CHAPTER 2 PRESENT LAND USE IN THE PORT AREA

The present land use in the Port of Colombo is shown in Fig.-II.2.1.

In the Queen Elizabeth Quay along the South-West Breakwater, there are four large berths with the length of 200 m and the water depth of −10.8 m. Each berth has its own transit shed and is used mainly for export and import of general cargo. Construction work for extending this Quay is almost completed, and containers of about 50,000 tons are currently being handled in the area between enlarged section and the No. 4 berth.

The area extending between the Queen Elizabeth Quay and the Bandaranaike Quay is called the Fort area. In this area, the passengers' landing facility, the supply and contact base to midstream berths, the landing point for lighter cargo handling, the base for supplying water to vessels, and the office buildings for customs and administration are located. The central part of the City of Colombo is located directly behind this area.

Two berths with the water depth of −10m and two berths with the water depth of −9m with transit sheds are located in the Bandaranaike Quay, and its north end is also serving as a berth with the water depth of approximately −6m. Cargo handled here consists mainly of general cargo.

There are two berths in Coaster Berths which extend from the Bandaranaike Quay to the canal entrance. Traffic across the canal at present exclusively relies upon a bridge with a single-lane road and one-way railroad which is the largest bottleneck in the existing port traffic, but an additional lane is currently under construction.

The other side of the canal, there are Baghdad and Pettah. These areas are serving as landing points for lighters with 5 transit sheds located there. Between the Baghdad and the Pettah areas is situated a boat building and repairing shop. It has a patent slip and a small slip. Also, a repair shop for buoys, etc. is located on the south side of the road behind the Pettah area.

Moving further to the north along the shoreline, there is a woodwork shop and a boat building and repairing shop having 4 slips for small boats near the Block Jetty. At the north of this area is the Kochchikade with one transit shed which is being used as a landing point for lighters and, at the same time, as a landing area for cargo of sailing crafts that sail to and from India. At the north of this area, the Navy Headquarter is located. Around this is the narrowest area in the Port, since the lot of a church occupies the eastern part of this area.

Facing the Barge Repairing Basin surrounded by the Navy's jetty and the Protection Pier, there is a total of 14 small slips on the north and the east shores of the Basin where boat building and repairing shops for lighters and small boats are located.

In the north of the Barge Repairing Basin, 18 jetties called the Coaling Jetties or the Seventeen Fingers are located, but lie idle except for mooring small ships since the import of coal was discontinued. The land area behind these jetties is currently vacant at its central to southern parts but is planned to be used as a space for storing empty containers. At its northern part, there are five transit sheds, and they are being used for storage, mainly of fertilizer.

From the northernmost part of the Coaling Jetties to the area adjoing to the North Guide Pier, there are threee dry docks owned by the Colombo Dockyard Ltd.; one 6,000 DWT dry dock called the New Dock between 16th and 17th jetties; one 30,000 DWT dry dock called the

Graving Dock adjacent to the North Guide Pier; and one 6,000 DWT dry dock called the Inner Dock at the east of the Graving Dock. A machine shop owned by Walker Sons & Co., Ltd., a private firm, is located behind the northern part of the Coaling Jetties adjacent to these docks. Its function is presently not related to the Dockyard nor the Port. The rent agreement for this land has been renewed every year and it is expected that the lot be returned to the Ports Authority very soon.

The North Guide Pier was originally used as a ship repair pier but is currently being used for cargo handling. Imported foods and general cargo are mainly handled at the North Guide Pier together with the South Pier, the north side of this Pier.

The North Pier facing to the South Pier is accommodated pipelines and is currently being used for importing crude oil. The north side of the North Pier is a sloped rubble revetment which functions to prevent agitation due to waves coming through the north entrance of the Port.

There is a small jetty called the South Jetty between the North Pier and the Prince Vijaya Quay which is the northernmost quay of the Port. Currently, it is used as the base for oil supply to vessels. There is an idle area behind the North Pier, and a transit shed at the area adjoing to the of Prince Vijaya Quay. This shed is being used by the Food Corporation for storing foods.

In addition to this, there are two other transit sheds in the Prince Vijaya Quay. The Quay is mostly being used for foods.

Though the railway is connected to almost all of the quays and piers in the Port, the amount of cargo transported by the railway is only 100,000 tons in 1978, consisting mainly of bag cargo such as foods and cement. The railway is thus used only at quays and piers for bulk cargo. The railway enters the Port through the Blomendahl Railway Gate located in the east of the Inner Dock.

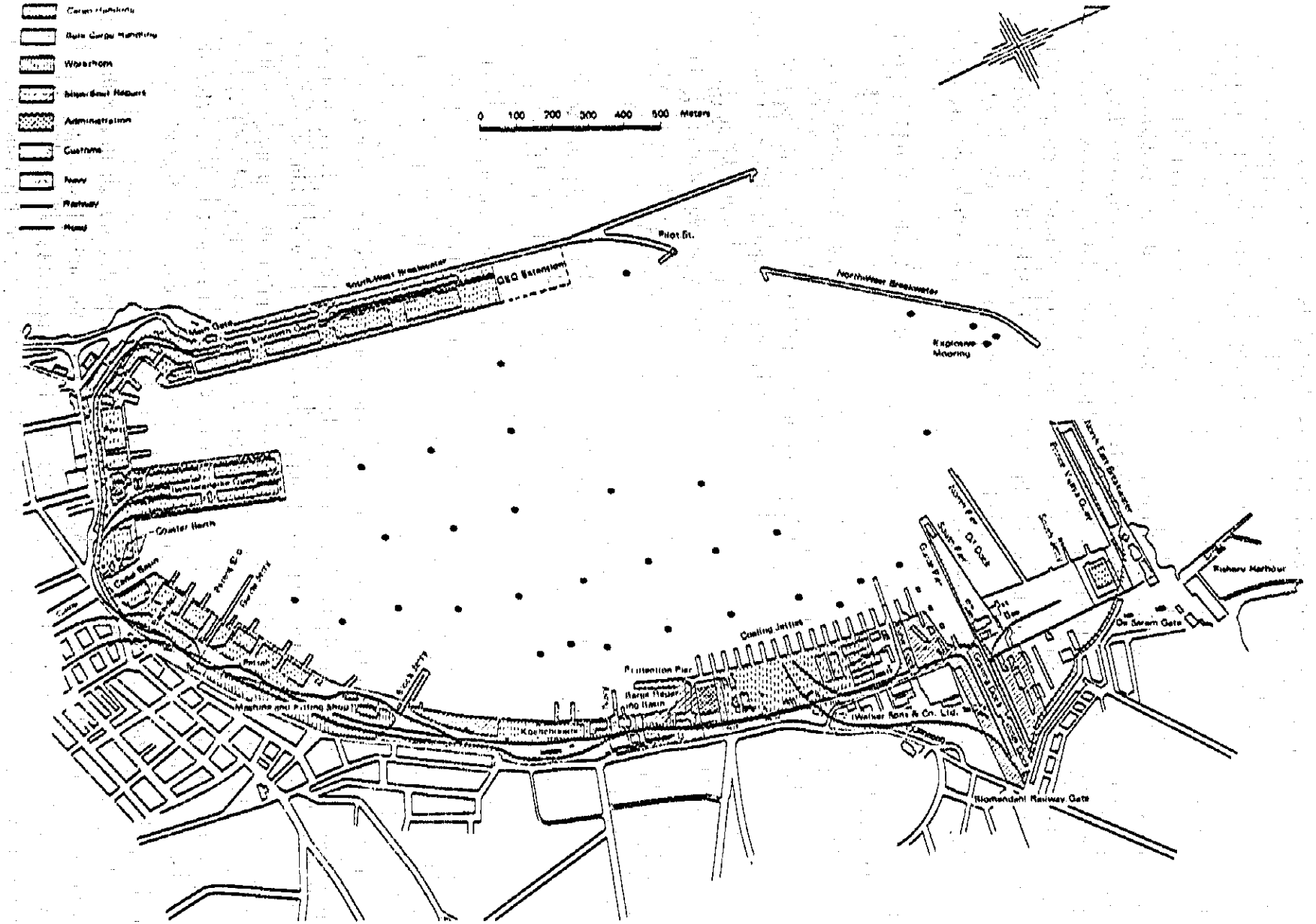
Roads in the Port function as major means of transport within the Port and as those between the Port and the city. The gates of the road network to the city are located at 8 places including the Main Gate at the area adjoining to the Queen Elizabeth Quay. The gates that are used frequently for cargo delivery are; the Main Gate and the De Saram Gate behind the Prince Fijaya Quay. At the time of the survey for the present study, the Urban Development Authority already had a plan for extending a new road to the east starting from a point near the existing Blomendahl Railway Gate as the road for connecting the Port to its service area, and strongly requested the team to adopt this route.

The Beira Lake is located in the south of the Port of Colombo and connected to the Port with a canal. The Beira Lake consists of three lakes of the East Lake, the West Lake and the South-West Lake, and they are connected to one another by channels. The West Lake and Sough-West Lake are being used as a park and other recreational purposes, that is, an environmental conservation. Facing to the East Lake, there are two repairing shops providing repair works for steel and wooden barges respectively at the center of the south shore of the lake. Many transit sheds are located along the north shoreline for storing foods and tea, thereby function as a lighter landing point, but actually they are scarcely being used because the canal was closed for about one year due to repairing of the canal lock. The Urban Development Authority is hoping to use the Beira Lake for the purpose of environmental conservation.

The current status in the land use in the Port of Colombo has been stated above. Because of the port itself being founded many years ago, the width of the quays is generally narrow and

spaces for open storage yard or freight handling yard are barely available. For these reasons, imported cars are placed in many areas, by which the small port area is further reduced resulting in traffic congestion at many points. On the other hand, boat building and repairing facilities having similar functions are dually located and the Coaling Jetties area, after discountinuing coal handling, is idle, all of which indicates the necessity of more adequate and effective land use in the Port.

Fig. – II.2.1 Current Land Use in the Port



CHAPTER 3 PORT FACILITIES

3-1 Berthing Facilities

Existing berthing facilities can be classified into an alongside berth and a midstream berth. Lists for each type of facility are given in Table II.3.1(a) and (b) respectively. The "length", the "water depth" and the "maximum vessels" in the tables are arranged in accordance with the technical standards currently used in Japan. For reference, the standard sizes of alongside berths, of general cargo vessels and of oil tankers are shown in Tables-II.3.2(a) to (c)

The summary of facilities is as follows:

	No. of berths	Total length(m)
Alongside Berth (excluding #5 of QEQ):	17	2,855
Breakdown:		
Large (water depth: 7.5m or more):	14	2,610
Small (water depth: less than 7.5m):	3	245
Breakdown:		
Dry cargo berth:	16	2,630
Oil berth:	1	225
Midstream berth:	23 to 25	
Breakdown:		
SW monsoon:	23	
NE monsoon:	23	

3-2 Cargo Handling Equipment

Cargo handling equipment owned by the Sri Lanka Port Authority is shown in Table-II.3.3. As apparent from this table the equipment is generally very old and considerably superannuated. This and the difficulty in obtaining parts of repairing exacerbate a low machine operation rate and increase the shortage in the number of cargo handling equipment. For instance, it was noticed at the time of the survey (as of June 1979) that the percentage of machines being repaired to all machines owned is 36% for forklift trucks and 56% for mobile cranes. Meantime, there are 298 wooden and steel lighters of more than 20 years old, 156 of which are not in commission at the time.

Approximately one portal wharf crane is installed per main alongside berth and they are used for cargo handling together with ship's derricks. Loading/unloading cargo is mainly performed alongside berths but partly performed by lighters at mid-stream berths in the Port. Loading/Unloading of these lighter cargo is performed by wharf crane or mobile crane installed at the lighter berth. Forklift is used for cargo handling and/or transporting cargo to/from transit

shed and warehouse, or for cargo handling in ship's hold, but their use remains a supplementary method of handling cargo and most of cargo handling is performed by hand work. Floating cranes which are steam-type cranes older than 30 years are used for maintenance and repair work for port facilities and for handling heavy cargo. It is pointed out by the Sri Lanka Ports Authority that their efficiency is poor with insufficient lifting capacity.

The Sri Lanka Ports Authority owns a repair shops for these cargo handling machines within the port area and performs maintenance and repair work by itself. It is generally said that, in the case for transporting vehicles such as forklifts, to buy a new one is more economical than to use one older than 8 ~ 10 years with maintenance and repair. It is observed that many forklifts and mobile cranes at the repair shop barely show their original shapes because of overhaul for major repair and it is felt that many of cargo handling machines owned by the Sri lanka Ports Authority should be replaced with new ones.

3-3 Present Situation of Facilities related to Wet Cargo

3-1-1 Cargo handling facilities

At present, North Pier and South Pier are used for handling of crude oil and refined oil. However, South-Pier is only used occasionally. In addition, South Jetty is used for bunkering. The layout of these facilities is shown in Fig.-II.3.1.

The piers used for oil handling were constructed in 1949 to 1954, and the water depths in front of them and the maximum drafts of tankers are as follows.

	Depth	Ship's Draft	Length of Pier
North Pier	36'	34'	1250'
South Pier	35'	32'	900'

The north side of North Pier forms a rubble-mound slope and does not allow berthing. These facilities are used mainly for crude oil, and also for the import and export of refined oil (see Tables-II.3.4 - II.3.6)

3-3-2 Refinery, etc.

The alignment of pipelines, and the location of refinery and distribution station are shown in Fig.-II.3.2.

The refinery was constructed in 1969 and is located about 10 miles inland from the Port. Its capacity is described below.

Area	:	160 acre
Total capacity of storage tanks (4 Nos.)	:	160,000 tons (actual capacity, 130,000 tons)
Total capacity of refined oil tanks	:	225,000 tons
Ground height	:	M.S.L. + 86'
Max. oil level height	:	G.L. + 13.68m

Refining capacity	: 38,000 Barrels/day (1,800,000t/Year)
Working days	: 330 days/year

An additional crude oil tank is being constructed.

The refinery is located in the industrial complex, together with fertilizer and chemical fiber factories which are being constructed. When they are in full operation, it is expected they will consume all the naphtha now exported and when this will be insufficient a small amount will have to be imported.

The distribution station is located 4 miles inland from the Port, and transports refined oil to 12 depots allocated over the country. Of these depots, the products are transported to the Trincomalle and Galle depots, by coastal tankers, and to the others, by road or rail. Dimensions of pipelines and pumps are as follows.

PIPELINES

(1)	Crude Oil	24" dia.	42653 ft. capacity	1300 tons per hr.
(2)	Naphtha	12 3/4"	20390	500
(3)	Fuel Oil	14"	20615	500
		10"	23223	225
(4)	White Oil	10"	20600	250
(5)	Gas Oil	10"	21523	250
(6)	Base Oil	8"	3960	200

PUMPS

(1)	Crude Oil Booster Pumps	2 x 250 BHP
(2)	Gas Oil pumps	2 x 110 BHP
(3)	White oil pumps	1 x 200 BHP
(4)	Fuel Oil pumps	1 x 550 BHP

Ships to shore connections – 8" & 10" diameter flexible hose connections at a maximum working pressure of 200 psi.

3-3-3 States of Operations

Cargo handling statistics of crude oil and refined oil are shown in Table-II.3.4, and the quantity of refined oil is given in Table-II.3.5. Table-II.3.6 shows volume of crude oil handled and number of tankers called. Table-II.3.7 shows the sizes of the tankers which called in 1978.

According to them, 60 to 70 tankers called the Port per year and an average 30,000 tons of crude oil per tanker was handled, with a berthing time of 2 to 3 days. Thus, the berth occupancy of the North Pier only for crude oil was

1978 : $2.5 \times 46/365 = 0.32$

77 : $2.5 \times 49/365 = 0.34$

When the refinery is in full operation, the occupancy based on (1,800,000 tons/30,000 tons per tanker =) 60 tankers will be

$$2.5 \times 60/365 = 0.41$$

showing some allowance compared with the limit of 50 to 60% usually taken.

Sizes of tankers now in operation are as follows.

The rates of imported crude oil by oil producers and the sailing days of tankers are as follows.

	DWT	GRT	L.O.A.	LPP	Beam
Max.	43695	29940	692'	669'	92'
Mean	30926.5	18684.4	616.9'	586.6'	80.7'

	Share	Sailing Day	Loading & Unloading
Saudi Arabia	48%	14 days	4 days
Iran	28	14	4
Iraque	14	14	4
Libia	10	24	4

Sri Lanka presently possesses one tanker the Tammanna, and others are chartered. The transportation cost is as shown below.

Shipping Cost

50%	World Scale	125
25%	"	165
25%	"	200
	Average World Scale	153.75

Furthermore, coconut oil, too, is handled by pipe, and in 1978, about 23,000 tons were exported. In this study, the improvement of the coconut oil handling facilities was not included, as the volume handled is small together with the higher safety of the cargo handling.

3-4 Transit Sheds and Warehouses

The locations, floor areas and main uses of transit sheds and werehouses are shown in Table-II.3.8. These transit sheds and warehouses are located behind alongside berths or lighter berths and used for storage and handling of import-export cargo. However, PVQ Warehouse 1 & 2, the Hangers Warehouse 1, 3 & T2, and the Repository Warehouse are occupied on a long-term basis as storage space for imported fertilizers and foods so that they do not fulfill the functions of transit sheds as port facilities.

Transit sheds and warehouses of the Queen Elizabeth Quay, the Bandaranaike Quay and the Prince Vijaya Quay are used to handle import-export cargo loaded to/unloaded from berthed ships, and other remaining transit sheds and warehouses are normally used for handling cargo loaded to/unloaded from lighters. There are special transit sheds and warehouses being allocated

separately from ordinary ones for storing special cargo such as duty free cargo (Bonded Warehouse), liquor (T3 Warehouse), cargo waiting long time for collection by consignees (Delft Warehouse), and cargo to be auctioned by customs because of unknown consignee or rejection of collection by consignee (F1 Warehouse). There are no statistic data for conditions of use of transit sheds and warehouses, such as the average turnround of cargo, amount of cargo handled per unit etc. But according to the Sri Lanka ports Authority, imported cargo is mostly delivered to receivers within two weeks after unloading (within 3 to 7 days on the average). The cargo unloaded at the Queen Elizabeth Quay and the Bandaranaike Quay and stored in transit sheds are transfeered to the Delft Warehouse if not taken by the consignee within a week, and are sold at auction by customs if not taken within another month.

Since stacking cargo in the transit sheds is mainly done by hand work, the present stacking height is limited 1 to 1.5 meter except in the case of bagged cargo such as foods, fertilizers and cement, which results in uneffective use of storage spaces.

Existing transit sheds and warehouses are all old and some of their roofs leak due to deterioration (particularly, those located in Fort district), but they may be used for some more years if sufficient repair, maintenance and management work is performed.

For open storage area, there is unpaved land at the Coaling Jetties,at behind the Queen Elizabeth Quay Warehouses No. 1 to 4 and at near the North Pier. The Queen Elizabeth Quay area is fully utilized as a storage area for unloaded vehicles and containers but the other two areas have not been used as open storage area and levelling of ground is being conducted.

3-5 Inside-port Road

The layout of the roads in the Port of Colombo is shown in Fig.-II.3.4. The road on Queen Elizabeth Quay is of sufficient width but is not laid out adequately due to the existing port facilities and cargo yards spotted here and there. A bridge crossing over the canal to Beira Lake is built at Point D, but it has a width of only one lane and is used jointly with the railway so is being extended for one more lane by bridging. At Point E the existing quarantine facilities, transformation station and control facilities are gathered and the road detours them at a sharp angle. Between Points A-B, a road width of about 4 lanes is securable, but between Points B-C, the road is very narrow with no allowance on each side so that only about 2 lanes are available. The road in Area F is newly constructed and adequate in both width and alignment. Point G is a bend encompassing the dry dock and is of narrow width. 8 Gates to the outside area are installed, but there are only two currently used for transport of port cargo, they are, gates b and h in Fig. II.3.4.

