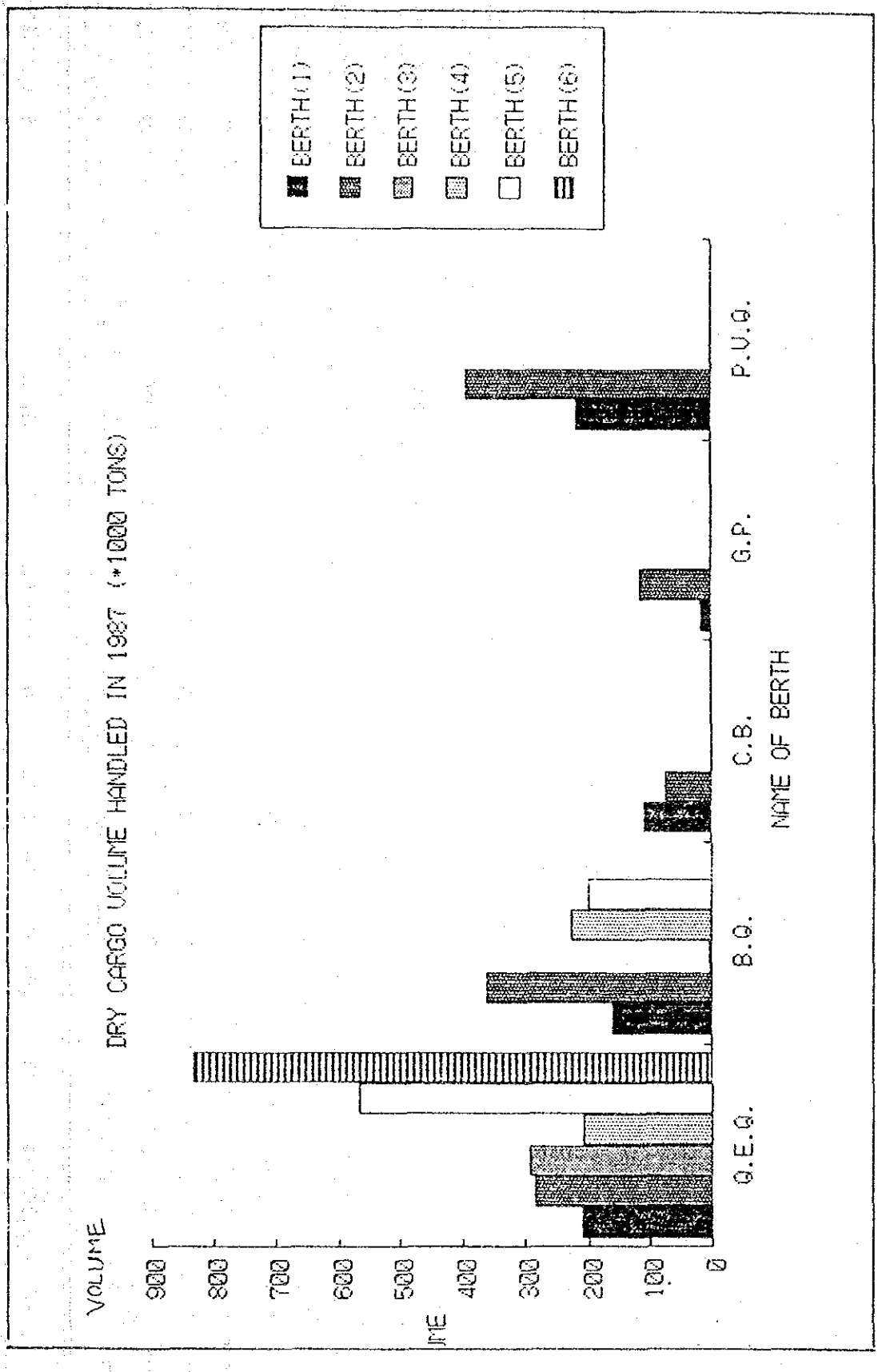
Total 0.750(=45'00")

Monthly Container Traffic - (T.E.U's) - 1988

PORT OF COLOMBO

MONTH	DISCHARGED							LOADED							Grand Total
	Domestic		T/S		Re-Stowing			Domestic		T/S		Re- Stowing			
	Laden	M/T	Laden	M/T	Laden	M/T	Total	Laden	M/T	Laden	M/T	Laden	M/T	Total	
January	3,662	1,275	19,906	3,664	252	32	29,091	4,121	1,146	18,673	3,205	238	32	27,415	56,506
February	3,399	2,458	16,082	4,097	398	192	26,626	4,303	756	17,488	3,812	423	192	26,974	53,600
March	4,123	2,124	18,634	4,347	158	66	29,452	4,610	1,160	18,085	4,624	158	91	28,728	58,180
April	3,893	1,666	18,541	3,136	151	50	27,437	3,901	1,281	18,802	2,858	163	44	27,049	54,486
May	3,948	2,381	16,718	3,689	170	49	26,955	4,261	1,177	16,065	3,912	160	55	25,630	52,585
June	3,593	736	17,869	3,018	266	14	25,496	4,975	1,172	16,904	2,900	235	4	26,190	51,686
July	4,259	1,086	22,511	3,037	268	35	31,196	4,685	1,319	20,413	3,455	264	33	30,169	61,365
August	4,680	1,845	17,616	2,814	192	120	27,267	5,553	1,494	21,043	3,114	192	113	31,509	58,776
September	4,000	2,016	18,888	2,776	137	46	27,863	4,309	1,235	16,437	1,931	146	50	24,108	51,971
October	4,409	2,066	20,662	3,055	434	16	30,642	5,150	1,009	21,002	3,941	418	6	31,526	62,168
November	4,061	1,755	12,058	2,314	350	75	20,613	4,199	713	11,283	1,255	360	81	17,891	38,504
December	3,677	1,385	7,361	1,700	315	-	14,438	3,661	543	7,819	1,813	301	-	14,137	28,575
Total	48,004	20,793	206,846	37,647	3,091	695	317,076	53,728	13,005	204,014	36,820	3,058	701	311,326	628,402


DRY CARGO HANDLED BY BERTHS IN 1987 (*1000 TONS)
IN
OUT
TOTAL
3000
2500
2000
1500
1000
500
0
A.E.A B.A. C.B. G.P. S.P. P.V.A J.C.T O.J. PETTA E.J. A.D.M M.J. STREAM
NAME OF BERTH


DRY CARGO VOLUME HANDLED IN 1987 (*1000 TONS)
VOLUME
IN
900
800
700
600
500
400
300
200
100
0
BERTH(1)
BERTH(2)
BERTH(3)
BERTH(4)
BERTH(5)
BERTH(6)
O.E.O.
B.O.
C.B.
G.P.
P.U.O.
NAME OF BERTH

MONTHLY TONNAGE OF LIQUID CARGO HANDLED
PORT OF COLOMBO - 1 9 8 8

TONNES

MONTH	D I S C H A R G E D												TOTAL DISCHARGED	
	CRUDE OIL						WHITE OILS							
	SPBM*		FEEDER TANKER		GAS OIL		KEROSENE OIL		BASE OIL		OTHERS			
	No.of Tankers	Tonnage	No.of Tankers	Tonnage	No.of Tankers	Tonnage	No.of Tankers	Tonnage	No.of Tankers	Tonnage	No.of Tankers	Tonnage	No. of Tankers	Tonnage
1987	N.A.	884,002	17	894,861	12	207,696	01	44,001	04	15,632	-	-	N.A.	2,046,192
1988	10	1,263,493	13	385,396	06	127,556	01	15,365	05	19,489	-	-	35	1,811,299
±% change	-	+42.9	-23.5	-56.9	-50.0	-38.6	0.0	-65.1	+ 25	+24.7	-	-	-	- 11.5
January	01	117,402	01	29,700	*01	19,028	* 1	5,057	01	3,907	-	-	04	175,094
February	-	-	01	29,446	01	24,907	-	-	-	-	-	-	02	54,353
March	01	128,616	02	59,556	-	-	-	-	-	-	-	-	03	188,172
April	01	128,416	02	63,145	01	20,756	01	5,172	01	3,893	-	-	06	221,382
May	-	-	02	59,434	01	21,030	-	-	-	-	-	-	03	80,464
June	01	128,476	01	27,458	-	-	-	-	01	3,729	-	-	03	159,663
July	01	125,147	02	56,188	-	-	-	-	-	-	-	-	03	181,335
August	01	124,599	01	30,229	*1	20,868	*1	5,136	-	-	-	-	03	180,832
September	01	124,709	01	30,240	-	-	-	-	01	3,986	-	-	03	158,935
October	01	128,047	-	-	01	20,967	-	-	-	-	-	-	02	149,014
November	01	127,939	-	-	-	-	-	-	01	3,974	-	-	02	131,913
December	01	130,142	-	-	-	-	-	-	-	-	-	-	01	130,142
TOTAL	10	1,263,493	13	385,396	06	127,556	01	15,365	05	19,489	-	-	35	1,811,299

*SPBM = Single Point Buoying Mooring * Same Tankers

Statistics Branch.

Table No: 3 Cont'd..

MONTH	L O A D E D											
	CHEMICAL	NAPTHA	BLACK FUEL OIL		COCONUT OIL (in Bulk)		OTHER		TOTAL LOADED		TOTAL HANDLED	
	No.of Tankers	Tonnage	No.of Tankers	Tonnage	No.of Tankers	Tonnage	No.of Tankers	Tonnage	No.of Tankers	Tonnage	No.of Tankers	Tonnage
1987	06	113,247	02	40,786	04	7,940	07	3,140	19	165,113	NA	2,211,305
1988	06	101,612	06	132,769	-	-	08	5,036	20	239,417	55	2,050,716
+% change	0.0	- 10.3	+200.0	+225.5	-	-	+ 14.3	+60.4	+ 5.3	+ 45.0	-	-7.3
January	01	21,951	-	-	-	-	01	649	02	22,600	06	197,694
February	-	-	-	-	-	-	01	647	01	647	03	55,000
March	01	19,228	-	-	-	-	01	648	02	19,876	05	208,048
April	01	10,448	01	20,937	-	-	01	697	03	32,082	09	253,464
May	-	-	-	-	-	-	01	649	01	649	04	81,113
June	01	10,470	01	20,958	-	-	01	648	03	32,076	06	191,739
July	-	-	01	26,949	-	-	01	649	02	27,598	05	208,933
August	-	-	-	-	-	-	-	-	-	-	03	100,832
September	01	19,931	01	18,873	-	-	01	449	03	39,253	06	198,188
October	-	-	-	-	-	-	-	-	-	-	02	149,014
November	01	19,584	01	20,056	-	-	-	-	02	39,640	04	171,553
December	-	-	01	24,996	-	-	-	-	01	24,996	02	155,138
TOTAL	06	101,612	06	132,769	-	-	08	5,036	20	239,417	55	2,050,716

Statistics Branch.

FLOATING CRAFT IN SLPA-COLOMBO

A.	BERTHING TUGS	HP	AGE	YEAR BUILT	BOLLARD PULL(T)
1.	Gotaimbara	2300	17	1972	22
2.	Nandamitra	2000	24	1965	20
3.	Suranimala	2000	23	1966	20
4.	Vasabha	2000	26	(1963)	20
5.	Mahasen	2600	9	(1980)	30
6.	Neelamala	2600	9	(1980)	30
7.	Sinhabahu II	2600	9	(1980)	30
8.	Airawana	3600	0	1989	40

B. DREDGERS

1.	Diyakawa	1972	Self Propelled, Trailing Suction Arms with six hoppers.
2.	Kakuluwa	1962	Self Propelled,Twin Screw. Grab-Hopper with six hoppers.
3.	Bin Ura	1971	Stationary, Bucket type
4.	Boowalla	1974	Stationary, Cutter Suction 16" Dia.

C. FIRE FLOAT

1.	Megha	1983	Self propelled. with remotecontrolled folding tower, 19 m above water line, 3,000 l/min water foam,4 fire monitor.

D. FLOATING CRANE

1.	Jumbo	1948	Steam crane ,stationary
2.	Giraffe	1948	Steam crane ,stationary, 60 tons at 60 feet radius.

E. TOWING TUGS small tugs

(18) nos. HP=275 to 350
Age : 22 years 50 %
18 years 25 %
2-10 ye 25 %

(02) nos. HP=550
Age : 4 years 1984 Dec

F. MOTOR LAUNCHES

(06) nos Timber Pilot Launches
Age : 10-45 years
HP : 80-120 HP

(02) nos GRP Pilot Launches
Age : 04 years
HP : 300 HP

FLOATING CRAFT IN SLPA-COLOMBO

G. WORK BOATS

(38) nos. Various Types, Hulls in Timber.
Age : 10-40 years
HP : 30-60 HP

H. PASSENGER CRAFT for carring stevedors

(04) nos Steel
Age : 20 years
HP : 100 HP

I. WATER BERGES

(16) nos Steel
Age : 25 years 90 %
05 years 10 %
Capacity 100 tons F/Water
Output 100 tons/Hour

J. CARGO LIGHTERS

(80) nos Steel
Age : over 22 years
Capacity 100 tons

K. DECK BERGES

Steel
(06) nos 100 tons
(06) nos 200 tons
Age : 8-10 years

L. MISCELLANEOUS CRAFT

1) Light House Service Vessel Steel
(01) no. 250 HP ,22 m long
Age:25 years

2) Diggers

(02) nos. Steam
(02) nos. Diesel

3) Hopper Berges
(06) nos. Steel

SRI LANKA PORTS AUTHORITY

DREDGERS - 1 9 8 7

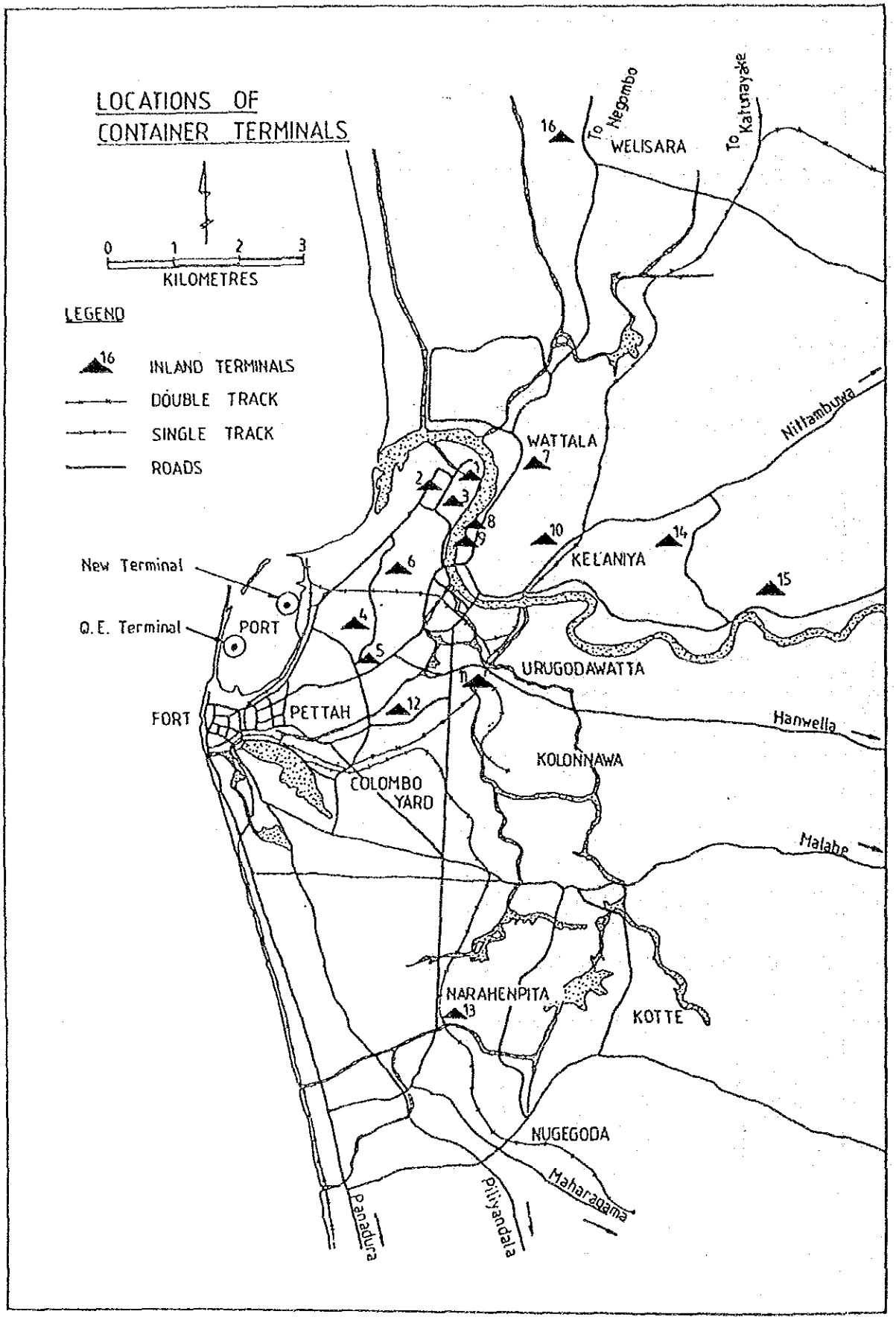
NAME / DESCRIPTION	DIYAKAWA	KAKULUWA	BIN URA	BOOWELLA
Type	Trailing Arm Drag Suction Dredger	Grab Hopper Dredger	Bucket Dredger	Cutter Suction Dredger
Builder	I.H.I. Japan	George Brown & Co. U.K.	Fleming & Fergusion U.K.	Dixie Dredger U.S.A.
Year Built	1972 - Ship No: 2310	1962 - Ship No: 274	1971 - Ship No: 814	1974
Propelled	Yes - Twin Screw	Yes - Twin Screw	No - Stationery	No - Stationary
Main Engine	Yanmar	Crosslay	Catepillar	Catepillar
M.E. Power	2 x 450 HP	2 x 200 HP	300 HP	480 HP
Dredging Capacity	500 m^3/Hr.	275 Yds^3/Hr.	675 Yd^3/Hr.	137.6 m^3/Hr.
Hoppers	640 m^3	210 Yds	N/A	N/A
Dredge Pump	I.H.I. - Japan	N/A	N/A	Thomas - U.S.A.
Dredge Engine Power	600 HP	N/A	300 HP	480 HP
Maximum Dredging Depth	16.8 m.	20.9 m	13.7 m	9.14 m
D.W.T.	1350 Tons	430 Tons	300 Tons	-
Dimensions	65.0 x 11.8 x 5.0 m^3	43.3 x 8.8x 3.7 m^3	46.0 x 9.1x3.2 m^3	12.2 x 6.1 x 3.0 m^3
Suction & Delivery Diameters	580 CM Suction 510 Delivery	Not Applicable	Not Applicable	16 in Suction 14 in Delivery

Source: Engineering Division.

Appendix Table 2-4-1 Container Freight Stations (Inland)

Name of CFS/CD	Address	Distance from Port km.	Land Area	W/House Space
ABC Containers (Pvt) Ltd.	182, Avissawella Road, Wellampitiya.	4.0	8000 sq.m	-
ACE Containers (Pvt) Ltd.	1) 775/5 Negombo Road, Mabole, Wattala.	6.0	48564 sq.m.	558 sq.m
	2) Phase I, I.P.Z. Katunayake.	30.0	2.5 Acres Paved Area	2000 sq.ft
Asha Aencies Container Freight Services & Depot.,	87, Nungamugoda Road, Kelaniya.	8.0	20300 sq.m	-
Bartleet Container Freight Station,	100, Negombo Road Wattala.	6.4	4050 sq.m	650 sq.m
Cargo Boat Despatch Co. Ltd., Container Depot.,	97, Negombo Road, Peliyagoda.	6.4	3050 sq.m	760 sq.m
Cayhaus Limited,	104, Nawala Road, Colombo 05.	6.4	8100 sq.m	4890 cu.m.
Ceylon Ocean Lines Container Services Ltd.	Pattiwila, Gonawala Kelaniya.	16.0	450 sq.m	450 sq.m
Ceylon Shipping Lines Ltd	8/2, Avissawella Road, Orugodawatte.	8.0	40500 sq.m	1132 cu.m.
East-West Container Ltd.	364, Dutugemunu Mawatha, Kandy Road, Peliyagoda.	7.2	40500 sq.m	1520 sq.m
Interocean Container Depot.,	480, Hendala Road, Wattala.	9.6	12150 sq.m	380 sq.m
Maritime Agencies CFS,	54, Centre Road, Mattakkuliya.	3.2	600 sq.m	625 sq.m
McLaren's Container Depot.,	776, Negombo Road, Welisara.	13.5	20300 sq.m.	380 sq.m.

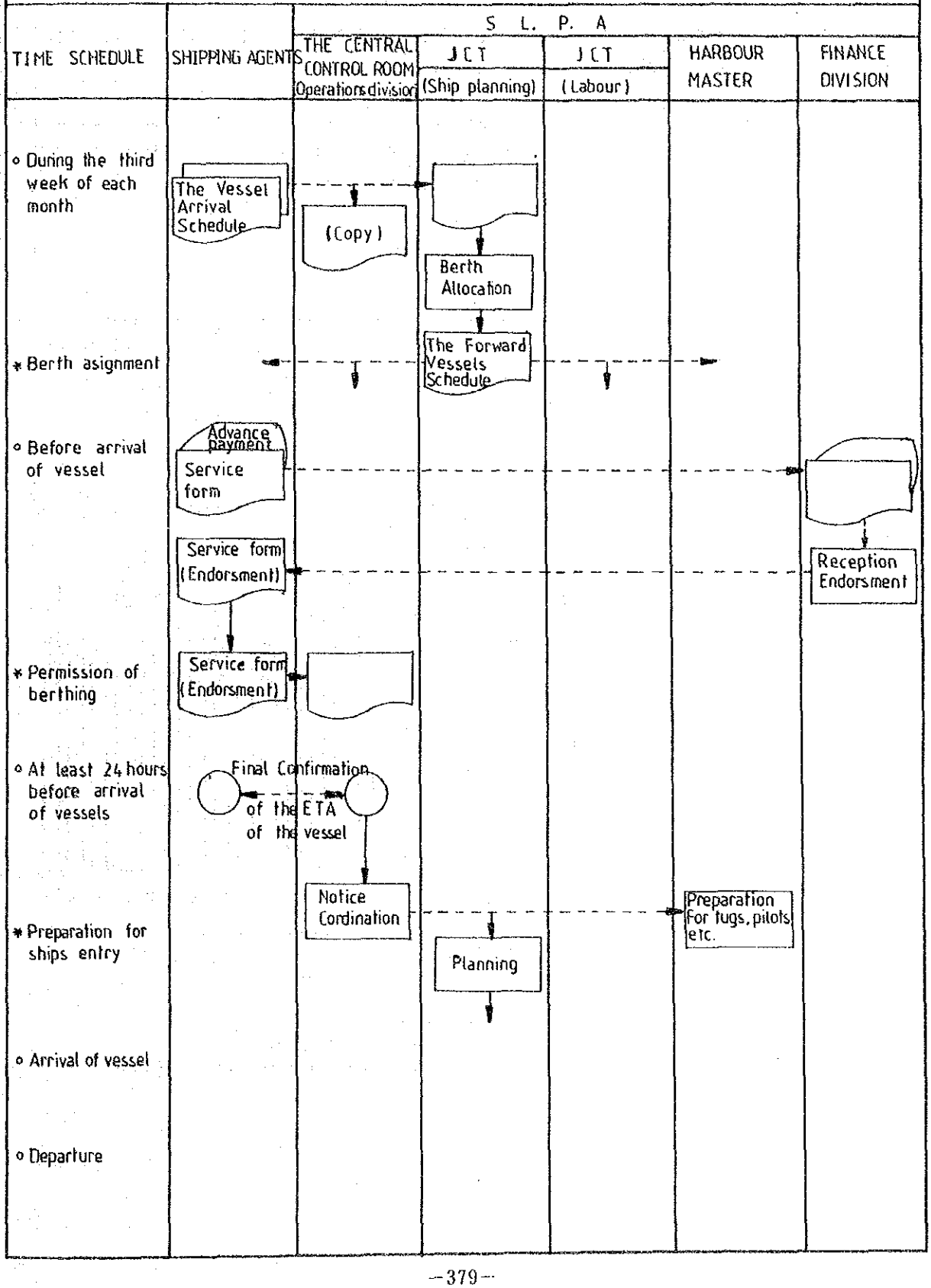
Appendix Fig. 2-4-1 Container Freight Stations (Inland)



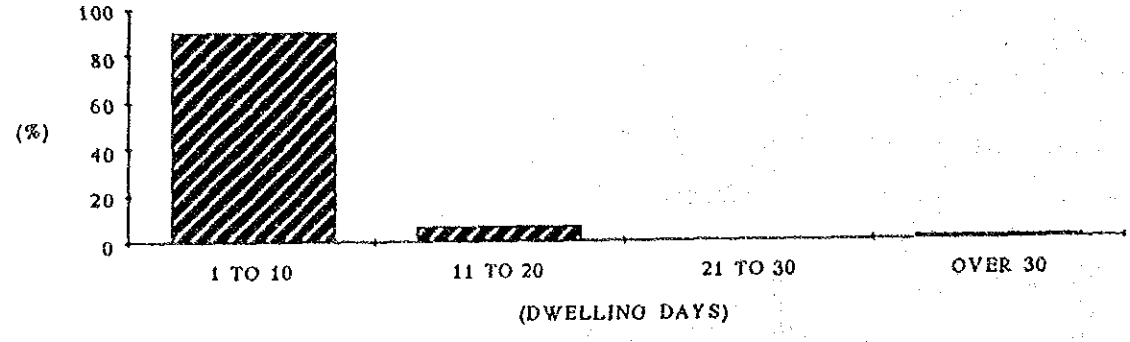
Appendix 2-4-2

FLOM CHART OF PROCEDURES CONCERNING SHIP'S ENTRY / DEPARTURE

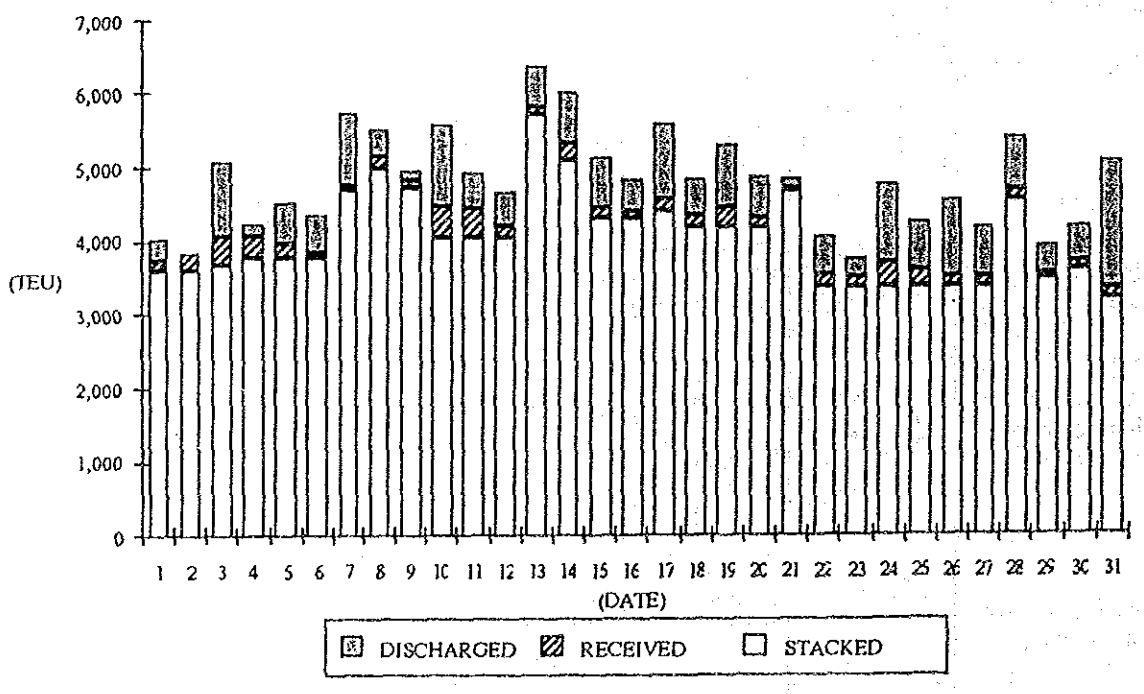
(J C T)



Appendix 2-4-3 Dwelling TIme of Export/Import Containers at JCT (Jan. to Aug. '88)



Appendix 2-4-4 Number of Containers at JCT (March, 1989)



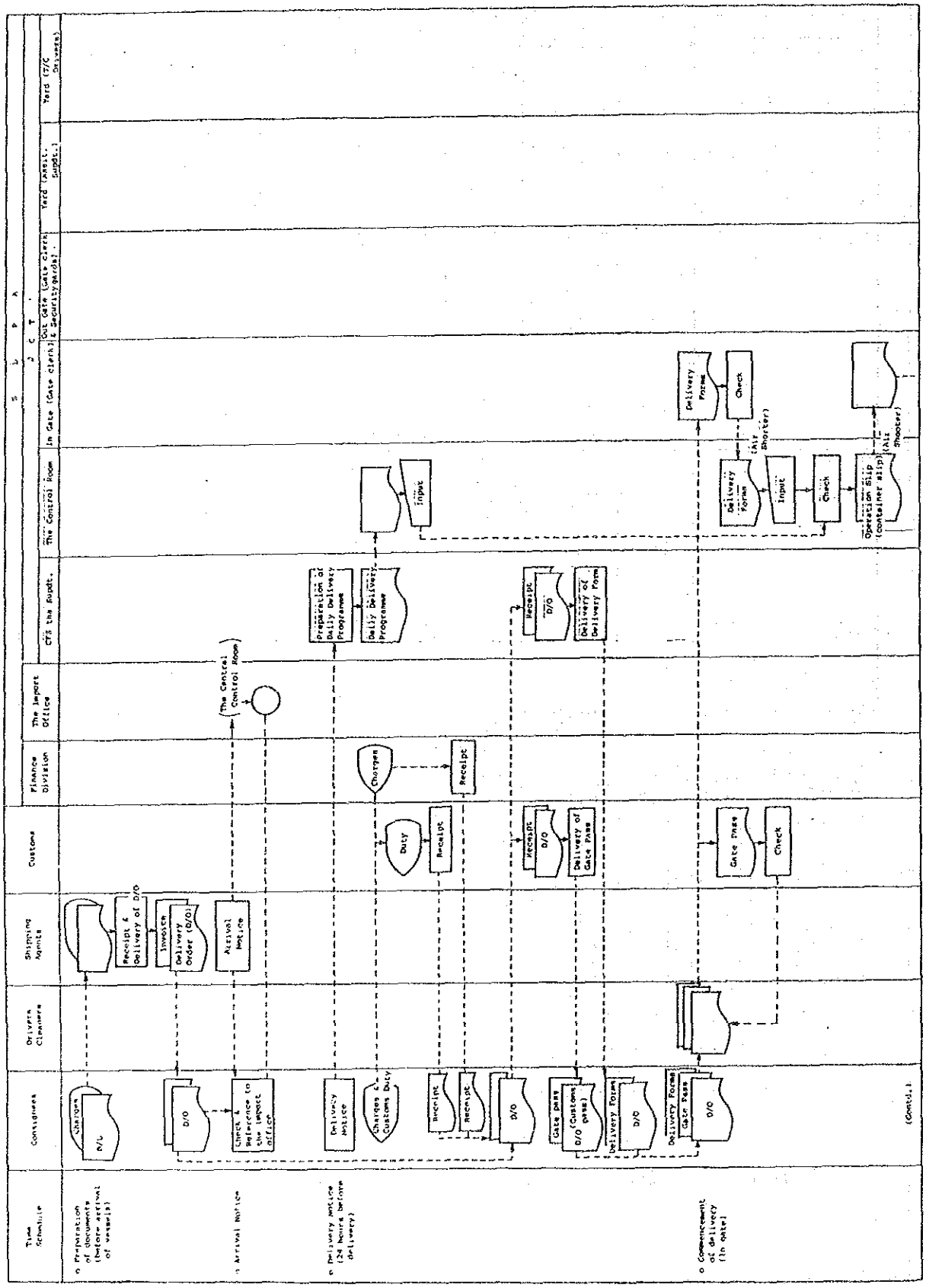
DISCHARGED : NUMBER OF CONTAINERS DISCHARGED ON THE DAY
RECEIVED : NUMBER OF CONTAINERS RECEIVED ON THE DAY
STACKED : NUMBER OF CONTAINERS STACKED AT THE BEGINNING OF THE DAY

