

## 2.1.4 Soil Conditions

The data for soil conditions of the Port of Aqaba are collected from the previous soil investigation report of existing port facilities.

### (1) Main port Area

For the construction of the slipway, six boring works were carried out in this area. The site investigation comprised 3 offshore boreholes together with 3 onshore boreholes. Shell and auger rig was employed for this study.

Boring No.	Drilling Depth (m)	
1	15.0	Offshore
2	25.0	"
3	15.0	"
4	15.0	Onshore
5	10.8	"
6	12.6	"

The results of boring works are as follows:

Boring No.	Depth (m)	Soil Strata	N Value
1	-4.43	Branched Coral	16
"	-8.00	Coral Sand	26-50
"	-14.00	Vesicular Coral	26-28
2	-3.50	Branched Coral	28
"	-8.00	Coral Sand	28-17
"	-14.00	Branched Coral	28-50
"	-20.00	Coral & Shell	16-50
"	-24.00	Igneous Gravel	46-50
3	-2.6	Branched Coral	13
"	-8.0	Branched Coral	17-25
"	-12.0	Vesicular Coral	20-41
4	+2.7	Fill Material	12
"	-4.0	Branched Coral	18-28
"	-10.0	Vesicular Coral	12-32
5	+2.9	Silty Sand	21
"	-4.0	Branched Coral	15-29
"	-10.0	Conglomerate	25-29
6	+2.9	Sand & Gravel	16
"	-4.0	Branched Coral	37-60
"	-9.0	Conglomerate	35-60

(2) Container Port Area

For the construction of the container berth, seventeen boring works were carried out in this area. The site investigation comprised 11 offshore boreholes together with 6 onshore boreholes.

Shell and auger rig was employed for this study.

Boring No.	Drilling Depth (m)	
1	10.5	Offshore
2	15.0	"
3	12.5	"
4	18.6	"
5	2.6	"
6	22.5	"
7	19.0	"
8	16.9	"
9	16.0	"
10	15.0	"
11	15.8	"
12	15.0	Onshore
13	9.6	"
14	6.5	"
15	25.0	"
16	8.1	"
17	12.0	"

The results of boring works are as follows.

Boring No.	Depth of Hard Strata (m)	Soil Stratum	N Value
1	-10.0	Dense Sand & Gravel	31
2	-14.5	Very Dense Sand	63
3	-12.5	Vesicular Coral	35
4	- 2.6	Sand & Gravel	12
5	-18.6	Dense Sand	44
6	-21.5	Dense Sand	45
7	-10.0	Branched Coral	100
8	-17.0	Vesicular Coral	69
9	-16.0	Dense Cobble	32
10	-15.5	Branched Coral	32
11	-15.8	Silty Sand	43
12	-15.0	Dense Sand	20
13	-19.5	Dense Sand	41
14	- 7.5	Dense Sand	50
15	- 4.5	Medium Sand & Gravel	30
16	- 7.5	Cemented Conglomerate	37
17	- 4.5	Dense Sand	25

## 2.1.5 Environment

### (1) Interviewees

JICA Study Team interviewed with government officials and NGO activists, obtained information, conducted preliminary sea water and ambient quality survey, and discussed the methodology of the environmental surveys.

The followings are officials of the government agencies and volunteers of NGO with whom JICA Study Team interviewed:-

Environment Department: Ministry of Municipal & Rural Affairs and the Environment	Dr. Saleh Al-Share (Director) Eng. Ramzi Al-Batyneh
Jordan Environment Society:	Mr. Suleiman E. Hanbali (Executive Director) Mr. Munir Adgham (National Coordinator) Eng. Mohammad Al-Hjouj (Aqaba Branch)
Environment Research Center: Royal Scientific Society	Eng. Ayman Al-Hassan (Acting Director) Eng. Ra'id M. Khashman Eng. Wa'el Sulaiman Dr. Yaseen M. Khayyat
Marine Science Station: University of Jordan	Dr. Ahmad Abu-Hilal (Director) Dr. Salim M. Al-Moghrabi

### (2) Previous Environmental Study in Aqaba

It is confirmed with Environment Department in Amman that "Aqaba Coastal Resources Environmental Management Study in Jordan - October 1993" is the latest environmental study conducted in Aqaba. The Department commented, however, that (1) the permanent current of Aqaba Bay might be clock-wise even though the study concluded it anti-clockwise, and (2) dust from the phosphate berth has been much reduced for dust collecting shooters have been installed after the study was conducted.

It is also confirmed with Royal Scientific Society in Amman (RSS) that no dust monitoring has been conducted after "Monitoring Dust Levels of Phosphate Handling and Load-Out Facilities at the Port of Aqaba - July 1990."