The inside-port railway are laid to all the wharves, except North Pier but it is obsolete and used only for the transport of foods and sundry goods at Bandaranaike Quay and Prince Vijaya Quay.

Transport statistics of port cargo by railway are shown in Table-II.3.9. The railway transport had decreased from 270,000 tons in 1975 to 100,000 tons in 1978, and its share is negligible when measured against the road.

Barges are used for the transport mainly of black tea, wheat, etc. through sheds installed around Beira Lake, but their share is very low.

The factors of the road, tunnels and bridges in the port are shown in Table-II.3.10 and Fig.-II.3.4. As seen, the road width is particularly narrow, about 8–10 m, in the section from the Guide Jetty to the Barge Repairing Basin.

3-6 Breakwaters and Approach Channel

The Port of Colombo is sheltered from the sea by three breakwaters. The South-West Breakwater extending from the southern end of the Port to the north is the oldest breakwater built with rectangular concrete blocks stacked obliquely for which the construction work commenced in 1875. The Queen Elizabeth Quay lies along the Breakwater and the Breakwater itself is the rear seawall of the Quay. There is 1,800 feet extension to the north starting from a point about 3,000 feet measured from its starting point. The original extension is 4,212 feet from the southern end to the present pilot station.

The Southern end of the North-West Breakwater is 800 feet to the north away from the pilot station. The Breakwater is an isolated breakwater built with rectangular concrete blocks stacked obliquely the same structure as the South-West Breakwater. Its total length is 2,670 feet. The inside of the part of this breakwater near the northern end is presently being used for explosive moorings.

The North-East Breakwater starts from a point 610 feet to the east away from the pilot station on the tip of the North-West Breakwater and presently serves as rear seawall for PVQ.

The Port entrances are located at the west and the north of the Port and the main channel runs in the West Entrance. The West Entrance has a width of approximately 190 m, but width of the waterway is considered to be only about 150 m in consideration of the clearance at each side. However, the large vessels that call this port at present are 30,000 to 40,000 DWT tankers. A tanker of this class have a length (L) of 200 meters so that the present width of waterway has only 0.75L at the most, which creates a safety problem.

The North Entrance is narrower than the West Entrance and laid out in such a manner that a vessel entering or departing to and from the Port is likely to receive lateral wind during SW monsoon season and to drift toward the shore. This entrance is not used often.

Since midstream berths are located almost all over the Port, not enough allowance for the waterway and the turning basin is available. A vessel coming into the Port cannot go further than a distance of about 2L after entering the sheltered area. And immediately after entering into the Port, it should turn with the aid of tugboats. This also creates another safety problem in maneuvering.

Table – II.3.1 (a) List of Facilities, Existing Alongside

Quays, Piers & Berths	Length in Meters (Feet)		Depth in Meters (Feet)	Max. Vessel (DWT)	Notes
	Waterfront	Berth			
QEQ	1,150 (3,773)	1,080 (3,543)			
#1		210 (689)	11.0 (36.1)	20,000*1	*1 About 75% of cargo vessels in the 20,000 DWT class can be accommodated.
#2		210 (689)	11.0 (36.1)	20,000	
#3		210 (689)	11.0 (36.1)	20,000	
#4		210 (689)	11.0 (36.1)	20,000	
#5*2		240 (787)	11.0*3 (36.1)	30,000	*2 Under construction.
BQ	940 (3,084)	805 (2,641)			*3 Desirably 12.0 m (39.4 feet) or more for 30,000 DWT cargo vessels.
#1 (West)		165 (541)	9.0 (29.5)	10,000	
#2 (West)		165 (541)	9.0 (29.5)	10,000	
#3 (North)		105 (344)	6.0 (19.7)	3,000	
#4 (East)		185 (607)	10.0 (32.8)	15,000	
#5 (East)		185 (607)	10.0 (32.8)	15,000	
CB	200 (656)	140 (459)			
#1		70 (230)	5.0 (16.4)	1,000	
#2		70 (230)	5.0 (16.4)	1,000	
PVQ	370 (1,214)	330 (1,083)			
#1		165 (541)	9.0 (29.5)	10,000	
#2		165 (541)	9.0 (29.5)	10,000	
NP	370 (1,214)	225 (738)			
#1		225 (738)	11.0*4 (36.1)	30,000 (Tanker)	*4 Desirably 11.5 m (37.8 feet) or more for 30,000 DWT tanker.
SP	280 (919)	185 (607)			
#1		185 (607)	10.0 (32.8)	15,000	
NGP	360 (1,181)	330 (1,083)			
#1		165 (541)	9.0 (29.5)	10,000	
#2		165 (541)	9.0 (29.5)	10,000	
Dry Cargo Berth Total	3,300(10,827)	2,870 (9,416)			
Oil Berth Total	370 (1,214)	225 (738)			
Alongside Total	3,670(12,041)	3,095(10,154)			

Table – II.3.1 (b) List of Facilities, Existing Midstream

Midstream Berths	No. of Berth	
	Large	Small
Midstream (SW Monsoon)	19	1
36'	10	0
33'	6	0
30'	3	1
Midstream (NE Monsoon)	19	3
36'	6	0
33'	8	2
30'	5	1
Inside NW Breakwater (SW/NE Monsoon)	3	0
36'	3	0

Table – II.3.2 (a) Standard Size of Alongside Berth

Length (m)	Depth (m)	Vessels (DWT)
60	4.5	700
70	5.0	1,000
90	5.5	2,000
105	6.0	3,000
130	7.5	5,000
165	9.0	10,000
185	10.0	15,000
210	11.0	20,000
240	12.0	30,000
270	13.0	50,000

Source: Technical Standards for Port Facilities in Japan, MOT, Japan

Table – II.3.2 (b) Standard Size of General Cargo Vessels

DWT	Overall Length m (feet)	Molded Width m (feet)	Molded Depth m (feet)	Draft in Full Load, m (feet)
700	51 (167)	8.5 (27.9)	4.6 (15.1)	3.8 (12.5)
1,000	58 (190)	9.5 (31.2)	5.1 (16.7)	4.2 (13.8)
2,000	74 (243)	11.7 (38.4)	6.3 (20.7)	5.1 (16.7)
3,000	86 (282)	13.2 (43.3)	7.2 (23.6)	5.9 (19.4)
4,000	95 (312)	14.4 (47.2)	7.8 (25.6)	6.4 (21.0)
5,000	103 (338)	15.4 (50.5)	8.4 (27.6)	6.8 (22.3)
6,000	124 (407)	16.9 (55.4)	9.5 (31.2)	7.2 (23.6)
7,000	129 (423)	17.6 (57.7)	10.0 (32.8)	7.5 (24.6)
8,000	135 (443)	18.3 (60.0)	10.4 (34.1)	7.8 (25.6)
9,000	139 (456)	18.9 (62.0)	10.8 (35.4)	8.0 (26.2)
10,000	144 (472)	19.4 (63.6)	11.2 (36.7)	8.2 (26.9)
15,000	162 (531)	21.7 (71.2)	12.7 (41.7)	9.1 (29.9)
20,000	177 (581)	23.4 (76.8)	13.8 (45.3)	10.0 (32.8)
30,000	199 (653)	26.1 (85.6)	15.7 (51.5)	11.0 (36.1)
40,000	217 (712)	28.3 (92.8)	17.2 (56.4)	11.9 (39.0)
50,000	232 (761)	30.0 (98.4)	18.4 (60.4)	12.7 (41.7)

Source: Technical Standards for Port Facilities in Japan, MOT, Japan.

Table – II.3.2 (c) Standard Size of Oil Tankers

DWT	Overall Length m (feet)	Molded Width m (feet)	Molded Depth m (feet)	Draft in Full Load, m (feet)
700	50 (164)	8.5 (27.9)	4.0 (13.1)	3.7 (12.1)
1,000	57 (187)	9.4 (30.8)	4.5 (14.8)	4.2 (13.8)
2,000	73 (240)	11.4 (37.4)	5.6 (18.4)	5.1 (16.7)
3,000	85 (279)	12.8 (42.0)	6.4 (21.0)	5.9 (19.4)
5,000	102 (335)	14.7 (48.2)	7.6 (24.9)	6.9 (22.6)
10,000	139 (456)	19.0 (62.3)	9.9 (32.5)	8.1 (26.6)
15,000	157 (515)	21.7 (71.2)	11.3 (37.1)	9.0 (29.5)
20,000	171 (561)	23.8 (78.1)	12.4 (40.7)	9.8 (32.2)
30,000	194 (636)	27.2 (89.2)	14.1 (46.3)	10.9 (35.8)
40,000	211 (692)	29.9 (98.1)	15.4 (50.5)	11.7 (38.4)
50,000	226 (741)	32.1 (105.3)	16.5 (54.1)	12.5 (40.0)
70,000*	250 (819)	35.9 (117.8)	18.4 (60.4)	13.6 (44.6)
100,000*	270 (886)	39.0 (128.0)	19.2 (63.0)	14.6 (49.7)
150,000*	291 (954)	44.2 (145.0)	23.0 (75.5)	17.9 (58.7)
200,000*	325 (1,065)	47.2 (154.9)	24.5 (80.4)	19.0 (62.3)
250,000*	348 (1,141)	51.8 (169.9)	25.6 (84.0)	20.0 (65.6)

*More than 800 feet in length

Source: Technical Standards for Port Facilities in Japan, MOT, Japan

Table – II.3.3 List of Cargo Handling Equipment (1979)

Equipment	Capacity (Tons)	Quantity			
		Total	Over 20 years	Over 10 years	Under 10 years
Forklift Trucks	2~2.5	71*	7	23	41
	6	2	–	–	2
	10~12	3	–	–	3
	25	2	–	–	2
Mobil Cranes	2~4	20	15	5	–
	10	5	–	5	–
Portal Wharf Cranes	3	1	1	–	–
	6	19	19	–	–
Wharf Cranes	1.5~3	13	13	–	–
Floating Cranes	60	2	2	–	–
Platform Trucks	2	37	37	–	–
Lighters	20~80	298	298	–	–

(Source: SLPA)

* Including 18 units on order.

Table – H.3.4 Oil Statistics

Crude Oil Imports

1970	1,833,632 M. Tons.
71	1,547,548
72	1,770,350
73	1,720,355
74	1,550,190
75	1,457,267
76	1,439,374
77	1,520,200
78	1,457,122

Imports of Refined Products – M. Tons.

	1976	1977	1978
Motor Gasoline		2,191	3,675
Aviation Turbine Fuel		5,010	46,101
Aviation Gasoline		1,014	–
Auto Diesel		21,807	60,310
Kerosene		23,501	13,152
Xylene		285	297
		53,808	123,535

Exports of Refined Products M. Tons.

	1976	1977	1978
Fuel Oil		58,840	87,347
Naptha		99,307	74,977
		158,147	162,324

Coastal Tanker – Refined Products to Galle & Trincomalee

Auto Diesel	39,756	18,481
Kerosene	19,805	24,597
Marine Diesel	990	–
Fuel Oil		40,717

Table – II.3.5 Refinery Production (in tons)

	1978	1977
LP6	5,335	3,101
Premium Gasoline	103,943	84,275
Regular Gasoline	16,680	19,072
Chemical Naptha	82,372	102,197
SBP Solvents	1,279	1,136
	209,629	209,782
Avtur	34,465	71,482
Kerosene	210,585	185,447
Gas Oil	242,200	276,620
Marine Diesel	113,147	88,232
Laws	1,286	994
Low Sulphur Diesel	4,096	3,576
	605,779	626,351
Fuel Oil 500"	16,338	22,924
800"	117,692	109,860
1000"	213,537	182,382
1500"	199,810	230,183
	545,377	545,349
Bitumen	24,872	25,202
Refinery Fuel & Loss	79,697	87,425
	1,466,596	1,496,855

Table – II.3.6 Statistics, Wet Cargo Traffic

	Crude Oil I/T	Black Oil I/T	White Oil I/T	Baselub Oil I/T	Export Refined Oil	Export Ch.Napthal/T
'78 Jan	(3) 95,370	–	(1) 6,396	–	–	–
Feb	(3) 93,455	–	(1) 9,733	(1) 1,109	–	(1) 18,023
Mar	(5) 163,600					
Apr	(1) 130,078		1 10,289	(1) 29,353	(1) 21,619	(1) 19,451
May	(1) 117,121	–	–	(1) 3,398	–	–
Jun	(5) 151,020	–	(1) 15,081	–	(1) 25,161	
Jul	(2) 61,116	–	(1) 18,681	–	–	(1) 18,719
Aug	(3) 89,439	–	(1) 18,576	3,632	–	–
Sep	(6) 187,111	–	–	–	(1) 21,627	
Oct	(1) 123,959	–	18,188	–	–	17,658
Nov	(3) 91,219		(1) 11,319	(1) 3,795	–	–
Dec	(1) 113,666		(3) 58,859	(1) 3,780	(1) 17,959	–
	(9)30,982,913		(0)	(5)	(1)	(1) 18,471
	1, 1,125,214		16,7122	613.4	21,591.5	Total (68)
'77 Jan	(3) 91,039		1 19,281			
Feb	(1) 31,790		(1) 18,297	(1) 3,363		
Mar	(5) 147,281					
Apr	(5) 156,188		1 500			
May	(1) 125,135		1 18,556	3,362		1 21,589
Jun	(3) 92,681					1 17775
Jul	(6) 174,833					
Aug	(5) 151,261				1 19,663	1 19,059
Sep	(5) 157,192			1 2,950		
Oct	(1) 126,580				1 19,803	17,921
Nov	(3) 88,406		1 19,611	3,151		
Dec	(5) 163,010				1 18,415	19,896
	(9) 30,7285		(5)15,2556	(1) 3,2065	(3)19,3036	(5) 19,818
	1,505,699		–			Total (66)
'76 Jan	(1) 121,015	–	–	–	(1) 19,683	–
Feb	(3) 91,331	–	–	–	–	(1) 18,701
Mar	(3) 56,929	–	–	–	(1) 19,135	–
Apr	(1) 121,308	–	(1) 197	3,152	–	(1) 16,216
May	(6) 176,327	–		–	(3) 11,501	–
					19,288	
					33,789	
Jun	(3) 88,236	–	–	(1) 3,198	–	–
Jul	(1) 121,091	–	(1) 503	–	–	–
Aug	(3) 80,935	–	–	–	18,538	18,0[illegible]
Sep	(6) 187,971	–	–	(1) 3,295	–	16,039
Oct	(1) 25,857	–	–	–	14,195	20,255
Nov	(3) 95,563	–	–	(1) 2992	–	–
Dec	(1) 121,767	–	(1) 9,587	–	–	(1) 17,989
	(3) 29,9620		8,937			
	1,288,369		(3) 6,507	(1) 3,159.2	19,918.1	(6)178763
						Total (63)

Note: No. in Parentheses denotes Nos. of Tanker.

Table – II.3.7 Tanker Called During 1978

Name of vessel.	DWT	GRT	Arrivals	Departure.	LOA	LBP	Beam	Year Build	Tonnage Discharged/Load
Buzurgan	36,400	21,375	5. 1.	7. 1.	659	626	86	1973	Dis.30,000 T Crude Oil
Messiniaki Pnoi	30,294	17,355	16. 1.	18. 1.	558	531	85	1972	Dis.3500T L.O.
Buzurgan	36,400	21,375	24. 1.	26. 1.	659	626	86	1973	Dis.30,000T C.O.
Nand Kala	6,703	3,827	9. 2.	10. 2.	344	321	53	1972	Dis.1,000T T.B.Avtur.
Kirkuk	36,400	21,375	7. 2.	9. 2.	659	629	86	1972	Dis.30,000T C.O.
Arca	18,642	12,222	12. 2.	14. 2.	557	529	68	1959	Dis.30,000T C.O.
Tammanna	30,673	18,351	22. 2.	23. 2.	656	616	79	1959	Dis.30,000T C.
Kirkuk	36,400	21,375	23. 2.	24. 2.	659	629	86	1972	Dis.30,000T C.O.
Buzurgan	36,400	21,375	4. 3.	5. 3.	659	629	86	1973	Dis.30,000T C.O.
Tojo Maru	43,695	29,940	6. 3.	8. 3.	692	669	92	1962	Dis.36,000T C.O.
Babagurgur	36,397	21,375	13. 3.	15. 3.	659	629	86	1973	Dis.30,000T C.O.
Buzurgan	36,400	21,375	18. 3.	20. 3.	659	626	86	1973	Dis.30,000T C.O.
Ain Zalah	36,330	21,375	24. 3.	26. 3.	659	629	86	1972	Dis.31,000T C.O.
Tammanna	30,673	18,351	02. 4.	07. 4.	659	616	79	1959	Dis.30,000T C.O.
Kirkuk	36,400	21,375	15. 4.	17. 4.	659	629	86	1972	Dis.30,000T C.O.
Ain Zalah	36,330	21,375	20. 4.	22. 4.	659	629	86	1972	Dis.30,000T C.O.
Hindustan	32,240	19,867	25. 4.	30. 4.	627	598	86	1976	Dis.10,000T A.Turbine.
Bianca	26,122	16,094	12. 5.	14. 5.	620	585	73	1959	Dis.30,000T C.O.
Tammanna	30,673	18,351	07 5.	12. 5.	656	616	79	1959	Dis.30,000T C.O.
Rumaila	36,330	21,375	21. 5.	23. 5.	659	629	86	1972	Dis.32,000T C.O.
Tammanna			01. 6.	04. 6.					Dis.30,000T C.O.
British Hazel	20,795	12,964	10. 6.	11. 6.	561	528	72	1964	Dis.19,000T.Gas oil Load 3,000T KO.
Rumaila			11. 6.	14. 6.					Dis.32,000T C.O.
Tammanna			20. 6.	23. 6.					Dis.30,000T C.O.
Rumaila			29. 6.	02. 7.					Dis.32,000T C.O.
Tammanna			13. 7.	15. 7.					Dis.30,000T C.O.
Acteon	18,380	12,226	16. 7.	19. 7.	557	529	68	1961	Dis.8,000T Avtur& 4,000T Gas Oil.
Kirkuk			21. 8.	23. 8.					Dis.30,000T C.O.
Acteon			27. 8.	30. 8.					Dis.18,000T Avtur & Gas Oil.
Tammanna			01. 9.	03. 9.					Dis.30,000T C.O.
Jambur	35,338	21,375	04. 9.	06. 9.	659	629	86	1959	Dis 31,000T C.O.