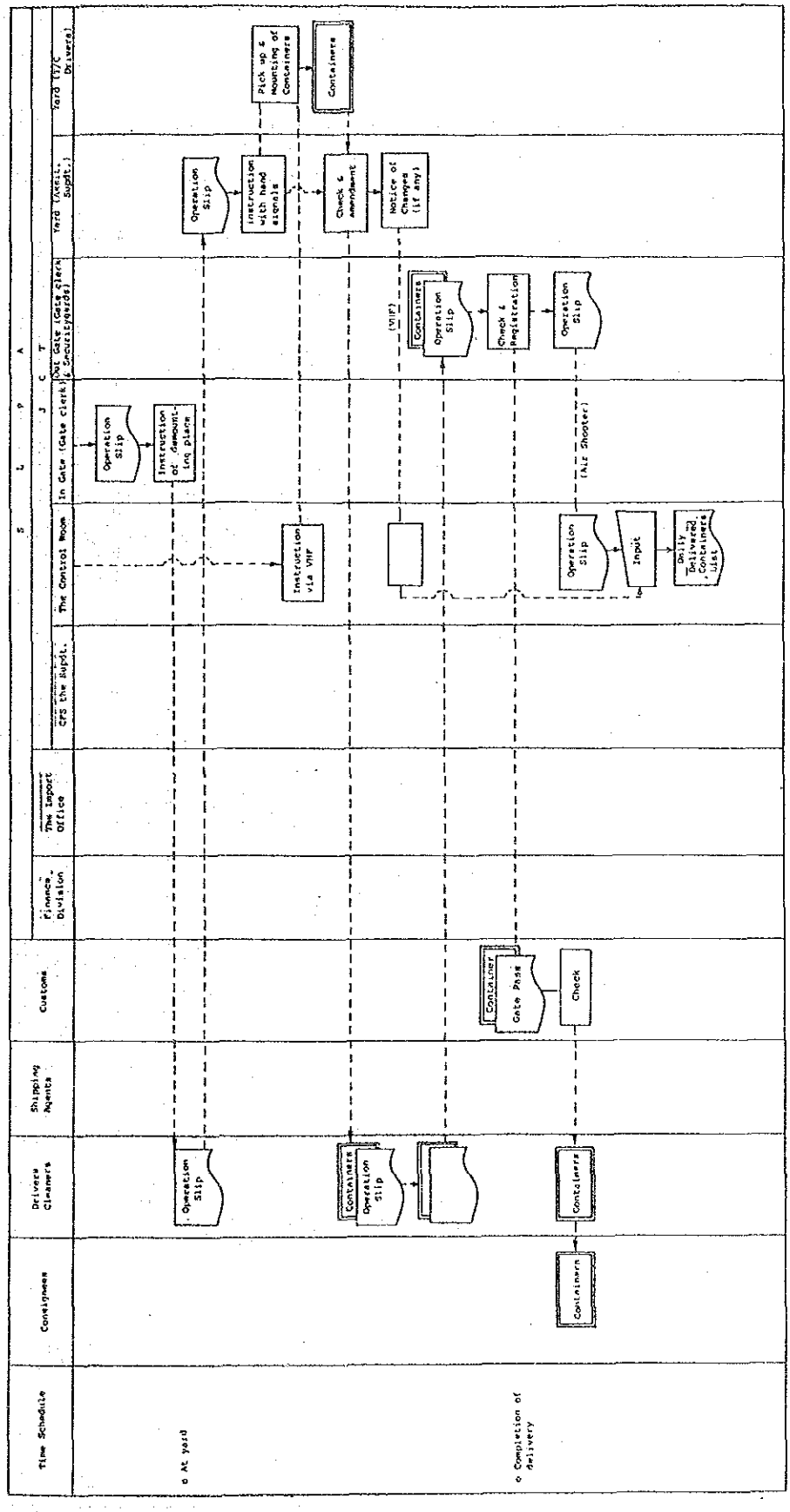
Appendix 2-4-5 Cargo Handling Equipment (Port of Colombo)

	O.C.T.		J.C.T.		OTHERS		STREAM	
Type of Equipment	No. of Units	Capacity	No. of Units	Capacity	No. of Units	Capcity	No. of Units	Capacity
Cranes	2	30~35.5T	4	35.5T	52	1.5~130T	2	60T
Transfer Cranes	4	35	10	35.5				
Forklifts	4	42						
	8	40	1	40				
	11	25						
	2	15						
			2 (CFS)	5				
	5 (CFS)	2.4	12 (CFS)	2.5	70	2.5		
Prime Movers	12		24 (1-CFS)					
Trailers(Chassis)	5	40'	43 *	40'				
	25	20'	30 *	20'				
Tractors					4			
Barges Deck							12	100~250
Barges other							159	45~110

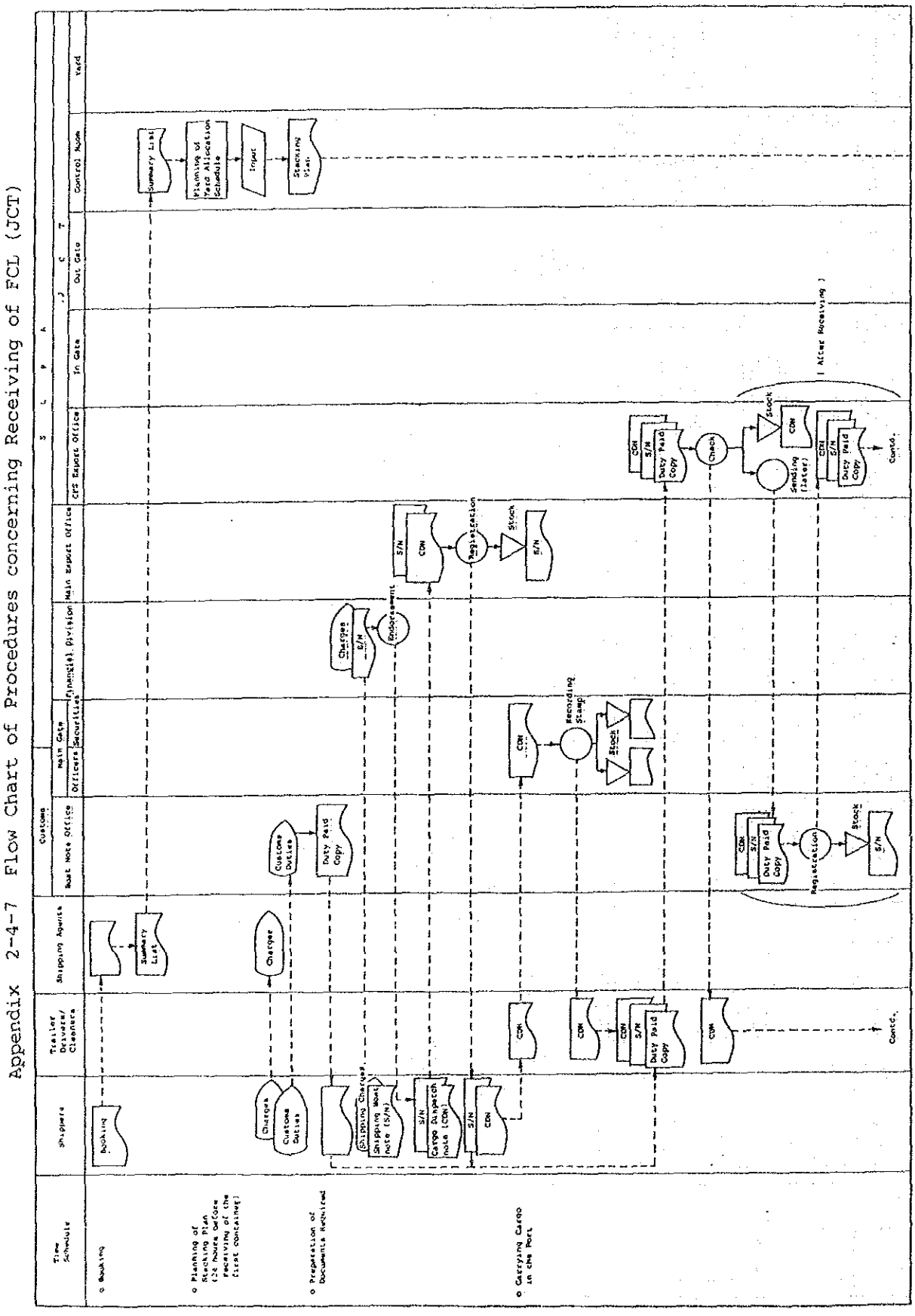
* 12 FOR CFS

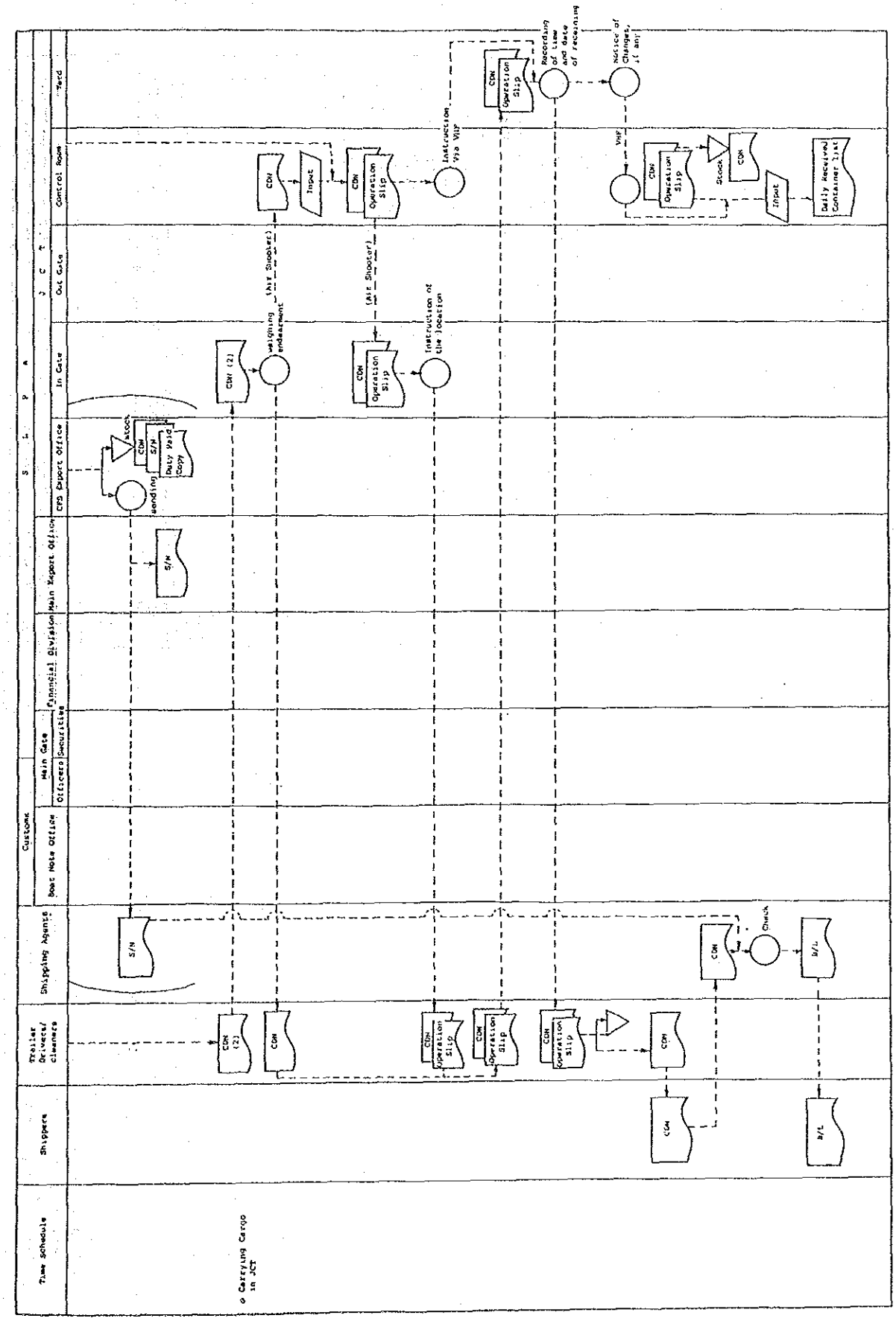
Appendix 2-4-6 Flow Chart of Procedures concerning Delivery of FCL (JCT)




S L P A C T
Time Schedule
Consignees
Drivers Cleaners
Shipping Agents
Customs
Finance Division
The Import Office
CFS (the Supt.)
The Control Room
In Gate (Gate clerk)
Out Gate (Gate clerk & Security guards)
Yard (Asst. Supdt.)
Yard T/T/C Drivers)
o At yard
o Completion of delivery
Operation Slip
Instruction of demurrage plan
Instruction via VHF
Pick up & Mounting of Containers
Containers
Instruction with hand signals
Check & Amendment
Notice of Changes (if any)
(VHF)
Check & Registration
(Air Shooter)
Input
Daily Delivered Containers List
Container
Gate Pass
Check

Appendix 2-4-7 Flow Chart of Procedures concerning Receiving of FCL (JCT)

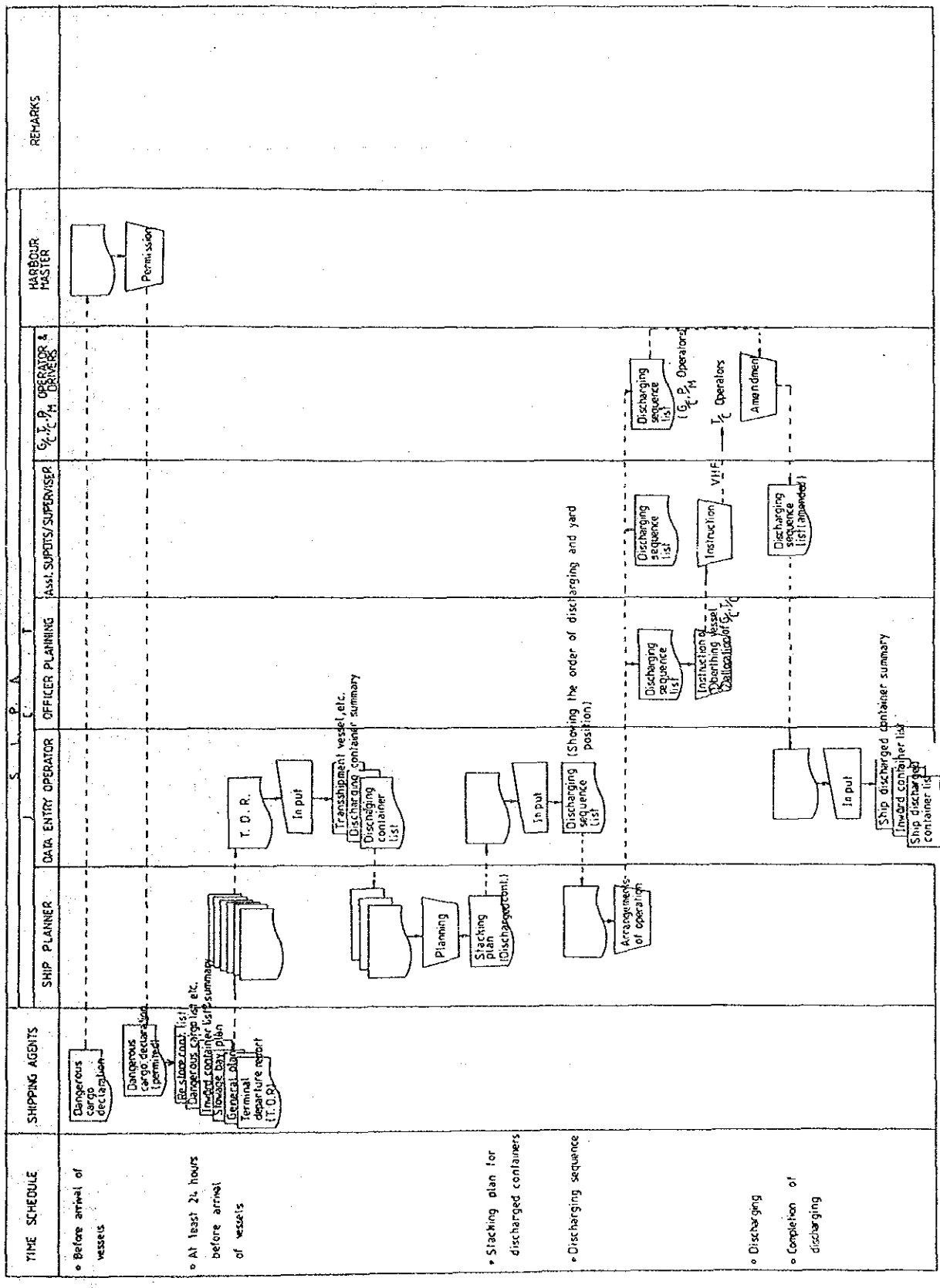



Time Schedule
Shippers
Trailer Drivers/ cleaners
Shipping Agents
Customs
Boat Note Office
Main Gate
Officers
Securities
Financial Division
Main Export Office
CFS Export Office
In Gate
Out Gate
J C T
Control Room
Yard
S/N
CDN (2)
CDN
Operation Slip
Input
Daily Received Container List
B/L
Check
Stock
VHF
Instruction via VHF
Recordsing of time and date of receiving
Notice of Changes, if any
Instruction of the location
(Air Shooter)
(Not Shooter)
weighing endorsement
sending
Daily Void Copy
Carrying Cargo in JCT

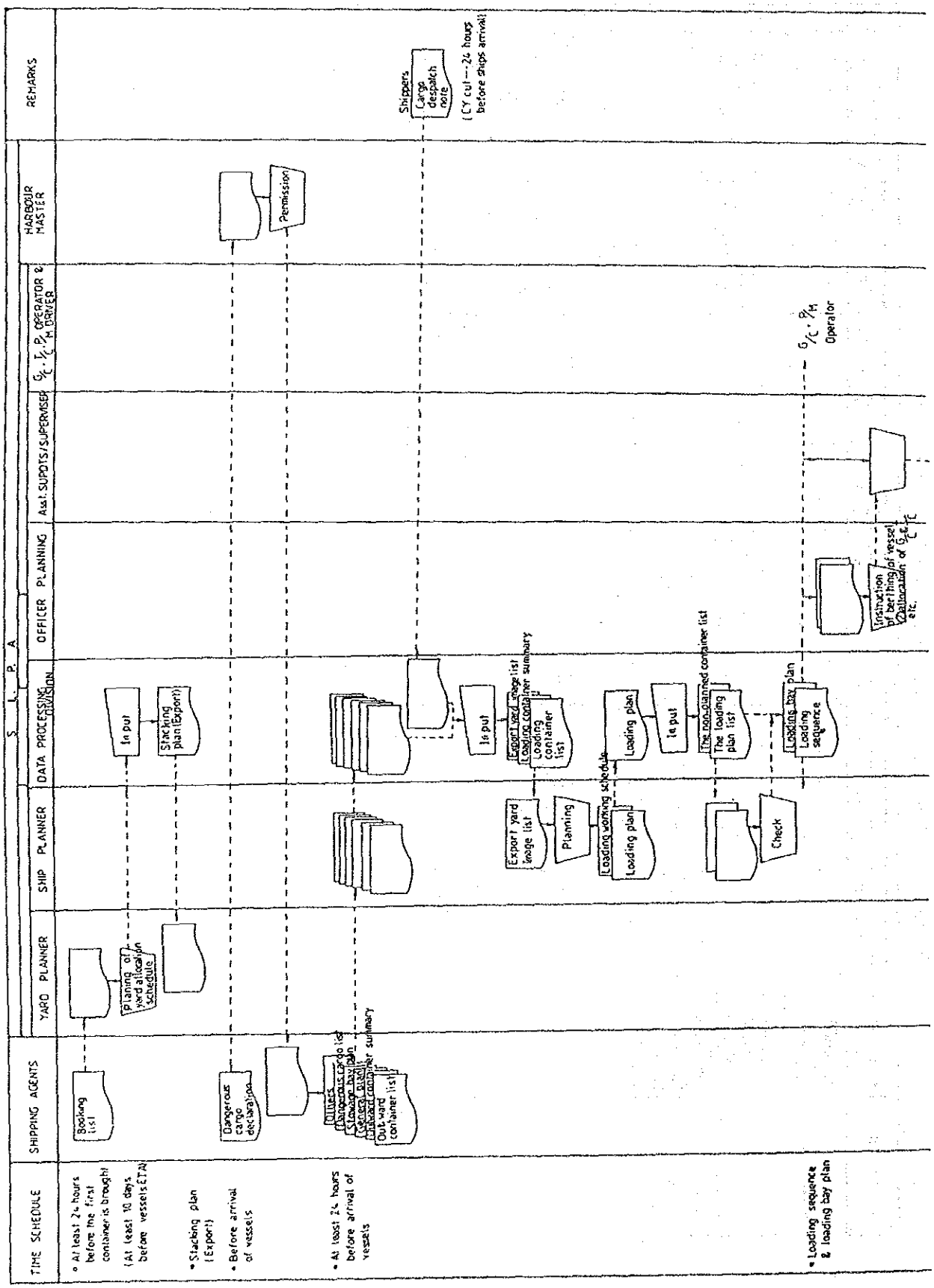
Appendix 2-4-8 No. of Employees at QCT and JCT

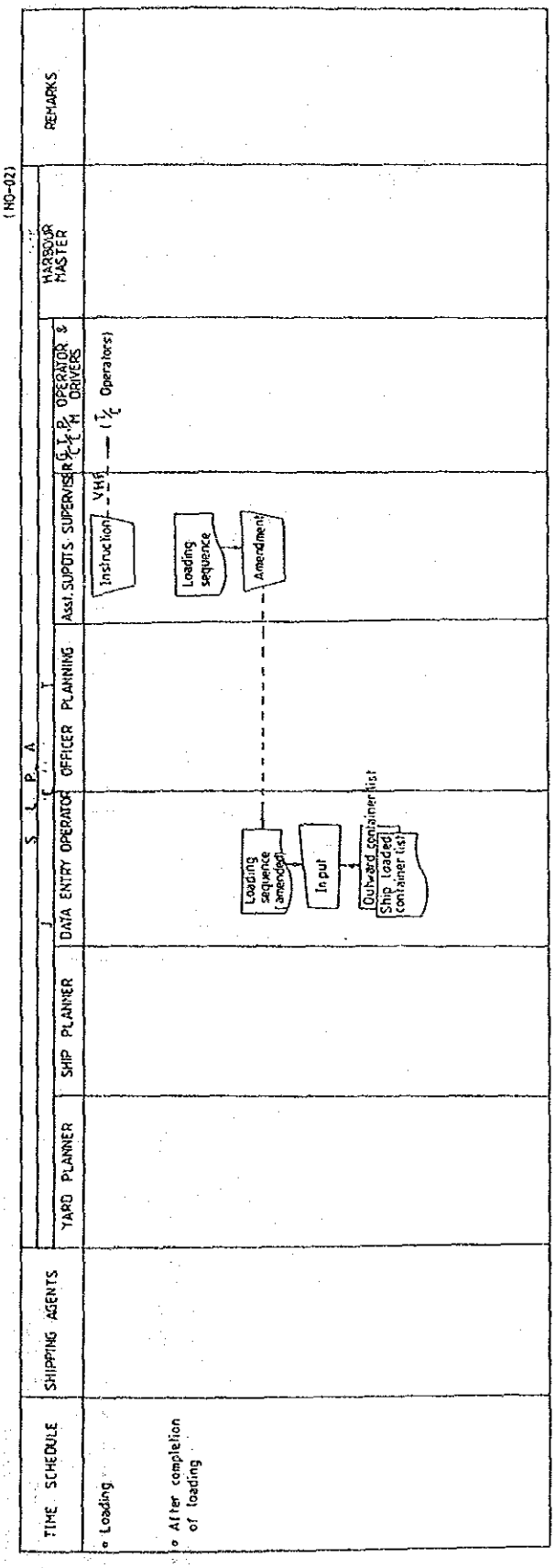
			QCT	JCT
OPERATIONS DIVISION	NON-LABOUR GRADE	EXECUTIVES,CLERKS,ETC.	161	182
		PLANNERS(STACKING,ETC.)	2	11
		TALLY CLERKS	30	23
		GANTRY CRANE OPERATORS	10	17
		TRANSFER CRANE OPERATOR	30	14
		FORK LIFT OPERATORS		13
		PRIME MOVER OPERATORS	16	52
		TOTAL	249	312
	LABOUR GRADE	WINCHMAN	47	
		GANTRY CRANE SIGNALERS	10	4
		STEVEDORE LABOURERS	228	81
		WHARF LABOURERS	241	
		GEARMAN	5	
		KANGANIES	25	4
		YARD ASSIST.	60	23
		TINDAL HATCH	15	
		CASUAL LABOURERS		23
		PALETISERS & STRAPPERS	11	
		OTHERS	25	
		TOTAL	667	135
	TOTAL		916	447
SECURITY DIVISION			235 (INCLUDING QEQ)	130
TOTAL(EXCLUSIVE OF ENGINEERING DIVISION)			1,151	577

Appendix 2-4-9 Flow Chart Discharging Procedures (JCT)

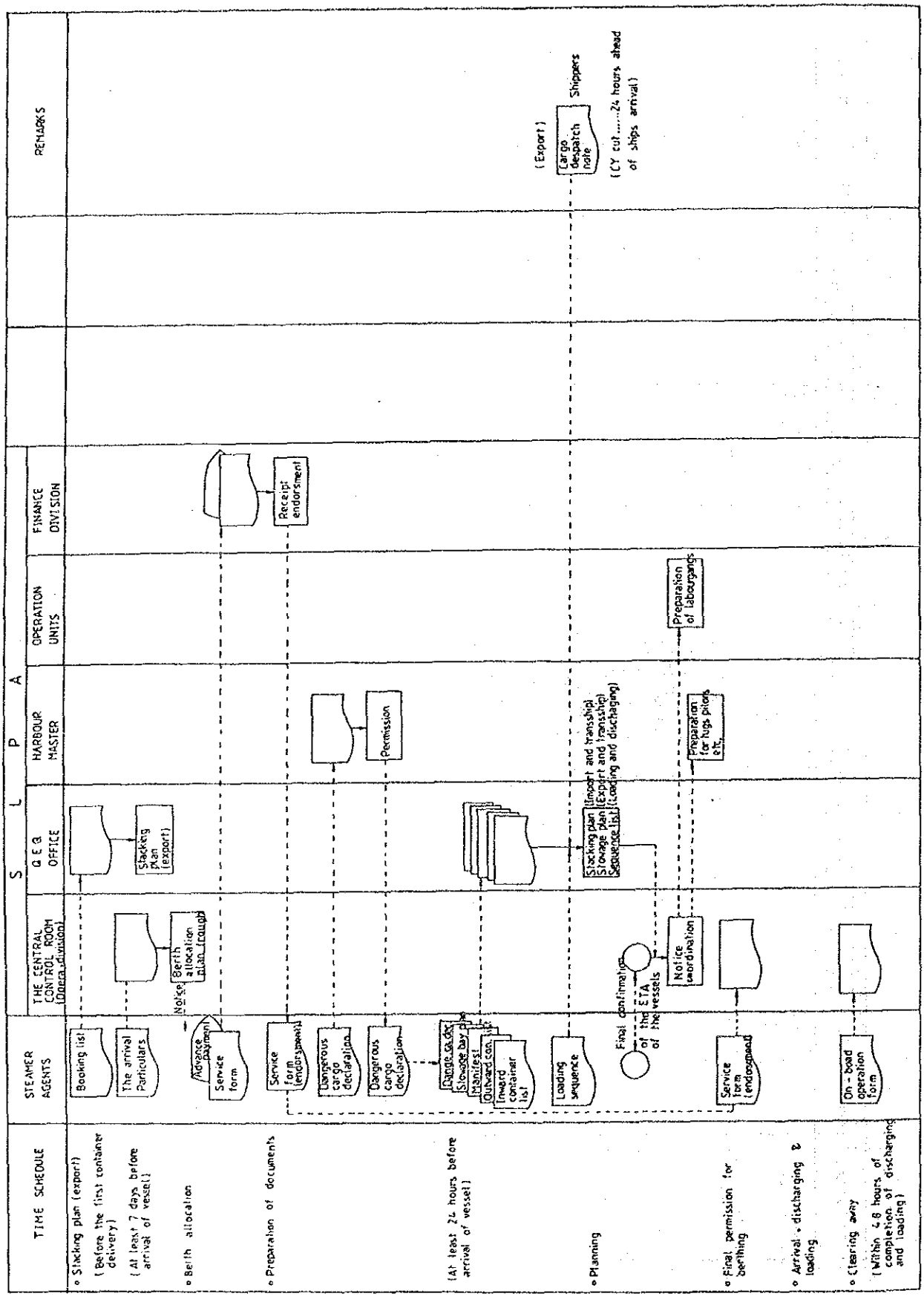


Appendix 2-4-10 Flow Chart of Loading Procedures (JCT)




(NO-02)
S L P A
TIME SCHEDULE
SHIPPING AGENTS
YARD PLANNER
SHIP PLANNER
DATA ENTRY OPERATOR
OFFICER PLANNING
Assi. SUPDTS. SUPERVISOR
G.I.P.C.F.M OPERATOR & DRIVERS
HARBOUR MASTER
REMARKS
Loading
After completion of loading
Instruction
VHF
(½ Operators)
Loading sequence
Amendment
Loading sequence amendment
Input
Outward container list
Ship loaded container list

Appendix 2-4-11 Flow Chart of Procedures Concerning Ship's Entry/Departure & Discharging/Loading (Except JCT)



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Telefax: 21067 WALKINN CE

Our Ref: 174 - 185 & 199 - 210

12th June 1989

CERTIFICATE OF ANALYSIS

EXAMINATION OF 24 SAMPLES OF WATER

Client :- Japan Port Consultants Ltd.
C/o Sri Lanka Ports Authority,
45, Leyden Bastian Road,
Colombo 1.

Reference Client's letter dated 3rd May 1989 and the subsequent discussions we had with Mr. K. Sasaki, J I C A Study Member & Mr. T. Ichizono, General Manager for Overseas Project Department, about the water quality investigation in the Port of Colombo under the Port of Colombo Expansion Project.

Samples:- 24 Samples of water drawn by Bamber & Bruce Ltd. under the supervision of Mr. K. Sasaki, Engineer J I C A Study Team.

Water samples were obtained at two depth layers (- 0.5 M and - 2.0 M) from each of the following 6 points at the harbor basin of the Port of Colombo, once on the 25th and then on the 26th of May 1989:-

(1) Barge Repair Basin
(2) Cannal
(3) Outfall of city drainage canal
(4) Central part of the harbor
(5) Entrance Channel and
(6) North Pier.

The 12 samples of 25th May 1989 were drawn between 2.00 p.m. & 4.30 p.m. and the 12 samples of 26th May 1989 were drawn between 10.00 a.m. & 12.00 noon.

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[illegible] WALKINN CE

Service required:-

To examine each of the water samples for the following parameters:-

(a) Hydrogen ion exponent (pH)
(b) Chemical oxygen demand (COD)
(c) Oil content (OC)
(d) Dissolved oxygen (DO)
(e) Sulphide content (S)
(f) Coliform group (CG)

Period of Laboratory Analysis:-

All the 24 samples were analysed between 26th of May 1989 and 9th of June 1989.

Presentation of Test Results

The test results were presented in a tabular form, as requested by the Client. Each of the six points selected for the examination of water was represented by a separate table.

Grading of the quality according to the remarks used in this report

Remarks	Quality %
Good	80 - 100
Fair	60 - 80
Average	40 - 60
Below Average	20 - 40
Bad	0 - 20

Chief Analyst
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[illegible]

I METHODS OF ANALYSIS

(a) Hydrogen ion exponent (pH)

The pH of the water samples were measured by using an ion electrode. We used PI1-3 pH meter.

The pH meter was calibrated by means of the standard buffer solutions. The electrode was then washed with distilled water and then immersed in the test-water. The pH of the test water reading was noted.

At the end of the experiment the calibration of the pH meter was checked against the standard buffer solutions in order to ascertain that the pH meter was not gone out of calibration. All the results agreed within 0.05 pH units.

(b) Chemical oxygen demand (COD)

The test method ($KMnO_4$ at 100°C for 30 minutes) for the determination of COD was provided by Mr. Minoru Tanaka, Environmental Engineer of Japan Port Consultants Ltd. in 1985 when we carried out a similar analysis for him.

Procedure:-

9 ml of distilled water and 1 ml of test water were taken into a 50 ml conical flask. 10 ml of H_2SO_4 (1 + 2) and 1 gram $AgSO_4$ (fine powder) were added into the flask. The mixture was shaken for 20 minutes. 2.00 ml of N/40 $KMnO_4$was added into the flask. A light pink colour remained (More $KMnO_4$ was added whenever the pink colour disappeared). The flask was kept in a water bath at 100°C for 30 minutes. 2.00 ml of N/40 $Na_2C_2O_4$ was added into the flask. The pink colour disappeared. The solution in the flask was titrated against N/40 $KMnO_4$ at 60 - 80°C until a light pink colour appeared.

Calculation:-

1 ml of N/40 $KMnO_4$ = 0.2 mg of O_2

A blank determination was also carried out using 1 ml of distilled water instead of 1 ml of test-water.

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(c) Oil content (OC)

The oil content of each of the water samples was expressed as n-Hexane extract using gravimetric procedure.

The oil content in a known amount of water sample was extracted with n-Hexane in a separating funnel. The hexane with the extract was transferred to a tared tin foil basin. The hexane was evaporated and the residue was weighed. The p.p.m. level of oil in the water sample was then calculated.

(d) Dissolved oxygen (DO)

Winkler's method, a volumetric procedure, was adopted. This method depends on the oxidation of manganous hydroxide by the oxygen in solution and the subsequent titration of an equivalent amount of iodine set free from potassium iodide.

The method was divided into three stages.

(x) Preliminary oxidation which involves the use of conc H_2SO_4, N/80 $KMnO_4$ and $K_2C_2O_4$.

(y) Fixation of the dissolved oxygen which involves the use of $MnSO_4$ KOH and KI.

(z) Measurement of the dissolved oxygen by liberation of iodine and titration with thiosulphate solution.

Calculation:-

One ml of N/80 $Na_2S_2O_3.5H_2O$ = 0.1 mg O_2.

The p.p.m level of dissolved oxygen in the water sample was calculated from the volume of N/80 sodium thiosulphate used in the titration.

Chief Analyst
[illegible]

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(e) Sulphide content (S)

The method given by Mr. Minoru Tanaka, Environmental Engineer of Japan Port Consultants Ltd., in 1985 was followed.

The total sulphide content of a sample of water constitutes the free sulphide and bonded sulphide.

Total sulphide = Free sulphide + Bonded sulphide.