Table – II.3.8 Transit Sheds and Warehouses (1979)

Location	Identification	Floor Area (m^2)	Description
QEQ	#1 W/H	5,110	Import/export general cargo
	#2 W/H	5,110	"
	#3 W/H	7,432	"
	#4 W/H	7,432	"
	(Sub Total)	(25,084)	
Fort	Bonded W/H G.FL.	1,008	Duty free cargo
	#9 W/H	1,310	Import general cargo
	#10 W/H	1,161	"
	T2 W/H	2,475	Bad order (for sales)
	T3 W/H	756	Liquor
	B3 W/H	587	Import general cargo
	F1 W/H	2,118	Sales cargo
	F2 W/H	3,345	Import general cargo
	F3 W/H	2,508	"
	(Sub Total)	(15,268)	
BQ	#1 W/H	5,518	Import/export general cargo
	#2 W/H	5,518	"
	#3 W/H	4,905	"
	#4 W/H	4,905	"
	Delft W/H	3,402	Import general cargo. Waiting for delivery
	(Sub Total)	(24,248)	
Baghdad	Transit Shed	2,350	Export general cargo by lighters
	#1 W/H	4,097	Import/export general cargo by lighters
	#2 W/H	3,274	"
	(Sub Total)	(9,721)	
Pettah	#1 W/H	2,363	Import general cargo by lighters
	#2 W/H	2,363	"
	#3 W/H	2,947	"
	(Sub Total)	(7,673)	
Koachchikade	#1 W/H	1,304	Import general cargo by lighters
	#2 W/H	1,304	"
	#3 W/H	1,304	"
	Hanger W/H 1 & 3	3,312	Import fertilizer
	Hanger T2	2,542	"
	(Sub Total)	(9,766)	
PVQ	#1 W/H	3,345	Import food staffs
	#2 W/H	3,345	"
	Repository W/H	5,574	"
	(Sub Total)	(12,264)	
Chalmars Quay	New Cement Stores	738	Cement
	Cement W/H	1,104	"
	(Sub Total)	(1,842)	
Beira Lake	#1 W/H	4,250	Import/export general cargo
	#2 W/H	4,250	"
	Ground Floor	2,247	"
	1st Floor	2,247	"
	(Sub Total)	(12,994)	
Grand Total		118,860	

Table – II.3.9 Goods Transported by Railway (in Tons)

	1975	1976	1977	1978
Rice	88,014	31,832	10,294	6,633
Flour	150,347	51,132	20,864	52,696
Others	33,050	50,387	44,744	39,859
Total	271,411	133,351	75,902	99,188

(Source: Administration Report, 1976, 1977 and 1978, Trains & Goods Office)

Table – II.3.10 Dimension of Road, Tunnel, Bridge (Existing)

1. Road

Section No	Distance(m)	Width(m)
1	10 – 100	15 m
2	100 – 150	15 m
3	150 – 310	15 m
4	310 – 360	15 m
5	360 – 420	15 m
6	420 – 500	25 m
7	500 – 530	25 m
8	530 – 590	25 m
9	590 – 720	25 m
10	720 – 790	25 m
11	790 – 810	25 m
12	810 – 960	35 m
13	990 – 1260	12 m
14	1260 – 1360	15 m
15	1360 – 1420	10 m
16	1420 – 1480	10 m
17	1480 – 1620	20 m
18	1620 – 1780	20 m
19	1920 – 2010	15 m
20	2010 – 2390	08 m
21	2390 – 2920	08 m
22	2920 – 3050	10 m
23	3050 – 3170	10 m
24	3170 – 4000	12 m
25	4000 – 5000	10 m
26	5000 – 5500	10 m

2 Tunnel

	SALGADO BRIDGE	TUNNEL ALUTHMAWATHE	
LENGH	44'-0"	58'-0"	58'-0"
SPAN	30'-0"	16'-0"	16'-0"
HEIGHT	17'-0"	15'-0"	15'-0"

3. Bridge crossing Canal

Width - 15'-0"

Span - 110'-0"

Fig.-II.3.1 Oil Handling Facilities

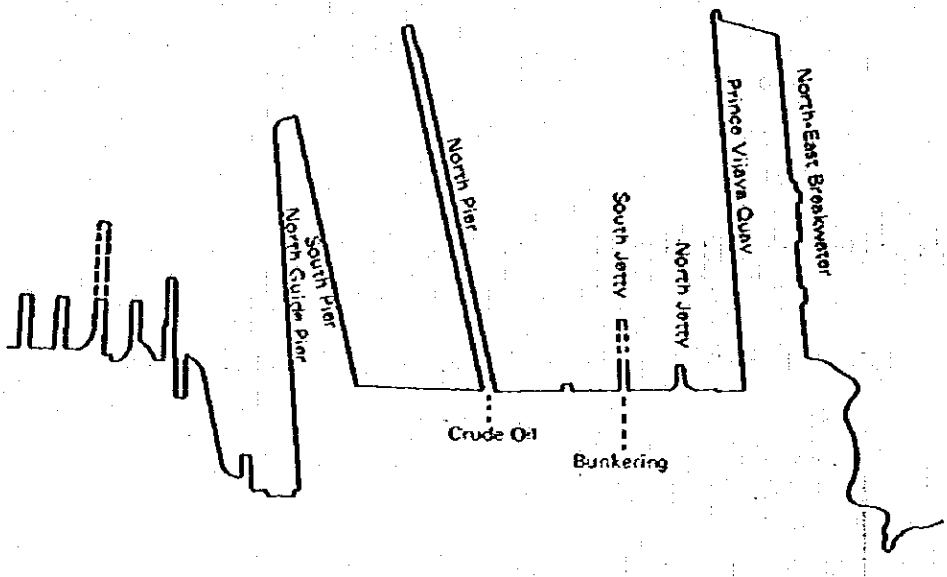


Fig. – II.3.2 Pipe Line & Refinery

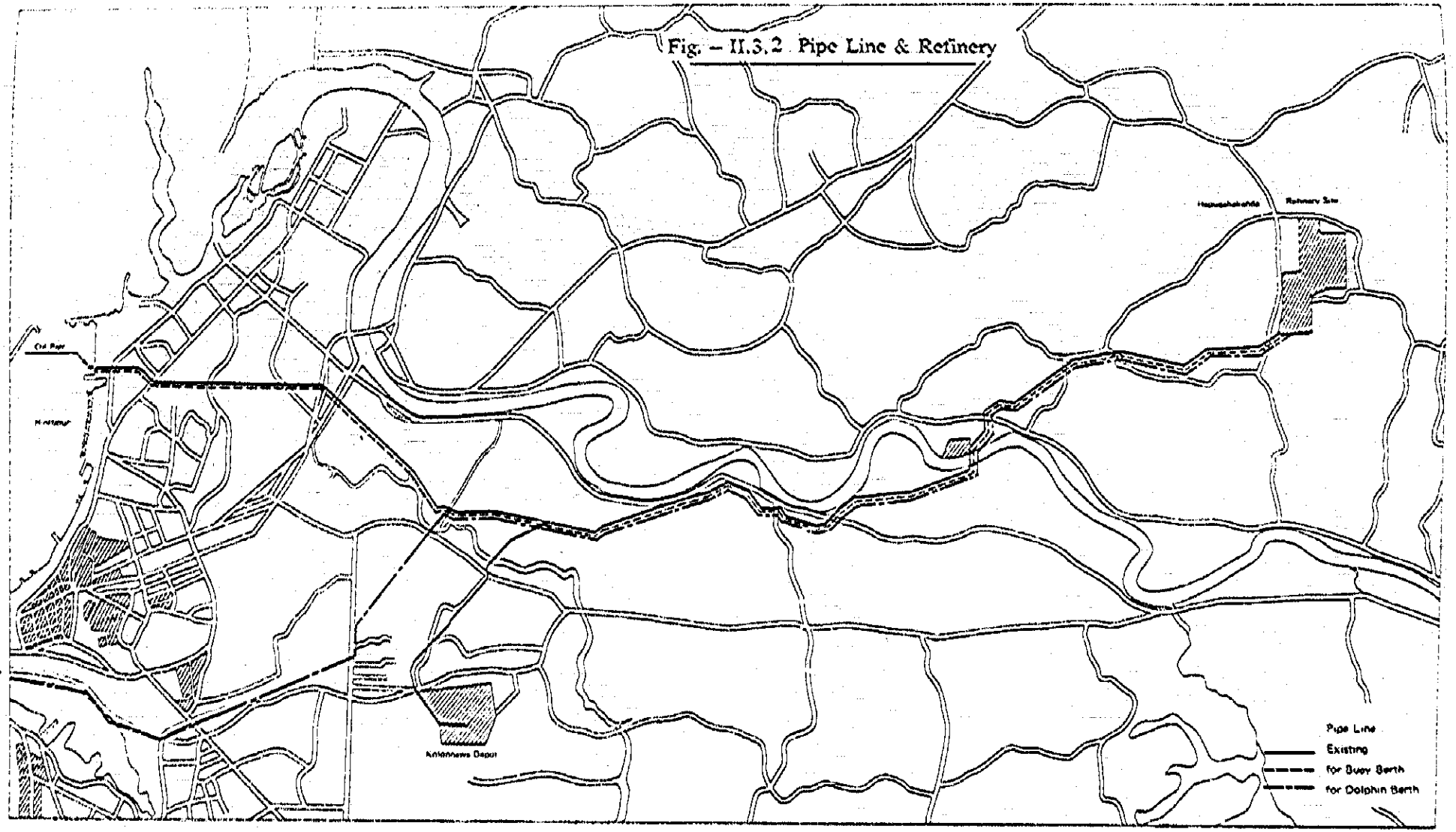
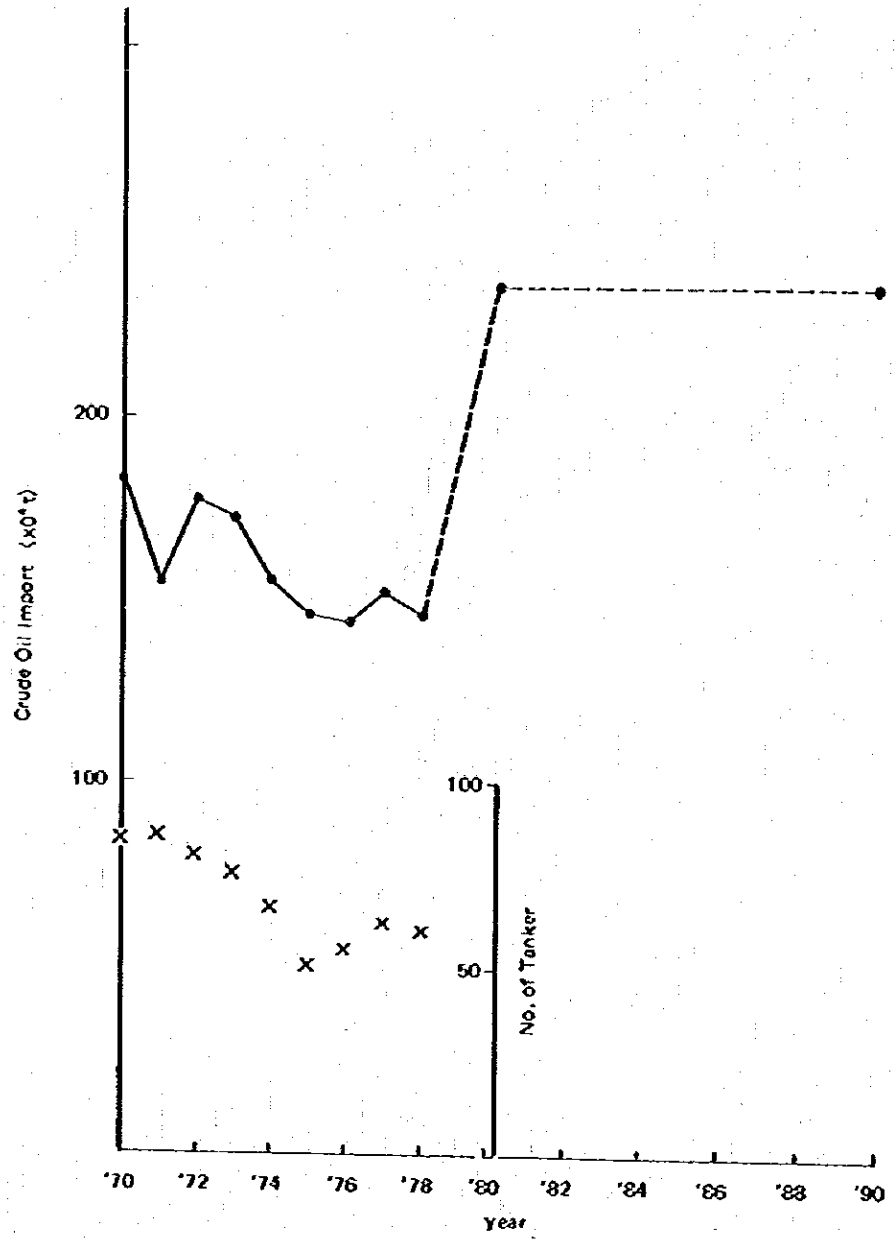


Fig. – II.3.3 Crude Oil Import No. of Tanker



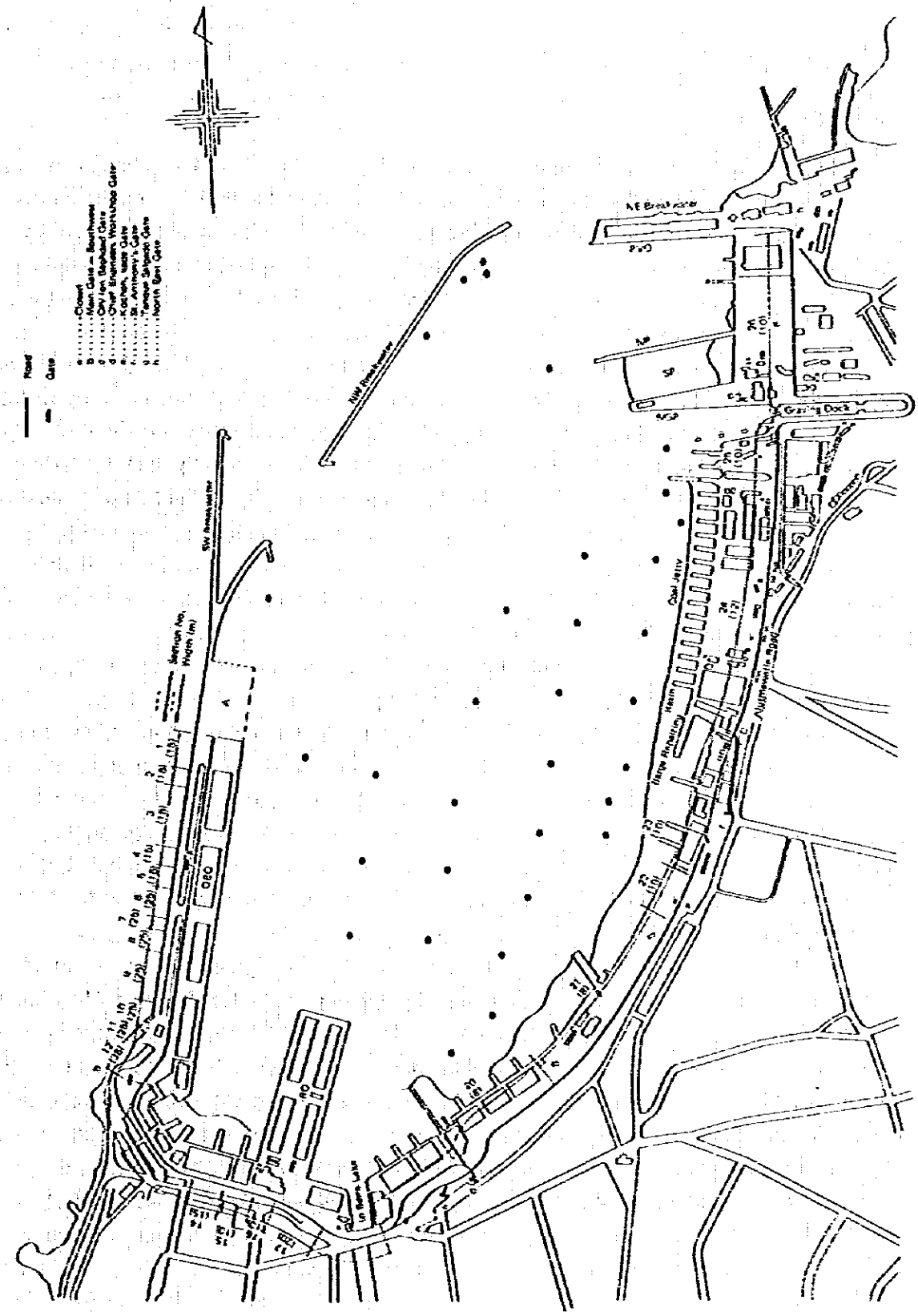


Fig. – II.3.4 Inside-port Road (Existing)

CHAPTER 4 PORT ACTIVITIES

4-1 Tonnage of Cargo Handled

4-1-1 Dry Cargo

The yearly tonnages of cargo handled are shown in Table-II.4.1. Changes in tonnage of imported dry cargo handled by commodity is indicated in Table-II.4.2, exported dry cargo in Table-II.4.3, dry cargo by quay and stream in Table-II.4.4, and food cargo by quay in Table-II.4.5(a) to (c). The details of dry cargo handled by quay in 1978 are shown in Table II.4.5(d). The yearly tonnages of cargo handled by lighter landing point in last three years is indicated in Table-II.4.6.

The import which had been nearly 2,400,000 tons in the middle of sixties dropped to 1,200,000 tons in 1976 as a result of strict import restrictions which continued up to July 1977. However, the present government revised its policies to adopt liberalization of import and revision of the foreign exchange system, hence import has gradually increased since then to reach about 1,900,000 tons in 1978. About 900,000 tons of imported goods are foods consisting mainly of rice, flour and sugar. Also, the import of ertilizer has increased considerably as a result of the strengthening of the food self-sufficiency policy of the government. This means that 1,270,000 tons out of 1,900,000 tons of imports are bag cargoes. In respect to export, tea, rubber and coconut products amount to about 3/4 of the total export.

The total import is about 2,000,000 tons, the total export is about 1,000,000 tons, and total tonnage of cargo handled is about 3,000,000 tons.

Cargo handled at the quays and midstream berths in 1978 total about 2,600,000 tons and 300,000 tons respectively. The share of midstream berth is a little more than 10%.

The breakdown of tonnages of cargo handled at each quays and piers indicates character of them. For example, the Queen Elizabeth Quay mainly handles general cargo, with an 18% share of foods, and its export tonnages are almost same as those for import. About 1/4 of total cargo tonnage of the port is handled at the Queen Elizabeth Quay. About one-half of the total tonnage of the port is being handled by these two quays.

Most of the cargo handled at the Bandaranaike Quay are general cargo except about 5% of foods, and most of the cargo handled at the Coaster Berths are for shipping. More than 90% of cargo handled at the Prince Vijaya Quay are foods and its share to total tonnage is in 3rd place after the Queen Elizabeth Quay and the Bandaranaike Quay. The North Pier is an oil berth. At the South Pier and the North Guide Pier 90% of cargo handled are foods and imported general cargo. Kochchikade is used for cargo handling by sailing crafts with about 400 gross tonnage importing vegetables from India. At the midstream berths, about 10% or more of the total cargo of the port is handled. In addition, tranship cargo of about 5 to 10 thousand freight tons are handled in the Port.

4-1-2 Wet Cargo

The change in tonnages of wet cargo handled in the past is shown in Table-II.4.7. Wet cargo mainly consists of imported crude oil, but about 300,000 tons of petroleum products were exported and imported in 1978. Petroleum products are also transported locally to Trincomalee and Galle. In addition, some coconut oil is exported as bulk.

4-2 Containers

As a result of the development of containerization of the world marine transport, the number of containers handled at the Port of Colombo has gradually increased, and a total of 5,281 containers is recorded for 1979 (from the Port Cargo Corporation statistics). Most of these containers are handled at the Queen Elizabeth Quay No. 4 and the completed portion of the Queen Elizabeth Quay No. 5 which is now under construction, but they are all loaded/unloaded by ships' cranes or trailers since there is no existing crane which is capable of handling containers in these berths (also in other berths in the Port of Colombo). The only container handling equipment available is forklifts owned by the Sri Lanka Port Authority (one for 12 ton, and two for 25 ton; refer to Paragraph 3-2 ((Cargo Handling Equipment") and one 40-ton forklift leased from a shipping company. All containers arestuffed/unstaffed within the port area (mainly at areas behind berths stated above) and house delivery, that is delivery of containers with cargo, is not adopted, which means that container cargo are actually treated the same as conventional shipping cargo. It is said that customs authorities at the Port of Colombo are presently studying the adoption of the house delivery system.

It is clearly apparent that the demand for container shipping will considerably increase with the growth of world containerization of sea transportation of goods. The Sri Lanka Port Authority reports that a certain shipping company has already requested tranship of containers at the Port of Colombo. There is an urgent need to install container handling equipment/facilities and to arrange and establish regulations, customs clearance procedure and port tariff schedules to cope with and facilitate containerization.

4-3 Calling Vessels

The total number of vessels called, their gross tonnages and net tonnages are shown in Table-II.4.8. Trends in the number of vessels called, broken-down by type, are shown in Table-II.4.9. And changes in the tonnage brought/loaded per vessel are shown in Table-II.4.10.

In 1978, a total of 1690 vessels called the Port of Colombo. Among them, 60 oil tankers and 1,190 dry cargo vessels called the Port for the purpose of loading/unloading cargo. The average gross tonnage of vessels is about 8,300 GT, and the average net tonnage is about 4,900 NT. The average deadweight tonnage is about 12,200 DWT. Excluding oil tankers, the average DWT is about 8,000 tons. Tonnage brought/loaded per vessel is about 8,500 tons for foods, about 1,700 tons for imported cargo other than foods and about 1,800 tons for export.

In addition to the above, 178 sailing crafts with average gross tonnage of about 400 GT called the Port of Colombo in 1978 and 382 ships called for bunker.

4-4 Port Congestion

The tonnages of cargo handled per berth and per meter in 1978 are shown in Table-II.4.11. These tonnages range from 150 to 240 thousand tons per berth with an average of 180 thousand tons. They also are within the range of 900 to 1460 tons per meter with an average of 1,024 tons. These figures are considerably high compared to those of other countries but, in consideration of the low cargo handling productivity stated in the next section (about 1/4 of the cargo handling productivity generally achieved in Japan), these figures are considered to be surprising. From the viewpoint of vessels called, this situation means that the vessels have to wait for a long time for berthing and the berths are always occupied by vessels. To grasp this situation euqntitatively, it is analyzed by using the queuing theory. The average awaiting period (days) and average working period (days) are shown in Table-II.4.12(a) and (b) respectively. Though there is a big difference between foods and general cargo, the average value of all cargo will be used for analysis here since all berths are handling both foods and general cargo to a certain degree. Concerning the number of small berths, each of the north end berth in the Bandaranaike Quay and 2 small berths of the Coaster Berths is counted as 0.5 berth. The all of the midstream berths are counted as 4.3 berths in consideration of the tonnage of cargo handled and the cargo handling productivity of lighters. Rounding off for simplicity, the midstream berth is assumed to be equal to 4.5 berths giving a total number of 19 berths.

The results of calculations made by using the above figures as input for the queuing theory are shown in Table-II.4.13. These results show that the average rates of berth occupancy in 1977 and 1978 are almost 100%. This means that theoretically the awaiting period become infinite.

The results of this analysis well reflect the existing situation observed during the in situ survey by the team (66 days in total) in which all berths including the midstream berths in the Port were always fully occupied by vessels and several vessels were always awaiting outside the Port.

The above analysis is made only for vessels called for loading and unloading but, in addition to these vessels, about 400 to 500 ships call annually the Port for bunker and about 60 oil tankers call annually the Port for unloading.

Table – II.4.1. Yearly Tonnage of Dry Cargo Handled

(Unit: Freight Tons)

Year	Food Cargo	General Cargo	Coal	Total Imports	Total Exports	Total Imports and Exports
1960	753,083	1,267,854	239,408	2,260,345	540,355	2,800,700
1961	702,682	1,104,336	150,537	1,957,555	504,446	2,462,001
1962	697,876	1,231,584	211,585	2,141,045	508,674	2,649,719
1963	686,039	1,090,238	164,786	1,941,063	471,903	2,412,966
1964	755,394	1,185,987	173,485	2,114,866	612,776	2,727,642
1965	903,434	1,118,979	173,577	2,195,990	679,801	2,875,791
1966	869,461	1,300,376	196,116	2,365,953	689,260	3,055,213
1967	827,689	1,176,635	196,632	2,200,956	733,536	2,934,492
1968	824,050	1,329,495	163,491	2,317,036	757,711	3,074,747
1969	779,252	1,303,037	136,642	2,218,931	789,615	3,008,546
1970	937,375	1,056,545	20,212	2,014,132	754,797	2,768,929
1971	835,331	967,848	33,272	1,836,451	839,686	2,676,137
1972	700,467	809,427	25,349	1,535,243	891,190	2,426,433
1973	830,541	626,046	30,763	1,487,350	864,887	2,352,237
1974	748,368	725,328	3,855	1,477,551	844,759	2,322,310
1975	802,353	546,685	13,786	1,362,824	918,400	2,281,224
1976	659,302	585,471	–	1,244,773	999,993	2,244,766
1977	958,166	753,912	9,661	1,721,739	1,009,725	2,731,464
1978	836,219	1,059,234	–	1,895,453	1,049,685	2,945,138

Source: P(C)C

Table – II.4.2 Commoditywise Tonnage of Dry Cargo Handled (Import)

(Unit: Freight Tons)

Commodities	1970	1971	1972	1973	1974	1975	1976	1977	1978
1. Rice	N/A	254,638	250,372	291,270	271,313	360,716	304,489	374,638	141,106
2. Flour	N/A	280,110	235,604	338,298	437,059	378,764	307,464	487,767	538,354
3. Sugar	N/A	300,583	214,491	200,973	39,996	62,873	47,349	95,761	156,759
4. Total Food Cargo (1+2+3)	937,375	835,331	700,467	830,541	748,368	802,353	659,302	958,166	836,219
5. Cement	N/A	8,294	27,749	686	485	–	–	19,928	–
6. Fertilizer	N/A	319,905	281,861	280,079	376,614	177,129	220,570	294,087	435,338
7. Potatoes	N/A	5,625	7,247	3,555	–	360	–	–	2,227
8. Onions	N/A	18,487	–	–	–	–	–	302	13,209
9. Chillies	N/A	11,341	7,066	692	–	–	–	–	4,037
10. Other Bag Cargo	N/A	86,648	101,595	53,629	30,910	11,905	5,726	–	–
11. Case Cargo	N/A	4,626	15,617	3,732	3,001	3,246	1,172	–	–
12. General	N/A	483,052	355,972	272,150	302,249	343,319	349,654	423,763	578,533
13. Ex-Buggalows	N/A	29,870	12,320	11,523	12,069	10,726	8,349	15,832	25,890
14. Total General Cargo (5 to 13)	1,056,545	967,848	809,427	626,046	725,328	546,685	585,471	753,912	1,059,234
15. Coal (in bulk)	20,212	33,272	25,349	30,763	3,855	13,786	–	9,661	–
16. Total Imports (4+14+15)	2,014,132	1,836,451	1,535,243	1,487,350	1,477,551	1,362,824	1,244,773	1,721,739	1,895,453

Source: P(C)C

N/A – Not available.

Table – II.4.3 Commoditywise Tonnage of Dry Cargo Handled (Export)

(Unit: Freight Tons)

Commodities	1970	1971	1972	1973	1974	1975	1976	1977	1978
1. Tea	N/A	357,533	366,949	389,433	367,795	440,826	456,399	471,368	463,812
2. Rubber	N/A	132,259	134,377	140,531	132,016	144,827	135,132	143,885	141,206
3. Desiccated Coconut	N/A	57,353	51,914	39,347	45,075	51,508	48,349	32,618	38,232
4. Fibre	N/A	140,306	140,506	153,745	159,363	102,394	132,228	151,936	132,459
5. Copra (bag cargo)	N/A	16,378	45,461	2,071	274	1,079	940	327	447
6. Coconut oil (in drums)	N/A	73,206	75,690	39,333	36,755	53,339	47,106	36,923	11,047
7. Total Coconut Products (3+4+5+6)	N/A	287,243	313,571	234,496	241,467	208,320	228,623	221,804	182,955
8. General	N/A	60,453	74,127	98,101	100,779	121,818	177,983	171,361	252,955
9. Per Buggalows (solding craft)	N/A	2,198	2,166	2,326	2,702	2,609	1,856	1,307	847
10. Total Exports	754,797	839,686	891,190	864,887	844,759	918,400	999,993	1,009,725	1,049,685*

Source: P (C) C

N/A – Not available.

* Includes 8,700 tons of rice (In November, '78)

Table – II.4.4 Tonnage of Dry Cargo Handled According to Quay and Stream

(Unit: Freight Tons)

	Discharged			Loaded			Total		
	Alongside	Stream	Total	Alongside	Stream	Total	Alongside	Stream	Total
1962	1,315,943	825,102	2,141,045	349,066	159,608	508,674	1,665,009	984,710	2,649,719
1963	1,214,571	726,492	1,941,063	300,168	171,735	471,903	1,514,739	898,227	2,412,966
1964	1,463,148	651,718	2,114,866	353,399	259,377	612,776	1,816,547	911,095	2,727,642
1965	1,465,122	730,868	2,195,990	378,075	301,726	679,801	1,843,197	1,032,594	2,875,791
1966	1,590,420	775,533	2,365,953	348,642	340,618	689,260	1,939,062	1,116,151	3,055,213
1967	1,477,075	723,881	2,200,956	368,061	365,475	733,536	1,845,136	1,089,356	2,934,492
1968	1,594,795	722,241	2,317,036	422,823	334,888	757,711	2,017,618	1,057,129	3,074,747
1969	N/A	N/A	2,218,951	N/A	N/A	789,615	N/A	N/A	3,008,546
1970	N/A	N/A	2,014,132	N/A	N/A	754,797	N/A	N/A	2,768,929
1971	1,497,340	339,111	1,836,451	543,599	296,087	839,686	2,040,939	635,198	2,676,137
1972	1,299,840	235,403	1,535,243	671,922	219,268	891,190	1,971,762	454,671	2,426,433
1973	1,365,941	121,409	1,487,350	767,842	97,045	864,887	2,133,783	218,454	2,352,237
1974	1,388,783	88,768	1,477,551	750,462	94,297	844,759	2,139,245	183,065	2,322,310
1975	1,264,980	97,844	1,362,824	810,920	107,480	918,400	2,075,900	205,324	2,281,224
1976	1,132,680	112,093	1,244,773	867,148	132,845	999,993	1,999,828	244,938	2,244,766
1977	1,589,897	131,842	1,721,739	837,261	172,464	1,009,725	2,427,158	304,306	2,731,464
1978	1,733,121	162,332	1,895,453	904,254	145,451	1,049,685	2,637,355	307,783	2,945,138

N/A – Not available

Source: P(C)C

Table – II.4.5 (a) Yearly Tonnage of Food Handled According to Location
1976 to 1978
– Imports –

(Unit: Freight Tons)

Location	1976	1977	1978
Queen Elizabeth Quay	54,289	86,577	137,695
Bandaranaike Quay	85,474	237,851	37,238
Prince Vijaya Quay	427,407	455,310	449,343
South Pier	68,508	82,221	101,297
North Guide Pier	23,247	88,183	105,621
Stream	378	8,024	5,025
Total	659,303	958,166	836,219

Source: P (C) C

Table – II.4.5 (b) Yearly Tonnage of General Cargo Handled According to Location
1976 to 1978
– Imports –

(Unit: Freight Tons)

Location	1976	1977	1978
Queen Elizabeth Quay	105,534	190,699	259,697
Bandaranaike Quay	220,808	232,043	296,906
Coaster Berth	11,882	17,000	22,841
Prince Vijaya Quay	1,160	977	15,442
North Pier	–	9	151
South Pier	52,972	98,898	86,473
North Guide Pier	73,050	84,297	194,360
Kochchikade	8,349*	15,832*	26,056*
Stream	111,715	123,818	157,307
Total	585,470	763,573	1,059,233

* Sailing Crafts.

Source: P (C) C

Table – II. 4.5 (c) Yearly Tonnage of Exports Cargo Handled According to Location
1976 to 1978

(Unit: Freight Tons)

Location	1976	1977	1978
Queen Elizabeth Quay	356,496	371,441	358,053
Bandaranaike Quay	255,133	278,412	359,268
Coaster Berth	80,546	52,276	111,668
Prince Vijaya Quay	18,562	6,344	18,555
North Pier	4	25	10
South Pier	38,965	9,102	16,508
North Guide Pier	115,586	118,354	39,326
Kochchikade	1,856*	1,307*	847*
Stream	132,845	172,464	145,451
Total	999,993	1,009,725	1,049,686

* Sailing Crafts.

Source: P (C) C

Table – II.4.5 (d) Dry Cargo Handled According to Location – 1978

Location	Imports				Exports		Total		Share
	Food		General Cargo						
	Amount (F. ton)	%	Amount (F. ton)	%	Amount (F. ton)	%	Amount (F. ton)	%	%
Queen Elizabeth Quay	137,695	18.2	259,697	34.4	358,053	47.4	755,445	100	25.7
Bandaranaike Quay	37,238	5.4	296,906	42.8	359,268	51.8	693,412	100	23.5
Coaster Berth	0	0	22,841	17.0	111,668	83.0	134,509	100	4.6
Prince Vijaya Quay	449,343	93.0	15,442	3.2	18,555	3.8	483,340	100	16.4
North Pier	0	0	151	93.8	10	6.2	161	100	0.0
South Pier	101,297	49.6	86,473	42.3	16,508	8.1	204,278	100	6.9
North Guide Pier	105,621	31.1	194,360	57.3	39,326	11.6	339,307	100	11.5
Kochchikade	0	0	26,056*1	96.9	847*1	3.1	26,903*1	100	0.9
Stream	5,025	1.6	157,307	51.1	145,451	47.3	307,783	100	10.5
Total	836,219	28.4	1,059,233	36.0	1,049,686	35.6	2,945,138	100	100

*1 Sailing crafts.

Table – II.4.6 Tonnage of Food and General Cargo Landed Ex-Lighters According to Units – 1976 to 1978

(Unit: Freight Tons)

Year	Location	Food	General	Total
1976	Unit 2*1	649	68,454	69,103
	Unit 4 & 6*2	1,555	47,749	49,304
	Unit 7*3 & 10*4	–	12,487	12,487
	Total	2,204	128,690	130,894
1977	Unit 2	3,470	49,966	53,436
	Unit 4 & 6	3,664	47,024	50,688
	Unit 7 & 10	–	15,929	15,929
	Total	7,134	112,919	120,053
1978	Unit 2	–	67,878	67,878
	Unit 4 & 6	481	69,395	69,876
	Unit 7 & 10	–	25,790	25,790
	Total	481	163,063	163,544

Source: P (C) C

*1 Unit 2 (Fort Area) ..... w/h No. 9 ~ F1.
*2 Unit 4 & 6 ..... Pettah No. 1/2 including Chalmers Quay.
*3 Unit 7 ..... Kochchikade
*4 Unit 10 ..... Hangar w/h 1/2/3 → storage
(Unit 5 ..... Baghdad: Export/T. Shipment cargo)

Table – II.4.7. Yearly Tonnage of Wet Cargo

(Unit: Metric Tons)

Year	Oils				Coconut Oil*2	Total
	Import		Export	Local Transport	Export	
	Crude Oil	Refined Oil	Refined Oil	Refined Oil		
1970	1,833,632	N/A*1	N/A	N/A	N/A	2,197,973
1971	1,547,548	N/A	N/A	N/A	N/A	1,872,338
1972	1,770,350	N/A	N/A	N/A	N/A	2,073,435
1973	1,720,355	N/A	N/A	N/A	N/A	1,962,138
1974	1,550,190	N/A	N/A	N/A	N/A	1,738,854
1975	1,457,267	N/A	N/A	N/A	N/A	1,968,358
1976	1,439,374	N/A	N/A	N/A	N/A	N/A
1977	1,520,200	53,808	158,147	60,551	N/A	N/A
1978	1,457,122	125,535	162,324	83,795	23,418	1,852,194

*1 N/A: Not available
*2 Excludes those in drums

Source: Ceylon Petroleum Corporation and CPC

Table – II.4.8. Total No. of Ships Arrived and their N.R.T. and G.R.T.

Year	No. of Ships	G.R.T.	N.R.T.
1960	2713	17,733,591	10,195,581
1961	2449	17,309,381	9,879,332
1962	2189	15,500,298	8,918,851
1963	2028	15,003,362	8,446,367
1964	2002	14,739,428	8,592,040
1965	2140	14,977,508	8,593,470
1966	2338	15,560,007	9,525,691
1967	2561	18,182,521	10,571,589
1968	2294	16,178,771	9,364,165
1969	2232	15,891,512	9,100,012
1970	2044	14,365,425	8,255,828
1971	1895	12,689,778	7,253,560
1972	1748	11,717,343	6,698,683
1973	1722	12,482,839	7,142,445
1974	1520	11,984,561	6,992,698
1975	1576	12,997,343	7,735,183
1976	1666	13,588,324	8,163,973
1977	1653	13,559,311	7,955,352
1978	1690	14,071,820	8,337,936

N.R.T.: Net Registered Tonnage
G.R.T.: Gross Registered Tonnage

Source: P(C)C

Table – II.4.9. Composition of Ships Called

Year	Passenger Liners	Cargo Vessels	Colliers	Tankers	Bunkering Vessels	Others	Total
1966	173	1,248	29	112	531	245	2,338
1967	131	1,300	22	111	716	281	2,561
1968	65	1,281	22	111	671	144	2,294
1969	61	1,291	18	100	668	144	2,282
1970	32	1,227	3	85	570	127	2,044
1971	12	1,133	6	86	560	98	1,895
1972	7	1,074	2	81	505	77	1,746
1973	7	920	3	76	622	94	1,722
1974	10	891	–	66	522	31	1,520
1975	14	942	2	51	516	51	1,576
1976	14	1,024	–	55	519	54	1,666
1977	20	1,019	1	63	515	35	1,653
1978	24	1,190	–	60	382	34	1,690

Source: P(C)C

Table – II.4.10 Tonnage Brought/Loaded per Vessel

(Unit: Freight Tons)

Year	Food Cargo Dischargers			Mixed Cargo Dischargers			Loaders		
	No. of Vessels	Tonnage Handled	Tonnage Brought per Vessel	No. of Vessels	Tonnage Handled	Tonnage Brought per Vessel	No. of Vessels	Tonnage Handled	Tonnage Loaded per Vessel
1964				462	894,288	1,936			
1965				504	972,452	1,929			
1966	100	858,071	8,581	632	1,218,708	1,928			
1967	88	784,650	8,916	644	1,075,871	1,671			
1968	90	830,777	9,231	658	1,218,640	1,852			
1969*1	75	741,307	9,884	599	1,292,856	2,158			
1970*2	86	758,349	8,818	466	820,670	1,761			
1971	105	843,336	8,032	524	946,162	1,806			
1972	75	872,296	11,631	530	859,883	1,622			
1973	96	861,656	8,976	397	629,565	1,586	545	868,505	1,588
1974	95	772,235	8,129	377	735,969	1,952	521	857,470	1,646
1975	108	821,848	7,610	387	558,861	1,444	559	909,010	1,626
1976	93	685,653	7,373	401	574,361	1,432	555	983,292	1,772
1977	106	973,056	9,180	429	693,321	1,616	539	962,210	1,785
1978	101	857,019	8,485	591	987,595	1,671	548	1,000,253	1,825

*1 11 months only
*2 10 months only

Source: Statistical Information, P (C) C

Table – II.4.11 Cargo Handled per Berth/per meter – 1978

Location	No. of Berth	Length (m)	Cargo Handled (F. tons)	Cargo Handled per Berth (F. tons) '000	Cargo Handled per m (F. tons)
Queen Elizabeth Quay	4	840	755,445	189	899
Bandaranaike Quay	4.5*1	770*2	693,412	154	901
Coaster Berth	1*1	93*2	134,509	135	1,446
Prince Vijaya Quay	2	330	483,340	242	1,465
South Pier	1	185	204,278	204	1,104
North Guide Pier	2	330	339,307	170	1,028
Total/Average	Total 14.5	Total 2,548	Total 2,610,291	Average 180	Average 1,024

*1 Small berths are counted as 0.5 berths each.