Free sulphide:-

A known volume of the test sample was steam distilled. The distillate was collected in 1% $zn(C_2H_3O_2)_2.2H_2O$ solution. Excess I_2 was added, acidified with HCl and titrated against standard $Na_2S_2O_3.5H_2O$ solution in the usual way using starch solution close to the end point.

Calculation:-

1 ml of 0.01 N I_2 = 0.16 mg S

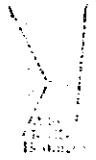
Bonded sulphide:-

The method is similar to free sulphide. The only difference is that in the distillation flask a suitable volume of sample and 15 ml 1:5 HCl were taken.

(f) Coliform Group (CG)

The most probable number per 100 ml of test sample was obtained by plating 5 portions in each of 3 dilutions in geometric series using lactose broth.

15 screw cap test-tubes each containing a small inverted Durham tube were used for one sample. 10 ml of double strength broth and 10 ml of sample were taken in 5 tubes. 10 ml of single strength broth and 1 ml of sample were taken in another 5 tubes. 10 ml of single strength broth and 0.1 ml of sample were taken in the final 5 tubes. The tubes were incubated at 37°C for 48 hours. At the end of 48 hours the positives in each of the 3 dilutions were counted. The most probable number against the positive tubes were read from the Chart.



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11 RESULTS OF ANALYSIS

SAMPLING POINT NO : 1

B A R G E R E P A I R B A S I N

TIDE LEVEL		HIGH TIDE		LOW TIDE		AVARAGE VALUE	NOTE
SAMPLING DEPTH		-0.5 Metre	-2.0 Metre	-0.5 Metre	-2.0 Metre		
pH	-	7.20	7.10	7.10	7.50	7.23	Good
C.O.D.	P.P.M	NiL	Nil	Nil	Nil	NiL	Very good
OiL Conteny	P.P.M	4	115	264	120	125.75	Below Average
Dissolved Oxygen	P.P.M	1.08	1.24	1.40	1.48	1.30	Below Average
Sulphide	P.P.M	0.32	0.44	1.36	0.72	0.72	Average
Coliform Group	M.P.N 100ml	1,600	≥2,400	≥2,400	33	≥1,608.25	Bad
Our Reference No.		175	174	199	200	____	____
Date of Sampling		25th MAY 1989		26th MAY 1989		____	____

COMMENTS :- The Coliform count is high. The presence of oil and Sulphide may be due to the contamination of fuel oil used in ships.The quality of the samples are below average.

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11 RESULTS OF ANALYSIS

SAMPLING POINT NO : 2

C A N A L

TIDE LEVEL		HIGH TIDE		LOW TIDE		AVARAGE VALUE	NOTE
SAMPLING DEPTH		-0.5 Metre	-2.0 Metre	-0.5 Metre	-2.0 Metre		
pH	-	7.50	7.40	7.40	7.40	7.43	Good
C.O.D.	P.P.M	Nil	10	Nil	10	5.00	Good
Oil Conteny	P.P.M	43	13	294	149	124.75	Below Average
Dissolved Oxygen	P.P.M	1.00	1.12	1.40	0.96	1.12	Below Average
Sulphide	P.P.M	0.88	0.32	0.88	1.36	0.86	Average
Coliform Group	M.P.N 100ml	920	920	430	44	578.50	High
Our Reference No.		184	178	201	202	____	____
Date of Sampling		25th MAY 1989		26th MAY 1989		____	____

COMMENTS :- The samples are of average quality.

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11 RESULTS OF ANALYSIS

SAMPLING POINT NO : 3

OUTFALL OF CITY DRAINAGE CANAL

TIDE LEVEL		HIGH TIDE		LOW TIDE		AVARAGE VALUE	NOTE
SAMPLING DEPTH		-0.5 Metre	-2.0 Metre	-0.5 Metre	-2.0 Metre		
pH	-	7.60	7.70	7.50	7.40	7.55	Fair
C.O.D.	P.P.M	NiL	210	Nil	10	55.00	Below Average
Oil Conteny	P.P.M	130	109	83	185	126.75	Below Average
Dissolved Oxygen	P.P.M	0.64	1.10	1.44	1.60	1.20	Below Average
Sulphide	P.P.M	0.24	0.40	1.68	1.20	0.88	Average
Coliform Group	M.P.N 100ml	2,400	11	70	280	690.25	Below Average
Our Reference No.		183	179	203	204	____	____
Date of Sampling		25th MAY 1989		26th MAY 1989		____	____

COMMENTS :- The samples are of average quality.

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11 RESULTS OF ANALYSIS

SAMPLLING POINT NO : 4

CENTRAL PART OF THE HARBOR BASIN

TIDE LEVEL		HIGH TIDE		LOW TIDE		AVARAGE VALUE	NOTE
SAMPLING DEPTH		-0.5 Metre	-2.0 Metre	-0.5 Metre	-2.0 Metre		
pH	-	7.80	7.80	7.60	7.60	7.70	Fair
C.O.D.	P.P.M	NiL	Nil	Nil	10	2.50	Good
OiL Conteny	P.P.M	198	72	158	260	172.00	Below Average
Dissolved Oxygen	P.P.M	0.68	0.82	1.32	1.56	1.10	Below Average
Sulphide	P.P.M	0.72	0.48	1.68	1.80	1.17	Below Average
Coliform Group	M.P.N 100ml	21	13	6.1	7.8	11.98	Good
Our Reference No.		181	180	205	206	____	____
Date of Sampling		25th MAY 1989		26th MAY 1989		____	____

COMMENTS :- The samples are of fair quality.

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11 RESULTS OF ANALYSIS

SAMPLLING POINT NO : 5

ENTRANCE CHANNEL

TIDE LEVEL		HIGH TIDE		LOW TIDE		AVARAGE VALUE	NOTE
SAMPLING DEPTH		-0.5 Metre	-2.0 Metre	-0.5 Metre	-2.0 Metre		
pH	-	7.60	7.70	7.60	7.60	7.63	Fair
C.O.D.	P.P.M	10	Nil	10	Nil	5.00	Good
OiL Conteny	P.P.M	112	32	260	391	198.75	Below Average
Dissolved Oxygen	P.P.M	1.60	1.60	1.56	1.50	1.57	Below Average
Sulphide	P.P.M	0.22	0.26	1.80	0.88	0.79	Below Average
Coliform Group	M.P.N / 100ml	32	130	7.8	8.3	44.53	Fair
Our Reference No.		176	177	207	208	____	____
Date of Sampling		25th MAY 1989		26th MAY 1989		____	____

COMMENTS :- The samples are of fair average quality.

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CEYLON CHAMBER OF COMMERCE
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11 RESULTS OF ANALYSIS

SAMPLLING POINT NO : 6

NORTH PIER

TIDE LEVEL		HIGH TIDE		LOW TIDE		AVARAGE VALUE	NOTE
SAMPLING DEPTH		-0.5 Metre	-2.0 Metre	-0.5 Metre	-2.0 Metre		
pH	-	7.50	7.20	7.60	7.60	7.48	Good
C.O.D.	P.P.M	Nil	Nil	70	10	20.00	Average
Oil Conteny	P.P.M	86	123	148	180	134.25	Below Average
Dissolved Oxygen	P.P.M	1.12	0.82	1.38	1.28	1.15	Below Average
Sulphide	P.P.M	1.04	0.64	0.64	1.60	0.98	Average
Coliform Group	M.P.N 100ml	39	12	8.3	1.8	15.28	Good
Our Reference No.		185	182	209	210	____	____
Date of Sampling		25th MAY 1989		26th MAY 1989		____	____

COMMENTS :- The samples are of fair quality.

BAMBER & BRUCE LTD
S. Ambalavanar
Chief Analyst

Chief Analyst:
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THE INTERNATIONAL CONTAINER TRAFFICS

It would be more or less a common understanding among the shipping circles that the containerization has unlikely been motivated by requirements from the seaside but, on the contrary, wherever the inland transport systems are containerized, the gate ports and seaborne traffics linking therewith are likely compelled to be containerized. The origin of containerization has well exemplified this fact and therefore, it is worthwhile to give a brief review on the history of containerization hereafter.

On reiteratig the History, It can be classified into four stages, the experimental container transport in U.S. coastal trades, the international container transport among developed countries, the subsequent container transport between developed and developing countries and worldwide the networks of container traffic of today's.

The containerization was first invented by an American genius called Mr. Malcom P. McLean, the founder of Sealand Inc. He started his business with the tracking company of small scale in the prewar days and introduced an unit load system with which he linked the road transport with the railway transport, then extending to the seaborne transport in 1956. Thus the intermodal transport was first seen in the shipping circles. His basic ideas lay in the safer transport from door to door, the faster and simpler transloading at the terminal and an more economical cost.

The business environment prevailing in U.S.A. around that time gave him a great impact for success. In The postwar America, there commenced mass productions and consequent mass transports. Rationalization and modernization in logistics was foot-lighted. Having inaugurated in 1956, the entire U.S. coastal trades were soon containerized by the early sixties. The pioneers are Pan Atlantic Steamship Co. which had been taken over and operated by Mr. McLean

and was renamed Sealand Service Inc. in 1960. The first cellular container ship was built in October 1957 and It replaced immediately tanker-converted container ships thereto employed.

As the intermodal transports with containers requere a huge amounts of investment, many shipowners were in fact rather hesitant to step into it at the early stage. However, it had met requirements on the part of cargoes in view of shorter transit time and safety and therefore, almost all major shipping lines in developed countries were soon compelled to be involed in this revolution, enabling them survive on the competition arena. The overhelming trend of containerization thus started in major trades among developed countries in mid-Sixties and completed more or less by 1973. Developing countries with their ports and fleets, however, were left outside of this trend and have still suffered from chronic port congestions throughout those periods. Sri Lanka was not exceptional.

The first container service on a liner route started in 1966 when Sealand inaugurated to place four of C-II type fully cellular ships on The U.S. East Coast/Europe trade which was followed by Seatrain of U.S.A. and European ship-operaters-Atlantic container Line Service Ltd. on a consortium basis.

In 1967 and 1968, two liner routes between Japan and U.S. West coast were containerized. -Pacific South West Service (P.S.W.) and Pacific North West Service (P.N.W.) respectively. In 1969, two liner routes from Oceania for Europe and Japan were containerized.

Shortly after, The competition among container operatirs became keener and their container vessels were upgraded and jumbonized.

In 1971, United States Line inaugurated a epoch-making full container service on Japan/New York liner run, deploying eight fully cellular vessels of 1,210 TEU's capacity and 22 knots of speed. Japanese and third flag vessels soon followed it and this trade was completely containerized by 1973.

Fareast/Europe liner routes which has the oldest history of a century

length were also containerized, firstly by Trio Group in 1971 and followed by Scandutch Group in 1972 and finally by Ace Group in 1975. Thus major liner routes in the world connecting triangular area of Japan-U.S.-Europe were fully containerized within several years after Sealand having commenced the first international container service on the Trans-atlantic Trade.

However, there can be seen a stagnant trend in The speed of containerization in the following few years. The world experienced so called "Oil Shock" in 1973 which broucht a sharply soaring oil prices and a world-wide stagnation in the trades and industries. It continued until 1976/77 when another developments in containerization took place. The petroleum producing countries increased their revenves greatly which reflected on their purchasing powers. Asian developing coontries commenced remarkable high economical growths and all these phenomena changed trade patterns and cargo movements to be more diversified.

State-owned national lines in certain developing countries were gradually stepping into international container services with new container fleets and terminals. United Arab Shipping Co. (U.A.S.C.) of six Arabian countries was a typical example. Ceylon Shipping Cooporation (C.S.C.) of Sri Lanka, though having participated in this field at a slightly later stage, also belongs to this category. The container service routes connecting between the North and the South have thus been high-lighted from those days.

The chronological record of the services inaugurated are listed herein under.

July, 1976 - Europe & Mediterranean Sea / Middle East Trade (Pionnered by Sealand and now operated on a consortium called Integrated Joint Container Service)

December, 1976 - Europe / Caribbean Sea Trade (Caribbean Overseas Line)

July, 1977 - Europe & Mediterranean Sea / South Africa Trade (South Africa Europe Container Service)

November, 1977 - Europe / West Africa Trade (East Asiatic Co. of Denmark)

May, 1978 - U.S.A./ Middle East Trade (U.A.S.C.)

August, 1978 - Japan & Fareast / Middle East Trade (Oasis Container Express Line)

August, 1978 - Australia / Middle East Trade (Gulf Shipping Lines of Pakistan)

April, 1979 - U.S.A./ Middle East Trade (Ibero Lines of Spain)

June, 1980 - Japan & Fareast / Indonesia Trade (Japan Indonesia Container Service)

January, 1981 - Europe & Mediterranean Sea / East Africa Trade (British East African Containers)

April, 1981 - Japan & Fareast / West Coast of South America Trade (Andes Express Service)

April, 1981 - Japan / Bangkok Trade (Japan Bangkok Container Club)

December, 1981 - Japan & Fareast / South Africa Trade (Safari Service)

From the year of 1981 onwards, many other trades were containerized and the Indian subcontinent region and Colombo was gradually containerized by C.S.C. and Cobra consortium as detailed in the next chapter.

The container trades which had initially linked with the major ports in the developed countries extended their service area to the ports of the developing countries. Today, we can see that a single service route has gradually been enlarging its service scope. For example, Japan / U.S. Westcoast service which had connected merely two countries of Japan and USA has now been covering various Asian ports down to Singapore. The small feeder boats pioneered these extention and the mother boat followed it for a direct call. The container service networks have ever been developed to seek for uncovered area. Some container operator has established the round-the-world container service. Evergreen Maritime Cooperation which has reportedly been taking a serious look at Colombo, had commenced the round-the-world service since 1984.

The entire marine routes of the world would be containerized in due course

not only by bilateral national lines but also by many of cross traders. However, it is feared that a protectionism in field of cargo reservation which has been adopted by relative governments of the developing countries might discourage cross traders in participating in containerization of these area.

Another features which cannot be overlooked at in the recent container trade are positive activities of independent carriers. In the past days, the conference boats have dominated over the trade while the independent carriers whose activities remained outside of the conference were regarded as a minority. The situation has remarkably changed now where many independent carriers have been grown powerful enough to extend similarly high quarity services as conference carriers have. They are comprised of two different natures of shipping companies. One is the newly grown ambitious operator of the West represented by Evergreen Maritime Cooperation Ltd. of Taiwan and another is the less commercial operator of U.S.S.R. and the Eastern Block represented Odessa Ocean Container Service, D.S.R. Lines and Polish Ocean Lines, all of which are regular callers of Colombo. Under the circumstances, the shipping conferences have inevitably been losing their cotrol over the trades and therefore the competions would become severer for survival for the timebeing until the new scheme for stability of trade is devised.

Finally, we would look again at the unique position of the port of Colombo. Sri Lanka has a small hinterland where there is no positive requirement for containerization originating from its inland itself. However, due to its ideal geographical location in the Indian Ocean, Colombo has become a gate port of containers to / from various ports in the subcontinent, as if these ports in the region were hinterlands of Colombo. We can see here the case that requirments for containerization has come not necessarily from its own inland but from its regional areas via seaways.

MAINLINE SERVICES

LINE	SERVICE ROUTES	FREQUENCY	VESSELS DEPLOYED		FEEDER
			TYPE	TEUS	
A.P.L.	Kaohsiung-Singapore-Colombo-Fujairah-Colombo-Singapore-Kaohsiung	Weekly	Cellular & Gearless	2,800	Own Feeder Eagle Contr carrier
Yang Ming	Kaohsiung-Keelung-Yokohama-Kobe-Busan-Keelung-Kaohsiung-Hongkong-Singapore-Colombo-Jeddah-Genoa-Hamburg-Rotterdam-Felixstone-Antwerp-Le Havre-Genoa-Jeddah-Colombo-Singapore-Hongkong-Koahsiung	Weekly	Cellular & Gearless	3,090 - 1,940	Seacon, India Steamship Sindbad, CSL P.N.C.
	EUROPE				
C.S.C.	Karachi-Bombay-Colombo-Karachi-Suez-Port Said-Alexandria-Hanburg-Felixstowe-Rotterdam-Alexandria-Port Said-Suez-Karachi	Bi-Weekly	Cellular/Non Cellular Geared	1,328 - 1,074	Own Feeder
	FAR EAST				
	Colombo-Singapore-Yokohama-Nagoya-Kobe-Busan-Keelung-Hongkong-Singapore-Colombo	Two Sailings	Cellular &	537	Own Feeder
	RED SEA				
	Colombo-Khor Fakkan-Hodeidah-Jeddah-Aquaba-Khor Fakkan-Colombo	Three Sailings Monthly	Cellular & Geared/ Gearless	410-412	Own Feeder
	U.S.A. (C.S.C./MAERSK)				
	Colombo-Singapore-Los Angeles-Miami-Charleston-Baltimore-Philadelphia-New York	Weekly	Cellular/Non-Cellular Geared/Gearless	537 - 175	
	AUSTRALIA (C.S.C./P.N.L.)				
	Colombo-Singapore-Brisbane-Sydney-Melbourne Colombo-Singapore-Fremantle-Adelaide	Every 10 days	-"-	-"-	
	SINGAPORE				
	Colombo-Singapore-Colombo	Week Shuttle	-"-	-"-	
COBRA (P & O C L, H-L N-L OOM OOS)	Colombo-Bombay-Karachi-Suez-Marseilles-Tilbury-Rotterdam/Antwerp-Hamburg/Bremen Haven-Le Havre-Marseilles-Suez-Karachi-Colombo	Two Sailings Monthly	Cellular or Partly Cellular & Geared	1,305-980	Cobra-CSL Joint Feedar
EACON (DSR-POL)	Gdansk/Rostock-Hanburg-Antwerp-Lanarca-Khor Fakkan-Colombo-Singapore-Hongkong-Busan-Tokyo-Kobe-Hongkong-Singapore-Colombo-Lanarca-Antwerp-Hamburg-Rostock/ Gdynia	Every 13 days For Europe & Every 24 days For Far East	Cellular & Gearless	1,633 - 918	Seacon
ODESSA OCEAN	Ilyichvsk-Genoa-Jeddah-Singapore-Hongkong-Singapore-Penang-Madras-Colombo-Naples-Genoa-Ilyichevsk	Every 18 days	Cellular & Gearless	800	Own Feeder (Haldia/Colombo) C.S.L.
U.A.S.C.	Busan-Keelung-Hongkong-Singapore-Colombo-Aquaba-Jeddah	Bi-weekly	Cellular & Gearless	2,000 - 800	-Nil-
S.S.L. (G.S.L.)	Nagoya-Yokohama-Kobe-Keelung-Hongkong-Singapore-Colombo-Eilat	Monthly	Cellular & Gearless	1,300 - 996	Seacon
Lloyd Triestino	Barcelona-Marseilles-La Spezia-Naples-Mina Qaboos-Karachi-Bombay-Colombo	Every 3 weeks	Partly Cellular & Geared	585	Seacon & C.S.L.
	EAST BOUND ROUND-THE-WORLD FA/SOUTH AMERICA				
NedLloyd	Singapore-Hongkong-Keelung-Busan-Kobe-Nagoya-Yokohama-Cristobal-Willenstad-San Juan-Rio Hama/St. Lucia-Bridgetown-P.O. Spain-Fortaleza-Salvador-Rio de Janerio-Montevideo-Buenos Aires-Durban-Colombo-Singapore	Monthly	Geared Multi-Purpose Type	628	Sindbad Seacon

MAINLINE SERVICES II

LINE	SERVICE ROUTES	FREQUENCY	VESSELS DEPLOYED		FEEDER
			TYPE	TEUS	
	FAR EAST - EAST AFRICA				
NedLloyd	Singapore-Colombo-Mahe-Mombasa-Dar-Es-Salaam-Singapore	Monthly	Cellular & Geared	379	Sindbad Seacon
ANZGS (P & OCL/BSL)	Singapore-New Plymouth-Port Chalmers-Lyttleton-Sydney-Melbourne-Adelaide-Fremantle-Singapore-Muscat-Dubai-Damman-Kuwait-Bahrain-Karachi-Bombay-Colombo-Singapore	One Every 3 weeks	Cellular & Gearless/	871 - 719	Seacon
Indian Ocean (P & OCL/INL)	Colombo-Dar-Es-Salaam-Mombasa-Karachi-Bombay-Colombo	Two Sailings Monthly	Cellular & Geared	254 - 210	Seacon
Contship	Barcelona-Marseilles-La Spezia-Naples-Suez-Jeddah-Karachi-Bombay-Colombo-Djibouti-Suez-Barcelona	Two Sailings Monthly	Cellular & Geared	580	- Nil-
Lloyd Brasileiro	Rio de Janeiro-Santos-Japan-Kongkong-Keelung-Singapore-Colombo-Durban-Rio de Janeiro-Santos	Monthly	Geared Multi-Purpose Type	796	- Nil-
	AUSTRALIA				
S.C.I.	Bombay-Colombo-Singapore-Melbourne-Fremantle-Singapore-Colombo-Bombay	Monthly	Non-Cellular & Gearless	495	Seacon
	U.S.A. VIA EUROPE				
	Madras-Colombo-Suez-Felixstower-Rotterdam-Hamburg/Bremen Haven-New York-Baltimore-Savannah-Felixstowe-Rotterdam-Hamburg/Bremen Haven-Suez-Colombo-Madras	Every 22 days	- " -	430	Seacon
H.O.L.					
	SOUTH AMERICA VIA E. AFRICA				
	Kobe-Nagoya-Yokoyama-Busan-Keelung-Hongkong-Singapore-Colombo-Port Louis-Reunion-Mombasa-Dar-es-Salaam-Santos-Buenos Aires-Montevideo-Paranaca-Santos-Durban-Singapore-Hongkong-Yokohama-Nagoya-Kobe	Monthly	Geared Multi-Purpose Type	400	Seacon
	GAMA SERVIDE				
Hoegh	New York-Baltimore-Norfork-New York-New Orleans-Tampico-Houston-New York-Jeddah-Colombo-Singapore-Surabaya-Jakarta-Palembang-Singapore-Port Kelang-Belawan-Padang-Colombo-Bombay-Halifax-New York	Every 3 weeks	Geared Multi-Purpose Type	900 - 700	
	AMEP SERVICE				
	Tacoma-Vancouver-Crofton-Los Angeles-Brisbane-Sydney-Melbourne-Damman-Dubai-Colombo-Phuket-Belawan-Port Kelang-Singapore-Kaohsiung-Long Beek-Auckland-Tacoma	Every 4 weeks	Square hold & Geared "Con Bulker" Type	1,660	

FEEDER SERVICE

LINE	SERVICE ROUTES	FREQUENCY	VESSELS DEPLOYED		FEEDER
			TYPE	TEUS	
	AXCL				
Saa Consortium	Colombo-Bombay-Cochin-Colombo	Every 14 days	Cellular & Geared	358	D.S.R. P.O.L. Y.M.L. L-T
	AXCL				
	Colombo-Bombay-Karachi-Dubai-Khor Fakkan-Bombay-Cochin-Colombo	Every 14 days	- " -	584/300	Cobra P & O.C.L. Sealand G.S.L. E.M.C. B.S.L.
	AXCL				
	Colombo-Karachi-Colombo	Every 12 days	- " -	450	M.O.L. NedLloyd
	BXCL				
	Colombo-Madras-Colombo	Weekly	- " -	325	
	BXCL				
	Colombo-Chittagong-Mongla-Calcutta-Colombo	Every 9 days	- " -	375/358	
C.S.C.	Colombo-Tuticorn-Cochin-Mangalore-Colombo	Weekly	- " -	101	C.S.C. Cobra Y.M.L.
	Khor Fakkan-Dubai-Daman-Kuwait-Khor Fakkan-Muscat-Khor Fkkan-(Red Sea Service)-Colombo	Weekly	Non-Cellular & Gearless	175	
Cobra/C.S.L.	Colombo-Chittagong-Calcutta-Colombo	Every 10 days	Cellular & Geared	508	Cobra, Y.M.L. L-T Hoegh
	Coromondel Service				
	Colombo-Madras-Colombo	Weekly	- " -	245	
E.C.C. (Eagle)	Colombo-Bombay-Cochin-Colombo	Weekly	- " -	245	A.P.L.
	Colombo-Madras-Colombo	Weekly	- " -	250	
Sealand	Port Rasid-Colombo-Tumoorin-Port Rasid	Every 14 days	Cellular & Geared	550	Sealand
Sindbad (N-L, NOL KLINE)	Singapore-Colombo-Karachi-Bombay-Cochin-Madras-Singapore	- " -	Cellular & Non Cellular Geared	460/307	N-L, Y.M.L.
M.O.L.	Singapore-Colombo-Karachi-Bombay-Colombo-Singapore	Every 10 days	Non Cellular Geared	916	P & O.C.L. Hoegh Sealand

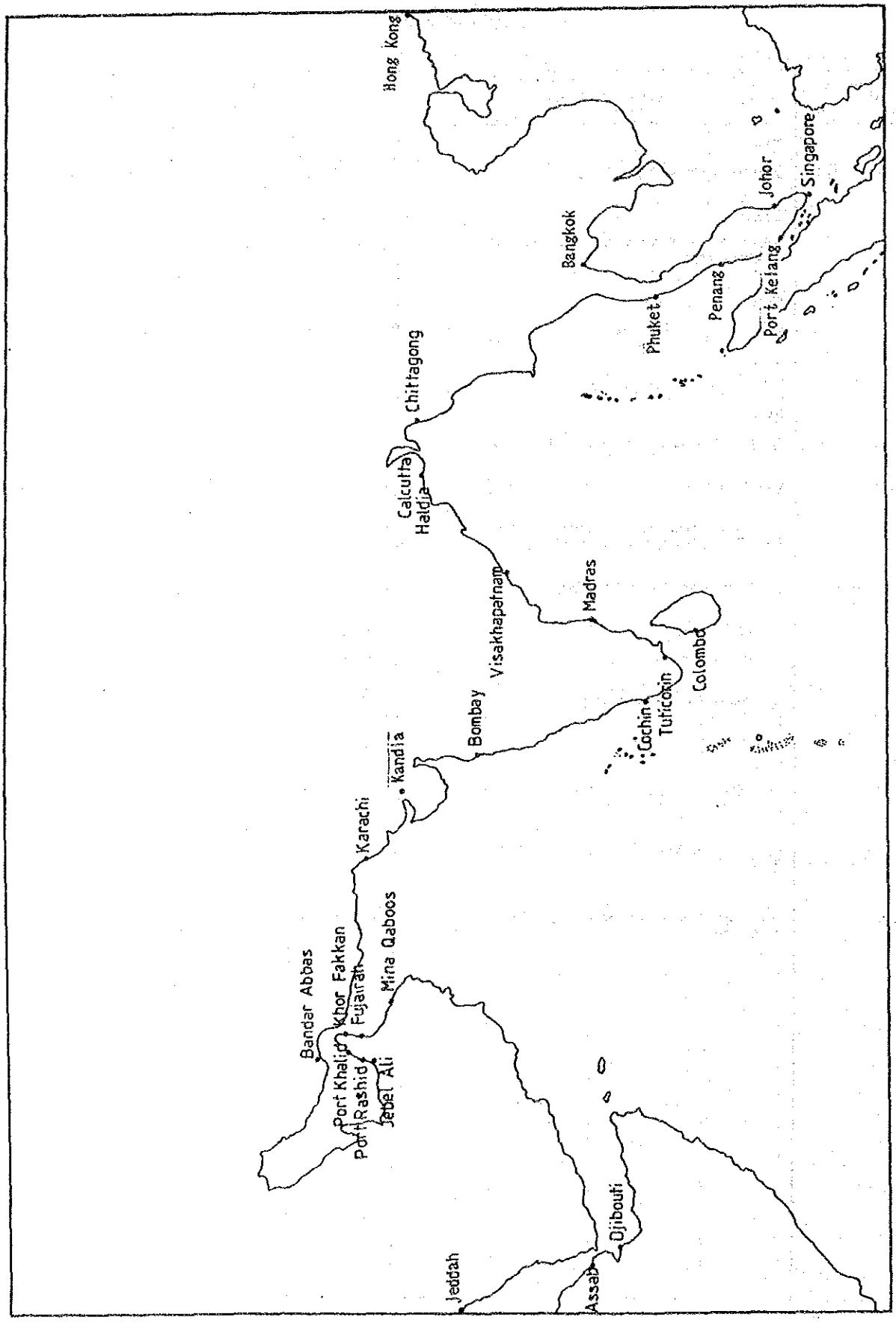

Hong Kong
Singapore
Johor
Bangkok
Penang
Port Kelang
Phuket
Chittagong
Calcutta
Haldia
Madras
Visakhapatnam
Colombo
Cochin
Tuticorin
Bombay
Kandla
Karachi
Mina Qaboos
Fujairah
Khor Fakkan
Bandar Abbas
Port Khalid
Port Rashid
Jebel Ali
Djibouti
Jeddah
Assab

Table A 5-1 Population of Sri Lanka (From 1979 to 1987)

(Unit: Million)

Year	Males	Females	Total
1979	7.5	7.0	14.5
1983	7.9	7.5	15.4
1984	8.0	7.6	15.6
1985	8.1	7.7	15.8
1986	8.2	7.9	16.1
1987	8.3	8.1	16.4

Source: Statistical Pocket Book, 1988,
Ministry of Plan Implementation.

Table A 5-2 GDP by Industrial Origin at Constant 1985 Factor Cost Prices (Rs. Million)

	1985	1986	1987	1990	1991	Growth Rate 86/91
1. Tea Growing	5,269	5,203	5,269	5,466	5,540	1.3
2. Rubber Growing	1,164	1,172	1,202	1,227	1,244	1.2
3. Coconut Growing	3,342	3,414	2,954	3,247	3,461	0.3
4. Paddy	9,379	9,004	7,724	9,931	10,299	2.7
5. Other Agriculture	21,915	22,770	23,908	26,533	27,541	3.9
6. Total Agriculture	41,069	41,563	41,058	46,404	48,084	3.0
7. Mining & Quarrying	3,328	3,397	3,594	4,540	4,766	7.0
8. Tea, Rubber C'nut Processing	5,646	5,604	5,636	5,850	5,947	1.2
9. Other Industries	16,203	17,013	17,864	21,075	22,551	5.8
10. Total Industries	21,849	22,617	23,500	26,926	28,497	4.7
11. Construction	11,640	12,106	12,675	14,630	15,362	4.9
12. Services	70,435	74,661	78,991	91,700	96,743	5.3
13. GDP 1985 Const. Prices	148,321	154,344	159,818	184,199	193,453	4.5

Source; Public Investment 1987 - 1991 National Planning Division, Ministry of Finance and Planning

Table A 5-3 Value and Volume of External Trade

	*-1 Value of External Trade			*-2 Volume of Marine External Trade		
Year	Export (Rs.Mill.)	Import (Rs.Mill.)	Total (Rs.Mill.)	Export (Thousand tons)	Import (Thousand tons)	Total (Thousand tons)
1981	20,585	35,251	55,839	1,249	3,976	5,225
1982	21,454	41,946	63,400	1,370	4,192	5,562
1983	25,096	45,553	70,649	1,158	4,567	5,752
1984	37,347	47,541	84,888	1,158	4,740	5,837
1985	36,027	53,015	89,222	1,287	5,022	6,309
1986	34,072	54,609	88,681	1,502	5,196	6,698
1987	*-3 39,527	*-3 60,697	100,224	1,231	4,369	5,510

Source *-1 : Statistical Pocket Book 1988

*-2 : Port Statistics Sri Lanka, SERIES VIII

*-3 : Provisional

Table A 5-4 The Major Countries for Export and Import

Country	Import			Export		
	1985	1986	1987	1985	1986	1987
United Kingdom	2,618,590	2,822,355	4,134,882	1,864,668	1,892,593	2,159,183
Canada	926,927	590,652	511,733	629,193	638,820	701,440
Australia	1,573,253	767,321	599,619	428,960	391,551	400,277
India	2,027,934	2,221,892	2,459,786	169,320	330,686	181,581
Pakistan	922,632	1,292,325	1,373,705	741,886	949,349	923,179
U.S.A.	3,503,268	3,291,245	3,358,854	7,650,119	8,480,276	10,434,332
U.S.S.R.	186,901	597,643	347,772	844,121	447,685	507,581
China	1,920,546	2,418,025	1,876,176	463,818	477,255	478,215
Japan	7,668,423	8,933,892	8,957,624	1,747,995	1,813,101	1,950,891
G.D.R.	29,006	21,631	23,748			
France	865,752	703,451	1,017,323			
Burma	124,354	76,432	150,436			
Iran	4,537,899	1,069,315	3,064,560			
G.B.R.				1,868,407	2,305,487	2,946,362
Sourth Africa				343,490	300,961	410,194
Others	22,133,312	26,415,329	31,873,499	15,149,805	13,351,137	16,337,892
Bunkers				2,333,978	1,713,416	1,818,652

Source: Statistical Pocket Book 1988

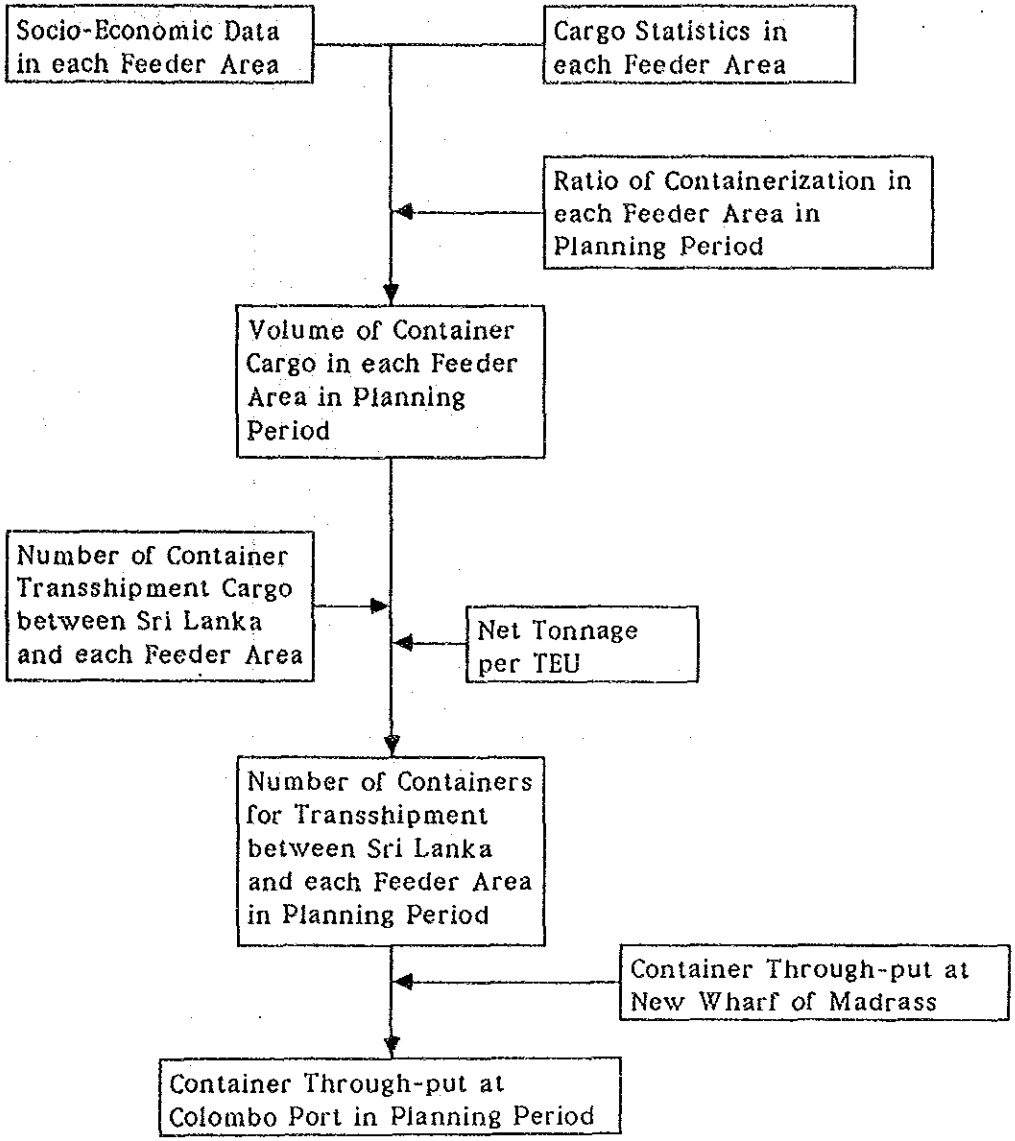


Fig. A 5-5 Forecasted Flow of Transhipment Container Cargoes

Table A 5-6 GDP of Bangladesh at 1980 Constant Prices

(Unit: 000 million T.K.)