*2 Length of small berths is assumed as 2/3 of its actual length.

Table – II.4.12 (a) Turn Round Time, Average Awaiting Period

Year	Food Cargo Dischargers		Mixed Cargo Dischargers		Loaders		Total	
	No. of Vessels	Average Awaiting Period per Vessel (days)	No. of Vessels	Average Awaiting Period per Vessel (days)	No. of Vessels	Average Awaiting Period per Vessel (days)	No. of Vessels	Average Awaiting Period per Vessel (days)
1973	96	1.5	397	0.4	545	0.3	920	0.51
1974	95	1.5	377	0.5	521	0.3	891	0.55
1975	108	2.4	387	0.6	559	0.4	942	0.76
1976	93	2.5	401	0.8	555	0.6	1,024	0.87
1977	106	10.4	429	2.3	539	0.9	1,019	2.53
1978	101	7.5	591	1.4	548	0.8	1,190	1.70

Source: Statistical Information, P (C) C

Table – II.4.12 (b) Turn Round Time, Average Working Period

Year	Food Cargo Dischargers		Mixed Cargo Dischargers		Loaders		Total	
	No. of Vessels	Average Working Period per Vessel (days)	No. of Vessels	Average Working Period per Vessel (days)	No. of Vessels	Average Working Period per Vessel (days)	No. of Vessels	Average Working Period per Vessel (days)
1973	96	7.6	397	4.0	545	4.7	920	5.30
1974	95	7.5	377	5.0	521	4.5	891	5.55
1975	108	9.7	387	4.4	559	4.8	942	5.77
1976	93	10.4	401	4.7	555	4.6	1,024	5.28
1977	106	14.7	429	5.8	539	5.3	1,019	6.77
1978	101	13.9	591	5.0	548	4.8	1,190	5.87

Source: Statistical Information, P (C) C

Table – II.4.13 Average Awaiting Period by Queuing Analysis, Conventional Berth

Year	Yearly Cargo Vessels Called	Average Working Period per Vessel (days)	No. of Berths	Average Rate of Berth Occupancy	Average Awaiting Period (days)	
					(M/M/S)*1	(M/D/S)*2
1976	1,024	5.28	19	0.78	0.28	0.15
1977	1,019	6.77	19	0.99	∞	∞
1978	1,190	5.87	19	1.01	∞	∞

*1 Both the distribution of the intervals of vessels' arrivals and the distribution of working periods are assumed to be Poisson distributions.

*2 A Poisson distribution is assumed for the intervals of vessels' arrivals, whereas a regular distribution for working periods.

CHAPTER 5 CARGO HANDLING

5-1 Statistics

some of indexes related to cargo handling shown in 1978 statistics prepared by the Port (Cargo) Corporation are extracted in the Table-II.5.1.

It is remarkable that the average cargo handling efficiency of 8.5 tons/hour/gang for import general cargo ship and 9.0 tons/hour/gang for export ship is considerably poor. While the cargo handling efficiency is greatly effected by commodity, packing style, weight, etc. of cargo, it is 1/3 to 1/4 of the ordinary level of 20 to 40 tons/hour/gang. In addition, since the average number of gangs working per ship is small with 2.5 or 2.8 gangs/shift, the average tonnage handled per ship per day is only 336 tons for import general cargo ships and only 384 tons for export ships, which suggests that the Port of Colombo is not an efficient port. Considering 800 to 1,000 tons/day which is generally expected for a port by liner shipping comapnies, it has to be said that the Port of Colombo does not fully fulfill the requirements of shipping companies that are one of the biggest users of the Port.

Regardless of this low efficiency, the annual cargo tonnage of 180,000 tons handled per berth or of 1,024 tons handled per meter of berth length is satisfactorily high in comparison with the standard of 900 tons/m for a large-scale port. This is due to the extremely high rate of berth occupancy of nearly 100%, which results in underisrable waiting for berths at almost all times of ship's arrival. (Refer II-4-4 Port Congestion).

5-2 Present Situation of Cargo Handling

According to the Sri Lanka Ports Authority, present cargo handling is classified into the following three categories:

① Foods (import):
"Direct delivery" where cargo is directly unloaded from ship to the consignee's trucks or trailers. The Prince Vijaga Quay and the North Guide Pier is mainly used.

② Import general cargo:
Cargo unloaded from ships is transferred into transit sheds behind the berths and stored there until delivery, but some cargo is directly unloaded to consignee's trucks, mainly in the Queen Elizabeth Quay and the Bandaranaike Quay. Cargo unloaded from ships to liters at midstream berths is landed at lighter berths, transferred into transit sheds and stored there until delivery.

③ Export:
Export cargo is generally brought to the ship's side directly by shipper's trucks then loaded to the ship (this is called "direct alongside"). Some cargo are brought into and stored in transit sheds before loading on to ships. This is mostly black tea to be

palletized in transit sheds. It is mostly handled at the Queen Elizabeth Quay, the Bandaranaike Quay and the North Guide Pier.

Handling and transporting of cargo from ship to receiver are mainly performed by hand work, and cargo handling equipment such as forklifts are occasionally used for handling cargo. Specifically, while unloading from ship to wharf apron is performed by ship's derrick cranes or by berth's cranes (portal wharf crane) using rope slings or rope-net slings, handling and transporting between transit shed and wharf apron is mainly done by hand with handcarts, which makes the operation extremely inefficient. It is frequently seen that stevedores (ship's gang) are idle waiting for the completion of tallying, sorting, and transporting to transit sheds of cargo previously unloaded. Thus, a improvement of efficiency by mechanization of cargo handling between transit sheds and the wharf apron will be the key factor for improving the overall efficiency of cargo handling. The situation is the same in delivery of cargo to consignee's trucks.

Because of stacking cargo for storing in transit sheds by hand, the stacked cargo height is naturally limited to an average of 1.0 to 1.5 meters, so that shed space is not effectively utilized.

The mechanization of cargo handling is again required for the purpose of effective utilization of transit sheds.

The "direct alongside" method for loading is widely adopted by shippers instead of carrying cargo into sheds in advance of the ship's arrival to save shipping costs for the shippers. From the viewpoint for the efficient cargo handling, this method will create difficulty in planning work schedules and carrying out planned schedules because the arrival of cargo and order of arrival are generally inaccurate and inconsistent. In fact, cargo which is planned to be loaded in accordance with a loading schedule tends to frequently fail to arrive in time, or cargo scheduled for subsequent arrival frequently arrives earlier than expected. Therefore, compared to loading work for cargo stored beforehand in transit sheds, cargo handling efficiency for "direct alonside" is generally poor and the present situation is not desirable. A similar situation also occurs in the "direct delivery" method for imported foods.

According to the Port (Cargo)Corporation statistics, cargo handled through lighters at mid-stream berths amounts to about 10% of the total cargo handled in the last several years. Unloading/loading of cargo from/to lighters is carried out by using mobile cranes or wharf cranes at lighter berths. The cargo transport situation between the apron and transit sheds and storage in these sheds for the lighter cargo is the same as that explained above.

5-3 Administration

Port cargo handling works are directly controlled by the Sri Lanka Ports Authority (previously by the Port (Cargo) Corporation) using its own employees, and various handling charges as well as port dues (such as tonnage dues, harbour dues, pilotage, etc.) are the important income sources of the Sri Lanka Ports Authority. Number of employees of the Port (Cargo) Corporation from 1975 to 1978 is shown in Table-II.5.2, in which it is noted that the considerable increase in 1978 was needed to cope with the increase of import cargo as a result of the government's import liberalization policy.

The standard compositions of gangs (working groups) are as follows:

Stevedore (on board)		Landing (ashore)		Delivery (shed)	
Tindal:	1	Kangany:	1	Kangany:	1
Winchmen:	4	Labours:	14	Labours:	6 to 8
Holdmen:	12 (unloading)				
	16 (loading)				

It is advised that about 80 to 90 gangs of stevedores are available and even landing/delivery gangs can be used as stevedore gangs if the latter becomes insufficient. According to the work schedule, the day shift is from 07:30 to 16:30 and night shift from 16:30 to 24:00 and, in addition, overtime extension from 00:00 to 04:00 or 06:30 is workable. Employees work for either day or night shift, changing the shift of each worker every other week.

Employees mostly belong to the National Employees Union (50%) but some employees belong to other labour unions such as the Sri Lanka Independent Republication Port Workers Union (12%), the Ceylon Mercantile Union (9%), the Government's import liberalization policy. so forth. It is said that the relationship between the Sri Lanka Ports Authority and labour unions is very good and there has been no labour dispute such as strikes in recent years, and also that the labor force surplus that may be caused by the mechanization of cargo handling in the future will be offset by a natural wastage.

Table – II.5.1 Statistics of Cargo-Handling (1978)

	Imports		Exports	(Ex lighters)
	Poods	Generals		
Tonnage handled per year (Tons)	836,000	1,059,000	1,050,000	(308,000)
Nos. of ships callings per year	101	591	548	
Tonnage handled per ship (Tons)	8,500	1,700	1,800	
Output per day per ship (Tons)	600	336	384	
Working period per ship (Days)	13.9	5.0	4.8	
Nos. of gangs employed per ship	2.8		2.5	
Output per gang per hour (Tons)	20.1	8.3	9.0	(4.7)
Output per year (Tons)	180,000 tons/berth or 1,024 tons/m			

(Source: P (C) C Statistic, 1978)

Table – II.5.2 Port (Cargo) Corporation Labour Force

	Non Labour	Labour	Total
As at 31. 12. 1975	3,009	9,722	12,713
31. 12. 1976	3,027	9,235	12,262
31. 12. 1977	3,051	9,215	12,266
31. 12. 1978	3,069	11,100	14,169

(Source: P(C)C Statistical Information)

CHAPTER 6 PORT CHARGES

Though the Sri Lanka Ports Authority was established on the 1st of August 1979 by amalgamating the Colombo Port Commission, the Port (Cargo) Corporation, and the Port Tally and Protective Services Corporation, the port tariffs previously employed by the above three organizations are still effective without any revision.

For the container charges, a new "Schedule of Charges for Handling Containers" has been decided with the approval of the Minister of Trade and Shipping.

Actual revenue of the Port of Colombo is shown in Table-II.6.1. Details of the revenue of the Port in 1978 are shown in Table-II.6.2. The port charges of the Port of Colombo are given in Table-II.6.3.

Table – II.6.1 Actual Revenue by Section

(Unit: Million Rs.)

	1975	1976	1977	1978
CPC section	62	57	63	73
P(C)C section	129	150	209	299
PTPSC section	–	–	13	18
Total	191	207	285	390

source: CPC, P(C)C and PTPSC

Note 1. For the years of 1977 and before, revenues from the dual exchange rate system (FEEC's) are included.
2. The totals of the revenues of 1975 and 1976 do not include the revenue of PTPSC section.

Table – II.6.2 Detail of 1978 Revenues

(Unit: Million Rs.)

	Revenue	Ratio	Section	Item
Stevedoring	157	40%	P(C)C	H
Landing and Delivery	105	27	"	A
Rents	29	7	CPC	
Port and Harbour Dues	23	6	"	
Shipping	21	5	P(C)C	B
Tally and Protective	18	5	PTPSC	
Supply of Water	6	2	P(C)C	D
Pilotages	4	1	CPC	
Quay Charges	4	1	"	Port Charges 2
Other Collection	22	6		
Total	390	100%		

source: CPC, P(C)C and PTPSC

Table – II.6.3 List of Port Charges by Section

Section	Items
CPC	Port and Harbour Dues 1. Entering Dues 2. Over-hour Dues 3. Buoy Rent Charges 4. Tonnage Dues 5. Import Harbour Dues 6. Reshipment Harbour Dues 7. Export Harbour Dues Rents 1. Import Warehouse Rent 2. Reshipment Warehouse Rent 3. Bonded Warehouse Rent 4. Export Warehouse Rent 5. Airfright Warehouse Rent Patent Slip Pilotage Port Charges 1. Tug Charges 2. Charges for Use of Along Side Berths 3. Charges for Block Jetty Slip, Boat House Slip 100 ton Slip Ways and Barge Repair Yard 4. Hire of Port Commission Floating Cranes 5. Oil Facilities 6. Charges for The Use of Port Commission Cranes 7. Locos 8. Mechanical Equipment 9. Handling of Gypsum 10. Handling of Coal 11. Laying of a Sand Carpet 12. Lake to Harbour Canal Locks 13. Chain Testing 14. Radio Telephone Equipment 15. Diving Charges 16. Port Fire Brigade & Salvage 17. Launch for Ambulance Purposes 18. Fumigation 19. Fresh Water 20. Priestman Grab 21. Weigh Bridge 22. Hire of Lorries 23. Hire of Other Floating Crafts 24. Air Compressors 25. Portable Telephones 26. Charges for Use of Government Launches & Small Tugs 27. Special Concessions for Vessels Calling for Bunkers only
P(C)C	Conventional A. Landing and Delivery B. Shipping C. Transhipping and Re-shipping D. Supplying Fresh Water E. Handling Coal and Coke F. Hiring of Cargo Barges, Lighters, Pontoon Barges, Tugs and Motor Launches G. The Hire of Gear used in the Ports H. Discharging and Loading Cargo (Stevedoring)
Container*	Charges for Handling Containers
PTPSC	

*"Container" section is provided to conform to the V-7 form.

source:

CPC section	GAZETTE	14,933/4 – 23.11.1970
	GAZETTE	14,777/1 – 30.11.1967
	GAZETTE	303/10 – 9.2.1978
	GAZETTE	148/8 – 30.1.1975
P(C)C section	Charges at a glance	14.3.1979
SLPA	Scale of Rates for Container Operations Charged at the Port of Colombo Act No. 5 of 1979	

PART III
CARGO TRAFFIC FORECAST

PART III CARGO TRAFFIC FORECAST

CHAPTER 1 BASIC PRINCIPLES

The present government shifted the economic system of the Nation from a severely regulated trade system to a liberalized trade plan in July 1977. The national economic plan, however, has not been fixed. At this stage, it is extremely difficult to forecast the port cargo traffic through the ports without some ambiguity, as this is closely related to the nation's economic activities.

Generally, future cargo traffic through the ports is macroscopically forecast, using the correlation between the port cargo traffic and some specific macroscopic economic indicators of past years. In the case of Sri Lanka, however ,the drastic changes in the economic policies during the last two years prevents the adoption of the macroscopic approach.

In this report, therefore, the total volume of cargo in Sri Lanka is, as a principle, forecast for each main goods, based on the individual future demand/supply plans. Then, this volume is apportioned to each port in consideration of their functions and service areas. In doing so, the present share is not changed except for the imported wheat allocated to the Port of Trincomalee. Thus, the Port of Colombo is assumed to be the nation's only port for international trade.

CHAPTER 2 SOCIAL AND ECONOMIC FRAMEWORK

The present forecast is carried out based on the key indicators given in the "Public Investment 1979--1983" published by the Ministry of Finance and Planning in February 1979. The main indicators employed here are as follows:

(1)	GDP growth rate	5.5% per annum
(2)	Increase in industries (including construction)	8.6% per annum
	Manufacturing industries only	8.0% per annum
	Construction only	12.0% per annum
(3)	Increase in agricultural production	4.5% per annum
(4)	Population increase	1.5% per annum
	1978: 14,400,000 people	
	1983: 15,500,000 people	

(5) Besides the above figures, the table "Export and Import Projections – 1978, 1979 and 1983" contained in the "Public Investment 1979 – 1983" (see Table – III. 2.1) is used.

Table – III.2.1 Export and Import Projections – 1973, 1979 and 1983

		Values At Current Prices in Millions of US Dollars		
		1978 (Estimate)	1979	1983
1. Export f.o.b.		836	900	1,205
Tea	Volume Mn. lbs.	425	440	475
	Value	406	406	484
Rubber	Volume Mn. lbs.	304	330	300
	Value	128	149	177
Coconut	Volume Mn. nuts	526	440	690
	Value	62	59	109
Gems	Value	33	34	38
Petroleum	Value	59	65	55
Industrial goods	Value	61	88	203
Other	Value	87	99	139
2. Imports c. & f.		972	1,167	1,819
(a) Food		297	278	333
(i) Rice and Flour	Volume Th. tons	757	538	223
	Value	171	142	80
(ii) Sugar	Volume Th. tons	150	152	127
	Value	37	34	60
(iii) Wheat grain	Volume Th. tons	110	170	575
	Value	10	23	114
(iv) Other food	Value	79	79	79
(b) Non-food	Value	87	107	140
(c) Intermediate Goods		366	482	853
(i) Fertilizer	Volume Th. tons	442	460	370
	Value*	55	63	73
(ii) Petroleum	Volume Mn. tons	15	18	26
	Value**	165	234	412
(iii) Other	Value	146	185	368
(d) Investment goods	Value	222	300	493

* Includes agro-chemicals.
** Includes refined products

CHAPTER 3 COMMODITY FORECAST

3-1 Export

3-1-1 Tea

There will not be any great increase in the export of tea, which is a major export item. 2.1%, the annual rate of increase in the five years shown in Table-III.2.1 is considered to be a reasonable rate. So, anticipaiting a 2.1% annual increase from the 1978 total export volume of 511,000 tons (in freight ton), the export in 1983 and 1988 is 567,000 and 630,000 tons respectively.

Since the share of Trincomalee in the export of tea is likely to remain about the same level as at present (50,000 tons for 1983 and 55,000 tons for 1988), Colombo will handle 517,000 tons in 1983 and 575,000 tons in 1988.

3-1-2 Rubber

Like tea, rubber is a leading export item of Sri Lanka. However, its export is unlikely to increase for some time to come. In Table-III.2.1, there is an increase of 0.6% in actual revenue value in the next five years. Quantitatively, there is no increase over the level of 1978. In other words, the export of rubber is expected to be relatively favorable in terms of revenue and thus should encourage export efforts. It is therefore believed that quantitative increase in exports proportionate to the 0.6% revenue increase can be realized in the future. Since the total export in 1978 was 153,000 tons, 158,000 and 163,000 tons are forcasted for export in 1983 and 1988 respectively.

Colombo will handle 146,000 tons, and 148,000 tons -- the remainder is forcasted as the amount handled through the Port of Galle.

3-1-3 Conconuts and Coconut Products

According to Table-III.2.1, the annual increase in the export of coconuts in the five years from 1978 is 5.5%. So, it is considered that the export of related items: coconuts, coconut fiber and coconut oil in drums, will also increase by 5.5% in the future. Export by items is shown in Table-III.3.1.