	Year	GDP
Actual	1975	156.0
	1976	156.6
	1977	174.4
	1978	183.5
	1979	197.8
	1980	233.3
	1981	250.0
	1982	282.7
	1983	330.7
	1984	275.5
	1985	275.5
Estimate	1990	344.6
	1995	440.7
	2001	609.4

Source of Actual Data: Kaigai Kyouryoku Binran, OECF

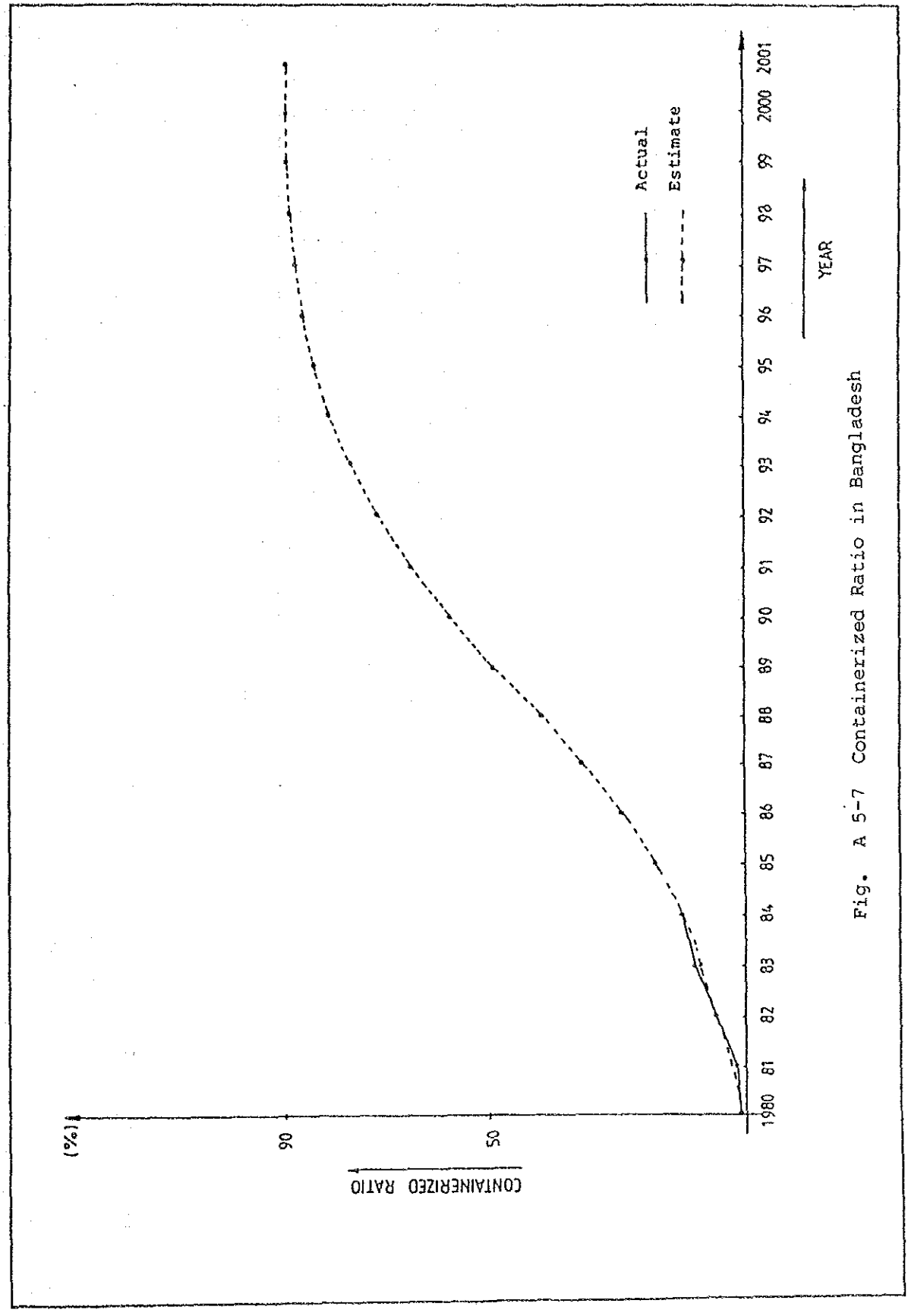


Fig. A 5-7 Containerized Ratio in Bangladesh

Table A 5-8 GDP of India at 1980 Constant Prices

(Unit: 000 million Rs.)

	Year	GDP
Actual	1975	1,706.1
	1976	1,092.0
	1977	1,187.1
	1978	1,257.3
	1979	1,192.3
	1980	1,274.5
	1981	1,337.5
	1982	1,387.1
	1983	1,506.7
	1984	1,567.1
	1985	1,665.9
	1986	1,756.2
Estimate	1990	2,134.0
	1995	2,274.0
	2001	3,651.0

Source of Actual Data: Data frome OECF

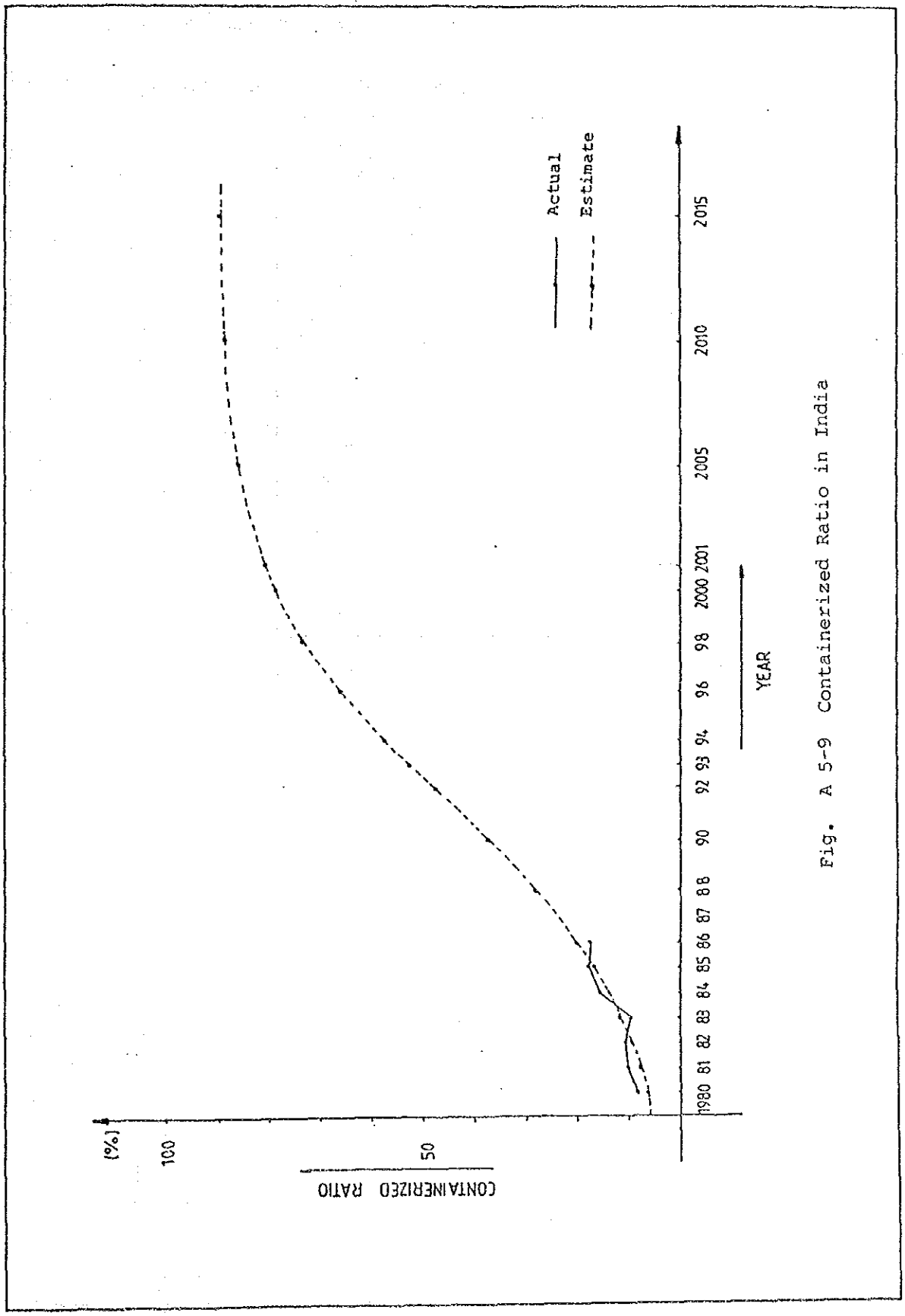


Fig. A 5-9 Containerized Ratio in India

Table A 5-10 GDP of Pakistan at 1980 Constant Prices

(Unit: 000 million T.K.)

	Year	GDP
Actual	1975	176.9
	1976	185.3
	1977	190.1
	1978	205.6
	1979	213.9
	1980	234.5
	1981	250.9
	1982	266.4
	1983	283.0
	1984	297.7
	1985	322.3
	1986	346.7
Estimate	1990	395.0
	1995	441.3
	2001	564.8

Source of Actual Data: Kaigai Kyouryoku Binran, OECF

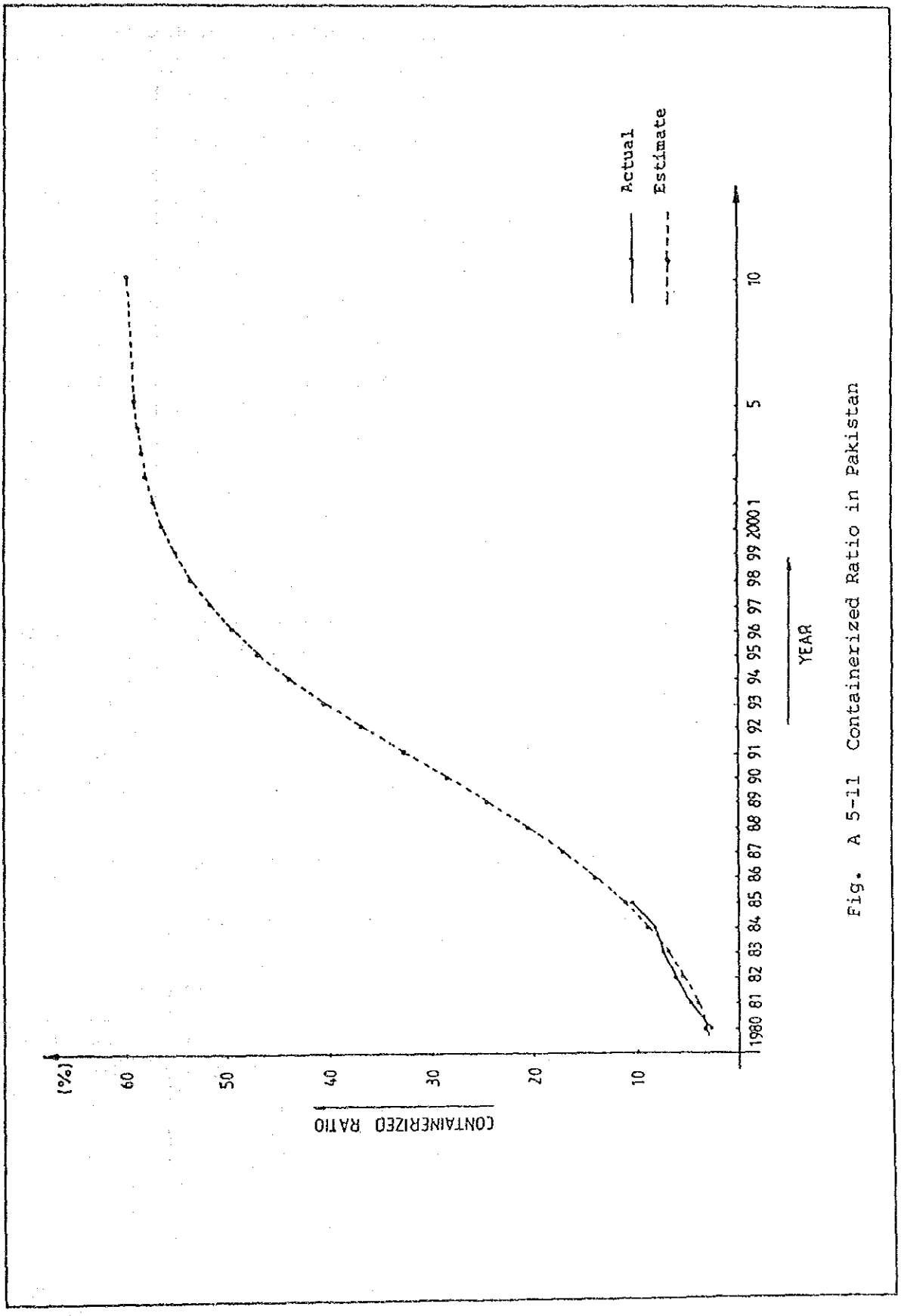


Fig. A 5-11 Containerized Ratio in Pakistan

Table A 5-12 Population & Population Index of Gulf Red Sea

	Year	Population (Million)	Population Index (1980=100)
Actual	1975	66.2	85.7
	1976	68.3	88.4
	1977	70.3	91.3
	1978	72.5	93.9
	1979	74.8	96.9
	1980	77.2	100.0
	1981	89.6	103.0
	1982	82.0	106.2
	1983	84.5	109.4
	1984	87.0	112.7
	1985	88.6	114.7
	1986	91.4	118.3
Estimate	1990	100.5	129.8
	1995	114.4	148.1
	2001	125.9	162.7

Source of Actual Data: From OECF

Table A 5-13 Number of TEUs in Gulf and Red Sea (1980 - 1985)

Year	Population Index (1980 = 100.00)	Number of TEUs (Thousand TEUs)
1980	100.0	648
1981	103.0	771
1982	106.2	1,022
1983	109.4	1,881
1984	102.7	2,061
1985	114.7	2,068

Table A 5-14 Ratio of Containerization (Macro Forecast)

	Year	Ratio of Containerization (Export)	Ratio of Containerization (Import)
Actual	1982	0.255	0.186
	1983	0.249	0.181
	1984	0.276	0.300
	1985	0.295	0.171
	1986	0.395	0.195
	1987	0.447	0.231
Estimate	1990	0.533	0.267
	1996	0.727	0.379
	2001	0.819	0.480

Source of Actual Data: Port Statistics, Sri Lanka

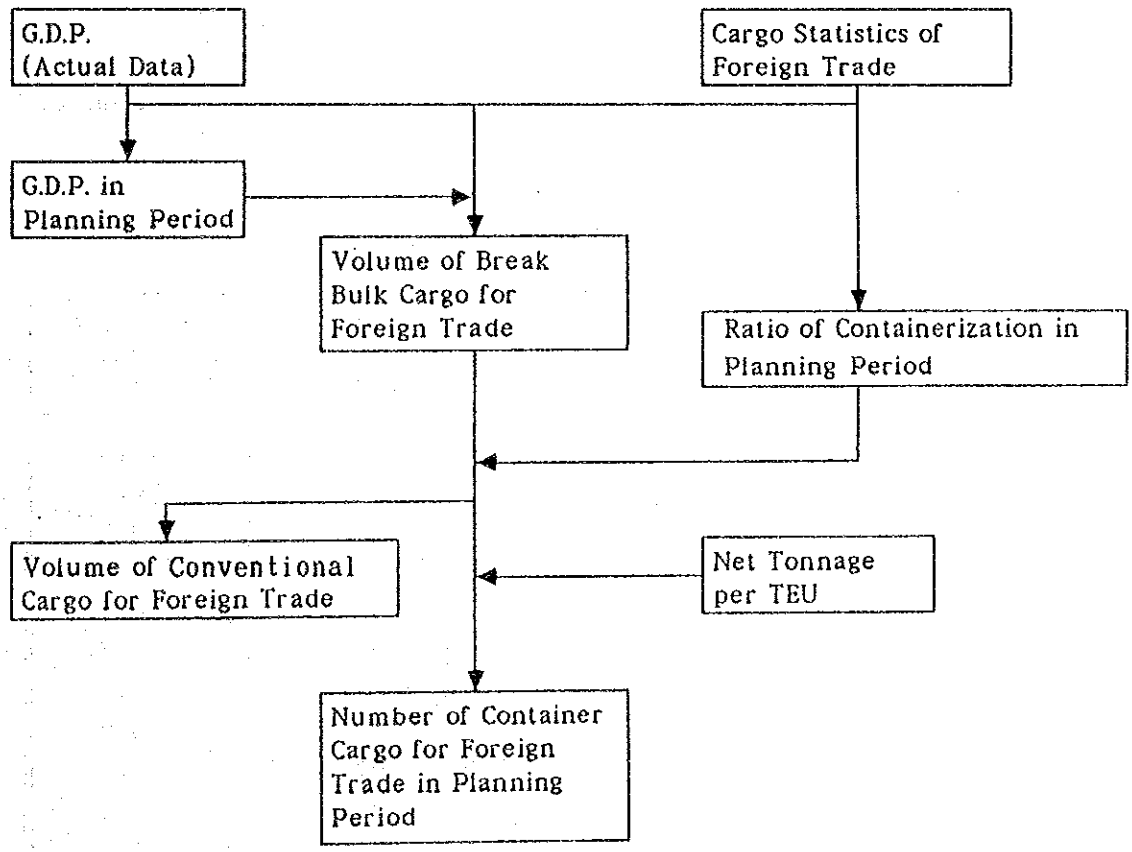


Fig. A 5-15 Forcasted Flow of Foreign Trade Cargoes by Macro - Economic Forecast

Table A 5-16 Rice Production, Import and Supply

Year	Production (000 MT)	Import (000 MT)	Supply (000 MT)	Population (Million)
1976	852	425	1,352	13.7
1977	1,141	542	1,635	13.9
1978	1,285	187	1,495	14.2
1979	1,304	311	1,440	14.5
1980	1,451	129	1,608	14.7
1981	1,516	157	1,663	15.0
1982	1,466	161	1,616	15.2
1983	1,689	123	1,735	15.4
1984	1,645	26	1,816	15.6
1985	1,810	182	1,970	15.8
1986	1,760	220	1,841	16.1
1987	1,447	102	1,730	16.4
Total	17,366	2,565	19,875	-

Source: Agricultural Statistics of Sri Lanka

Table A 5-17 Sugar Consumption, Import, Production and Per Capita Consumption

Year	Consumption (000 MT)	Import (000 MT)	Production (000 MT)	Population (Million)	Per Capita Consumption (kg)
1976	79	46	23	13.7	5.8
1977	124	100	23	13.9	8.9
1978	191	163	26	14.2	13.5
1979	246	245	20	14.5	17.0
1980	244	209	27	14.7	16.6
1981	220	238	25	15.0	14.7
1982	198	123	24	15.2	13.0
1983	258	268	22	15.4	16.8
1984	275	236	20	15.6	17.6
1985	282	267	20	15.8	17.8
1986	361	324	35	16.1	22.4
1987	400	340	35	16.4	24.4

Source: Agricultural Statistics of Sri Lanka

Appendix 5-18

Table A 5-18 Consumption of Fertilizer for Paddy

Year	Paddy Production (000 M.T.)	Total Cultivated Area (hectares 000)	Paddy Production (kg/hectare)	Fertilizer (M.T.)
1978	1,891	876	2,159	113,808
1979	1,917	839	2,285	73,603
1980	2,133	845	2,524	145,010
1981	2,230	877	2,543	164,784
1982	2,156	845	2,551	141,383
1983	2,479	824	3,008	159,937
1984	2,420	990	2,444	171,432
1985	2,661	882	3,017	153,041
1986	2,588	895	2,892	197,380
1987	2,128	781	2,725	150,896
1988	2,466	865	2,851	204,000

Source: Central Bank

Appendix 5-19

Table A 5-19 Consumption of Fertilizer for Tea

Year	Tea Production (000 M.T.)	Tea Production Area (hectares 000)	Tea Production per Hectare (kg/hectare)	Fertilizer Applied (M.T.)
1979	206.4	244,203	845.2	105.4
1980	191.4	244,813	781.8	109.9
1981	209.9	244,916	857.2	103.3
1982	187.8	242,141	775.6	102.7
1983	179.3	230,065	779.3	115.5
1984	208.0	227,874	912.8	137.2
1985	214.1	231,650	924.3	149.9
1986	211.3	222,905	947.9	128.8
1987	213.2	221,498	962.5	136.3

Source : Central Bank

Table A 5-20 Consumption of Fertilizer for Coconuts

Year	Coconut Production (Million Nuts)	Coconut Production * (000M.T)	Fertilizer Consumption (M.T)	Consumption of Fertilizer per Ton (kg)
1979	2,393	2,991	49,700	16.6
1980	2,026	2,533	55,800	22.0
1981	2,258	2,823	37,700	13.4
1982	2,521	3,151	30,250	9.6
1983	2,312	2,890	35,700	12.4
1984	1,942	2,428	49,985	20.5
1985	2,958	3,698	41,020	11.1
1986	3,041	3,801	31,640	8.3
1987	2,292	2,865	42,173	14.7

Source: Central Bank
* : Fresh nuts 1MT = 800 nuts

Table A 5-21 Consumption of Fertilizer for Rubber

Year	Rubber Production (Million kg)	Fertilizer Consumption (M.T.)	Rubber Production Area (Hectares)
1979	153.0	23,500	226,416
1980	133.1	22,000	227,235
1981	124.0	16,800	205,605
1982	125.2	16,485	205,690
1983	140.0	18,500	205,649
1984	142.0	23,496	205,589
1985	137.5	24,246	205,508
1986	137.8	26,258	205,200
1987	123.0	24,706	205,100

Source : Central Bank

Table A 5-22 Cement Consumption and Production (1982 - 1987)

Year	*-1 Production ('000 MT)	*-2 Import ('000 MT)	Consumption ('000 MT)	*-3 Population ('000)	Per Capita Consumption (kg)
1982	537.1	387.2	924.3	15,200	60.8
1983	480.8	441.8	922.6	15,400	59.9
1984	408.3	456.1	864.4	15,600	55.4
1985	356.1	362.6	718.7	15,800	45.5
1986	559.3	347.3	906.6	16,100	56.3
1987	620.0	361.9	981.9	16,400	59.9

Sources *-1: (1) Economic & Social Statistics of Sri Lanka, Central Bank
(2) Data from Tokyo Cement
*-2: Port Statistics, Sri Lanka Port Authority
*-3: Statistical Pocket Book

Table A 5-23 Per Capita Consumption of Onion

Year	Population (Million)	Demand (000 MT)	Production (000 MT)	Import (000 MT)	Per Capita Consumption (kg)
1983	15.4	103.1	95.3	7.8	6.7
1984	15.6	84.3	36.7	47.6	5.4
1985	15.8	103.3	41.7	61.6	6.5
1986	16.1	104.4	57.1	47.3	6.5
1987	16.4	95.7	61.3	34.4	5.8
AVE.					6.2

Table A 5-24 Volume of Onion Production

Year	Production
1976	58,422 tons
1977	61,518
1978	58,500
1979	67,900
1980	66,900
1981	59,100
1982	67,500
1983	95,300
1984	36,700
1985	41,700
1986	57,124
Average	60,969

Source : Agricultural Statistics of Sri Lanka, 1988

Table A 5-25 Other Break Bulk Cargo Import (1982 - 1987)

(000 MT)

Year	Other B.B
1982	917.0
1983	1,023.0
1984	1,120.6
1985	1,339.2
1986	1,259.6
1987	1,181.6

Table A 5-26 Import of Dry Bulk

(Unit: 000 MT)

Year	1986	1987
Cement Bulk	191.6	212.7
Other Bulk	120.4	114.1
Total	312.0	326.8

Table A 5-27 Import of Oil & Oil Products (1979 - 1987)

(Unit: 000 MT)

Year	Crude Oil Import	Crude Oil Input	Oil Procuts Import
1979	1,444	1,409	319
1980	1,861	1,885	111
1981	1,711	1,729	156
1982	1,941	1,905	270
1983	1,492	1,431	473
1984	1,733	1,781	140
1985	1,657	1,620	182
1986	1,639	1,696	147
1987	1,779	1,707	252

Table A 5-28 Other Break Bulk Cargo Export (1982 - 1987)

(000 MT)

Year	Other B.B
1982	353.2
1983	278.6
1984	339.8
1985	395.4
1986	385.9
1987	324.9

Table A 5-29 Coconut Products (Port Statistics)

Year	Products (Total) (000 MT)	Oil (In Drums) (000 MT)	Oil (Bulk) (000 MT)	Ratio of Bulk Oil (000 MT)
1981	128	23	17	0.13
1982	215	36	3	0.01
1983	233	-	31	0.13
1984	154	4	7	0.05
1985	241	6	58	0.24
1986	205	-	75	0.37
1987	85	-	8	0.09
Average				0.15

Appendix 6-2-1 Existing Oil Handling Facilities

Product	Pipe Size	Loading Arm	Capacity Tons/Hr.
Fuel Oil	12"	8"	500
Gasoline/Jet Fuel	12"	8"	500
Gasoil	12"	8"	500
Naptha	12"	8"	500
Bunker Fel Oil	12"	-	350
Marine Diesel Oil	6"	-	250
Bunker Gas Oil	6"	-	120
Base Lube Oil	10"	8"	300

Appendix 6-2-2 Planned Oil Handling Facilities at Dolphin Berth

Type of Fluid	Discharging or Receiving	Pipe Size	Loading Arm	Remarks
Crude Oil	Receiving	24"	12"	
Fuel Oil	Discharging	12"	8"	Sea water is used for oil purging
Gasoline Jet Fuel	Receiving Receiving	12"	8"	Sea water is used for oil purging
Gas Oil	Receiving	12"	8"	
Naptha	Discharging	12"	(8")	Commonly used with Jet Fuel Loading Arm
Base Lube Oil A Base Lube Oil B Base Lube Oil C	Receiving Receiving Receiving	10"	8"	Pigging system is used.
Bunker Fuel Oil Marine Diesel Oil Bunker Gas Oil	Discharging Discharging Discharging	12" 6" 6"	- - -	
LPG	Receiving	6"	6"	

Appendix 6-2-3 Berth Capacity

HANDLING RATE (TON/HR)	WORKING DAY	WORKING HOUR	BERTH OCCUPANCY	ACTUAL WORK RATE	BERTH CAPA ('000 TON)
15	360	24	65	0.7	63
	"	"	100	"	90
25	"	"	65	"	105
	"	"	100	"	151
35	"	"	65	"	148
	"	"	100	"	211
45	"	"	65	"	190
	"	"	100	"	272
55	"	"	65	"	232
	"	"	100	"	332
150	"	"	65	"	630
	"	"	100	"	900
250	"	"	65	"	1050
	"	"	100	"	1510
350	"	"	65	"	1480
	"	"	100	"	2110
450	"	"	65	"	1900
	"	"	100	"	2720
550	"	"	65	"	2320
	"	"	100	"	3320

Appendix 6-2-4 Subsidiary Loan Conditions

(1) SL-P4 (21,Oct. 1980) - J¥ 7,600,000,000
No.L Terminal
Interest 08% & 190,000,000 x 40 (40 times)

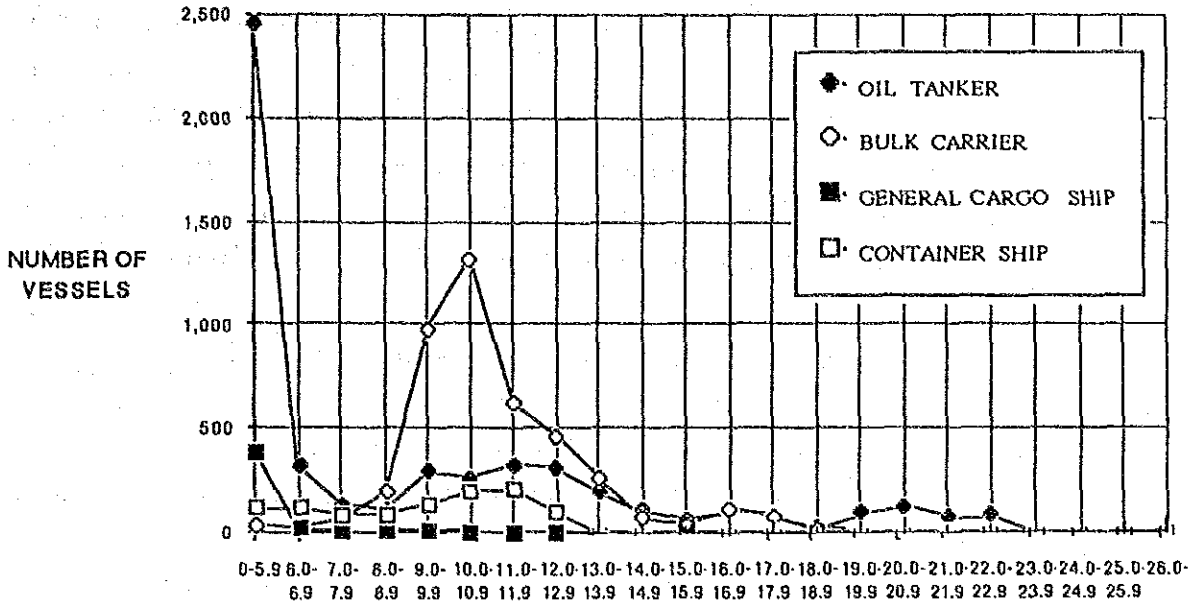
(2) SL-P7 (23,Apr. 1984) - J¥ 6,362,000,000
No.2 Terminal
Interest 14% & 212,086,000 + 212,066 x 29 (30 times)

(3) SL-P8 (13,May;1985) - J¥ 2,579,000.000
Handling equipments
Interest 14% & 86,160,000 + 85,960,000 x 29 (30 times)

(4) SL-P12 (13,Oct. 1987) - J¥ 1,955,000,000
New access road, Container Crane
Interest 10% & 65,168,600 x 30 (30 times)

Appendix 6-2-5 Number of Vessels by Draft

SOURCE : Lloyd's Register of Shipping 1988



NUMBER OF VESSELS BY DRAFT

DRAFT (m)	OIL TANKER	BULK CARRIER	GENERAL CARGO SHIP	CONTAINER SHIP
0-5.9	2449	39	386	122
6.0-6.9	321	24	18	122
7.0-7.9	139	67	7	85
8.0-8.9	114	197	10	88
9.0-9.9	296	975	11	142
10.0-10.9	261	1309	2	203
11.0-11.9	324	631		209
12.0-12.9	307	466		97
13.0-13.9	197	267		
14.0-14.9	108	72		
15.0-15.9	67	42		
16.0-16.9	98	110		
17.0-17.9	83	72		
18.0-18.9	20	26		
19.0-19.9	94	9		
20.0-20.9	129			
21.0-21.9	70			
22.0-22.9	81			
23.0-23.9	4			
24.0-24.9	2			
25.0-25.9	5			
26.0-	3			

The Ship Maneuvering Test

The ship maneuvering test was executed by the study team using computer simulation.
The objects are to determine the maneuverability and the traces of the ships, which give various suggestions for the layout of the breakwaters, and determining the width and alignment of the entrance channel.
Two layouts are tested changing the positions, and sea conditions.

the present layout of the port, and the other is the future layout (Master Plan-A).
The test results are summarized in Table A-6-3-2-1 (1).
Some of the traces are shown in Fig. A 6-3-2-1 (1) to Fig. A 6-3-2-1 (3) for reference.