3-1-4 Other General Cargo

Chief among the other general cargo are food, textiles and industrial products, including chemicals. The Government of Sri Lanka attaches that utmost importance to the future export of these items. According to Table-III.2.1, it proposes to increase its exports from US$61 million in 1978 to US$203 million in 1983. The plan is to increase the export of industrial products and other items by 18% a year during the five years from 1978 to 1983. The actual increase rate in the future export of other general cargoes is 14%, the remainder after subtraciting 4% representing inflation in the international market. Since 154,000 tons of cargo were exported from Co-

lombo in 1978, it is assumed that 489,000 and 941,000 tons will be exported in 1983 and 1988, respectively.

3-1-5 Coconut Oil and Refined Petroleum Oil

The wet cargo consists of the export of coconut oil and the local transport of refined petroleum oil, both are transported by tankers.

The growth rate of the export of coconut oil is assumed 5.5% per annum, exactly the same as that employed for coconut products. Hence, the amounts of coconut oil to be exported are estimated as 31 thousand metric tons for 1983 and 40 thousand metric tons for 1988.

Refined petroleum oil, products of the refinery located four miles east to the Port, is locally transported by coastal tankers to the Port of Galle and the Port of Trincomalee and amounts to 84 thousand metric tons alltogether in 1978. Since little information is available concerning the number and the capacity of coastal tankers in future and the unloading capacity in the outer port in the future, it is assumed here that the amount of refined oil to be delivered locally from the Port of Cobombo in the future not less than that in 1978. Thus, 84 thousand metric tons are employed here both for 1983 and 1988.

3-2 Import

3-2-1 Rice and Flour

At present, rice and flour are the most important import items. The import of rice will decrease or become totally unnecessary in the future since the Government is now making positive efforts to establish rice self-sufficiency. Flour is now imported as a finished product but, when a flour mill being constructed at Trincomalee is completed, the import of flour will be replaced for the most part by the import of wheat.

The total per-capita consumption of rice and flour in 1978 was 145 kg with 42.6 kg for rice and 102.4 kg for flour. The import figures were forcast from their production and consumption, on the assumption that this level of consumption will continue for some time.

The domestic production of rice in 1978 was 1,295,000 tons, with the shortage of 141,000 tons imported. Since rice production is being increased at annual rate of 4%, the import of rice will soon be unnecessary. For flour, its import will be replaced by the import of wheat when the Trincomalee flour mill, with an annual production capacity of 500,000 tons, is completed. But the domestic production of wheat is hardly feasible, at least for the present. So, the import of large quantities of flour or wheat will continue in the future. When the above-mentioned flour mill is in operation, most wheat will arrive in Trincomalee, and the flour produced from the mill will be shipped from Trincomalee to Colombo.

Table-III.3.2 shows the forecast made on the import or domestic shipment of rice and flour to Colombo in consideration of production and consumption when the flour mill is in operation.

3-2-2 Wheat

According to Table-III.2.1, a national total of 757,000 tons of what will be imported in 1983. Most of this amount will be handled through Trincomalee with the exception of 75,000 tons, which will be imported at Colombo.

Thus, in 1988, Sri Lanka will import large quantities of wheat but all will be handled through Trincomalee and none will be imported at Colombo.

3-2-3 Sugar

In 1978, 157,000 tons of sugar were imported at Colombo but in the future, all necessary sugar will be produced domestically. In table-III.2.1., the import of sugar in 1983 is 127,000 tons, reflecting yearly decreases at a rate of 4.3% from the 1978 level. It can be assumed that imports will continue decreasing at this rate after 1983. Thus, an import of 100,000 tons is predicted for 1988.

3-2-4 Cement

The present domestic production capacity of cement totals 740,000 tons/year. The consumption was 420,000 tons in 1976 and 342,000 tons in 1977 and the present average annual consumption is estimated at about 425,000 tons from the two-year average. Thus the cement mills are operating at only about 60% of their total capacity of 740,000 tons to supply this demand.

The future consumption of cement will increase with the increase of construction work (12% annually) and is estimated at 750,000 tons in 1983 and 1,320,000 tons in 1988. Thus, in 1983 the consumption will approximately equal the production and there is no need for imports as far as the demand/supply balance is concerned. However, the government plans to import 150,000 tons of high-quality cement for the Mahaweli development project to ensure adequate quality. Assuming two years as the period of this import, 75,000 tons of cement will be imported each year.

In 1988, more cement will be consumed than can be supplied by the present production capacity but, by that time, the production capacity reportedly will be increased by about 200,000 tons. So imports are estimated at 380,000 tons (1,320,000 t – 940,000 t = 380,000 t).

3-2-5 Chemical Fertilizers

The total import of chemical fertilizers in 1978 was 435,000 tons. This amount can be regarded to equal to the total national consumption since the production capacity in Sri Lanka was zero. The future consumption will increase with the increase of agricultural production and is estimated at 540,000 tons in 1983 and 675,000 tons in 1988.

As for domestic production, a plant with total urea producing capacity of 316,000 tons/year is presently being constructed and will be completed by 1983.

Of the 1983 consumption of 540,000 tons, 370,000 tons to be imported as in Table-III.2.1 comprises types other than urea. Urea, which represents the remaining 170,000 tons, will be supplied by domestic production. It is believed that the consumption tendency prevailing in 1983

will continue in 1988. So, in 1988 chemical fertilizers, other than urea, will amount to 461,000 tons imported, and 240,000 tons supplied by domestic production.

3-2-6 Other General Cargo

The 624,000 tons of cargo handled through Colombo in 1978 may be divided by annual import values in 1976 and 1977 into 118,000 tons of consumer goods, 393,000 tons of intermediate goods and 113,000 tons of investment goods. The import of each type of goods is as shown in Table-III.3.3, and assumes that the volume of the cargoes handled through Colombo will increase in accordance with the GDP increase rate (5.5%) for consumer goods, the industrial increase rate (8%) for intermediate goods, and the overall construction/service increase rate (6.5%) for investment goods.

3-2-7 Crude and Refined Oil

The capacity of the oil refinery at Hapugahakanda has been increased from the previous 38 thousand barrels per day to the present 51 thousand barrels per day after October 1979. The amount of crude and refined oil to be imported after the upgrading of the refinery forecast by the Ceylon Petroleum Corporation are shown in Table-IV.3.5. The forecast shows 2,350 thousand metric tons of crude oil are to be imported annually after the upgrading of the refinery, and refined to be imported totals 401 thousand metric tons for 1983 and 635 thousand metric tons for 1988.

Table – III.3.1 Forecast on Coconuts and Coconut Products Handled through the Port of Colombo

(Unit: 1,000 tons)

	1978	1983	1988
Desited Coconut	38	50	65
Coconut Fiber	132	172	225
Coconut Oil	24	31	40

Note: The 24,000 tons for coconut oil is the average for 1977 and 1978.

Table – III.3.2 Forecast on Rice and Flour Handled through the Port of Colombo

(Unit: 1,000 tons)

	1978	1983	1988	Remarks
Population (in million people)	14.4	15.5	16.7	Annual increase rate: 1.5%
Rice (Domestically produced)	1,295	1,573	1,903	Annual production increase rate: 4%
(Imported)	*1 141	*2 55	–	
Flour (Imported)	613	168	*3 121	50% of the flour produced by the Trincomales flour mill
(Domestic in-shipment)	–	220	250	

Note: *1 The 141,000 tons is only for Colombo and the national total is 180,000 tons.

*2 The amounts of rice and flour in 1983 are based on Table 3.2. Of these, the 55,000 tons for rice represents the shortage in domestic production. (Per-capita consumption: 105 kg)

*3 The 121,000 tons for flour in 1988 represents consumption in excess of the production capacity of the Trincomalee flour mill, which is 500,000 tons.

Table – III.3.3 Forecast on Volume of Other General Cargoes (by Types of Goods)

(Unit: 1,000 tons)

	Actual amount in 1978	1983	1988	Remarks
Consumer goods	118	154	202	Forecast GDP increase rate (5.5%)
Intermediate goods	393	577	848	Industrial increase rate (8.0%)
Investment goods	113	155	222	Construction and service (6.5%)
Total	624	886	1,272	

CHAPTER 4 CONTAINER FORECAST

4-1 Procedure of Container Forecast

The procedure of container cargo forecast is as follows:

a) To classify every cargo whether it is containerizable or not

b) To estimate the potential demand in container vessels by route

c) To estimate the rate of containerization at the target year by route

The "rate of containerization" mentioned above means that the ratio of the resultant containerized cargo to the total cargo suitable for containers.

The flow chart of the above procedure is shown in Fig.-III.4.1.

4-2 Container Forecast

4-2-1 Cargo Suitable for Containers

Generally, cargoes suitable for containers are general cargoes that are relatively expensive. In the case of the Port of Colombo, containers are used for all dry goods exported – including the other general cargoes other than coconut oil and oils which are treated as bulk cargoes. As for imports, containers are used only for general cargoes which are well-suited for it, with the use of containers for other cargoes unlikely to be realized. So, the volume of cargoes suitable for container transportation in 1983 and 1988 will be as follows:

	1983	1988
Export	1,405,000 tons	1,989,000 tons
Import	886,000 tons	1,272,000 tons

4-2-2 Container Transport Lines

"Container transport lines" refers to lines or areas where container ships are already operating, one of which the Port of Colombo is a part. Table-III.4.2 shows the state of operation – by lines – of container ships using this Port. These container transport lines comprise the following lines or areas:

U.K./Continent
Red Sea/Gulf
Straits/H.K./Jpn.
U.S.A./Canada
Aus./New Zealand

Table-III.4.3 shows the 1978 proportions of cargoes loaded or unloaded at the Port by ships operating on these lines.

4-2-3 Calculation of Volume of Container Cargoes

Generally, the rate of containerization can reach only 50% three to five years after the start of calling by container ships, and it will take seven to 10 years to reach 80%. Further, it cannot

be expected that containerization can be realized for all cargoes suitable for containers. Therefore, rates of containerization are assumed here by container transport lines and other lines as follows:

	1983	1988
Container transport lines	50%	80%
Other lines	--	50%

Table-III.4.3 shows the calculating procedure for container cargo. The total exports and imports will be 899,000 tons in 1983 and 2,398,000 tons in 1988. Generally, in the case of a developing country, the volume of export container cargoes is extremely small and the imbalance of export and import container cargoes makes containerization very difficult.

But Sri Lanka is characterized by the fact that export container cargoes somewhat exceed import container cargoes, thus the export and import cargoes are relatively balanced. This situation is indeed, favorable for containerization in the future.

4-3 Number of Containers Handled by Container Vans

The number of containers handled by container vans is calculated by the number of containers necessary for the larger of the volumes of export and import container cargoes. Thus, it is decided by the volume of export container cargoes in both 1983 and 1988. In the case of 8' x 8' x 20' containers, the average net content per-container is 17 tons. So, the annual total of containers handled is:

1983

Number: 560,000 t ÷ 17 t = 33,000

Loading and unloading: 33,000 x 2 = 66,000

1988

Number: 1,470,000 t ÷ 17 t = 86,470

Loading and unloading: 86,470 x 2 = 173,000

Of course, some of the unloaded containers are empty.

4-4 Tranship Container

Based on the information provided by the Colombo Port Commission, tranship containers are estimated as 4,800 TEU (one-way) for 1979 and 12,000 TEU (one-way) for 1988. By the linear interpolation, 7,200 TEU (one-way) is obtained for 1983.

Above figures are summarized as follows:

	No. of Containers (TEU, one-way)	Tonnage of Cargo (Freight tons, two-way)
1979	4,800	156,400
1983	7,200	244,800
1988	12,000	408,000

Table – III.4.1 Existing Container Route through Colombo

	Type	No. of Container Vessels	Service	TEU/Vessel
UK-Continent-Mediterranean/Southeast Asia	RO/RO	3	About Every 45 Days	637
Middle East/Far East	SC/Conventional	5	Non	628~250
Middle East/North America	SC	6	Fortnightly	439~277
Middle East/Australia	SC/Conventional	4	About 20/Year	432~328
Far East/PSW (India-Bangladesh Service)	SC	5	Weekly	387~287
Far East/PNW (South East Asia-India-Bangladesh Service)	SC	3	Weekly	387
Within Asia	na	2	Biweekly	792

Table – III.4.2 Composition Ratio of Cargoes by Lines

(Unit: %)

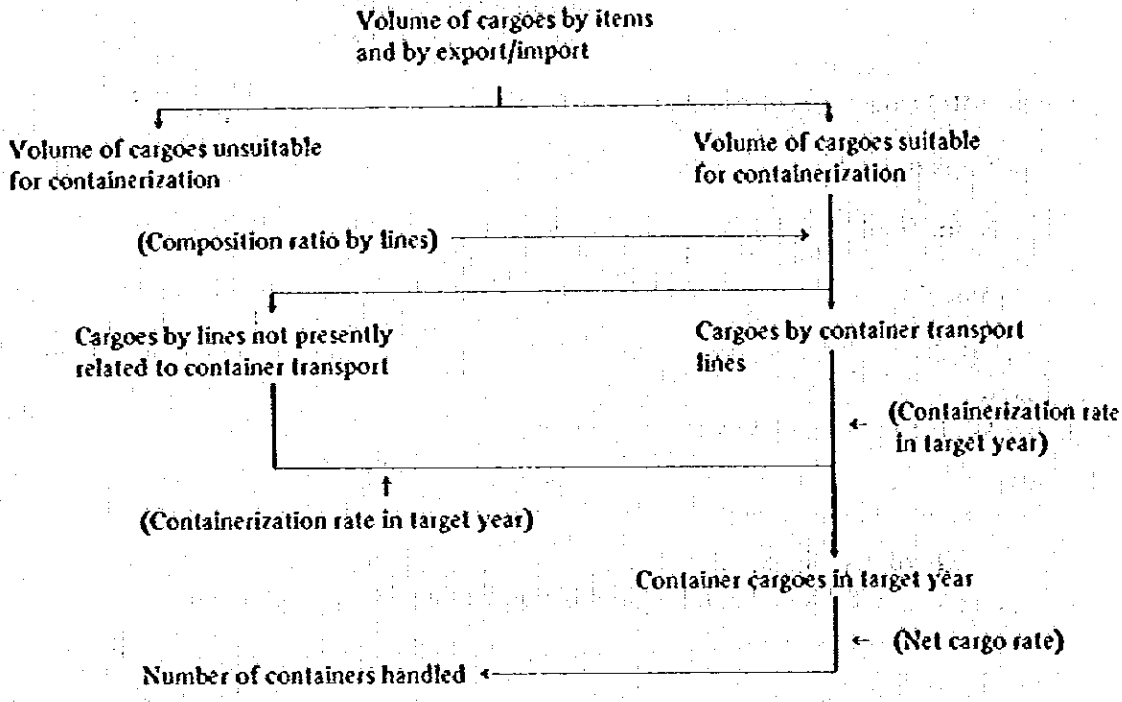
Line division	Export	Import	Remarks
Container transport lines	79.7	76.5	
Other lines	20.3	23.5	
Total	100.0	100.0	

Table – III.4.3 Calculation of Container Cargoes

(Unit: 1,000 tons)

Year	Export/ Import	Cargoes suitable for containers	Container transport lines	Other lines	Rate of containeri-zation	Container cargoes
1983	Export	1,405	1,120	–	50%	560
			–	285	–	–
	Import	886	675	–	50%	339
			–	208	–	–
	Total	2,291	1,795	493		889
1988	Export	1,989	1,585	–	80%	1,268
			–	404	50%	202
	Sub-total	1,989	1,585	404		1,470
	Import	1,272	973	–	80%	778
			–	299	50%	150
	Sub-total	1,272	973	299		928
	Total	3,261	2,558	703		2,398

Fig. – III.4.1 Flow Chart on Container Cargo Forecast



CHAPTER 5 SUMMARY TABLE ON CARGO FORECAST

Table-III.5.1 shows the results of forecasts on the volume of cargoes handled by the Port of Colombo by item and by type of packing.

Table – III.5.1 Traffic Forecast of the Port of Colombo

(Unit: Thousand Tons)

Items	Export					Items	Import					Total					
	1978	1983		1988			1978	1983		1988		1978	1983			1988		
	Total	Total	Container	Total	Container		Total	Total	Container	Total	Container	Total	Total	1988/1978	Container	Total	1988/1978	Container
Dry Cargo						Dry Cargo												
Tea	464	517		575		Rice	141	55	–	–	–							
Rubber	141	146		148		Flour	538	320*1	–	371*1	–							
Coconut	38	50		60		Sugar	157	127	–	100	–							
Coconut Fiber	132	172	(560)	225	(1,470)	Wheat	–	75	–	–	–							
Coconut Oil (In Drum)	11	31		40		Cement	–	75	–	380	–							
General Cargo	254	489		941		Fertilizer	435	370	–	461	–							
						General Cargo	624	886	(339)	1,272	(928)							
Sub Total	1,040*2	1,405	(560)	1,989	(1,470)	Sub Total	1,895	1,908	(339)	2,584	(928)	2,935	3,313	1.128	(899)	4,573	1.558	(2,398)
Wet Cargo						Wet Cargo												
Coconut Oil	23	30	–	39	–	Crude Oil	1,457	2,350	–	2,350	–							
Refined Oil	84*2	84*1	–	84*1	–	Refined Oil	126	401	–	635	–							
Sub Total	107	114	–	123	–	Sub Total	1,583	2,751	–	2,985	–	1,690	2,865	1.695	–	3,108	1.839	–
Grand Total	1,147	1,519	(560)	2,112	(1,470)	Grand Total	3,478	4,659	(339)	5,569	(928)	4,625	6,178	1.336	(899)	7,681	1.661	(2,398)

1) *1 includes local transport.
*2 excludes export of rice (10,000 tons)
*3 excludes export of refined oil (162,000 tons)
2) Tranship Container (245,000 tons for 1983 and 408,000 tons for 1988) is excluded in the Table.

PART IV
MASTER PLAN

PART IV MASTER PLAN

CHAPTER 1 GENERAL

1-1 Requirements for the Plan

In accordance with the economic policies of the country and the results of the present survey, the requirements for the Plan are formulated and shown in Table-IV.1.1.

1-2 Basic Lines of the Plan

With these requirements in mind, the basic lines of the Plan are selected as follows:

① The future increase in the cargo traffic, together with the reduction of existing and anticipated Port congestion, shall be met by raising the cargo handling productivity through mechanization and by constructing additional berthing facilities.
For crude oil import, the necessary expansion of the facilities shall be considered with the expansion of the existing oil refinery.

② An urgent demand for containerization shall be met by providing container berths through the modification of existing berths or, if necessary, through the construction of new container terminals.

③ A more effective and adequate land use shall be considered.

④ The existing road network shall be improved, to increase road transport capacity and to insure proper interfacing of Port and city road plans.

⑤ The existing safety problem which involves the existing Oil Dock and midstream berths shall be, to some extent, solved.

⑥ An urgent need for the expansion of large vessel repair facilities shall be considered. The need consists of two proposals, that is the construction of a dry dock and the modification of existing cargo handling berths to ship repair berths.

1-3 Target Years of the Plan

Considering the recent drastic changes in the economic policies of the country, a realistic target year with a short time span must be selected for a project. Thus, mainly from the viewpoint of the reliability of the forecast, the year of 1983, the final year foreseen in the "Public Investment 1979 – 1983" is employed as the target year for the Urgent Plan, and 1988, 10 years after 1978, the starting year of almost all informations on which the present Study is based, is employed as the target year for the Master plan.

CHAPTER 2 PLANNING OF PORT LAYOUT AND LAND USE

2-1 Civil Engineering Facilities

2-1-1 Conventional Berths

As already stated in Part III, the tonnage of dry cargo to be handled in 1988 are forecasted as follows:

Conventional cargo:	2,195,000 freight tons
Containers:	2,786,000 freight tons (including tranship containers of 12,000 TEU)
Total	4,981,000 freight tons

Assuming the tonnage to be handled per alongside berth is 150,000 freight tons, the number of alongside berths required to cover the above forecast conventional cargo is 14.6.

On the other hand, in the year 1988, the entire North Guide Pier including the South Pier is planned to be modified to ship repair berths, thus two berths in the North Guide Pier and one berth in the South Pier become unavailable. Also, the width of the North Pier is planned to be widened to 50 meters after the removal of the oil berth to allow the U-turn of lorries, and two large berths is planned there. Thus, the number of alongside berths in the port is 14.5 in total assuming small berth in the Bandaranaike Quay and the Coaster Berths are counted as 0.5 berth each. The total length of alongside berths is summed up as 2,603 meters, assuming only two-thirds of the length of the small berths are taken into account. The results are shown in Table-IV.2.1.

Now let's review these figures by using queuing theory. The tonnage brought/loaded per vessel is assumed the same as that in 1978, that is: 8,500 tons for food import and 1,700 tons for import/export of general cargo. Cargo handling period of 3.6 days is used considering the reduction of 2.3 days due to the raise of productivity after introducing cargo handling equipment. The results of the analysis reveal that the rate of berth occupancy is 73% and average awaiting period is about 0.22 to 0.11 day, which is considered to be reasonable.

2-1-2 Container Berths

The number of containers handled per berth is governed by the various factors described below.

① Physical properties of a container terminal – the scale of berths, the area of a marshalling yard, the capacity of CFS and the number of container cranes

② Method of operation of a container terminal

③ Container cargo – TEU brought/loaded per vessel, ratio of LCL to FCL and the balance of export and import

400 to 800 thousand freight tons per berth for one-way transport is commonly assumed in a planning. Here, 600 thousand freight tons for export is employed and this gives, from the export/import ratio, 400 thousand freight tons for import. Thus, the total cargo per berth is one million freight tons.

From the above mentioned cargo handling capacity together with the forecast container traffic, three container berths are required in 1988. Now, the queuing theory is applied to examine this. The container cargo brought/loaded per vessel is assumed to increase by 50% of that of conventional cargo in consideration of feeder services to neighbouring countries. This gives 2,550 tons per vessel, which correspond to 150 TEU per vessel assuming 17 tons/TEU. Thus, the average container handling period can be evaluated as one day considering an usual container crane capacity of 20 TEU/h. Using the above figures, the results of queuing analysis show a rate of berth occupancy close to 100%, which means the awaiting period is theoretically infinite.

To make clear this situation, the queuing analysis for four container berths is carried out. With four berths, the rate of berth occupancy drops down to about 75% with an awaiting period of 0.5 to 0.25 days, which is considered to be reasonable. It should be noted, however, that the queuing analysis should be used only as a verification, since there exist uncertainties both in input data and the method of analysis itself.

The possibility of the occurrence of port congestion for three berths is likely to be lower than analyzed. The reason is that a container vessel is usually operated on a fixed schedule because of its high building cost, while, in the analysis, a random arrival distribution of container vessels is assumed. In addition, as stated later, since one berth in Queen Elizabeth Quay is used as a container berth at least until the completion of the Master Plan, the freedom of retaining it as a container berth remains in the meantime. Also, as stated later, three container berths are designed as continuous berths which make possible the higher efficiency of the use of berths than those located separately from each other. For these reasons, the number of container berths is planned to be three and continuous berths is considered.

2-1-3 Oil Berth

Imported crude oil of 1,457 thousand metric tons was unloaded mainly at the oil berth in the North Pier in 1978. As is stated before, it is urgently required to transfer the existing oil berth to another safer location to secure the safety of the Port and, in addition, to meet the increased production capacity of the refinery due to its expansion from the previous 38,000 barrels/day to the present 51,000 barrels/day.

As will be stated in IV.3.3 Oil Berth, however, a feasibility study can not be carried out without more detailed informations concerning the bedrock depth in the approach channel. Thus, a feasibility study including a survey of the bedrock depth in the approach channel is strongly recommended herewith, and an oil berth for 60,000DWT tankers immediately behind the North-West Breakwater is adopted here under the assumption that all the sea bottom material to be dredged in the approach channel is sand.

To accept 60,000 DWT tankers inside the Port, the layout of the West Entrance must be improved by removing the south end of the North-West Breakwater and by extending the South-West Breakwater along the approach channel. Thus, the approach channel is planned to be

widened by 50m from the existing 150m to 200m. This widening necessitates the removal of 75m of the North-West Breakwater.

2-2 Port Layout

2-2-1 Alternatives

From the results of the foregoing section, it is desired to have a new continuous shoreline of 900 meters for the container berths. This shoreline is desirably secured within the existing area of the Port and two alternatives is considered here. One is the modification of the entire Queen Elizabeth Quay to container berths by widening the backup yard. The other is the construction of a new quay somewhere inside the Port.

The biggest problem anticipated when modifying the existing Queen Elizabeth Quay to a new container terminal is that a container crane cannot be accommodated due to the lack of the bearing capacity of subsoil, as is stated in the Chapter 4 of the Part IV. The 200 meter extension can be reinforced to support a container crane by piling inside the existing cylinders, while the other part of the Quay must be drastically improved. There are two method to improve this part. One is to have the face line of the Quay moved forward by constructing a new structure in front of the existing structure and this makes narrower the sea area in between the Queen Elizabeth Quay and the Bandaranaike Quay than minimally needed. The other is to replace the existing quaywall by a entirely new structure and this involves a large scale of reconstruction including demolition of the transit sheds. Thus, the modification of the Queen Elizabeth Quay to a container quay is concluded to be unfeasible. In addition, 4 to 5 new berths with the length of 740 m to 925 m and with the water depth of at least −10m, for conventional cargo handling, must be constructed anyway to substitute the Queen Elizabeth Quay.

From the above discussion, the construction of a new quay with three continuous container berths is planned in the present study.

2-2-2 Details of Port Layout

(1) Container Quay

There are few options in determining the location for a continuous 900 m shoreline to be secured within the Port. The area along the existing shoreline from the canal to the Coaling Jetties is available for this purpose. Among the rest, the area just in front of the existing Coaling Jetties is selected as a location of a new quay. The reasons are as follows:

① This area is currently in idle.

② The area has the largest backup yard. And,

③ the area is least affected by waves coming directly from the West Entrance of the Port.

In determining the layout of the new quay (the Korteboam Quay) the Barge Repairing Basin and the adjacent sea area is retained to be used for miscellaneous purposes such as the mooring/landing of LUSH barges, sailing crafts and coaster, the mooring of boats, the

supply/labourer base for construction work, and the slip/boat repairs.

(2) North Pier

The width of the North Pier is windened to 50 meters to allow the U-turn of lorries on the Pier. The north side of the Pier is of a sloped rubble type similar to the existing structure. This is to reduce the reflection of invading waves from the North Entrance of the Port.

(3) Oil Berth and Improvement of Port Entrance Layout

As described in IV.3.3 Oil Berth, a new location immediately behind the North-West Breakwater is chosen for a 60,000 DWT tanker berth and bunkering dolphines after comparing with an off-shore bouy berth under the assumption that the dredging of the approach channel does not involve rock blastings.

The windening of the approach channel is necessary for the safer navigation of 60,000 DWT tankers. Thus, the south end of the North-West Breakwater is removed by 75m and the South-West Breakwater is extended by 150m along the approach channel. In addition, a seawall is planned to be built on the North-West Breakwater and a wave dissipating work is planned in front of it to prevent wave overtopping and to improve the degree of calmness in the approach channel.

(4) 65,000 DWT Dry Dock

As a location of a 65,000 DWT Dry Dock proposed by the Colombo Dockyard Ltd., the northernmost part of the existing Coaling Jetties adjacent to the existing New Dock is selected in the present study as has been proposed in its feasibility study.

The proposed layout determined from the above discussion is shown in Fig.-IV.2.1.

2-3 Hydraulic Verification of the Port Layout

In order to investigate the degree of harbour agitation both for the existing and proposed layouts, hydraulic calculations by a computer for selected incident waves are carried out.

2-3-1 Incident Waves and Reflection Coefficients

(1) Wave Direction

As input data for computer analysis, waves at the port entrances is used. Concerning deepwater waves, the predominant direction is WSW but deepwater waves having directions within the range of SW to WNW tend to be gradually refracted into the W direction as they approach the port entrances. Thus, the W-direction is adopted as a direction of input waves.

In addition, a NW-direction is adopted, which is close to the direction of the west entrance of the Port and is considered to affect the Port most severely. Though waves coming from almost any directions change their direction toward W that is normal to the seabed gradient, as they approach the port entrances, this is adopted for the purpose of examining the rather fictitious but severest conditions for the Port.

(2) Period of Incident Waves

The period of the incident waves is about 9 seconds for the relatively larger waves. In

investigating the harbour agitation, waves with higher frequency and with longer periods must be selected. Thus, waves with periods of 12 seconds are used here.

(3) Frequency of Incident Waves by Height

The frequency of deepwater wave hindcast from wind data observed at the tip of the South-West Breakwater for 13 years from 1963 to 1975 is shown in Table-IV.2.2. However, the data actually available are only for about 6 years equivalent since the observation had been performed intermittently over 13 years. This situation is taken into consideration when calculating the annual average number of days of occurrence in 13 years. Wave height at the port entrance is roughly 90% of those given in this Table.

(4) Reflection coefficients

Reflection coefficients are as follows:

North side of the North Pier:	60%
Coaling Jetties:	70%
Barge Repairing Basin:	70%
Canal Entrance:	0%
Wave dissipating work (NW Breakwater):	40%
Others:	90%

2-3-2 Cases for Calculations

Calculations are made for the following three cases:

Case 1: Existing layout

Case 2: After the completion of the Master Plan

Case 3: Master Plan without widening the approach channel

Case 3 is calculated so as to examine the effect of the proposed improvement of the port entrance layout.

2-3-3 Harbour Agitation

The results of calculations are shown in Figs.-IV.2.2(a) to (c) for the wave direction W and in Figs.-IV.2.3(a) to (c) for the wave direction NW.

Case 1: Existing layout

For the W direction, there are two spots, where the wave height ratio is 0.3, in front of Kochchikade and near the West Entrance. A contour line with wave height ratio of 0.2 exists surrounding these two spots. Also, spots with a ratio of 0.2 exist in front of the canal and in front of the Queen Elizabeth Quay. The influence due to the North Entrance is limited only to the area between the Prince Vijaya Quay and the North Pier and to the area along the North-West breakwater, and the wave height ratio there is 0.2 to 0.3. Assuming the allowable wave height for port activities be 0.5 m, the above results give, together with Table-IV.2.2, unworkable days of about 6.3 days per year.

For the incident wave with the NW direction, the inside of the Port is greatly agitated

buildings for customs, tally services, etc. behind this area are left unchanged as they are.

② Baghdad – Pettah – Kochchikade

This area is planned to be an area reserved for further developments. Construction work shops during the implementation of the present Plans can be sited here.

③ Kochchikade Basin

The Kochchikade Basin, the sea area between the existing land in Kochchikade and the Korteboam Quay is planned for mooring/berthing of small crafts such as boats, sailing crafts, coasters, LASH barges, construction work vessels, etc.

④ Barge Repairing Basin

The Barge Repairing Basin, the innermost part of the Kochchikade Basin, is the site for integrating boat repair functions in the Port.

⑤ Korteboam Quay

The Korteboam Quay with its backup yard is a comtainer terminal of the Port.

⑥ 65,000DWT Dry Dock – New Dock – Graving Dock – NGP

This area is planned for ship-building and repair area for large ships of the Colombo Dockyard Ltd.

⑦ Site of Walker Sons & Co., Ltd.

Facilities not related to port functions and owned by Walker Sons & Co., Ltd. is planned to be removed, and the site is used for the integration of repair shops and other similar functions.

⑧ NP – PVQ

This area is planned to be used for cargo handling (general cargo and bulk cargo).

⑨ Inside of the NW Breakwater

This area is planned as the site for an oil berth and a bunker berth, and for explosive moorings.

⑩ Beira Lake (East Lake)

The Beira Lake (East Lake) is suggested to be an environmental reservation, the same as the West Lake and South-West Lake. It is also suggested that the existing warehouses be removed under the warehouse complex scheme and that the barge repair shops be integrated to the Barge Repairing Basin inside the Port.

as is anticipated in advance. The contour line with the wave height ratio of 1.0 enters from the West Entrance thereby forming a long tongue-shape, and a spot with that of 1.0 also exists in front of Kochchikade. The influence of the northern opening is limited only to the area near the North Entrance. Considering that the wave height ratio in the Port is, on the average, 0.5 to 0.8, the number of unworkable days per year is 8.1 to 22.2 days. This assumes that deepwater waves with NW direction come to the Port without changing their direction.

Case 2: After the completion of the Master Plan

For the W direction, the degree of calmness in the port is greatly improved. Particularly, the influence of the West Entrance is greatly reduced. The area near the northern opening is also improved considerably.

Concerning the waves for the NW direction, the degree of improvement is not so great as is seen for the W direction. The contour line with the wave height ratio of 1.0 seen in front of Kochchikade in the existing layout moves to the front of the Korteboam Quay. The number of unworkable days,under the same assumption as the case 1, turns out to be 22.2 days per year. This is slightly worse than the case 1. The calmness near the North Entrance also drops slightly.

Case 3: The Master Plan without widening the approach channel

In this case, the calmness in the Port drops as a whole for both direction. For the direction of W, the contour line with the wave height ratio of 0.3 seen near the west entrance in the case 1 extends to the south up to the front of the Queen Elizabeth Quay. Surrounding this contour line, a wide area within the Port is more than 0.2. Since the wave height ratio is between 0.2 and 0.3, the number of unworkable days per year is 6.7 to 20.3.

For the waves with the NW direction, there are three spots with the wave height ratio of higher than 0.8. They are in front of the Queen Elizabeth Quay, the Korteboam Quay and between the Bandaranaike Quay and the Korteboam Quay. The wave height ratio in the port, as a whole, is roughly 0.5 to 0.8. The number of unworkable days is estimated as 8.1 to 22.2 days per year.

For the Queen Elizabeth Quay, the overall number of unworkable days summed up as, at most, 42.5 days per year by adding the number of unworkable days for the NW direction to that for the W direction. This gives the rate of unworkable days of 88.4%. This figure, though a little higher rate is desirable, is acceptable, since there are actually little possibility for high waves to come in the NW direction.

2-4 Plan for Land Use

The land use plan is shown in Fig.-IV.2.4

① QEQ – BQ – CB

This area is planned for cargo handling (general cargo). The front area between the Queen Elizabeth Quay and the Bandaranaike Quay is for the passengers' embarkation/ disembarkation facility and the water supply base as it is now, and administration

Table – IV.2.1. Number of Alongside Berths – 1988
(Dry Cargo, Conventional)

	No. of Berth		Length (m)
	Large*1	Small*1	
QEQ	5	0	1,080
BQ	4	1	770
CB	0	2	93
PVQ	2	0	330
NP	2	0	330
Total	13	3	2,603

*1 "Large" denotes for quaywalls with the water depth of –7.5m or deeper and "Small" for those with the water depth of shallower than –7.5m.

Table – IV.2.2 Wave Occurrence – Deepwater Wave

Wave Height (m)	Yearly Average Days	
	SW~WNW	NW
0 ~0.49	54.3	67.8
0.5 ~0.99	25.8	14.1
1.0 ~1.49	19.2	4.8
1.5 ~1.99	8.7	1.8
2.0 ~2.49	5.7	0.9
2.5 ~2.99	3.3	0.6
3.0 ~	3.0	0

Fig. – IV. 2.1 Port Layout – Master Plan
(L: 250m)