The captains' comments, who operates simulator are as follows:

(1) Present layout

Stern of the ship is likely to hit the two marked buoys when changing direction.
When I try to keep a rightside course, the ship nearly touches the QCT wharf. The stopping distance is 1L to 2L, as reported by the SLPA.
I was scarcely aware of the presence of the wind, because the effect from the wind is very small.
But it is very hard to maintain the correct course under the combined effects of waves and wind. I felt the torque of the wave was almost the same strength as the rudder.
In this regard, establishing the criteria for minimum sea conditions to enter the port is recommended.
The entrance to the port should have sufficient length (approx. 2 km)

(2) Future layout

At passing the top of the breakwater, I felt it was very hazardous.
It was too late to change course after passing the top of the breakwater.

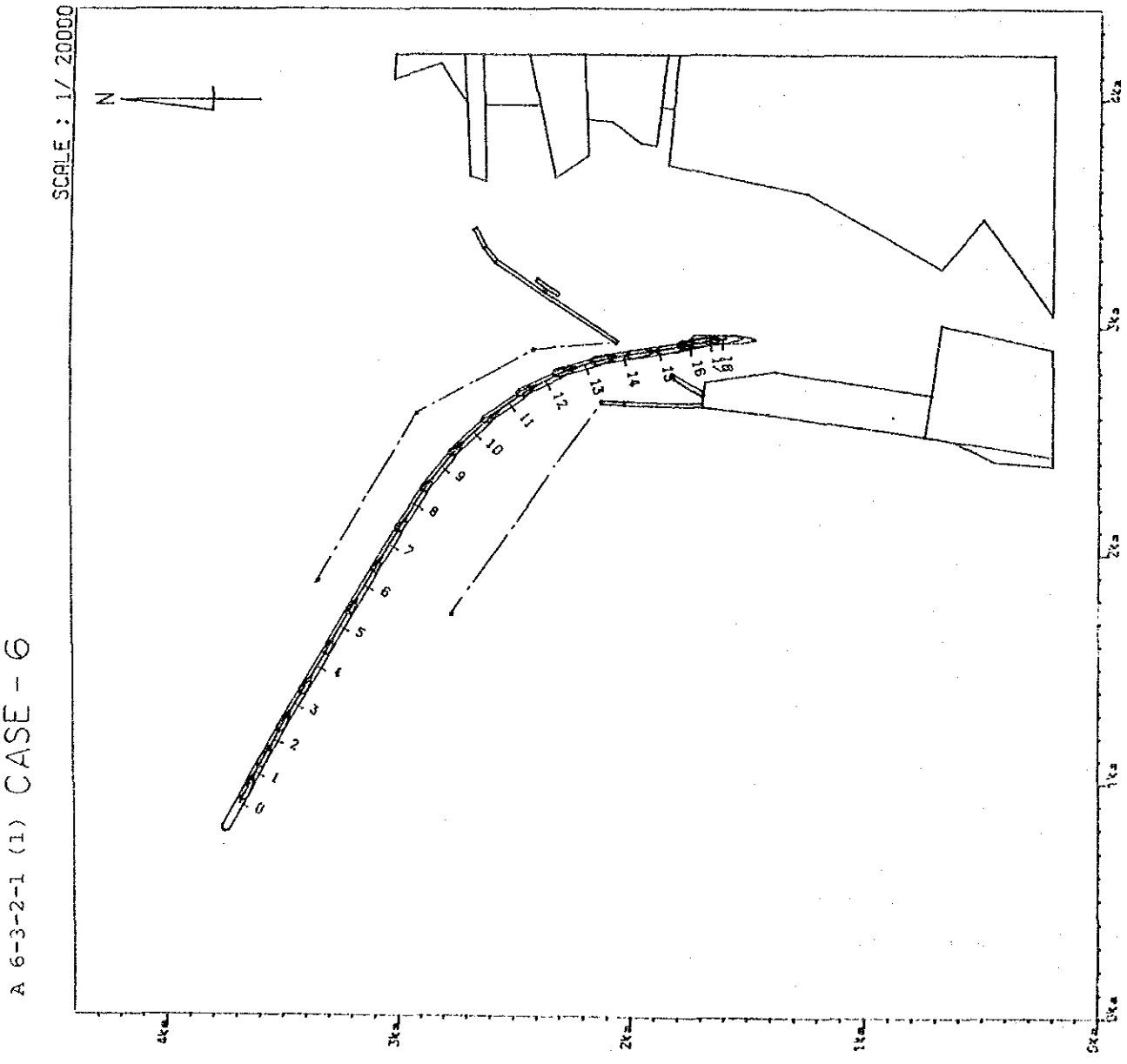
It was also difficult to change the course at the early stage of entering the port.

The difficulty in maneuvering the ship can mainly be attributed to the small under keel clearance, external forces (such as waves and wind), the length of the channel, and the speed of the vessel.
The stopping distance was shorter than expected, but it was obtained by astern power. The container vessel stopped within 600 meters from a speed of 6.5 knots.

Through all the simulation tests, it was observed that straightening of channel, widening the entrance, and deepening the channel seem necessary when big vessels such as the C-10 type container vessels or oil tankers with a deep draft over -12.5 meters come to the port. And the stopping distance for big oil tankers has to be examined again before they use the port.

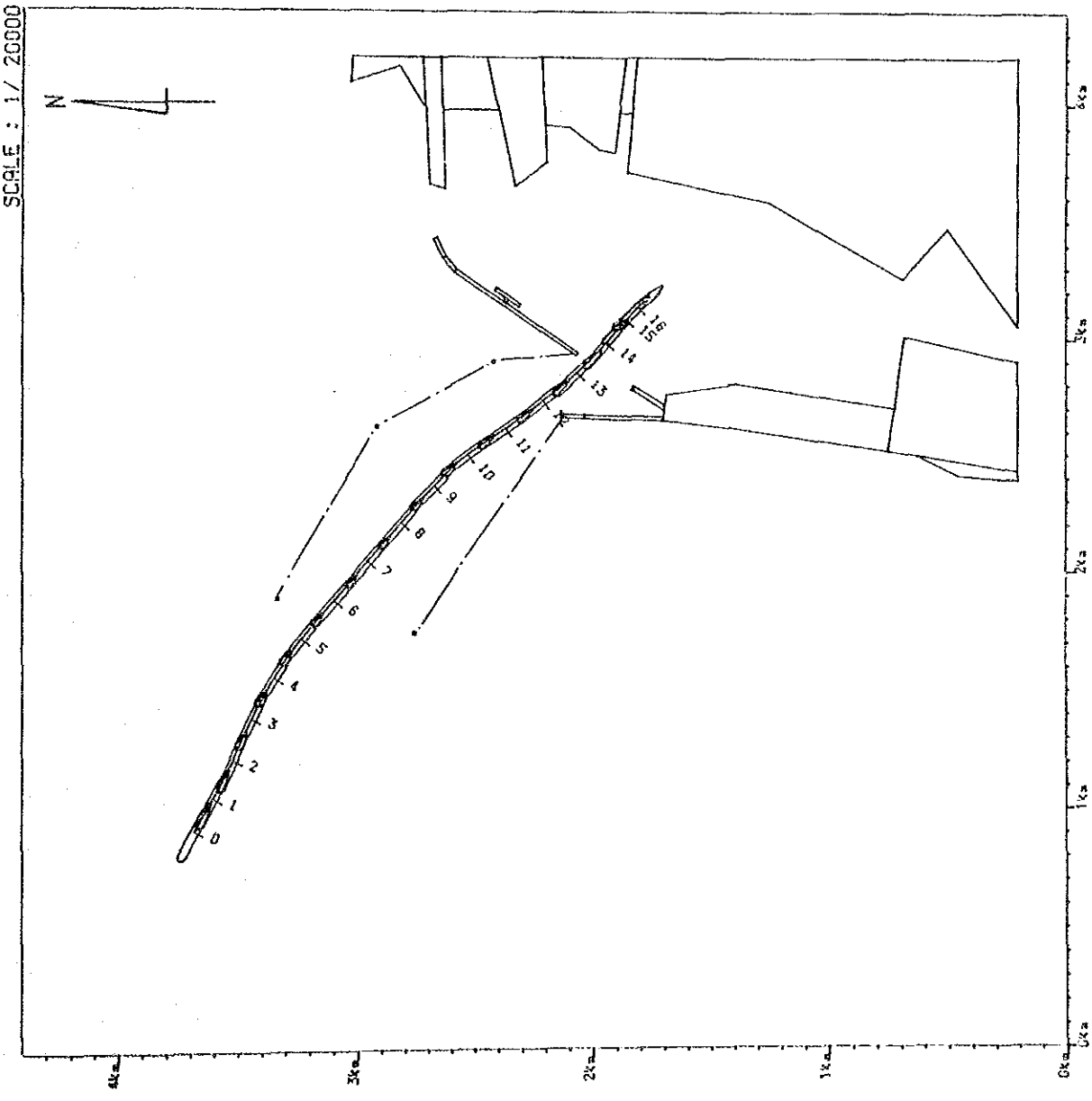
TIME	HEAD	VELO	RUDD	RPM	TD1	TD2	TD3	TD4	WIND	CURR	S-CU	DEPTH
day hr	deg	knot	deg						m/s	knot	deg	m
0 0	119	5.0	0	28	0	0	0	0	0	0.0	0	15.6
0 1	119	5.1	0	28	0	0	0	0	0	0.0	0	15.6
0 2	119	5.6	0	28	0	0	0	0	0	0.0	0	15.6
0 3	121	6.0	0	28	0	0	0	0	0	0.0	0	15.6
0 4	120	6.1	0	28	0	0	0	0	0	0.0	0	15.6
0 5	120	6.6	0	28	0	0	0	0	0	0.0	0	15.6
0 6	120	6.7	0	28	0	0	0	0	0	0.0	0	15.6
0 7	121	6.7	0	28	0	0	0	0	0	0.0	0	15.6
0 8	120	6.6	0	28	0	0	0	0	0	0.0	0	15.6
0 9	120	6.6	0	28	0	0	0	0	0	0.0	0	15.6
0 10	120	6.5	0	28	0	0	0	0	0	0.0	0	15.6
0 11	124	6.2	0	28	0	0	0	0	0	0.0	0	15.6
0 12	123	5.8	0	28	0	0	0	0	0	0.0	0	15.6
0 13	122	5.7	0	28	0	0	0	0	0	0.0	0	15.6
0 14	120	5.3	0	28	0	0	0	0	0	0.0	0	15.6
0 15	120	4.8	0	28	0	0	0	0	0	0.0	0	15.6
0 16	120	3.6	0	28	0	0	0	0	0	0.0	0	14.6
0 17	123	2.4	0	28	0	0	0	0	0	0.0	0	14.6
0 18	120	1.2	0	28	0	0	0	0	0	0.0	0	14.6

A 6-3-2-1 (1) CASE - 6



TIME	HSIG	VELS	RUDD	RPM	TD1	TD2	TD3	TD4	WIND	CURR	D-DI	DEPTH
hhh	deg	East	deg		tow deg	tow deg	tow deg	tow deg	m/s	East	deg	m
0 0'	119	5.0	0	30	0	0	0	0	0	0.0	0	30.0
1 0'	118	5.4	0	35	0	0	0	0	0	0.0	0	15.6
2 0'	115	6.0	10	28	0	0	0	0	0	0.0	0	15.6
3 0'	116	6.3	28	35	0	0	0	0	0	0.0	0	15.6
4 0'	123	6.4	11	34	0	0	0	0	0	0.0	0	15.6
5 0'	129	6.6	5	35	0	0	0	0	0	0.0	0	15.6
6 0'	130	6.8	0	35	0	0	0	0	0	0.0	0	15.6
7 0'	131	7.0	15	32	0	0	0	0	0	0.0	0	15.6
8 0'	131	6.8	30	32	0	0	0	0	0	0.0	0	15.6
9 0'	135	6.7	0	33	0	0	0	0	0	0.0	0	15.6
10 0'	143	6.4	-30	33	0	0	0	0	0	0.0	0	15.6
11 0'	144	6.3	-30	33	0	0	0	0	0	0.0	0	15.6
12 0'	142	6.4	-30	33	0	0	0	0	0	0.0	0	15.6
13 0'	138	6.0	-30	33	0	0	0	0	0	0.0	0	15.6
14 0'	133	5.0	-7	-33	0	0	0	0	0	0.0	0	14.8
15 0'	133	3.3	-30	-54	0	0	0	0	0	0.0	0	14.6
16 0'	138	1.6	-30	-34	0	0	0	0	0	0.0	0	14.6

A 6-3-2-1 (2) CASE - 7



A 6-3-2-1 (3) CACE-8

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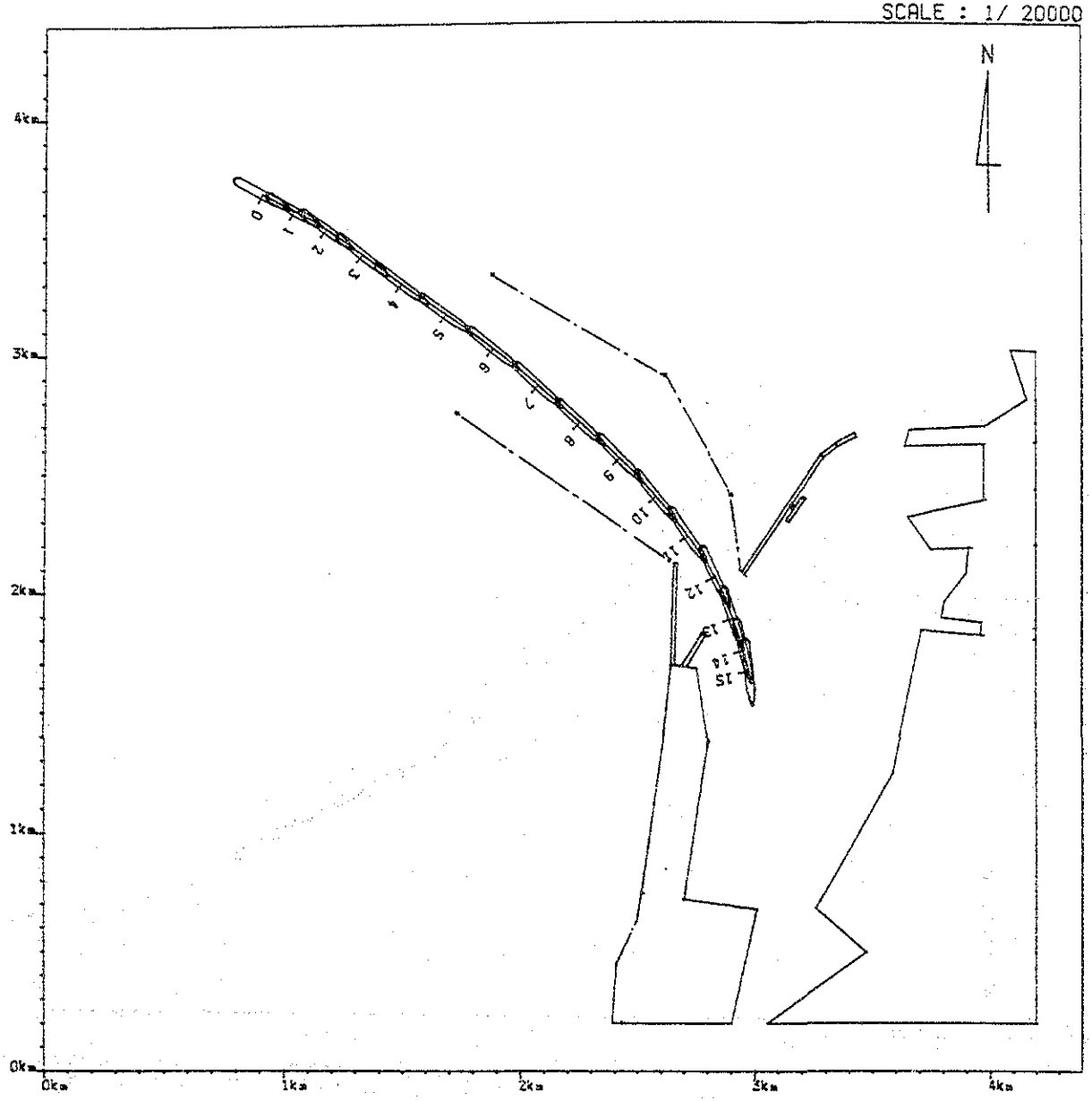
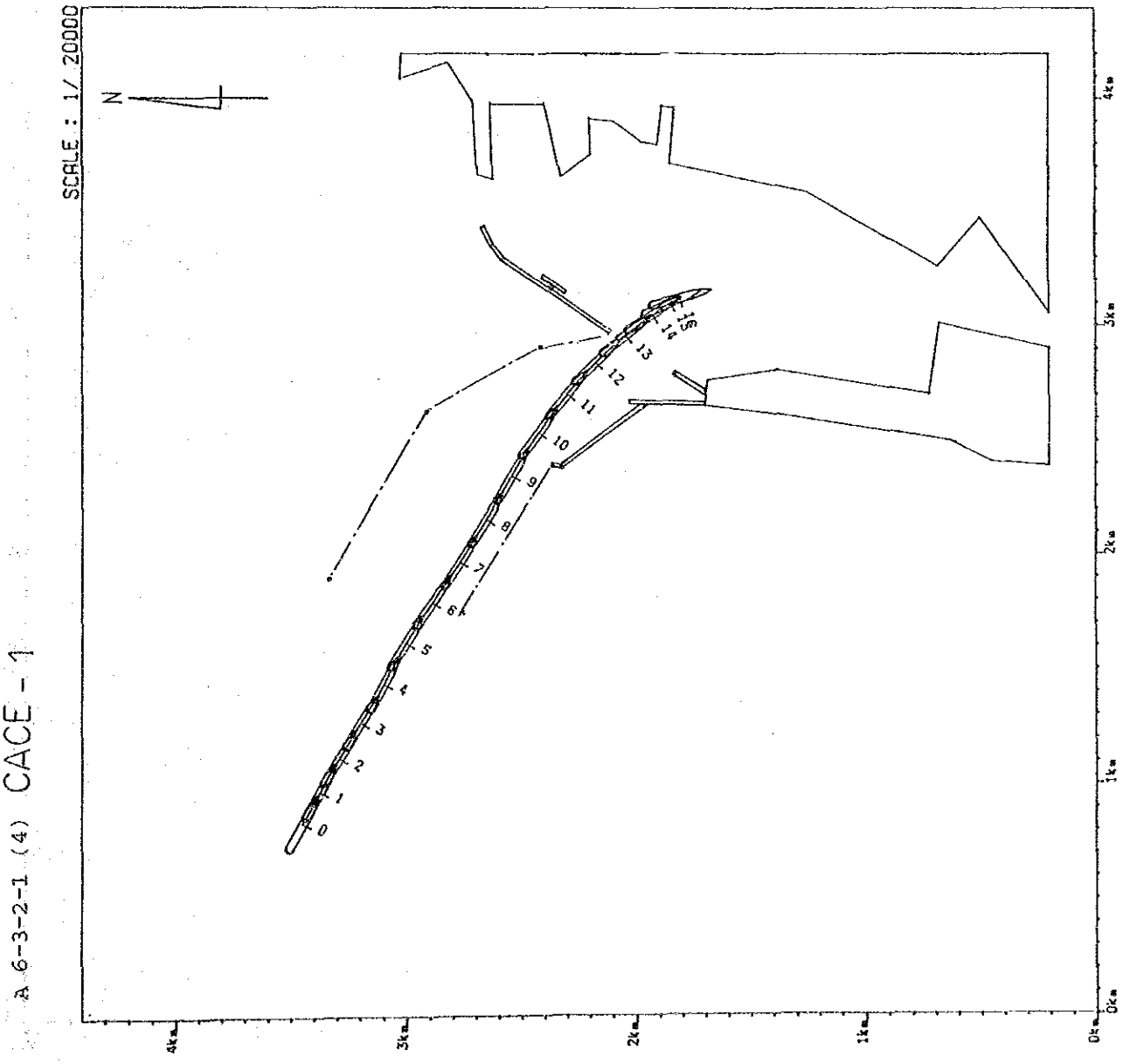


TIME sec	HEAD deg	VELO knot	RUDD deg	RPM	TG1 ton	deg	TG2 ton	deg	TG3 ton	deg	TG4 ton	deg	WIND m/s	CURR knot	D-CU deg	DEPTH m
0' 0"	119	5.0	0	0	0	0	0	0	0	0	0	0	*	0.0	0	30.0
1' 0"	120	4.8	0	0	0	0	0	0	0	0	0	0	*	0.0	0	15.8
2' 0"	126	5.6	-10	45	0	0	0	0	0	0	0	0	*	0.0	0	15.8
3' 0"	128	6.4	-20	46	0	0	0	0	0	0	0	0	*	0.0	0	15.8
4' 0"	128	7.0	-10	45	0	0	0	0	0	0	0	0	*	0.0	0	15.8
5' 0"	128	7.7	0	48	0	0	0	0	0	0	0	0	*	0.0	0	15.8
6' 0"	129	8.0	-15	34	0	0	0	0	0	0	0	0	*	0.0	0	15.8
7' 0"	132	7.8	-20	36	0	0	0	0	0	0	0	0	*	0.0	0	15.8
8' 0"	135	7.4	-30	36	0	0	0	0	0	0	0	0	*	0.0	0	15.8
9' 0"	135	7.4	-5	30	0	0	0	0	0	0	0	0	*	0.0	0	15.8
10' 0"	141	7.1	-30	27	0	0	0	0	0	0	0	0	*	0.0	0	15.8
11' 0"	145	8.7	0	37	0	0	0	0	0	0	0	0	*	0.0	0	15.8
12' 0"	155	6.5	0	0	0	0	0	0	0	0	0	0	*	0.0	0	14.8
13' 0"	161	5.8	-30	-48	0	0	0	0	0	0	0	0	*	0.0	0	14.8
14' 0"	168	3.7	-31	-54	0	0	0	0	0	0	0	0	*	0.0	0	14.8
15' 0"	174	2.2	0	-55	0	0	0	0	0	0	0	0	*	0.0	0	14.8

TIME	MEAN	YELD	ANGD	RPM	TG1	TG2	TG3	TG4	WIND	CURR	2-CU	DEPTH
hrs	deg	knot	deg		ton deg	ton deg	ton deg	ton deg	m/s	knot	deg	m
0h 0m	119	5.9	0	30	0 0	0 0	0 0	0 0	0	0.0	0	30.0
1h 0m	119	5.1	0	37	0 0	0 0	0 0	0 0	0	0.0	0	15.6
2h 0m	122	5.9	0	37	0 0	0 0	0 0	0 0	0	0.0	0	15.6
3h 0m	122	6.1	-15	36	0 0	0 0	0 0	0 0	0	0.0	0	15.6
4h 0m	118	6.4	5	37	0 0	0 0	0 0	0 0	0	0.0	0	15.6
5h 0m	121	6.6	3	33	0 0	0 0	0 0	0 0	0	0.0	0	15.6
6h 0m	125	6.6	-10	30	0 0	0 0	0 0	0 0	0	0.0	0	15.6
7h 0m	122	7.0	0	34	0 0	0 0	0 0	0 0	0	0.0	0	15.6
8h 0m	121	7.2	-10	35	0 0	0 0	0 0	0 0	0	0.0	0	15.6
9h 0m	120	7.3	10	31	0 0	0 0	0 0	0 0	0	0.0	0	15.6
10h 0m	126	7.0	0	4	0 0	0 0	0 0	0 0	0	0.0	0	15.6
11h 0m	131	6.4	20	1	0 0	0 0	0 0	0 0	0	0.0	0	15.6
12h 0m	136	5.8	20	1	0 0	0 0	0 0	0 0	0	0.0	0	15.6
13h 0m	141	5.3	-1	-35	0 0	0 0	0 0	0 0	0	0.0	0	14.6
14h 0m	142	4.0	26	-52	0 0	0 0	0 0	0 0	0	0.0	0	14.6
15h 0m	156	2.3	0	-43	0 0	0 0	0 0	0 0	0	0.0	0	14.6
16h 0m	165	0.8	0	-55	0 0	0 0	0 0	0 0	0	0.0	0	14.6

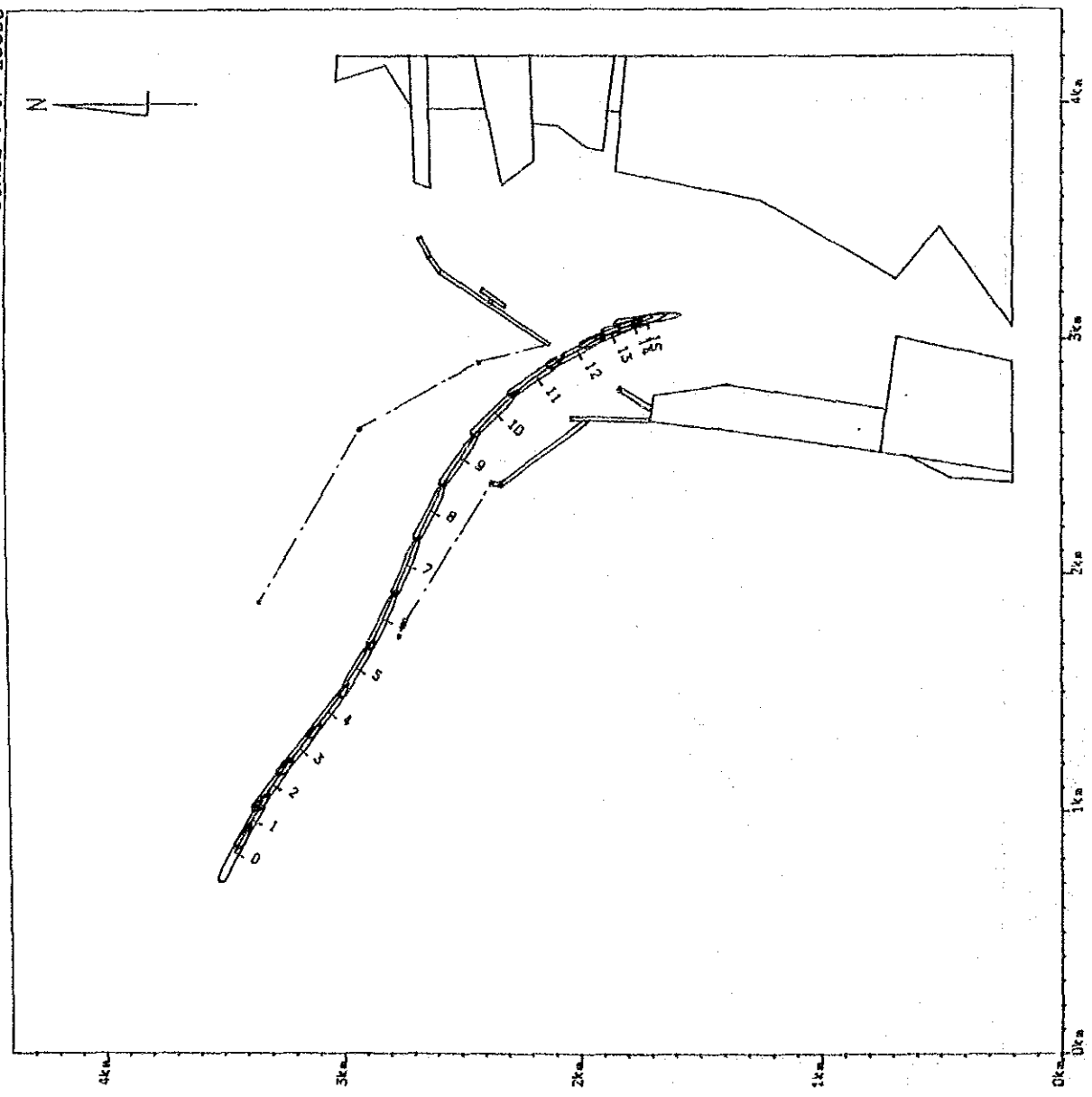


A 6-3-2-1 (4) CACE - 1

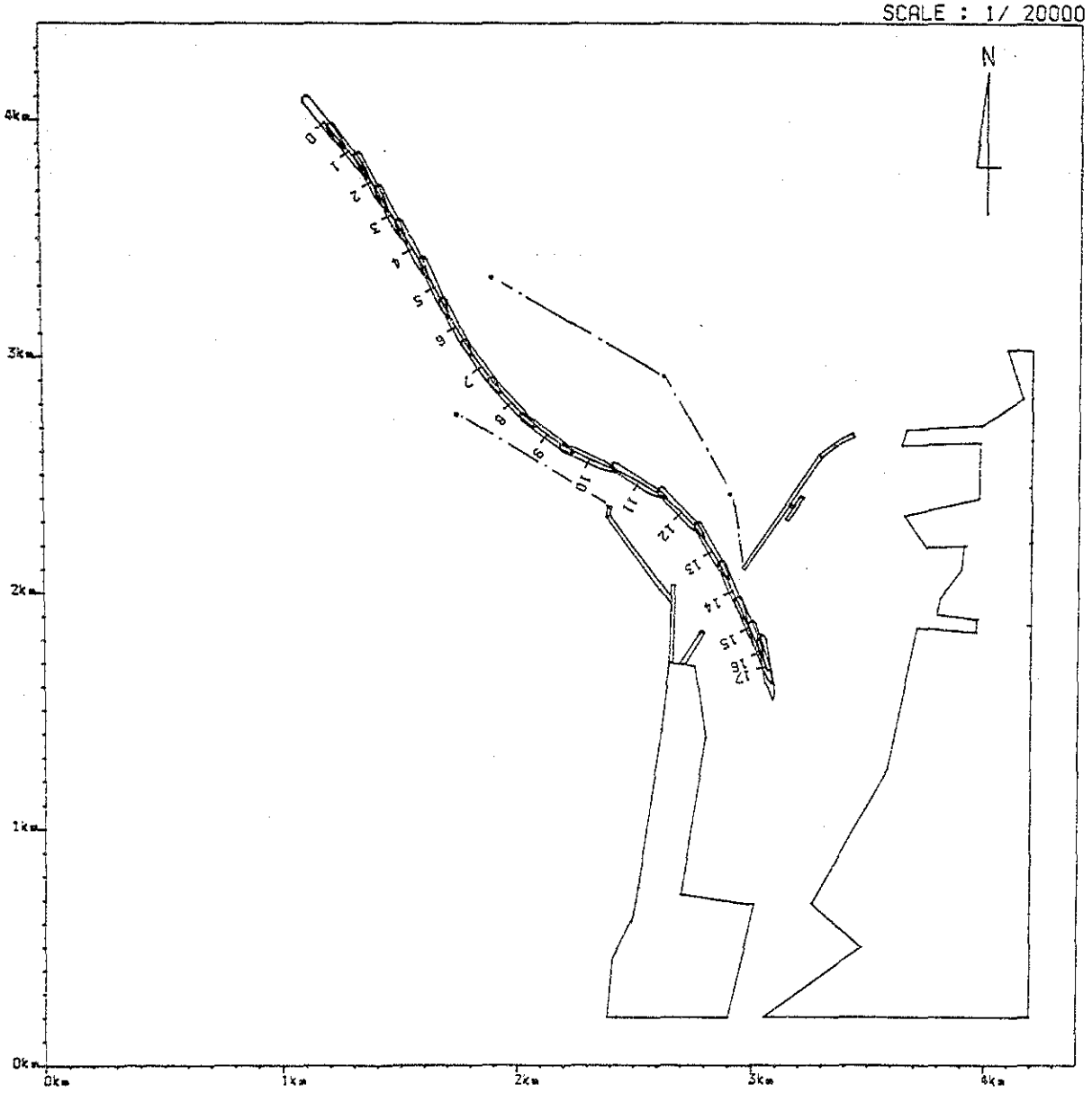
TIME	HEAD	VELO	HEAD	RPM	TD1	TD2	TD3	TD4	WIND	CURR	3-CU	DEPTH
HRS	deg	knot	deg		100 deg	100 deg	100 deg	100 deg	m/s	knot	deg	m
0	0	119	5.0	0	28	0	0	0	0	0.0	0	30.0
1	0	120	5.4	0	28	0	0	0	0	0.0	0	15.6
2	0	126	5.8	-11	33	0	0	0	0	0.0	0	15.6
3	0	130	6.1	-20	45	0	0	0	0	0.0	0	15.6
4	0	128	6.0	-20	45	0	0	0	0	0.0	0	15.6
5	0	122	7.3	-20	45	0	0	0	0	0.0	0	15.6
6	0	116	7.9	-10	45	0	0	0	0	0.0	0	15.6
7	0	113	8.2	0	33	0	0	0	0	0.0	0	15.6
8	0	116	8.2	0	33	0	0	0	0	0.0	0	15.6
9	0	124	8.1	17	33	0	0	0	0	0.0	0	15.6
10	0	133	7.7	20	33	0	0	0	0	0.0	0	15.6
11	0	145	7.1	27	0	0	0	0	0	0.0	0	15.6
12	0	151	6.0	-20	-45	0	0	0	0	0.0	0	14.6
13	0	156	4.2	-20	-45	0	0	0	0	0.0	0	14.6
14	0	164	2.5	0	-45	0	0	0	0	0.0	0	14.6
15	0	171	1.3	0	-45	0	0	0	0	0.0	0	14.6