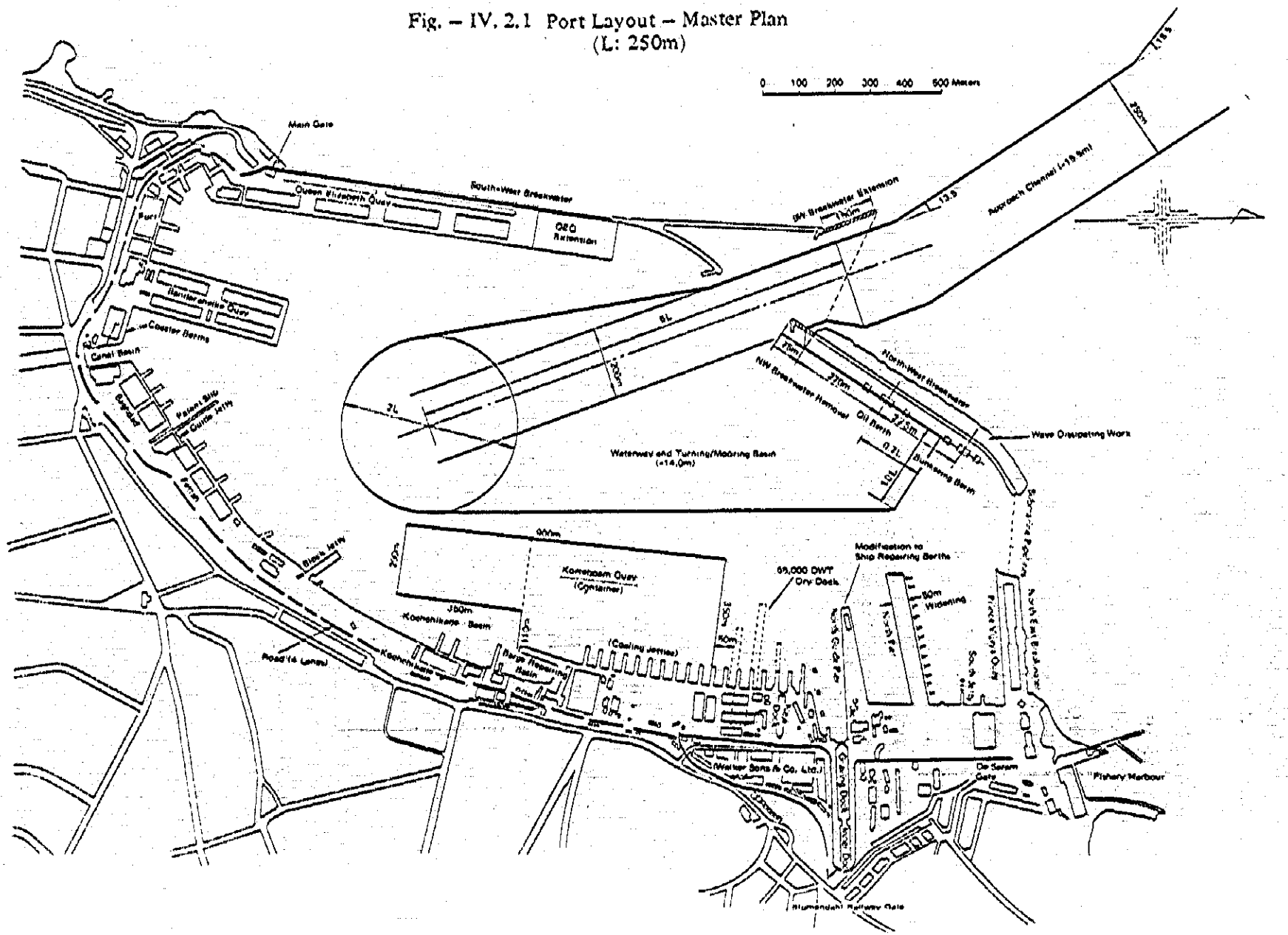


Fig. – IV.2.2 (a) Wave Height Ratio – Existing Layout
Wave Direction: W

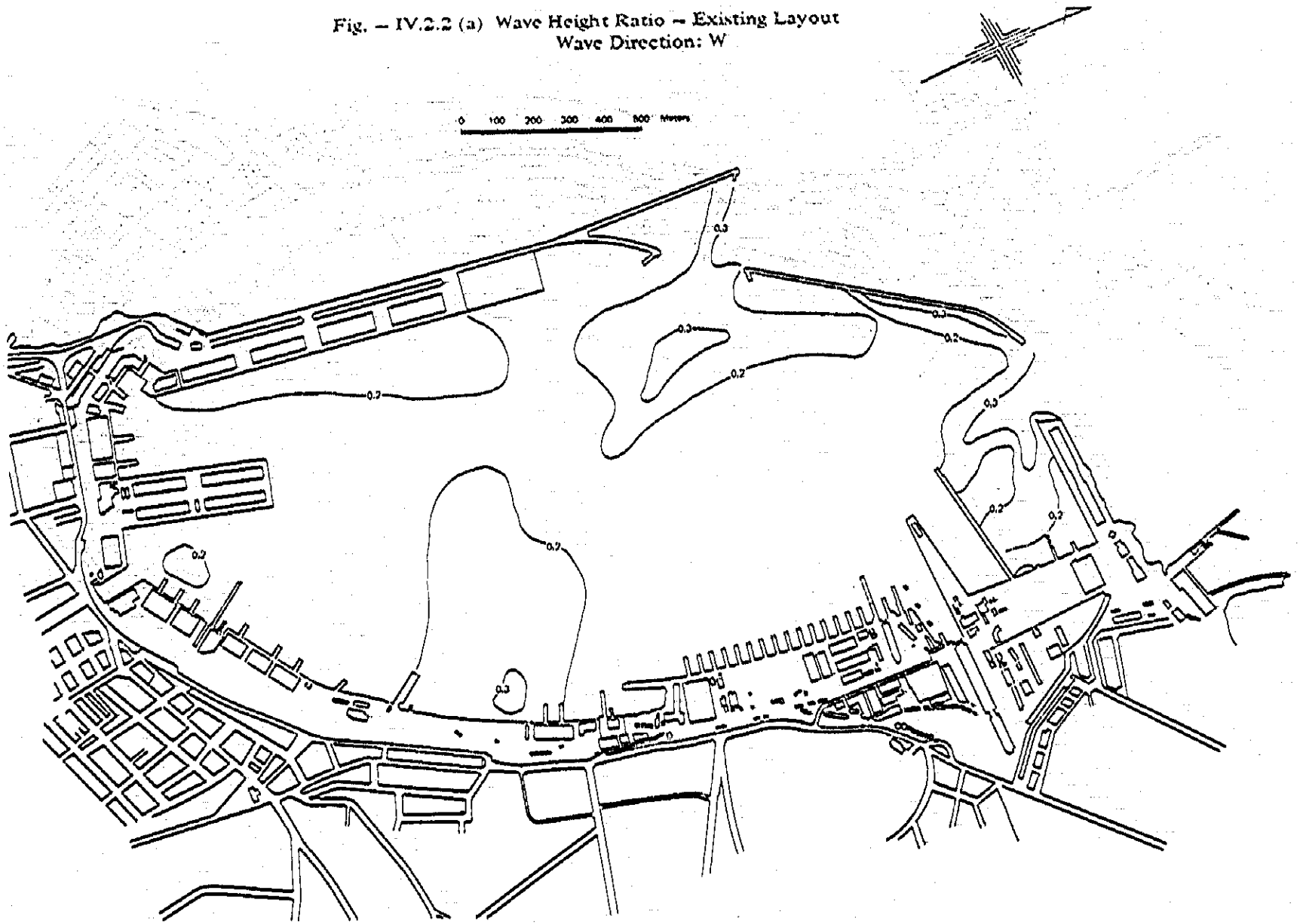


Fig. – IV.2.2 (b) Wave Height Ratio – Master Plan
Wave Direction: W

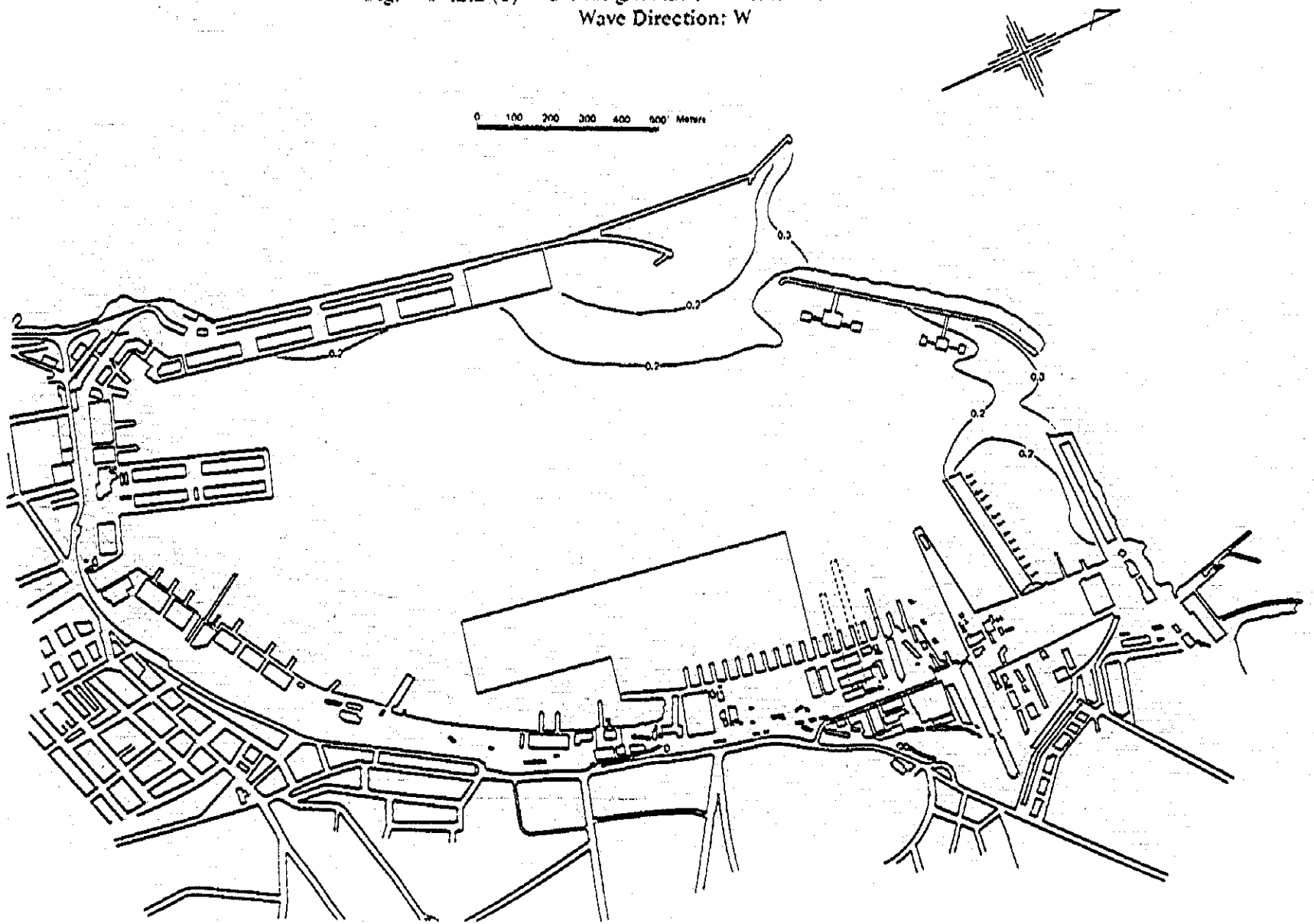


Fig. – IV.2.2 (c) Wave Height Ratio – Master Plan without Widening the Approach Channel
Wave Direction: W

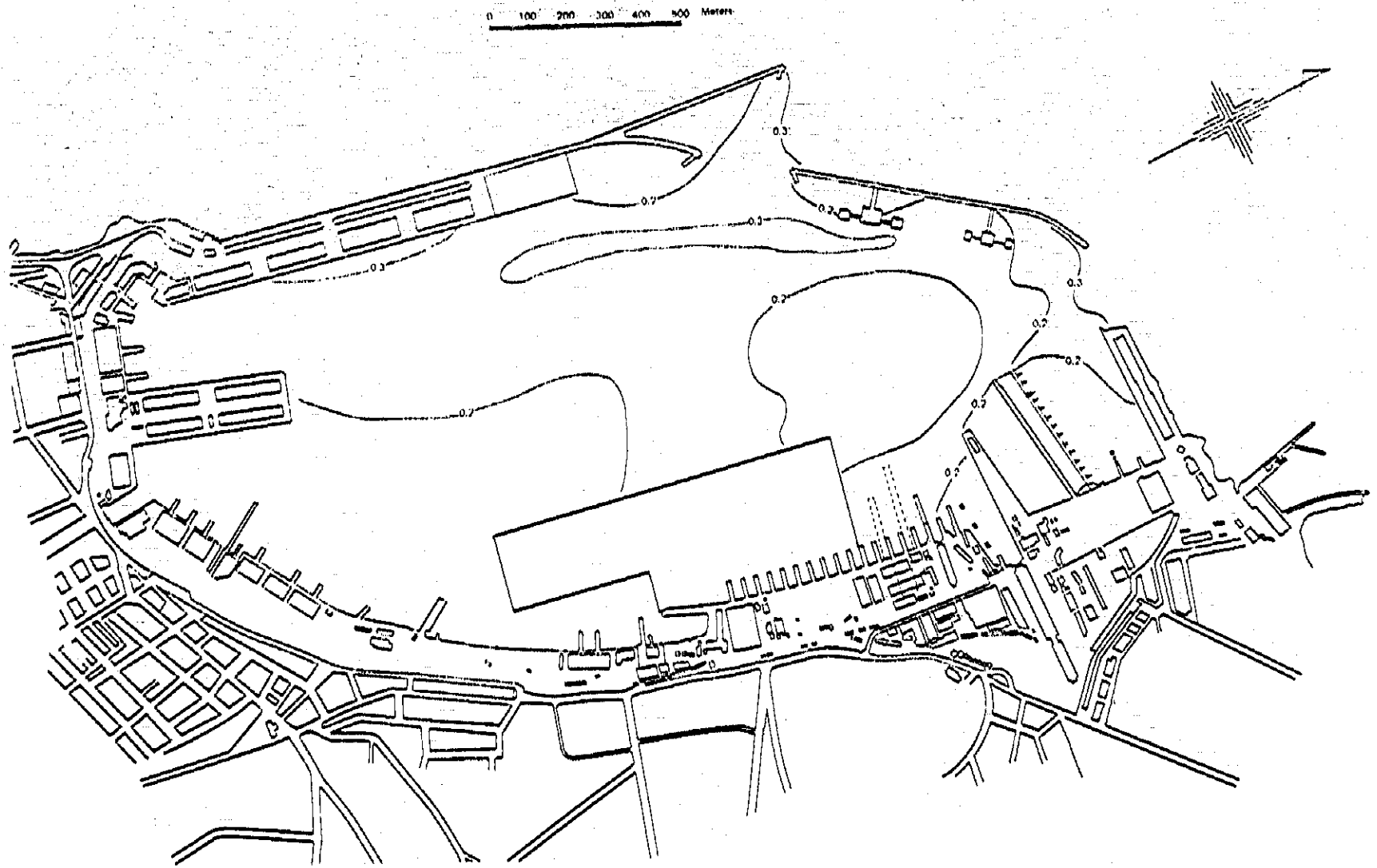


Fig. – IV.2.3 (a) Wave Height Ratio – Existing Layout
Wave Direction: NW

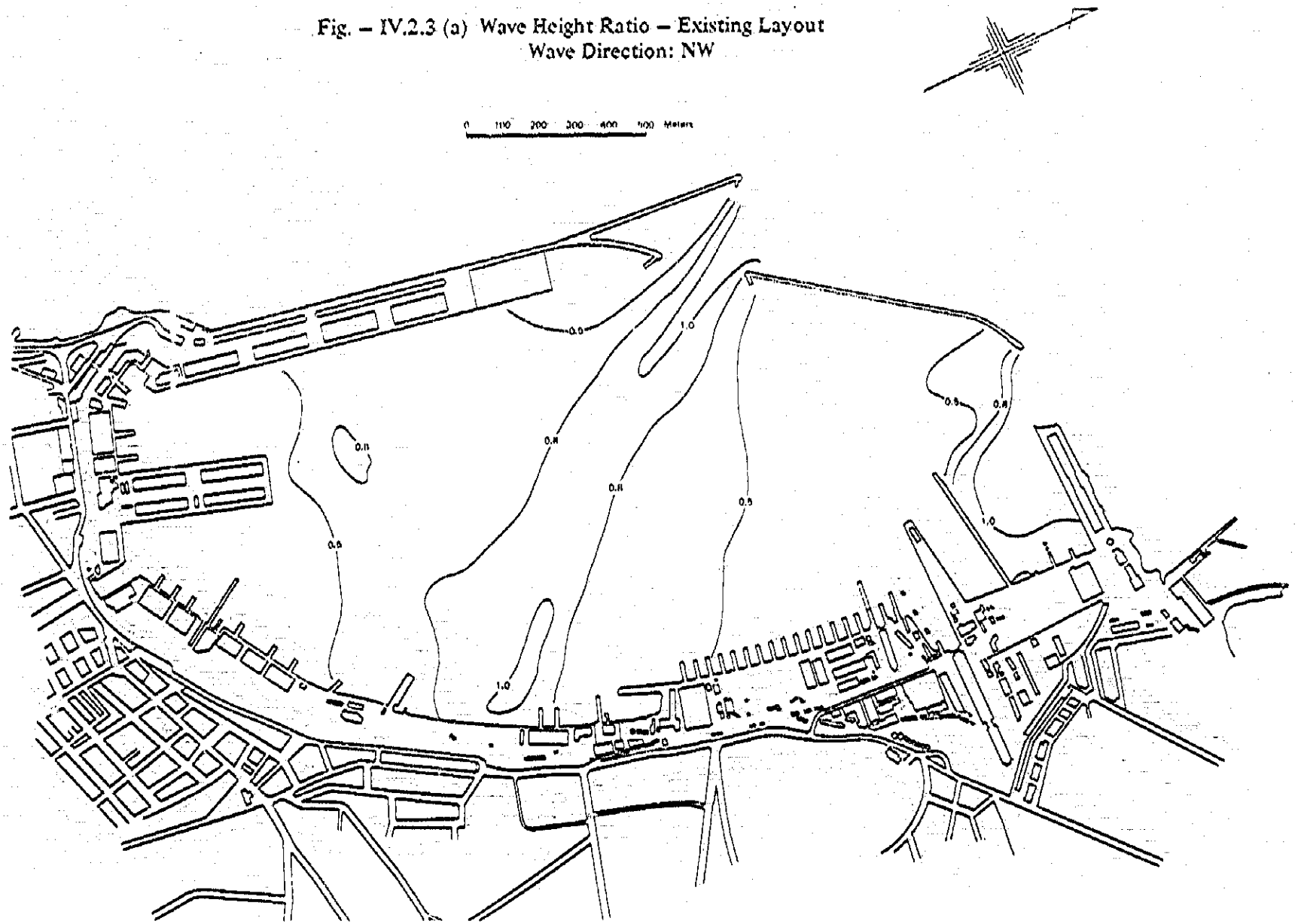


Fig. – IV.2.3 (b) Wave Height Ratio – Master Plan
Wave Direction: NW

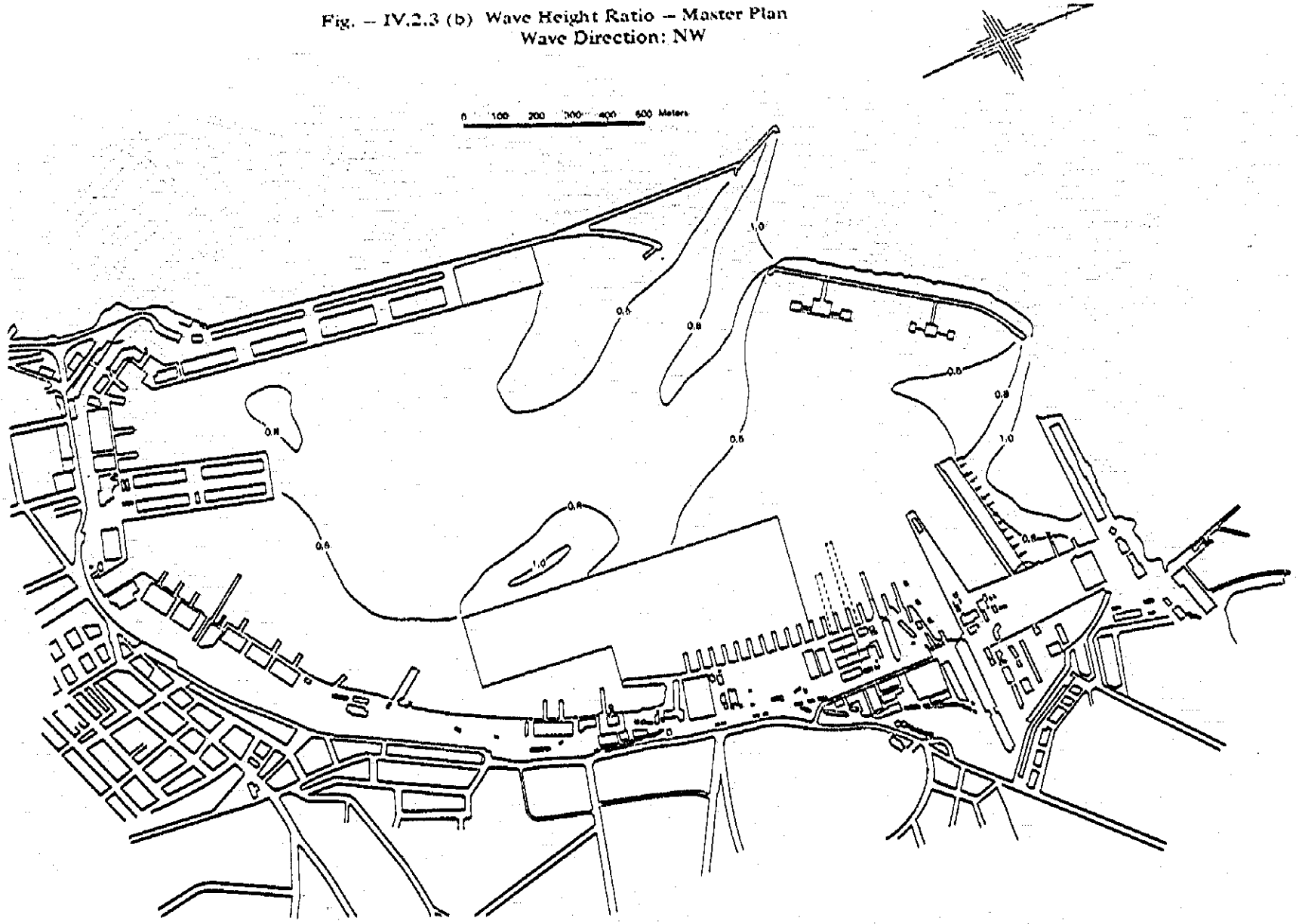


Fig. – IV.2.3 (c) Wave Height Ratio – Master Plan without Widening the Approach Channel
Wave Direction: NW