A 6-3-2-1 (5) CASE - 4

SCALE : 1/ 20000



A 6-3-2-1 (6) CACE-9



TIME mee	HEAD deg	VELO knot	RUDD deg	RPM	TG1 ton	deg	TG2 ton	deg	TG3 ton	deg	TG4 ton	deg	WIND m/s	CURR knot	D-CU deg	DEPTH m
0° 0"	142	5.0	0	20	0	0	0	0	0	0	0	0	8	0.0	0	30.0
1° 0"	143	5.1	0	35	0	0	0	0	0	0	0	0	8	0.0	0	15.6
2° 0"	151	5.3	-34	32	0	0	0	0	0	0	0	0	8	0.0	0	15.6
3° 0"	154	5.4	-35	46	0	0	0	0	0	0	0	0	8	0.0	0	15.6
4° 0"	153	5.8	-20	30	0	0	0	0	0	0	0	0	8	0.0	0	15.6
5° 0"	155	6.1	-35	47	0	0	0	0	0	0	0	0	8	0.0	0	15.6
6° 0"	153	6.3	-35	53	0	0	0	0	0	0	0	0	8	0.0	0	15.6
7° 0"	145	6.5	-35	46	0	0	0	0	0	0	0	0	8	0.0	0	15.6
8° 0"	137	6.5	-35	46	0	0	0	0	0	0	0	0	8	0.0	0	15.6
9° 0"	126	6.6	-35	54	0	0	0	0	0	0	0	0	8	0.0	0	15.6
10° 0"	114	7.3	0	47	0	0	0	0	0	0	0	0	8	0.0	0	15.6
11° 0"	122	7.4	30	36	0	0	0	0	0	0	0	0	8	0.0	0	15.6
12° 0"	136	7.0	30	36	0	0	0	0	0	0	0	0	8	0.0	0	15.6
13° 0"	150	6.5	35	28	0	0	0	0	0	0	0	0	8	0.0	0	15.6
14° 0"	158	5.9	-35	-41	0	0	0	0	0	0	0	0	8	0.0	0	14.6
15° 0"	156	4.7	-35	-54	0	0	0	0	0	0	0	0	8	0.0	0	14.6
16° 0"	161	3.0	0	-54	0	0	0	0	0	0	0	0	8	0.0	0	14.6
17° 0"	169	1.3	0	-54	0	0	0	0	0	0	0	0	8	0.0	0	14.6

Table A 6-3-2-1 (1) Test Cases

TEST NO.	CAPT.	PLAN	SHIP	WIND (m/s)	WAVE (H1/3, m)	COURSE OF SHIP(N=0°)
1	HOSOMI	FUTURE	CONTAINER	WSW, 7.5	NIL	118.7-141.5
2	SUGIYAMA	FUTURE	CONTAINER	NNE, 7.5	NIL	118.7-141.5
3	KUWASAKI	FUTURE	CONTAINER	NIL	NIL	118.7-141.5
4	HOSOMI	FUTURE	CONTAINER	WSW, 7.5	2.0	118.7-141.5
5	SUGIYAMA	FUTURE	CONTAINER	WSW, 7.5	2.0	118.7-141.5
6	KUWASAKI	PRESENT	CONTAINER	NIL	NIL	118.7-158.9
7	OOISI	PRESENT	CONTAINER	NNE, 7.5	NIL	118.7-158.9
8	HOSOMI	PRESENT	CONTAINER	WSW, 7.5	NIL	118.7-158.9
9	KUWASAKI	FUTURE	CONTAINER	WSW, 7.5	2.0	141.5-141.5

Table A 6-3-2-1 (2) Tested Vessel

CONTAINER VESSEL (52,000 DWT)

Loa (m)	Lp (m)	Breadth (m)	Depth (m)	Draft (m)	Displacement (ton)	Power /RPM (HP)
280	266	35	22.5	13.0	76,000	55,400/104

Table A 6-3-2-1 (3) Engine Propulsion (Model Ship)

		knots	RPM
A	NAV. FULL	26.0	104
H	FULL	11.51	44
E	HALF	9.12	36
A	SLOW	6.81	26
D	DEAD SLOW	5.01	20
	STOP	0.0	0
A	DEAD SLOW	-3.36	-20
S	SLOW	-4.56	-26
T	HALF	-6.10	-36
E	FULL	-7.70	-44
R			
N	NAV. FULL	-17.5	-104

Fig. A 6-3-2-1 (4) Ship Course Observed on 12, June

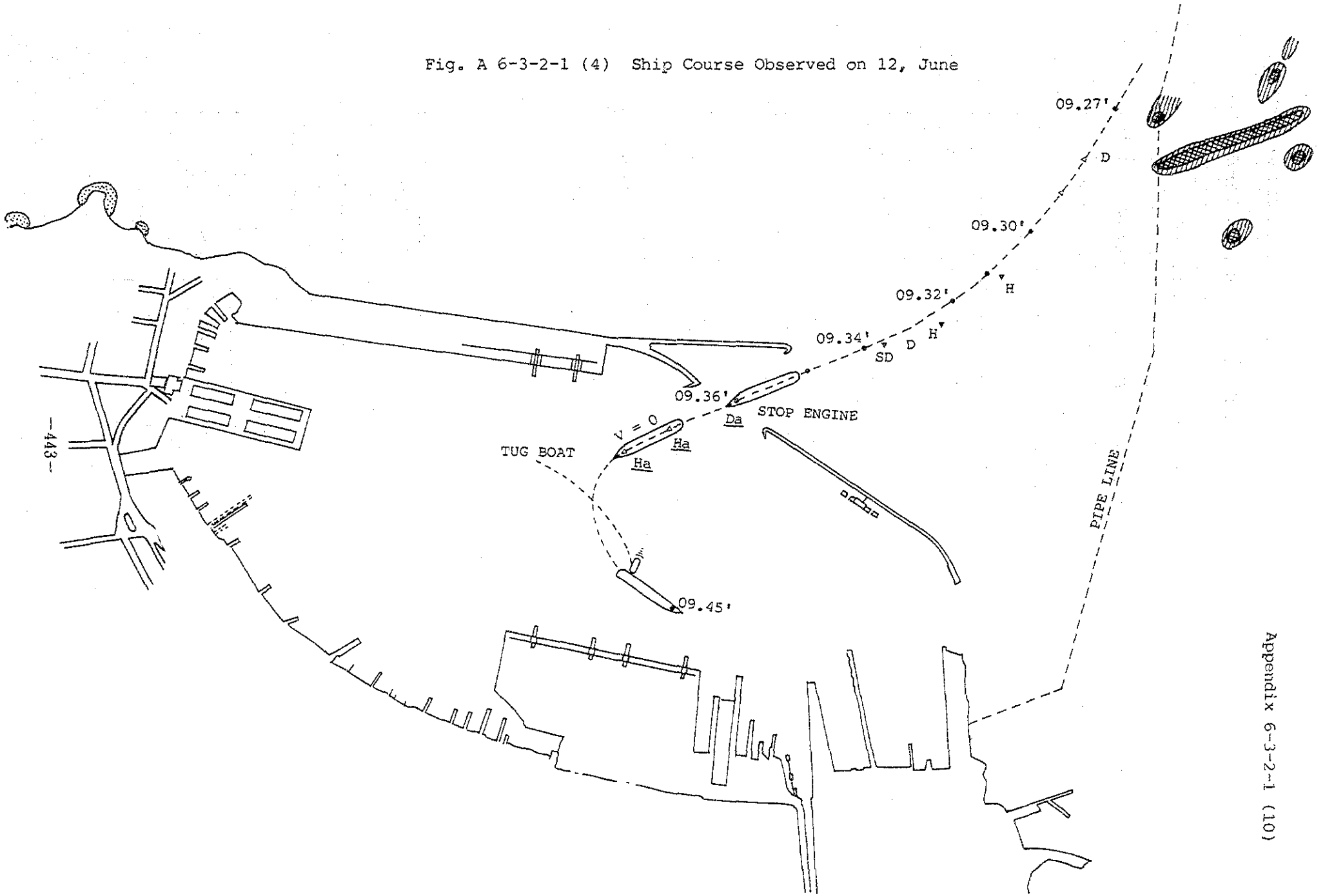


Table A 6-3-2-1 (4) President Garfield (Real Ship, Observed)

CONTAINER VESSEL (45,000 DWT, 3,000 TEU, built 1987,Mitsui Tamano)						
Loa (m)	Lp (m)	Breadth (m)	Depth (m)	Draft (m)	Displacement (ton)	Power /RPM (HP)
259	245	32.2	18.8	11.92	62,000	

Table A 6-3-2-1 (5) Engine - Propulsion (Real Ship)

		knots	RPM
A	NAV. FULL (CRITICAL SPEED)		65
H	FULL	14.8	55
E	HALF	12.1	45
A	SLOW	8.1	35
D	DEAD SLOW	6.7	25
	STOP	0.0	0
A	DEAD SLOW		-25
S	SLOW		-35
T	HALF		-45
E	FULL		-55
R			
N			

Table A 6-3-2-1 (6) Time and Distance to Stop

Note: Using Engine Full Astern and with minimum application of rudder

	Normal Load		Normal Ballast	
	Minutes	Miles	Minutes	Miles
Full Sea Speed	9.6	1.68	7.6	1.38
Full Speed	6.8	0.87	5.4	0.72
Half Speed	5.8	0.63	4.6	0.52
Slow Speed	4.2	0.35	3.3	0.29

Breakdown of Construction Cost for Master Plan.

Table A 6-5-4-1 (1) NNP No.3 & No.4 Berth

Main Item		Quantity		Unit Cost (US$)	Total Cost (1,000$)	Remarks
Civil Work	-11.0m Quay	210	m	39,285	8,250	
	-7.5m Quay	130	m	30,516	3,967	
	Revetment	30	m	7,200	216	
	Reclamation	26,000	m^3	6.7	174	
	Yard Paving	3,700	m^2	70	259	
	Sub-Total				12,866	
Wharf Crane		2	Nos	2,100,000	4,200	
Total					17,066	
Engineering Service					1,707	
Physical Contingency					1,707	
Grand Total					20,480	

Table A 6-5-4-1 (2) NNP Entrance Channel

Main Item	Quantity		Unit Cost (US$)	Total Cost (1,000$)	Remarks
Breakwater	120	m	30,374	3,645	
Lighthouse	2	NO	84,000	168	
Engineering				1,040	
Contingency				370	
Total				5,223	

Table A 6-5-4-1 (3) Construction Cost of FCT

Unit ; Thousand US$

Description			Quantity	UNIT	Construction Cost			Remarks
					Foreign	Local	Total	
Stage I	Civil Work	Revetment	230	m	1,992	2,199	4,191	
		Reclamation	1,300,000	m^3	7,839	910	8,749	
		Yard Paving	115,000	m^2	6,544	2,334	8,878	Including PC Slab for T/C
		Utilities	1	Sum	4,355	142	4,497	Water Supply Electricity
		Sub total (1)			20,730	5,585	26,315	
	Equipment	Transfer Crane	6	NO	7,794	0	7,794	
		Tractor & Chassis	12	Set	1,746	0	1,746	
		Sub Total (2)			9,540	0	9,540	
	Total				30,270	5,585	35,855	
	Engineering Service				1,816	279	2,095	
	Physical Contingency				2,073	559	2,632	10% of Sub Total (1)
	Total Stage I				34,159	6,423	40,582	
Stage II	Civil Work	-14.0M Quaywall	300	m	14,929	4,583	19,512	
		Reclamation	60,000	m^3	361	42	403	
		Yard Paving	6,000	m^2	341	122	463	
		Utilities	1	Sum	242	8	250	Water Supply Electricity
		Sub total (1)			15,873	4,755	20,628	
	Equipment Work Container Crane		2	NO	13,274	0	13,274	
	Total				29,147	4,755	33,902	
	Engineering Service		1	Sum	1,749	238	1,987	
	Physical Contingency				1,587	476	2,063	10% of Sub Total (1)
	Total Stage II				32,483	5,469	37,952	
Grand Total					66,642	11,892	78,534	

Table A 6-5-4-1 (4) Construction Cost of QCT (Master Plan-A)

Unit ; Thousand US$

Description		Quantity	UNIT	Construction Cost			Remarks
				Foreign	Local	Total	
Civil Work	-14.0M Quaywall	700	m	34,834	10,693	45,527	
	-12.0M Quaywall	300	m	13,436	4,124	17,560	
	Reclamation	570,000	m^3	3,434	396	3,830	
	Yard Paving	101,000	m^2	5,747	2,049	7,796	Excluding QCT No. 4, 5
	Utilities	1	Sum	6,261	126	6,387	Including 2 Generator
	Sub total (1)			63,712	17,388	81,100	
Buliding Work	Container Gate	450	m^2	320	220	540	15×30m 6 Lane
	Administration Bldg	2,250	m^2	1,350	450	1,800	25×30m 3 Stories
	Power Station	600	m^2	360	120	480	20×30m
	Work Shop	800	m^2	480	160	640	20×40m
	Sub Total (2)			2,510	950	3,460	
Total (A)				66,222	18,338	84,560	
Equipment Work	Container Crane	3	NO	22,301	0	22,301	Including Relocation Cost of Existing 3 Con/Crane
	Transfer Crane	12	NO	15,588	0	15,588	
	Tractor Chassis	30	Set	4,365	0	4,365	
	Sub Total (3)			42,254	0	42,254	
Total (B)				108,476	18,338	126,814	
Engineering Service				6,509	917	7,426	
Physical Contingency				6,622	1,834	8,456	
Grand Total				121,607	21,089	142,696	

Table A 6-5-4-1 (5) Realignment of Main Entrance Channel

Main Item		Quantity		Unit Cost (US$)	Total Cost (1,000$)	Remarks
SW Breakwater	Breakwater	550	m	63,550	34,953	
	Engineering				2,097	
	Contingency				3,495	
	Sub-Total				40,545	
Entrance Channel	Removal of Existing Breakwater	300	m	32,680	9,804	250+50m
	Dredging Channel	150,000	m^3	5	750	
	Dredging Harbour	500,000	m^3	10	5,000	
	Lighthouse	2	NOS	110,000	220	
	Contingency				1,577	10%
	Sub-Total				17,351	
Total					57,896	

Table A 6-5-4-1 (6) NQEQ Project (Master Plan-B)

Unit ; Thousand US$

	Main Works	Quantity		UNIT COST (US$)	TOTAL COST (1,000$)	QCT NO. 1		QCT NO. 2		QCT NO. 3		Remarks
						QTY	COST	QTY	COST	QTY	COST	
Reclamation QEQ	Revetment Type-A	1,450	m	51,630	74,864	980 m	50,597	330 m	17,038	140 m	7,229	
	Breakwater	510	m	61,059	31,140					510 m	31,140	
	Revetment Type-B	400	m	23,495	9,398					400 m	9,398	
	Reclamation	4,110,000	m³	7.6	31,236	1,930,000 m³	14,668	1,090,000 m³	8,284	1,090,000 m³	8,284	
	Yard Paving	334,500	m²	77.2	25,823	136,500 m²	10,537	99,000 m²	7,643	990,000 m²	7,643	
	Utilities	1	Sum		13,380	1 Sum	5,460	1 Sum	3,960	1 Sum	3,960	
	Sub-Total (1)				185,841		81,262		36,925		67,654	
Improvement QEQ	-14m Quaywall	1,000	m	35,810	35,810	340 m	12,176	330 m	11,817	330 m	11,817	
	Revetment Type-C	110	m	23,495	2,584					110 m	2,584	
	Reclamation	130,000	m³	6.7	871					130,000 m³	871	
	Yard Paving	136,800	m²	77.2	10,561	57,600 m²	4,447	39,600 m²	3,057	39,600 m²	3,057	
	Utilities	1	Sum		5,472	1 Sum	2,304	1 Sum	1,584	1 Sum	1,584	
	Sub-Total (2)				55,298		18,927		16,458		19,913	
Building Work	Office Building	11,100	m²	1,120	12,432	6,300 m²	7,056			4,800 m²	5,376	30x70m 20x80m
	Container Gate	800	m²	930	744	800 m²	744					20x40m
	Maintenance Shop	1,800	m²	1,200	2,160	1,800 m²	2,160					30x60m
	Power Station	1,300	m	930	1,209	900 m²	837			400 m²	372	30x30m 20x20m
	Sub-Total (3)				16,545		10,797		0		5,748	
Equipment Work	Container Crane	3	NO	6,637,000	19,911	2 NO	13,274	1 NO	6,637			
	Transfer Crane	18	NO	1,300,000	23,400	6 NO	7,800	6 NO	7,800	6 NO	7,800	
	Tractor Chassis	36	NO	145,500	5,238	12 NO	1,746	12 NO	1,746	12 NO	1,746	
	Replace Existing Crane	1	SUM		350			1 Sum	350			
	Sub-Total (4)				48,899		22,820		16,533		9,546	
Total					306,583		133,806		69,916		102,861	
Engineering Service					18,395		8,028		4,195		6,172	
Physical Contingency					30,658		13,381		6,992		10,285	
Grand Total					355,636		155,215		81,103		119,318	

[Reclamation behind Prince Vijaya Quay (PVQ)]

A sea area of about 13.5 ha north of PVQ will be filled up to create a site for redevelopment of the harbor area for the immediate future and which will, in the more distant future, be used to accommodate port information-related activities.

The outer limits of the reclamation area will be remarked by a submerged embankment of rubblework and the area can accommodate approximately 1,250,000 m^3 of dredged material. However assuming the yield of dredged spoils to be about 65 % nearly 800,000 m^3 of material can be made available for filling.

The volume of dredged material required for reclamation is estimated at nearly 750,000 m^3.

Figs. A and B illustrate the reclamation plan. According to this plan, a land area of 4.7 ha will be reclaimed in Stage I. If additional concrete caissons are fabricated in a floating dock during the breakwater extension works and installed on the submerged embankment, the water area enclosed by the revetment for the reclaimed area and the embankment may be used for dumping dredged spoils in the future, thereby eventually creating a total of 13.5 ha of reclaimed land including the 4.7 ha area planned for Stage I.

In connection with the reclamation work north of the PVQ area, it is necessary to undertake protective work for a drainage channel carrying drain water from the marshaland into the sea at the base of a Fishery Harbour breakwater located in the reclamation area. Prior to the reclamation and revetment works, appropriate measures should also be taken to reinforce a 36 in. dia. submarine pipeline (see Fig. C) connecting the PVQ with the existing single-point mooring buoy in an offshore area.

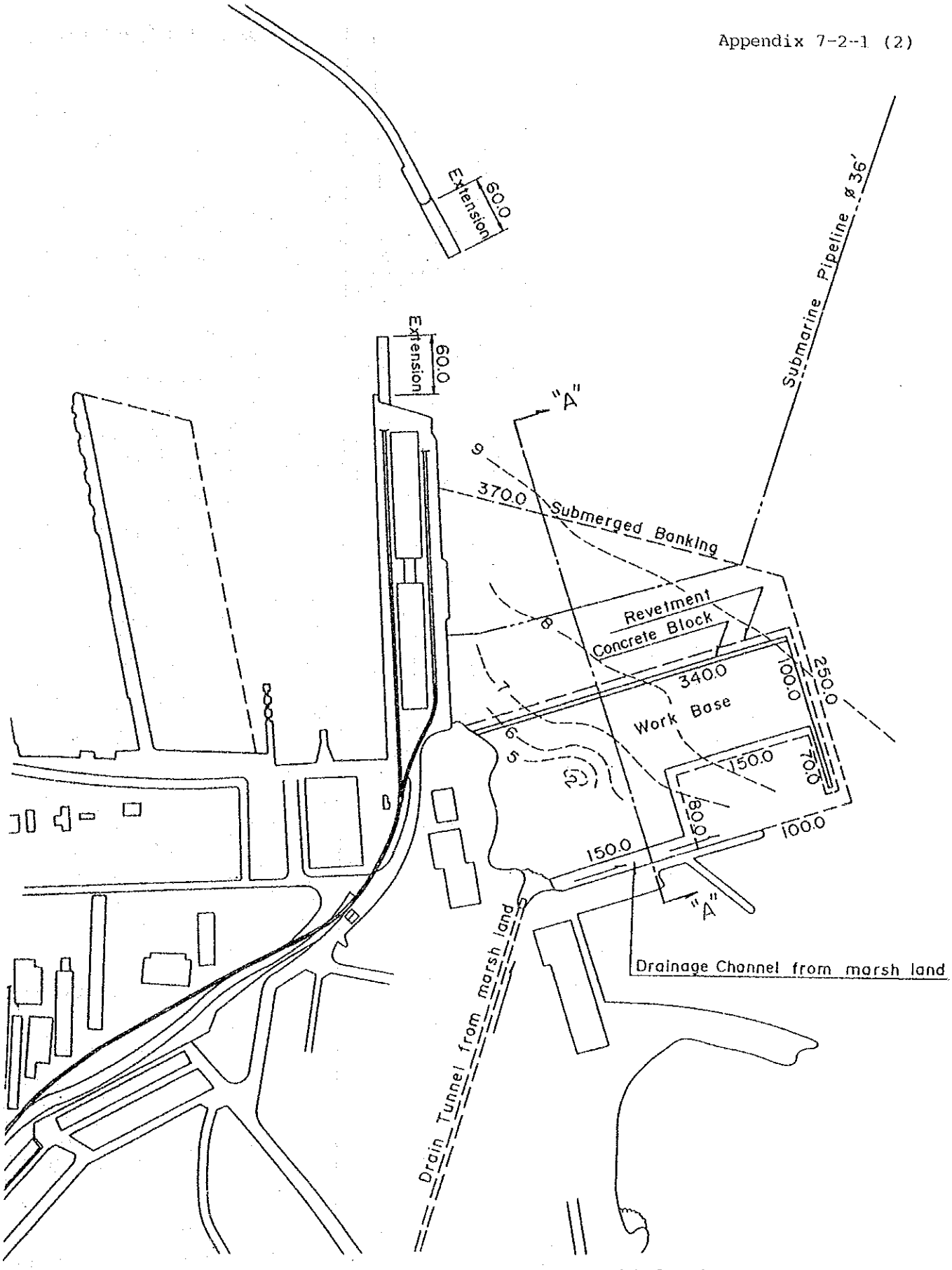


Fig. A Layout of Reclamation Land Behind PVQ

Scal ; 1/5,000; unit ; meter

Fig. B Cross Section (A-A) of Reclamation Land

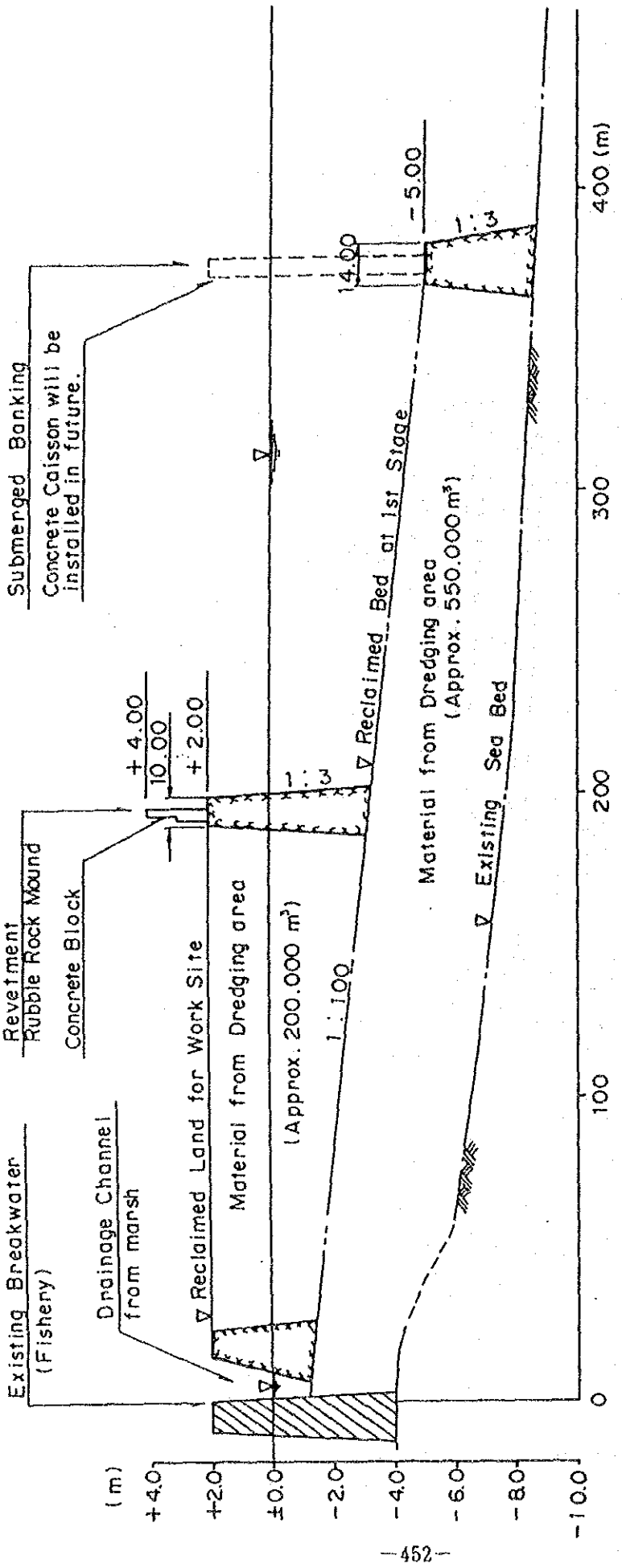
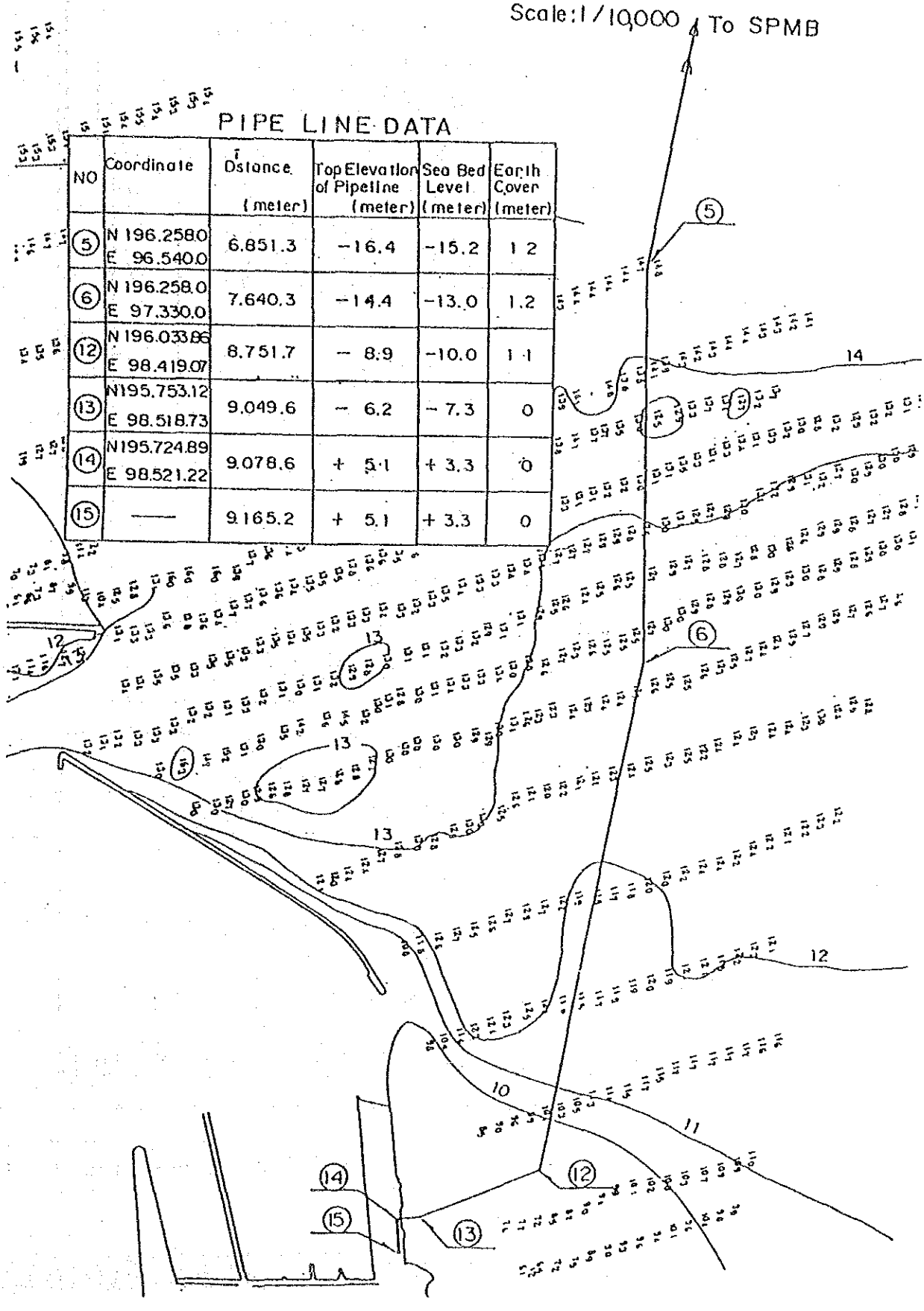
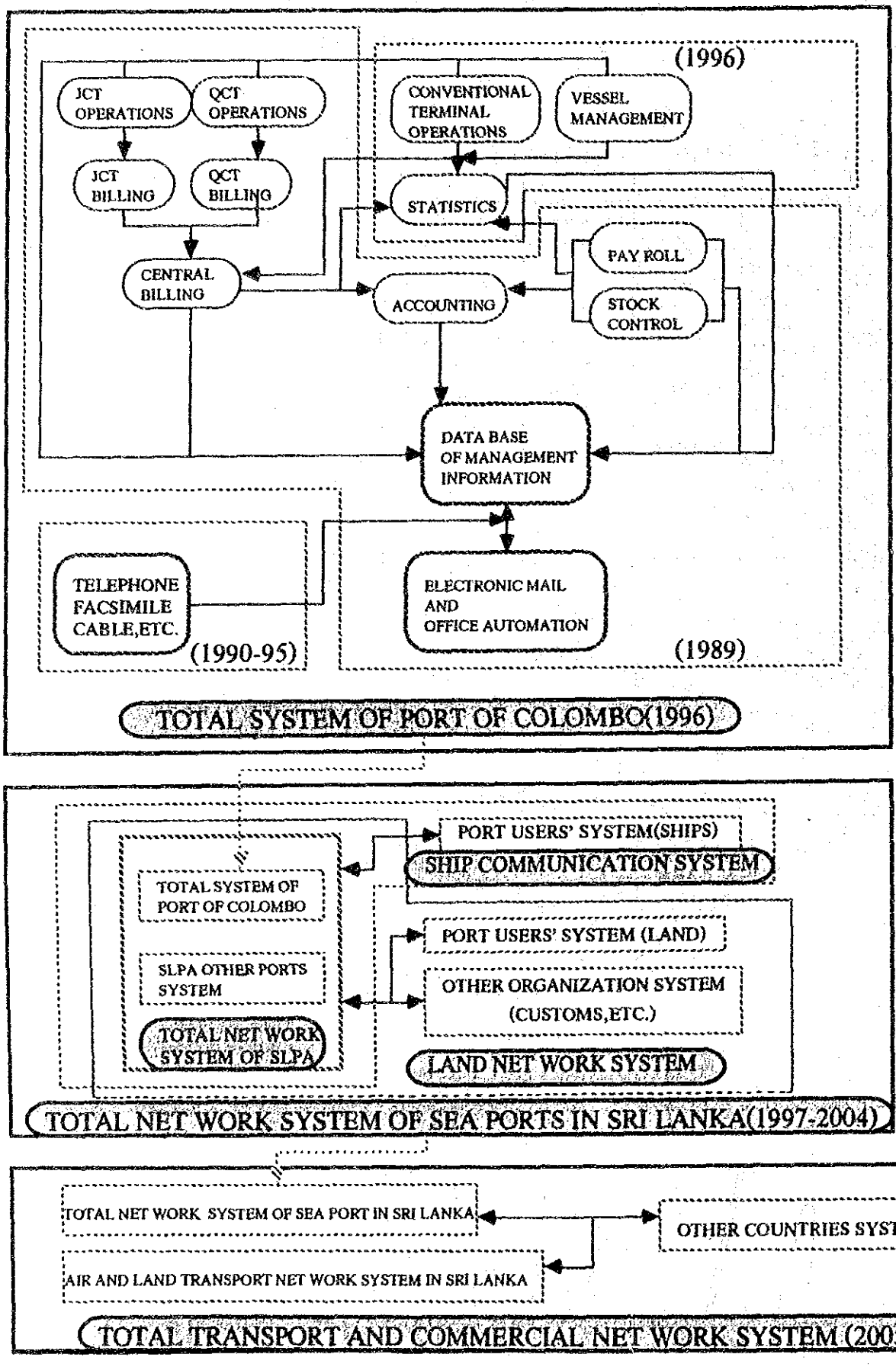


Fig. C Offshore Pipeline to SPMB



NO	Coordinate	Distance (meter)	Top Elevation of Pipeline (meter)	Sea Bed Level (meter)	Earth Cover (meter)
⑤	N 196.258.0 E 96.540.0	6.851.3	−16.4	−15.2	1.2
⑥	N 196.258.0 E 97.330.0	7.640.3	−14.4	−13.0	1.2
⑫	N 196.033.86 E 98.419.07	8.751.7	− 8.9	−10.0	1.1
⑬	N195.753.12 E 98.518.73	9.049.6	− 6.2	− 7.3	0
⑭	N195.724.89 E 98.521.22	9.078.6	+ 5.1	+ 3.3	0
⑮	——	9.165.2	+ 5.1	+ 3.3	0

Appendix 7-4-1 Development of Computer and Communication System



Appendix 7-5-1 Standard Conversion Factor

Year	Total Exports	Total Imports	Total Export Duty	Total Import Duty	Standard Conversion Factor
1981	20,199	35,530	3,685	3,226	1.0083
1982	21,124	36,876	2,484	3,222	0.98744
1983	25,183	42,021	2,459	4,836	0.96584
1984	37,005	46,913	3,175	7,945	0.94622
1985	35,035	49,069	1,873	8,396	0.92802
1986	34,092	51,281	1,574	10,014	0.91003
1987	39,861	59,750	1,680	11,540	0.90993
Average					0.95083 (0.951)

Appendix 7-5-2 Conversion factor for Unskilled Labour

Year	GDP of Agriculture Livestock & Fisheries (mill. Rs)	Population of Agriculture Sector ('000)	Per Capita GDP of Agriculture sect. ('000 Rs)	CFUL
1982	25,257.90	1,899	13.3	0.55
1983	30,467.60	1,927	15.8	0.653
1984	37,292.90	1,949	19.1	0.79
1985	38,505.80	1,979	19.5	0.806
1986	39,529.40	2,014	19.6	0.81
1987	43,069.20	2,045	21.1	0.872
Average				0.747

Appendix 7-5-3 Labour Cost for Construction

(Unit: thousand US$)

		MARKET PRICE							CONVERTION	ECONOMIC PRICE					
		1990	1991	1992	1993	1994	1995	TOTAL	FACTER	1990	1991	1992	1993	1994	1995
JCT NO.3	SKILLED	143.0	210.0	195.0	0.0	0.0	0.0	548.0	0.951	136.0	199.7	185.4	0.0	0.0	0.0
	UNSKILLED	70.0	113.0	97.0	0.0	0.0	0.0	280.0	0.747	52.3	84.4	72.5	0.0	0.0	0.0
	FOREIGENNER	1,945.0	2,783.0	2,401.0	0.0	0.0	0.0	7,129.0	1.000	1,945.0	2,783.0	2,401.0	0.0	0.0	0.0
	TOTAL	2,158.0	3,106.0	2,693.0	0.0	0.0	0.0	7,957.0		2,133.3	3,067.1	2,658.9	0.0	0.0	0.0
JCT NO.4	SKILLED	0.0	105.0	175.0	129.0	0.0	0.0	409.0	0.951	0.0	99.9	166.4	122.7	0.0	0.0
	UNSKILLED	0.0	61.0	122.0	59.0	0.0	0.0	222.0	0.747	0.0	45.6	76.2	44.1	0.0	0.0
	FOREIGENNER	0.0	1,133.0	2,163.0	1,269.0	0.0	0.0	4,565.0	1.000	0.0	1,133.0	2,163.0	1,269.0	0.0	0.0
	TOTAL	0.0	1,299.0	2,440.0	1,457.0	0.0	0.0	5,196.0		0.0	1,278.4	2,405.6	1,435.8	0.0	0.0
NEW NORTH PIER	SKILLED	0.0	42.0	155.0	59.0	76.0	35.0	367.0	0.951	0.0	39.9	147.4	56.1	72.3	33.3
	UNSKILLED	0.0	17.0	38.0	28.0	37.0	18.0	138.0	0.747	0.0	12.7	28.4	20.9	27.6	13.4
	FOREIGENNER	0.0	667.0	1,002.0	766.0	1,080.0	588.0	4,103.0	1.000	0.0	667.0	1,002.0	766.0	1,080.0	588.0
	TOTAL	0.0	726.0	1,195.0	853.0	1,193.0	641.0	4,608.0		0.0	719.6	1,177.8	843.0	1,179.9	634.7
PIPE LAYING	SKILLED	0.0	45.0	63.0	0.0	0.0	0.0	108.0	0.951	0.0	42.8	59.9	0.0	0.0	0.0
	UNSKILLED	0.0	30.0	33.0	0.0	0.0	0.0	63.0	0.747	0.0	22.4	24.7	0.0	0.0	0.0
	FOREIGENNER	0.0	621.0	945.0	0.0	0.0	0.0	1,566.0	1.000	0.0	621.0	945.0	0.0	0.0	0.0
	TOTAL	0.0	696.0	1,041.0	0.0	0.0	0.0	1,737.0		0.0	686.2	1,029.6	0.0	0.0	0.0
QEQ REHABILITATION	SKILLED	0.0	47.0	47.0	0.0	0.0	0.0	94.0	0.951	0.0	44.7	44.7	0.0	0.0	0.0
	UNSKILLED	0.0	16.0	16.0	0.0	0.0	0.0	32.0	0.747	0.0	12.0	12.0	0.0	0.0	0.0
	FOREIGENNER	0.0	444.0	417.0	0.0	0.0	0.0	861.0	1.000	0.0	444.0	417.0	0.0	0.0	0.0
	TOTAL	0.0	507.0	480.0	0.0	0.0	0.0	987.0		0.0	500.6	473.6	0.0	0.0	0.0
CHANNEL DRADGING	SKILLED	0.0	0.0	66.0	0.0	0.0	0.0	66.0	0.951	0.0	0.0	62.8	0.0	0.0	0.0
	UNSKILLED	0.0	0.0	79.0	0.0	0.0	0.0	79.0	0.747	0.0	0.0	59.0	0.0	0.0	0.0
	FOREIGENNER	0.0	0.0	1,012.0	0.0	0.0	0.0	1,012.0	1.000	0.0	0.0	1,012.0	0.0	0.0	0.0
	TOTAL	0.0	0.0	1,157.0	0.0	0.0	0.0	1,157.0		0.0	0.0	1,133.8	0.0	0.0	0.0
COMMUNICATION	SKILLED	0.0	0.0	7.0	2.0	0.0	0.0	9.0	0.951	0.0	0.0	6.7	1.9	0.0	0.0
	UNSKILLED	0.0	0.0	3.0	1.0	0.0	0.0	4.0	0.747	0.0	0.0	2.2	0.7	0.0	0.0
	FOREIGENNER	0.0	0.0	117.0	30.0	0.0	0.0	147.0	1.000	0.0	0.0	117.0	30.0	0.0	0.0
	TOTAL	0.0	0.0	127.0	33.0	0.0	0.0	160.0		0.0	0.0	125.9	32.6	0.0	0.0
TOTAL		2,158.0	6,334.0	9,133.0	2,343.0	1,193.0	641.0	21,802.0		2,133.3	6,252.0	9,005.2	2,311.4	1,179.9	634.7

The cost of the Skilled Labour of foreigners are estimated at international prices in section 7-3.

Appendix 7-5-4 Foreign Exchange Earnings of SLPA and Container Transshipment Cargo

Year	Foreign Exchange Earnings of SLPA		Container Transshipment Cargo at Colombo Port
	(Million Rs)	(Million US$)	(TEU)
1981	324.5	15.06	7,819
1982	382.9	17.95	32,261
1983	455.7	18.23	65,801
1984	842.5	32.06	88,105
1985	852.7	31.11	112,561
1986	1,120.0	39.27	220,456
1987	1,600.0	52.01	300,222
1988	1,900.0	57.52	485,501

Source:SLPA

Appendix 7-5-5 IRR Calculation (Base Case)

***** PORT OF COLOMBO
***** IRR(%) = 21.37

NO.	YEAR	COST	BENEFIT	BNFT.-COST	P. COST	P. BNFT	P.VALUE
1	1990	19437.00	0.00	-19437.00	19437.00	0.00	-19437.00
2	1991	68258.00	0.00	-68258.00	56240.20	0.00	-56240.20
3	1992	101736.00	11300.00	-90436.00	69065.50	7671.23	-61394.30
4	1993	33593.00	24400.00	-9193.00	18790.10	13648.00	-5142.06
5	1994	18738.00	37400.00	18662.00	8635.68	17236.30	8600.65
6	1995	16022.00	50100.00	34078.00	6083.92	19024.10	12940.20
7	1996	6458.00	63537.00	57079.00	2020.50	19878.60	17858.10
8	1997	6460.00	71863.00	65403.00	1665.27	18525.00	16859.70
9	1998	5037.00	73890.00	68853.00	1069.84	15694.00	14624.10
10	1999	5379.00	76917.00	71538.00	941.33	13460.50	12519.20
11	2000	7283.00	79946.00	72663.00	1050.13	11527.40	10477.20
12	2001	8359.00	83374.00	75015.00	993.07	9905.07	8911.99
13	2002	15155.00	83374.00	68219.00	1483.46	8161.14	6677.68
14	2003	6985.00	83374.00	76389.00	563.35	6724.25	6160.90
15	2004	6458.00	83374.00	76916.00	429.15	5540.35	5111.21
16	2005	7285.00	83374.00	76089.00	398.87	4564.89	4166.03
17	2006	5379.00	83374.00	77995.00	242.66	3761.18	3518.52
18	2007	8053.00	83374.00	75321.00	299.33	3098.97	2799.64
19	2008	6458.00	83374.00	76916.00	197.78	2553.35	2355.57
20	2009	8780.00	83374.00	74594.00	221.55	2103.80	1882.25
21	2010	8460.00	83374.00	74914.00	175.89	1733.39	1557.51
22	2011	6936.00	83374.00	76438.00	118.81	1428.21	1309.39
23	2012	47120.00	83374.00	36254.00	665.06	1176.75	511.69
24	2013	30766.00	83374.00	52608.00	357.78	969.57	611.79
25	2014	10578.00	83374.00	72796.00	101.36	798.86	697.51
26	2015	17611.00	83374.00	65763.00	139.03	658.21	519.18
27	2016	6458.00	83374.00	76916.00	42.01	542.32	500.32
28	2017	6460.00	83374.00	76914.00	34.62	446.84	412.22
29	2018	5037.00	83374.00	78337.00	22.24	368.17	345.92
30	2019	5037.00	83374.00	78337.00	18.33	303.35	285.02
	TOTAL	505776.00	2073460.00	1567680.00	191504.00	191504.00	0.05

UNIT = 1000 US$

Appendix 7-5-6 IRR Calculation (Case 1)

***** PORT OF COLOMBO
***** IRR(%) = 19.56

NO.	YEAR	COST	BENEFIT	BNFT.-COST	P. COST	P. BNFT	P.VALUE
1	1990	21381.00	0.00	-21381.00	21381.00	0.00	-21381.00
2	1991	75084.00	0.00	-75084.00	62798.60	0.00	-62798.60
3	1992	111909.00	11300.00	-100609.00	78283.60	7904.68	-70378.90
4	1993	36951.00	24400.00	-12551.00	21619.00	14275.70	-7343.22
5	1994	20612.00	37400.00	16788.00	10086.30	18301.30	8215.05
6	1995	17624.00	50100.00	32476.00	7213.05	20504.60	13291.60
7	1996	7104.00	63537.00	56433.00	2431.76	21749.20	19317.50
8	1997	7106.00	71863.00	64757.00	2034.44	20574.30	18539.90
9	1998	5541.00	73890.00	68349.00	1326.82	17693.30	16366.50
10	1999	5917.00	76917.00	71000.00	1185.02	15404.50	14219.50
11	2000	8011.00	79946.00	71935.00	1341.88	13391.40	12049.50
12	2001	9195.00	83374.00	74179.00	1288.20	11680.50	10392.30
13	2002	16671.00	83374.00	66703.00	1953.42	9769.33	7815.91
14	2003	7684.00	83374.00	75690.00	753.05	8170.86	7417.81
15	2004	7104.00	83374.00	76270.00	582.30	6833.93	6251.63
16	2005	8014.00	83374.00	75360.00	549.40	5715.75	5166.34
17	2006	5917.00	83374.00	77457.00	339.27	4780.53	4441.26
18	2007	8858.00	83374.00	74516.00	424.80	3998.33	3573.53
19	2008	7104.00	83374.00	76270.00	284.94	3344.12	3059.18
20	2009	9658.00	83374.00	73716.00	324.00	2796.95	2472.95
21	2010	9306.00	83374.00	74068.00	261.11	2339.31	2078.20
22	2011	7630.00	83374.00	75744.00	179.05	1956.55	1777.49
23	2012	51832.00	83374.00	31542.00	1017.33	1636.41	619.09
24	2013	33843.00	83374.00	49531.00	555.56	1368.66	813.10
25	2014	11636.00	83374.00	71738.00	159.76	1144.72	984.96
26	2015	19372.00	83374.00	64002.00	222.46	957.42	734.96
27	2016	7104.00	83374.00	76270.00	68.23	800.76	732.53
28	2017	7106.00	83374.00	76268.00	57.08	669.74	612.66
29	2018	5541.00	83374.00	77833.00	37.23	560.16	522.93
30	2019	5541.00	83374.00	77833.00	31.14	468.50	437.37
	TOTAL	556356.00	2073460.00	1517100.00	218790.00	218792.00	1.83

UNIT = 1000 US$

Appendix 7-5-7 IRR Calculation (Case 2)

***** PORT OF COLOMBO
***** IRR(%) = 17.29

NO.	YEAR	COST	BENEFIT	BNFT.-COST	P. COST	P. BNFT	P.VALUE
1	1990	19437.00	0.00	-19437.00	19437.00	0.00	-19437.00
2	1991	68258.00	0.00	-68258.00	58193.50	0.00	-58193.50
3	1992	101736.00	0.00	-101736.00	73946.30	0.00	-73946.30
4	1993	33593.00	11877.00	-21716.00	20816.70	7359.86	-13456.80
5	1994	18738.00	23647.00	4909.00	9899.36	12492.80	2593.44
6	1995	16022.00	35192.00	19170.00	7216.42	15850.70	8634.30
7	1996	6458.00	47311.00	40853.00	2479.84	18167.20	15687.40
8	1997	6460.00	54835.00	48375.00	2114.85	17951.70	15836.80
9	1998	5037.00	61850.00	56813.00	1405.85	17262.70	15856.80
10	1999	5379.00	69120.00	63741.00	1279.94	16447.20	15167.30
11	2000	7283.00	76298.00	69015.00	1477.48	15478.30	14000.80
12	2001	8359.00	79326.00	70967.00	1445.72	13719.80	12274.00
13	2002	15155.00	79326.00	64171.00	2234.64	11696.80	9462.17
14	2003	6985.00	79326.00	72341.00	878.09	9972.15	9094.05
15	2004	6458.00	79326.00	72868.00	692.14	8501.77	7809.64
16	2005	7285.00	79326.00	72041.00	665.65	7248.21	6582.56
17	2006	5379.00	79326.00	73947.00	419.02	6179.47	5760.45
18	2007	8053.00	79326.00	71273.00	534.83	5268.32	4733.50
19	2008	6458.00	79326.00	72868.00	365.66	4491.52	4125.86
20	2009	8780.00	79326.00	70546.00	423.83	3829.26	3405.43
21	2010	8460.00	79326.00	70866.00	348.17	3264.64	2916.47
22	2011	6936.00	79326.00	72390.00	243.36	2783.28	2539.92
23	2012	47170.00	79326.00	32156.00	1411.00	2372.89	961.89
24	2013	30766.00	79326.00	48560.00	784.61	2023.01	1238.40
25	2014	10578.00	79326.00	68748.00	229.99	1724.72	1494.73
26	2015	17611.00	79326.00	61715.00	326.44	1470.42	1143.97
27	2016	6458.00	79326.00	72868.00	102.06	1253.61	1151.55
28	2017	6460.00	79326.00	72866.00	87.04	1068.77	981.73
29	2018	5037.00	79326.00	74289.00	57.86	911.18	853.32
30	2019	5037.00	79326.00	74289.00	49.33	776.83	727.50
	TOTAL	505826.00	1887320.00	1381500.00	209567.00	209567.00	0.33

UNIT = 1000 US$

Appendix 7-5-8 IRR Calculation (Case 3)

***** PORT OF COLOMBO
***** IRR(%) = 15.88

NO.	YEAR	COST	BENEFIT	BNFT.-COST	P. COST	P. BNFT	P.VALUE
1	1990	21381.00	0.00	-21381.00	21381.00	0.00	-21381.00
2	1991	75084.00	0.00	-75084.00	64792.90	0.00	-64792.90
3	1992	111909.00	0.00	-111909.00	83334.50	0.00	-83334.50
4	1993	36951.00	11877.00	-25074.00	23744.70	7632.15	-16112.50
5	1994	20612.00	23647.00	3035.00	11429.80	13112.80	1682.98
6	1995	17624.00	35192.00	17568.00	8433.43	16840.10	8406.63
7	1996	7104.00	47311.00	40207.00	2933.48	19536.30	16602.80
8	1997	7106.00	54835.00	47729.00	2532.12	19539.70	17007.60
9	1998	5541.00	61850.00	56309.00	1703.84	19018.60	17314.80
10	1999	5917.00	69120.00	63203.00	1570.08	18341.00	16770.90
11	2000	8011.00	76298.00	68287.00	1834.37	17470.80	15636.40
12	2001	9195.00	79326.00	70131.00	1816.90	15674.60	13857.70
13	2002	16671.00	79326.00	62655.00	2842.64	13526.20	10683.50
14	2003	7684.00	79326.00	71642.00	1130.65	11672.30	10541.60
15	2004	7104.00	79326.00	72222.00	902.03	10072.40	9170.42
16	2005	8014.00	79326.00	71312.00	878.11	8691.91	7813.80
17	2006	5917.00	79326.00	73409.00	559.48	7500.58	6941.11
18	2007	8858.00	79326.00	70468.00	722.76	6472.54	5749.78
19	2008	7104.00	79326.00	72222.00	500.20	5585.41	5085.21
20	2009	9658.00	79326.00	69668.00	586.82	4819.87	4233.04
21	2010	9306.00	79326.00	70020.00	487.94	4159.25	3671.31
22	2011	7630.00	79326.00	71696.00	345.23	3589.18	3243.95
23	2012	51832.00	79326.00	27494.00	2023.75	3097.24	1073.49
24	2013	33843.00	79326.00	45483.00	1140.27	2672.73	1532.46
25	2014	11636.00	79326.00	67690.00	338.32	2306.40	1968.08
26	2015	19372.00	79326.00	59954.00	486.04	1990.28	1504.24
27	2016	7104.00	79326.00	72222.00	153.81	1717.49	1563.68
28	2017	7106.00	79326.00	72220.00	132.77	1482.09	1349.32
29	2018	5541.00	79326.00	73785.00	89.34	1278.95	1189.62
30	2019	5541.00	79326.00	73785.00	77.09	1103.66	1026.57
	TOTAL	556356.00	1887320.00	1330970.00	238904.00	238904.00	0.08

UNIT = 1000 US$

Appendix 7-5-9 Simulation Test for Checking the Length of Quays for Container Vessels

One of the most important factors in determining the scale of a wharf is the number of its berths. Methods used to determine the number of berths include the following: ① Method to determine the number macroscopically by giving the standard value of handled tonnage per-meter of berth length as a postulate. ② Method to determine the number of berths by assuming the frequency of ship entries and the cargo handling capacity. ③ Method to determine the number of berths by applying queuing theory. Here, method ③ is used to check the length of quays for container vessels in this project

(1) Application of queueing theory to port planning

Ships calling at a port expect to be moored at a designated berth immediately, in the order of arrival, and carry out cargo handling. If a ship is already berthed at the quay and there is no room for the present ship to be berthed, the latter ship has to wait until after the first ship completes its cargo handling and leaves. (The ship expects to be berthed as soon as it enters a port. However, the port management body wants to minimize the number of quays in order to increase the efficiency of use of quays. How to balance these desires of both sides, namely, what service level should be set, is important in port planning.)

This phenomenon of ships arriving and leaving a port can be analyzed by queuing theory, as in the analysis of the situation at a bank, where the variables include the number of windows and the time each customer takes at the windows. Using this example of a bank, if the arrival of customers, the number of windows and the service time for customers at the windows are compared respectively to the arrival of ships, the number of berths or length of quay and the berthing time by ship, the model of ship arrivals and departures at a port is, basically, the same as the model used for the phenomenon of window service at a bank. Yet, in spite of this similarity between ships waiting at a port and customers waiting at a bank, a queuing theory unique to ports must be developed for two reasons: the difference between the arrival pattern of customers and the arrival pattern of ships,

and the difference between the service time for customers by clerks and the berthing time by ships. To this end, the pattern of ship entries and the pattern of the berthing time must be found out. Great efforts are being exerted to clarify these patterns at ports. As to the pattern of ship entries, normally it is a random Poisson curve, namely, entry time intervals are of exponential distribution.

In the pattern of the berthing time by ships as expressed by a histogram, normally there is one peak that is rather on the left side and it often conforms to an Erlang distribution in Phase 2 or Phase 3. (See Fig. A- -1).

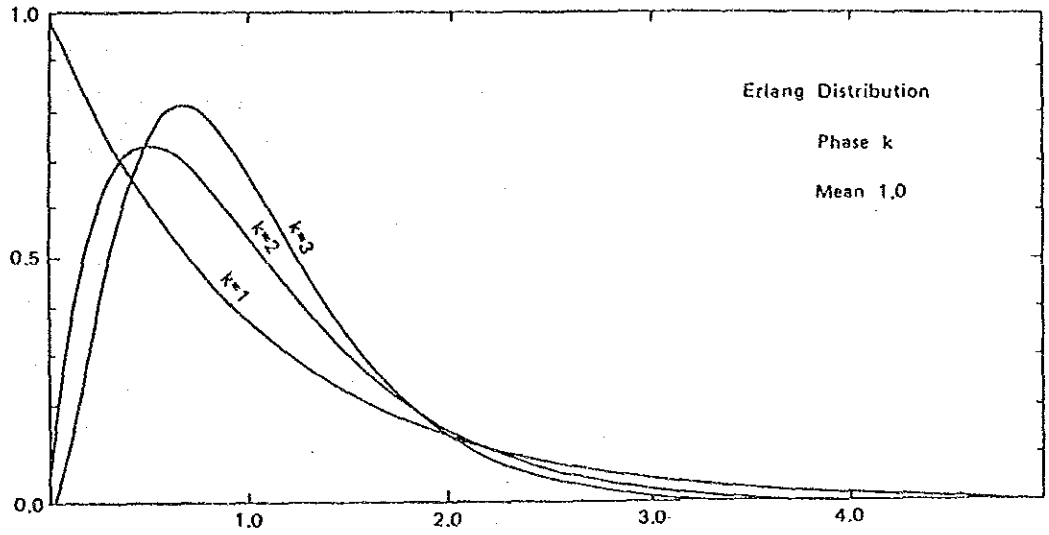


Fig. A 7-5-9-1 Erlang Distribution

As is known already, the following four factors are indispensable to the determination of the queuing phenomenon:

1 Distribution of arrivals of ships to be berthed
2 Distribution of berthing time
3 Number of berths or length of quay
4 Methods of service

Factor 4 concerns such matters as service in the order of arrival or preferential service. Normally, service in the order of arrival

predominates but, in the case of a container port, preferential service is considered for ships of main line services.

(2) Methodology of Simulation Test

Ships entering the port take a berth according to their order of arrival and then start loading/unloading work. If the berths are occupied, the ships wait until the preceding ships leave. Queuing theory has been used to make a projection concerning the situation of ships calling at or leaving the port. However, theoretical analysis alone cannot cope with the complicated reality of port activities. For this reason, a computer is used to follow the movement of ships, i.e. entering - berthing, - loading/unloading and leaving.

Input data are comprised of ship types, number of berths, frequency distribution of calling ships, and average mooring time by ship type by wharf. Out put data are comprised of the number of waiting ships, Average Waiting time by wharf and berth occupancy.

(3) Conditions of Simulation Test

1. The per-ships cargo volume (lot) and number of vessels are assumed based on actual data and the future trend of container cargo throughput.

2. The number of vessels at each wharf is calculated by the actual ratio of the number of mooring container vessels at each wharf to the total number of calling container vessels.

3. Full container vessels are moored at JCT and QCT.

4. Semi-Container vessels are moored at JCT and QEQ which includes QCT.

5. The quays are not used by berth unit. In this case, rather, the vessels occupy a certain quay length. For example, if a vessel which is 250m long is moored at a 600m long quay, the remaining available is 350m.

6. Simulation tests are excuted for 1988, 1992, 1993, 1994, 1996, 1997, 1999, 2000 and 2001.

Table A 7-5-9-1, Fig A 7-5-9-1 and Fig. A 7-5-9-2 show the simulation test input data.

Table A 7-5-9-1 Input Data of Simulation Tests

Name of Wharf	Year	Length of Wharf (m)	Kind of Vessel	Mooring hours per Vessel (hours)	Number of Mooring Vessels				
					Length of Vessels (m)				
					-120	120 -170	170 -220	220 -270	270-
JCT	1988	632			2	81	75	64	66
	1992	632			3	119	110	94	97
	1993	962			3	117	108	92	95
	1994	1,292	Vessel for		3	122	112	96	99
	1996	1,292	main line	19.0	4	143	132	113	116
	1997	1,292	service		4	152	140	120	124
	1999	1,292			5	170	156	133	138
	2000	1,292			5	179	165	141	146
	2001	1,292			5	189	174	149	154
	1988	632			86	108	22	-	-
	1992	632			188	236	47	-	-
	1993	962			203	254	51	-	-
	1994	1,292	Vessel for		218	273	55	-	-
	1996	1,292	feeder service	22.0	271	340	68	-	-
	1997	1,292			282	354	71	-	-
	1999	1,292			304	381	77	-	-
	2000	1,292			314	393	79	-	-
	2001	1,292			326	408	82	-	-
QCT	1988	450		23.0	21	215	66	-	-
	1992	450		23.0	25	132	38	-	-
	1993	450		23.0	14	142	46	-	-
	1994	450	Vessel for	23.0	18	138	54	-	-
	1996	450	main line	23.0	20	174	51	-	-
	1997	450	service	23.0	21	199	64	-	-
	1999	750		23.0	65	359	134	-	-
	2000	750		19.0	63	382	129	-	-
	2001	990		19.0	73	423	123	-	-
	1988	450		22.0	26	52	-	-	-
	1992	450		22.0	41	47	-	-	-
	1993	450		22.0	47	46	-	-	-
	1994	450	Vessel for	22.0	38	57	-	-	-
	1996	450	feeder service	22.0	82	69	-	-	-
	1997	450		22.0	85	68	-	-	-
	1999	750		22.0	185	134	-	-	-
	2000	750		22.0	188	135	-	-	-
	2001	990		22.0	164	126	-	-	-

Fig. A 7-5-9-1 Percent of Number of Vessels by Length at QCT

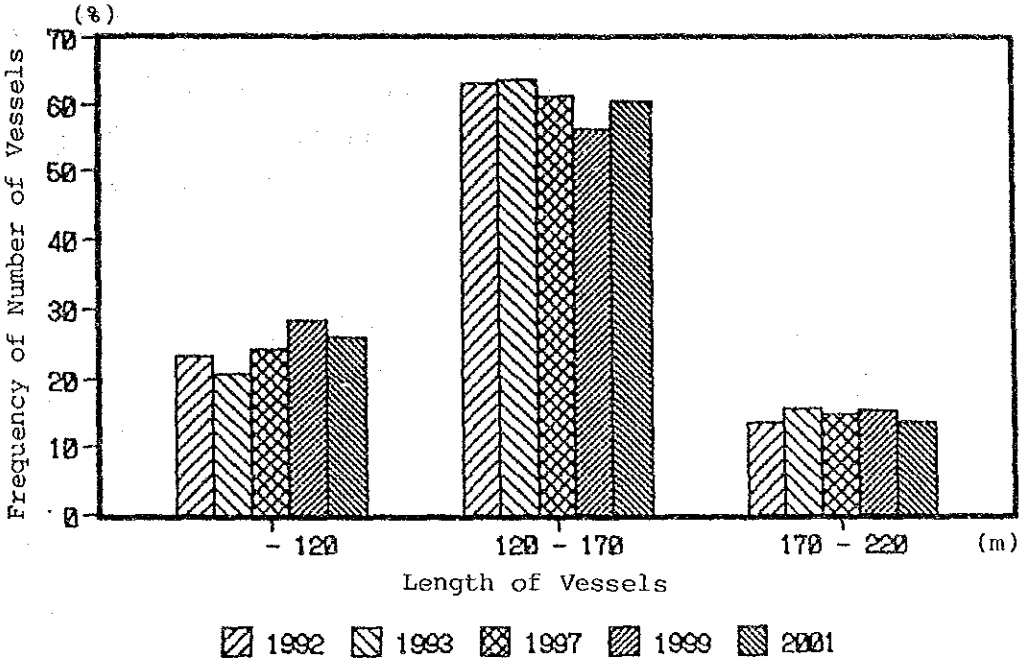
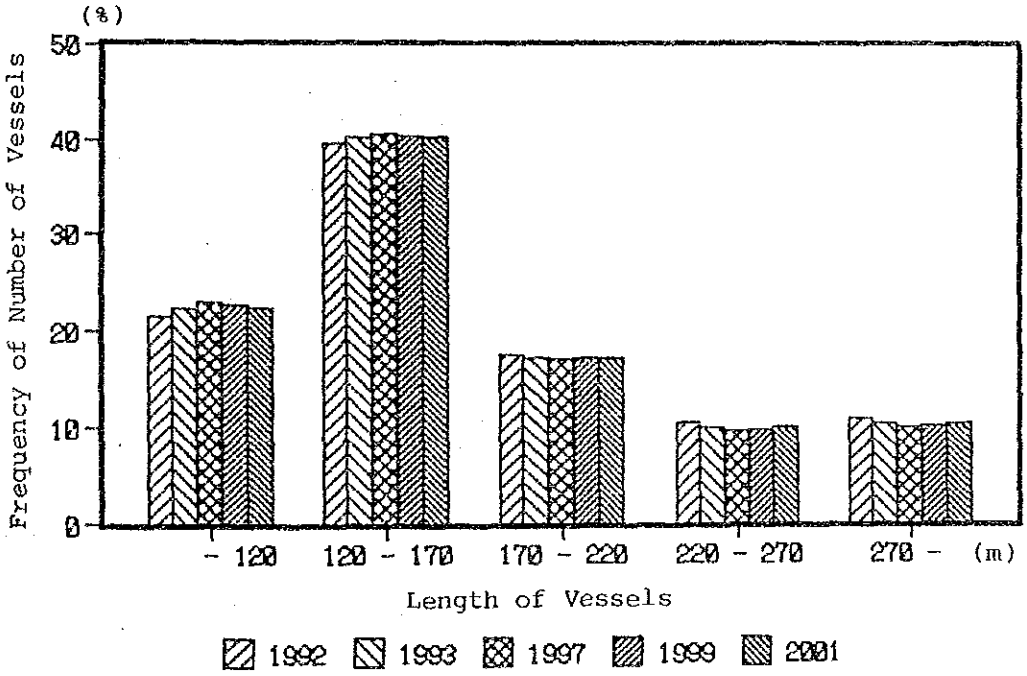


Fig. A 7-5-9-2 Percent of Number of Vessels by Length at JCT



(4) Results of Simulation Test

According to the results of the simulation tests, Fig. A 7-5-9-4 and Fig. A 7-5-9-5 show the average waiting time of total calling container vessels and the relation between the average waiting time of total calling container vessel and the berth occupancy rate.

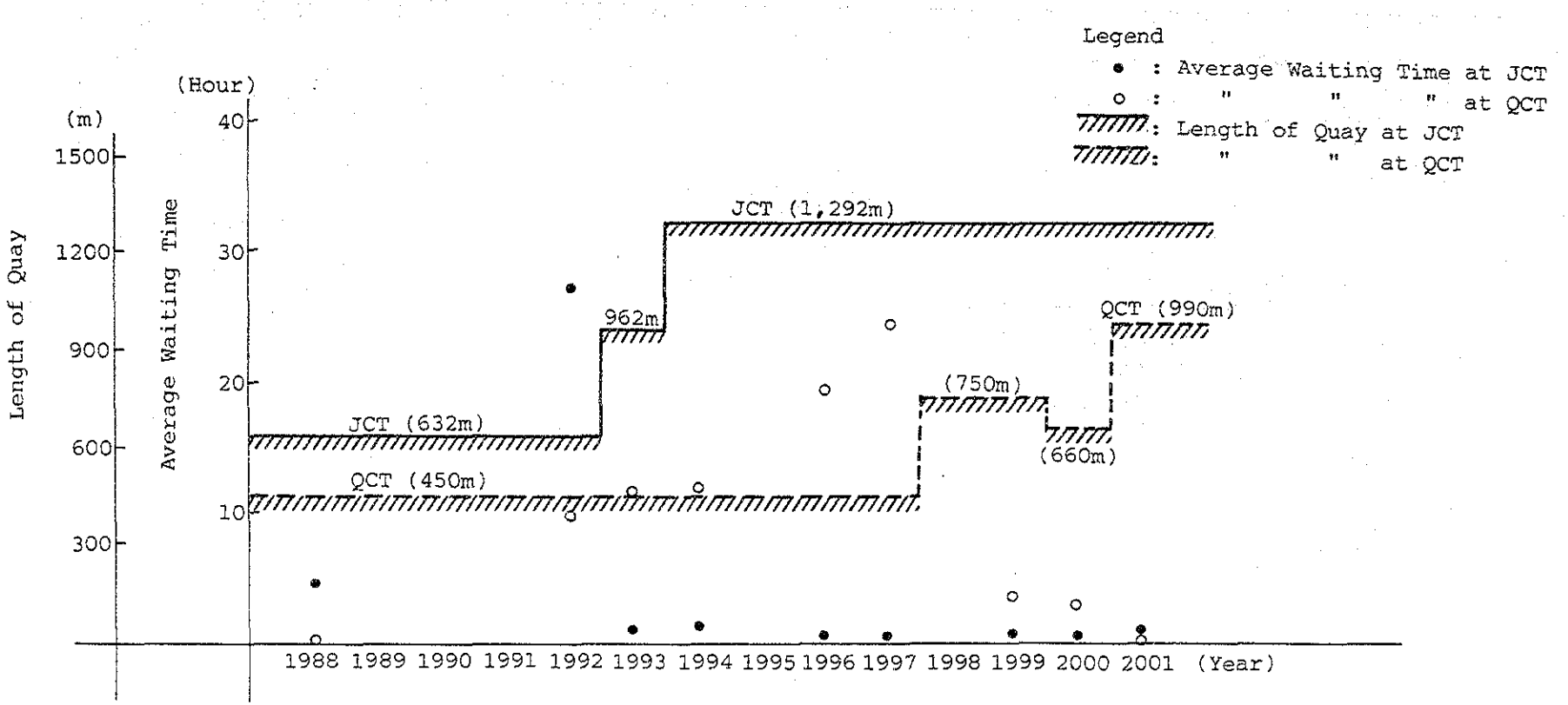


Fig. A 7-5-9-3 Average Waiting Time of Total Calling Vessels at JCT and QCT

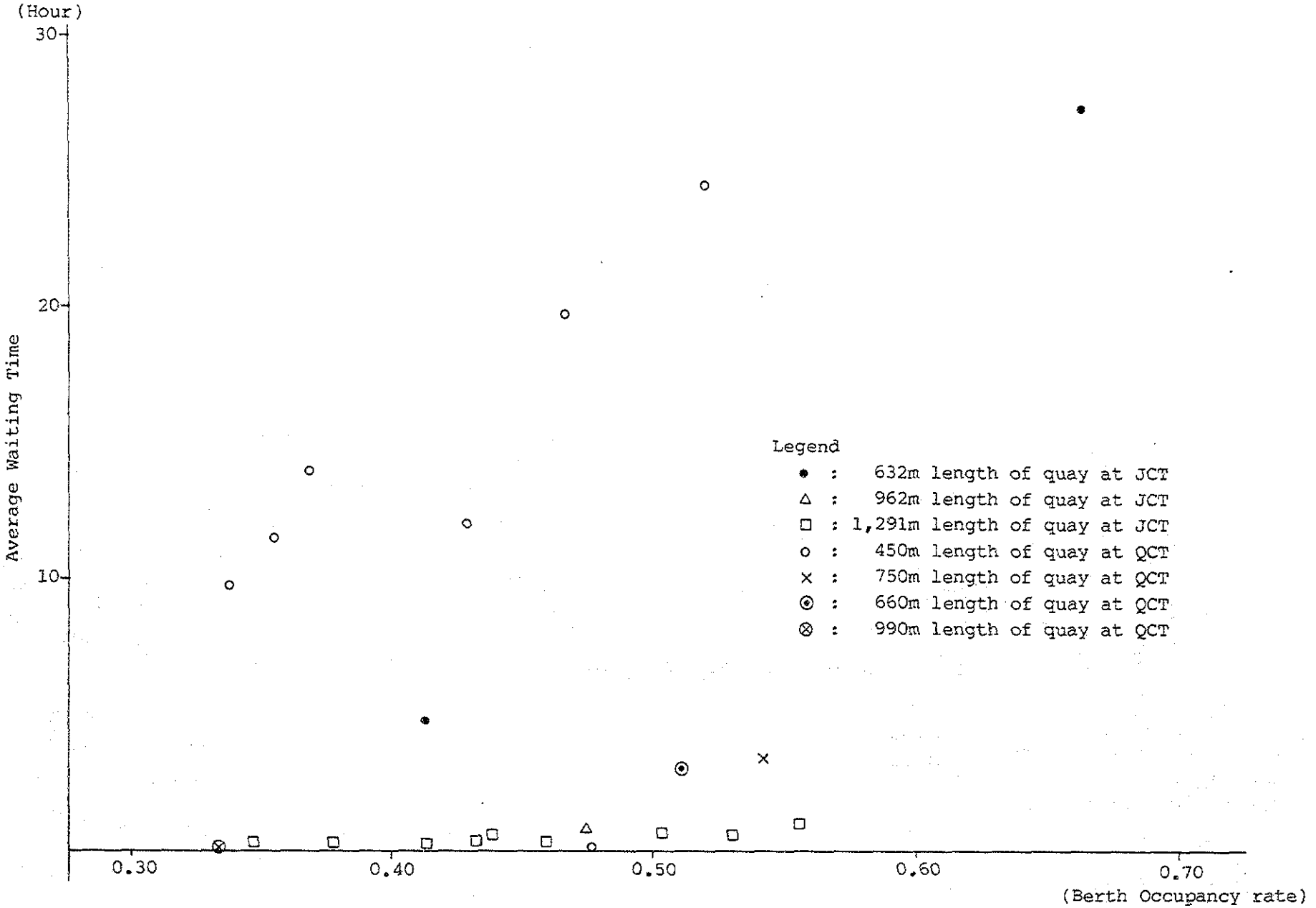


Fig. A 7-5-9-4 Relation between Berth Occupancy Rate and Average Waiting Time of Total Calling Vessels at JCT and QCT

Appendix 7-6-1 Main Charges for Container Operations at the Port of Colombo

Legend: (A) Shipping agents
(C/S) Consignees or Shippers

Charges of shifting containers from one unit to another unit (A)

01 Loaded	20'	34.90	US $
	40'	52.30	"
02 Empty	20'	26.50	"
	40'	39.75	"

Charges of supply of electricity (A)

20'	1.00	US $	per hour
40'	1.80	"	

Stevedoring charges (A)

01 Transhipment (all inclusive)	20'	51.50	US $
	40'	76.50	"

※ Loading (on carriers) is free of these charges

02 Import / Export (ship-stacking)	20'	106.70	US $
	40'	160.05	"

Charges of stuffing / destuffing (A)

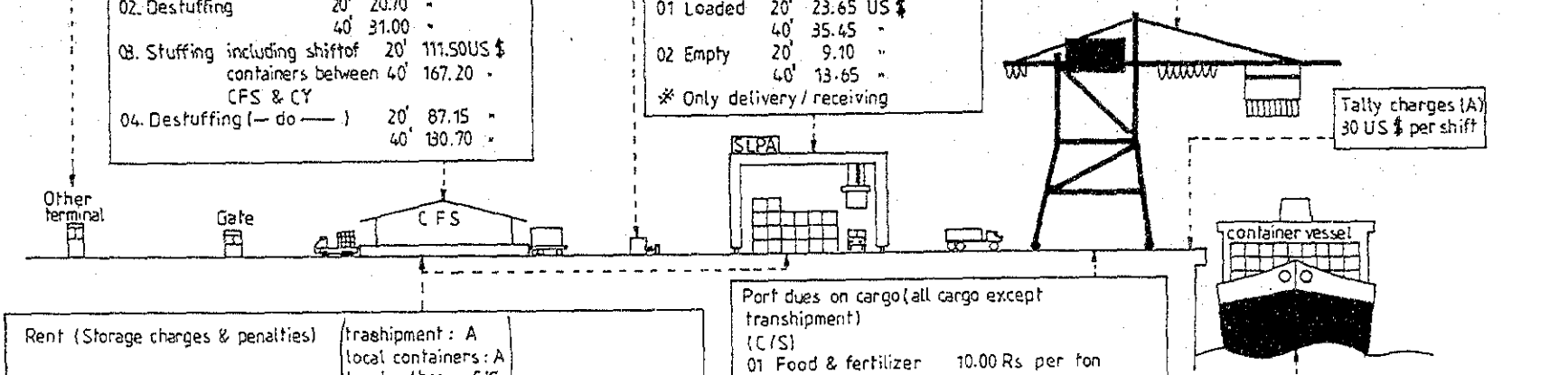
01. Stuffing	20'	11.20	US $
	40'	16.80	"
02. Destuffing	20'	20.70	"
	40'	31.00	"
03. Stuffing including shift of containers between CFS & CY	20'	111.50	US $
	40'	167.20	"
04. Destuffing (— do —)	20'	87.15	"
	40'	130.70	"

Charges of mounting / demounting to / from chassis (A)

01 Loaded	20'	23.65	US $
	40'	35.45	"
02 Empty	20'	9.10	"
	40'	13.65	"

※ Only delivery / receiving

Tally charges (A)
30 US $ per shift



Rent (Storage charges & penalties) (transhipment : A; local containers : A; local others : C/S)

01. Free time

(1) import	3	clear days (free of sat. sun. & holidays)
(2) export	7	"
(3) empty containers	3	"
(4) transhipment	28	normal days

02. Charges (in the case of the storage periods excessing the free time)

(1) Import / Export	1 ~ 7	days	6	Rs per ton. day	
	8 ~ 14	"	12	"	
	15 ~ 21	"	18	"	
	22 ~		24	"	
(2) Empty container			20'		40'
	1 ~ 31	days	6.95	US $ per day	13.85 US $ per day
	32 ~		20.75	"	41.50 "
(3) Transhipment					
(1) Loaded			5.20		10.40 "
(2) Empty	1 ~ 31	days	2.10	"	4.15 "
	32 ~ 45		6.95	"	13.85 "
	46 ~		20.75	"	41.50 "

Port dues on cargo (all cargo except transhipment)
(C/S)

01 Food & fertilizer	10.00	Rs	per ton
02 Other cargo (import)	10.30	"	
03 " (export)	10.00	"	
04 Bulk cargo (except petroleum)	5~5.15	"	
05 Cars (import)	103.00	Rs	per each
(export)	100.00	"	

Tonnage (all cargo except transhipment) (A)
0.35 US $ Per ton

Wharfage (all cargo except transhipment) (C/S)

01 Export tea	20.00	Rs	per ton
02 " coconuts products	24.00	Rs	per ton
03 Tinned food electric goods etc	0.0412	CIF value	
04 Textiles (import)	77.25	Rs	per ton
(export)	75.00	"	
05 Others (import)	41.20	"	
(export)	40.00	"	

Port dues on ship (A)

01 Entry dues (except outside harbour)	4.12	US $	per 100 G_T
02 Pilotage	4.12	"	
03 Light dues	3.09	"	
04 Professional pilotage fees			
~ 30,000 DWT AM6	23.90	US $	per movement
PM6~AM6	35.85	"	
above 30,000 DWT AM6~PM6	31.85	"	
PM6~AM6	47.78	"	
05 Dockage alongside	0.20	US $	per 100 G_T hour
06 Tug charges	145.98	US $	per tug movement

Appendix 7-6-2 Main Charges for Conventional Cargo Operations at the Port of Colombo (2)

Legend: (A) Shipping agents
(C/S) Consignees or shippers

Forklift charges (C/S)
(except direct delivery / receiving)

1. Up to 1 ton per package / pallet	Free	
2. Over 1 ton per package / pallet		
(1) Food & fertilizer	11.00	Rs per ton
(2) Others	11.33	"

Hire of forklift (A) or (C/S)
(direct delivery / receiving)

1.	Forklift up to 2.5 tons		710/40	Rs/US$ per shift
2.	"	2.5–10	285/16	per lift
3.	"	10 – 15	495/28	"
4.	"	15 – 25	745/42	"
5.	"	25 –	990/56	"

Stevedoring charges (A)

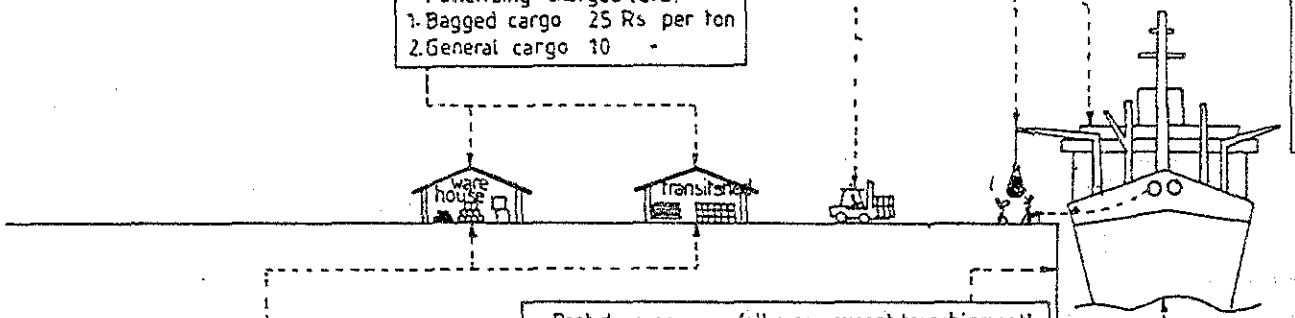
1. Import		
(1) Bagged cargo without shift gang	3.15	US$ per ton
(2) " by shift gang	5.20	"
(3) Others	3.65	"
2. Export	3.60	"
3. Bulk cargo	0.32 – 7.80	"

Palletising charges (C/S)

1. Bagged cargo	25	Rs per ton
2. General cargo	10	"

Tally charges (A)

1. Discharging		
(1) Bagged cargo	0.20	US$ per ton
(2) Others	0.40	"
2. Loading	0.35	" (M/T)
	0.40	" (W/T)



Rent (storage & penalties) (Transhipment: A, others: C/S)

1. Free time			
(1) Import	3	clear days	
(2) Export	7	clear days	
(3) Transhipment	28	normal days	
2. Charges (in the case of the storage periods exceeding the free time)			
(1) Import/Export	1 – 7 days	6	Rs. per ton day
	8 – 14	12	"
	15 – 21	18	"
	22 –	24	"
(2) Transhipment	29 days –	24	Rs per ton day

Port dues on cargo (all cargo except transhipment) (C/S)

1. Food & fertilizer	10.00	Rs per ton
2. Other cargo (import)	10.30	"
3. " (export)	10.00	"
4. Bulk cargo (except petroleum)	5–5.15	"
5. Cars (import)	103.00	Rs per each
(export)	100.00	"

Tonnage (all cargo except transhipment) (A)
0.35 US$ per ton

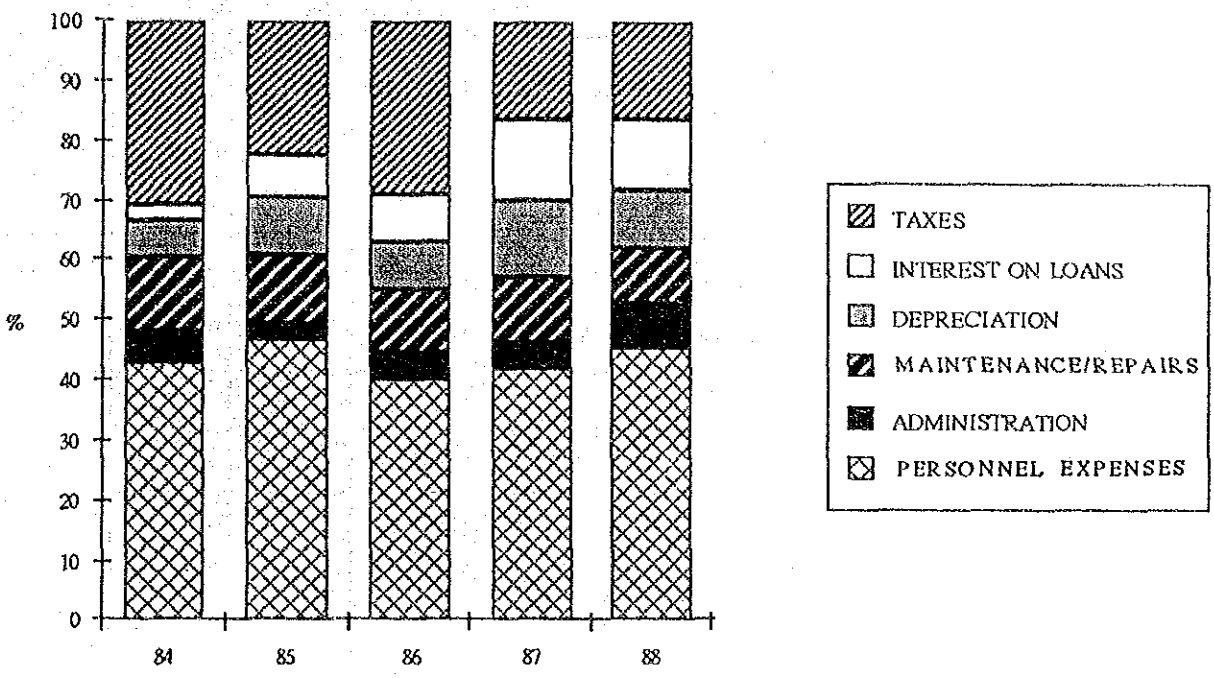
Wharfage (all cargo except transhipment) (C/S)

1. Export tea	20.00	Rs. per ton
2. " coconuts products	24.00	
3. Tinned food, electric goods, etc	0.0412	C.I.F value
4. Textiles (import)	77.25	Rs per ton
(export)	75.00	"
5. Others (import)	41.20	"
(export)	40.00	"

Port dues on ship (A)

1. Entering dues (except outside harbour)		4.12	US$ per 100 G/T
2. Pilotage		4.12	"
3. Light dues		3.09	"
4. Professional pilotage fees			
~30.000 DWT	AM6–PM6	23.90	US$ per movement
	PM6–AM6	35.85	"
above 30.000 DWT	AM6–PM6	31.85	"
	PM6–AM6	47.78	"
5. (1) Dockage alongside		0.20	US$ per 100 G/T hour
(2) Buoy berth		0.62	US$ per 100 G/T day
6. Tug charges		145.98	US$ per tug movement

Appendix 7-6-3 Share of Expenditure of SLPA



Appendix 7-6-4 Annual Cargo Handling Volume

(UNIT:CONTAINER '000TEU, OTHERS '000MT)

YEAR	CONTAINER			DRY CARGO			LIQUID BULK(EXCLUDING SPMB)		
	TRANSSHIPMENT	LOCAL	TOTAL	BREAKBULK	BULK	TOTAL	CRUDE *	OTHERS	TOTAL
1990	572	137	709	2,555	370	2,925	509	463	972
1991	668	150	818	2,498	384	2,882	524	467	991
1992	764	163	927	2,441	397	2,838	540	470	1,010
1993	860	176	1,036	2,383	410	2,793	555	474	1,029
1994	956	190	1,146	2,325	423	2,748	571	478	1,049
1995	1,052	203	1,255	2,267	470	2,737	662	491	1,153
1996	1,148	216	1,364	2,210	947	3,157	757	505	1,262
1997	1,196	242	1,438	2,191	1,000	3,191	858	519	1,377
1998	1,244	264	1,508	2,195	1,090	3,285	963	533	1,496
1999	1,238	292	1,530	2,157	1,117	3,274	1,074	549	1,623
2000	1,208	322	1,530	2,127	1,173	3,300	1,190	564	1,754
2001	1,176	354	1,530	2,089	1,222	3,311	1,312	580	1,892
2002	1,176	354	1,530	2,089	1,222	3,311	1,312	580	1,892
2003	1,176	354	1,530	2,089	1,222	3,311	1,312	580	1,892
2004	1,176	354	1,530	2,089	1,222	3,311	1,312	580	1,892
2005	1,176	354	1,530	2,089	1,222	3,311	1,312	580	1,892
2006	1,176	354	1,530	2,089	1,222	3,311	1,312	580	1,892
2007	1,176	354	1,530	2,089	1,222	3,311	1,312	580	1,892
2008	1,176	354	1,530	2,089	1,222	3,311	1,312	580	1,892
2009	1,176	354	1,530	2,089	1,222	3,311	1,312	580	1,892
2010	1,176	354	1,530	2,089	1,222	3,311	1,312	580	1,892
2011	1,176	354	1,530	2,089	1,222	3,311	1,312	580	1,892
2012	1,176	354	1,530	2,089	1,222	3,311	1,312	580	1,892
2013	1,176	354	1,530	2,089	1,222	3,311	1,312	580	1,892
2014	1,176	354	1,530	2,089	1,222	3,311	1,312	580	1,892
2015	1,176	354	1,530	2,089	1,222	3,311	1,312	580	1,892
2016	1,176	354	1,530	2,089	1,222	3,311	1,312	580	1,892
2017	1,176	354	1,530	2,089	1,222	3,311	1,312	580	1,892
2018	1,176	354	1,530	2,089	1,222	3,311	1,312	580	1,892
2019	1,176	354	1,530	2,089	1,222	3,311	1,312	580	1,892

* exclusive of volume handled at the SPMB

Appendix 7-6-5 Comparison of Depreciation System of Tangible Assets Between SLPA, Japan and UK/Europe

1 SERVICE LIFE

ASSETS			SERVICE LIFE (YEAR)		
KINDS	ITEMS	STRUCTURE	SLPA	JAPAN	UK/EUROPE
CIVIL ENGINEERING STRUCTURE	BREAKWATER, QUAYWALL	REINFORCED CONCRETE, BRICK OR STONE	100	50	35
		CONCRETE	100	30	35
		WOOD	100	10	
	BREAKWATER	SOIL	100	40	
	QUAYWALL	STEEL SHEET PILE	100	25	
	BRIDGE	REINFORCED CONCRETE	100	60	25～35
		STEEL	100	45	
		WOOD	100	15	
	PAVEMENT	CONCRETE, BLOCK, BRICK OR STONE	50	15	15
		ASPHALT	50	10	
	ROAD	CONCRETE, BLOCK, BRICK OR STONE	50	15	25
		ASPHALT	50	10	
	RAIL	STEEL	33.3	20	25
	RAIL SLEEPER	WOOD	33.3	8	
		CONCRETE OR STEEL	33.3	20	
	RAILWAY SIGNAL		33.3	30	
	RAILWAY CABLE		33.3	40	
	RAILWAY POLE		33.3	15	
	WATERWORKS	REINFORCED CONCRETE OR STONE		50	
		CONCRETE OR SOIL		30	
	SEWERAGE	REINFORCED CONCRETE OR STONE		35	
		CONCRETE OR SOIL		15	
	WALL	REINFORCED CONCRETE		30	
		CONCRETE		15	15
		BRICK		7	
		STONE		35	
		SOIL		20	
		METAL OR WOOD		10	
	DOCK	REINFORCED CONCRETE OR STONE		45	
		STONE		15	
	FLOATING DOCK	STEEL		20	
	BUOY	STEEL	8.7		
	POWER DISTRIBUTION TOWER	STEEL		50	
		REINFORCED CONCRETE		42	
	POWER DISTRIBUTION WIRE			30	
	TELEPHON WIRE			21	
ARCHITECTURE	OFFICE	REINFORCED CONCRETE	20	65	35
		BRICK OR STONE	20	50	
		METAL	20	24~45	
		WOOD OR PLASTIC	20	26	
	STORE, RESIDENCE, SCHOOL	REINFORCED CONCRETE	20	60	35
		BRICK OR STONE	20	45	
		METAL	20	20~40	
		WOOD OR PLASTIC	20	24	
	EATING HOUSE	REINFORCED CONCRETE	20	40	35
		BRICK OR STONE	20	45	
		METAL	20	20~35	
		WOOD OR PLASTIC	20	22	
	HOSPITAL	REINFORCED CONCRETE	20	47	35
		BRICK OR STONE	20	42	
		METAL	20		
		WOOD OR PLASTIC	20	18	
	SUBSTATION, POWER STATION, STATION, GARAGE, DEPOT, WAREHOUSE	REINFORCED CONCRETE	20	45	15～25
		BRICK OR STONE	20	40	
		METAL	20	20~35	
		WOOD OR PLASTIC	20	18	
	STOREHOUSE, WORKSHOP	REINFORCED CONCRETE	20	35	35
		BRICK OR STONE	20	34	
		METAL	20	18~28	
		WOOD OR PLASTIC	20	16	
	LIGHT HOUSE		20		15

ASSETS			SERVICE LIFE (YEAR)		
KINDS	ITEMS	STRUCTURE	SLPA	JAPAN	UK/EUROPE
BUILDING FITTINGS	ELECTRIC FACILITIES		13.3	15	
	WATER SUPPLY/DRAINING FACILITIES		20	15	
	AIR CONDITIONING FACILITIES		13.3	13~15	
	LIFT		13.3	17	
	FIRE FIGHTING EQUIPMENT		13.3	8	
CRAFTS	DREDGE	STEEL	10	7	10~15
		WOOD	10	5	
	TUGBOAT	STEEL	10	10	
		WOOD	10	6	
	LIGHTER	STEEL	10	12	
	BOAT	WOOD	10	8	
		PLASTIC	10	7	
VEHICLES OR CARRIAGES	LOCOMOTIVE		13.3	18	
	WAGON			20	
	TRUCK		13.3	4	6
	TRACTER		4	4	6
	TRAILER		10	4	6
	FOLKLIFT		13.3	4	6
CARGO HANDLING EQUIPMENT	CRANE, HOIST, WINCH, ETC. (MOVABLE)		4	7	6
	CRANE, HOIST, WINCH, ETC. (FIXED)		20	12	10~15
TOOL OR MACHINE	PRESS		4	2	
	CUTTER			2	
	SHIP REPAIR MACHINE			12	
	VEHICLE REPAIR MACHINE			13	
FURNITURES OR OFFICE EQUIPMENT	OFFICE DESK, CHAIR AND CABINET	METAL	20	15	
		OTHERS	20	8	
	RADIO, TELEVISION			5	
	AIR CONDITIONER			6	
	REFRIGERATOR, WASHER			6	
	CARPET			3	
	TYPEWRITER, FACSIMILE			5	
	COMPUTER, TELEPHONE			6	
	CLOCK			10	
	CAMERA			5	

2 SCRAP VALUE

SLPA 0%
JAPAN 10%

3 METHOD OF CALCULATION

SLPA STRAIGHT LINE METHOD
JAPAN STRAIGHT LINE METHOD OR FIXED PERCENTAGE METHOD

* JAPANESE DEPRECIATION SYSTEM

THE SERVICE LIFE, SCRAP VALUE AND METHOD OF CALCULATION OF ASSETS ARE FIXED UNIFORMLY ALL OVER THE COUNTRY BY INCOME TAX LAW AND CORPORATE INCOME TAX LAW.

Appendix 7-6-6 FIRR Calculation

FIRR= 0.08682045

(UNIT:1,000US$)

YEAR	REVENUE	COST			REVENUE-COST	PRESENT VALUE IN 1990		
		INVESTMENT	EXPENSE	TOTAL		REVENUE	COST	DIFFERENCE
1990		26,086	0	26,086	-26,086	0	26,086	-26,086
1991	3,651	81,101	328	81,429	-77,778	3,359	74,924	-71,565
1992	8,327	111,933	912	112,845	-104,518	7,050	95,536	-88,486
1993	13,003	34,482	4,358	38,840	-25,837	10,129	30,256	-20,127
1994	17,795	16,192	6,675	22,867	-5,072	12,755	16,390	-3,635
1995	22,471	13,004	7,035	20,039	2,432	14,819	13,216	1,604
1996	30,988	1,616	8,670	10,286	20,702	18,804	6,242	12,562
1997	35,869	1,618	8,850	10,468	25,401	20,027	5,845	14,182
1998	40,293	0	9,097	9,097	31,196	20,700	4,673	16,026
1999	43,649	463	9,308	9,771	33,878	20,633	4,619	16,014
2000	46,456	2,553	9,308	11,861	34,595	20,205	5,159	15,046
2001	49,441	3,665	9,308	12,973	36,468	19,786	5,192	14,594
2002	49,441	10,551	9,308	19,859	29,582	18,205	7,312	10,893
2003	49,441	2,116	9,308	11,424	38,017	16,751	3,870	12,880
2004	49,441	1,616	9,308	10,924	38,517	15,413	3,405	12,007
2005	49,441	2,555	9,308	11,863	37,578	14,181	3,403	10,779
2006	49,441	463	9,308	9,771	39,670	13,049	2,579	10,470
2007	49,441	3,210	9,308	12,518	36,923	12,006	3,040	8,966
2008	49,441	1,616	9,308	10,924	38,517	11,047	2,441	8,606
2009	49,441	4,265	9,308	13,573	35,868	10,165	2,790	7,374
2010	49,441	3,901	9,308	13,209	36,232	9,353	2,499	6,854
2011	49,441	2,047	9,308	11,355	38,086	8,605	1,976	6,629
2012	49,441	46,546	9,308	55,854	-6,413	7,918	8,945	-1,027
2013	49,441	29,236	9,308	38,544	10,897	7,285	5,680	1,606
2014	49,441	5,938	9,308	15,246	34,195	6,703	2,067	4,636
2015	49,441	14,336	9,308	23,644	25,797	6,168	2,950	3,218
2016	49,441	1,616	9,308	10,924	38,517	5,675	1,254	4,421
2017	49,441	1,618	9,308	10,926	38,515	5,222	1,154	4,068
2018	49,441	0	9,308	9,308	40,133	4,805	905	3,900
2019	49,441	0	9,308	9,308	40,133	4,421	832	3,589
TOTAL	1,201,881	424,343	241,393	665,736	536,145	345,239	345,239	0

Appendix 7-6-7 Financial Indicators (Sensitive Analysis)

YEAR	CASE I				CASE II				CASE III & CASE IV				
	RATE OF RETURN ON NET FIXED ASSETS (%)	DEBT SERVICE COVERAGE RATIO	OPERATING RATIO (%)	WORKING RATIO (%)	RATE OF RETURN ON NET FIXED ASSETS (%)	DEBT SERVICE COVERAGE RATIO	OPERATING RATIO (%)	WORKING RATIO (%)	RATE OF RETURN ON NET FIXED ASSETS (%)	DEBT SERVICE COVERAGE RATIO CASE III	DEBT SERVICE COVERAGE RATIO CASE IV	OPERATING RATIO (%)	WORKING RATIO (%)
1990	8.23	1.63	64.20	53.68	6.63	1.42	68.25	56.80	8.29	1.68	1.68	64.20	53.68
1991	7.21	1.69	63.26	53.32	5.94	1.44	67.22	56.21	7.39	1.74	1.77	63.24	53.32
1992	5.99	1.35	63.40	53.18	4.99	1.17	67.43	56.14	6.24	1.48	1.58	63.33	53.16
1993	4.85	1.06	71.61	55.83	3.81	0.94	75.20	58.31	4.94	1.25	1.43	71.05	55.83
1994	4.31	1.02	74.91	57.06	3.49	0.91	78.36	59.41	4.63	1.22	1.43	74.14	57.06
1995	4.93	0.86	73.02	55.86	4.07	0.78	76.36	58.16	5.30	1.02	1.16	72.27	55.86
1996	6.06	1.01	70.70	53.82	5.06	0.92	74.06	56.21	6.51	1.21	1.37	69.91	53.82
1997	7.08	1.15	68.41	52.38	5.99	1.05	71.65	54.70	7.58	1.37	1.55	67.66	52.38
1998	8.25	1.30	66.19	50.98	7.06	1.19	69.33	53.24	8.81	1.55	1.76	65.48	50.98
1999	9.33	1.45	64.29	49.63	8.04	1.33	67.33	51.83	9.94	1.73	1.96	63.60	49.63
2000	10.33	1.61	62.56	48.34	8.96	1.48	65.52	50.49	10.99	1.92	2.17	61.89	48.34
2001	11.47	1.79	60.93	47.14	10.02	1.65	63.81	49.23	12.20	2.13	2.40	60.28	47.14
2002	11.90	1.89	60.93	47.14	10.39	1.74	63.81	49.23	12.65	2.24	2.52	60.28	47.14
2003	12.33	2.00	60.93	47.14	10.76	1.85	63.81	49.23	13.11	2.37	2.66	60.28	47.14
2004	12.34	2.35	60.93	47.14	10.76	2.19	63.81	49.23	13.10	2.83	3.22	60.28	47.14
2005	12.77	2.74	60.93	47.14	11.13	2.57	63.81	49.23	13.56	3.37	3.88	60.28	47.14
2006	13.30	3.07	60.93	47.14	11.60	2.90	63.81	49.23	14.13	3.80	4.39	60.28	47.14
2007	13.26	3.37	60.93	47.14	11.54	3.20	63.81	49.23	14.06	4.19	4.84	60.28	47.14
2008	13.51	3.56	60.93	47.14	11.76	3.37	63.81	49.23	14.32	4.38	5.01	60.28	47.14
2009	13.97	3.77	60.93	47.14	12.16	3.57	63.81	49.23	14.81	4.60	5.19	60.28	47.14
2010	14.46	4.00	60.93	47.14	12.59	3.79	63.81	49.23	15.34	4.84	5.39	60.28	47.14
2011	15.21	4.27	60.93	47.14	13.16	4.05	63.81	49.23	16.03	5.10	5.61	60.28	47.14
2012	14.10	4.57	60.93	47.14	12.34	4.34	63.81	49.23	15.02	5.39	5.84	60.28	47.14
2013	13.59	4.92	60.93	47.14	11.93	4.67	63.81	49.23	14.52	5.72	6.10	60.28	47.14
2014	13.59	5.33	60.93	47.14	12.26	5.06	63.81	49.23	14.93	6.10	6.38	60.28	47.14
2015	13.99	5.82	60.93	47.14	12.32	5.52	63.81	49.23	15.00	6.52	6.68	60.28	47.14
2016	14.55		60.93	47.14	12.81		63.81	49.23	15.60			60.28	47.14
2017	15.17		60.93	47.14	13.36		63.81	49.23	16.27			60.28	47.14
2018	15.95		60.93	47.14	14.06		63.81	49.23	17.12			60.28	47.14
2019	16.76		60.93	47.14	14.78		63.81	49.23	18.00			60.28	47.14

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