In parallel to the above mentioned study in 1993, World Bank in coordination with Ministry of Planning and ARA established an environmental action plan of the Gulf of Aqaba. The action plan covers all the current environmental issues at the Gulf, i.e. industrial related pollution, marine pollution, water and waste water management, solid waste management, tourism and fisheries. The action plan proposes a strong initiative of ARA for preventing deterioration of environment and promoting a balanced development between industries and tourism. However, so far as JICA Study Team observes, ARA should be empowered with experts and financial support to a great extent to deal with the environmental issues.

### (3) Computer Simulation of Environment Analysis

European Community's study team left to ARA both the hardware and software for simulation of pollution dispersion in seawater and air in Aqaba after completing "Aqaba Coastal Resources Environmental Management Study in Jordan - October 1993." JICA Study Team assessed the use of the computer simulation and found out the fact that the computer simulation has not been run since the EC's study was conducted because no expert capable of conducting the simulation is available with ARA.

JICA Study Team concluded that the simulation can be only conducted by the EC's study team since the software is not open to experts of other agencies.

### (4) General Information on Environment of Aqaba

#### 1) Seawater

Sea water of the Gulf of Aqaba, even though it is dead end of Red Sea, is very clear. This is due to the fact that no river runs into the Gulf. To confirm the clarity through the year, JICA Study Team conducted in February and June respectively a survey of the seawater quality on 7 items; namely, temperature, turbidity, DO, pH, conductivity, salinity and transparency. Tables 2.1.6 ~ 7 summarize the results and show that the sea water is almost free from pollution and its quality is almost unchanged between in February and June. However, the transparency decreases at Phosphate Berth, very slight oil and grease membranes were observed inside the basin of Royal Yacht Club and in front of Berth No. 6 and No.7 of Main Port, and very slight higher temperature was observed at the cooling water outlet of Old Power Plant.

#### 2) Coral

Coral reef of Aqaba Bay attracts many tourists and divers. Therefore, preservation of corals is one of the most important issues in planning the port improvement.

The most beautiful and largest coral reefs exist near Marine Science Station, north and south of the station. The northern part is adjacent to the passenger berth, which is a potential expansion area for the container terminal.

No significant coral colony is found at Main Port except the south of Phosphate Berth where coral spotted alive. There would be no serious coral preservation issue for the improvement of Main Port. Corals are alive at the south of Fertilizer and Potash Berth. The extension of this berth should take the coral preservation into consideration.

The coast between Container Port and Industrial Port as designated to the tourism has three coral preservations. One diving center is being operated for tourist divers.

#### 3) Air Pollution

At Main Port, the dust emission from Phosphate Berth is considerable. The dust is generated at both the loading facilities and storage facilities. After installation of the dust collecting system of the loaders, the dust emission reportedly decreased to 10 %. The storage facilities, previously contributed to 30% of the total dust emission, still emit the considerable quantity of dust.

Prevailing winds through year is northerly. Occasionally during winter, however, the winds are southerly and dusts disperse to the residential area. Phosphate dust rather deteriorates the working conditions for workers and contamination to grain bulk cargoes, which is usually handled at No. 1 Berth next to Phosphate Berth.

According to the results of the monitoring in 1990, high levels of total suspended particulates (TSP) were present throughout the year in Aqaba's ambient atmosphere. Health-related TSP standards had been continuously exceeded at the Port and the residential area. The monitoring revealed, however, that the USSR-Yugoslavia short-term  $P_2O_5$  health-related standard had been infrequently exceeded and that the obtained levels of  $P_2O_5$  had been generally low.

At Industrial Port, there are the power plant of Jordan Electricity Authority and fertilizer complex of Jordan Phosphate Mines Co., Ltd. and Arab Potash Company being operated. Gas emission is observed. At leeward of these plants, JICA Study Team observed  $NH_3$ ,  $CO$ ,  $SO_2$  in the air.

#### 4) Water Supply

Water Authority, Ministry of Water and Irrigation, supplies drinking water through pipeline. The source of water is fossil aquifer near Wadi Rum. No shortage of water supply is reported. However, as the aquifer cannot be recovered from rain, water preservation measures are vital.

#### 5) Sewerage

Water Authority, Ministry of Water and Irrigation, manages sewerage pipelines covering about 80 % of all the total households. The domestic wastewater, once collected into the main pump station at a low area by gravity flow, is pumped up to the sewerage treatment plant (Wastewater Stabilization Ponds) within the residential development area with a 3.5 km pipeline. Treated water is being used for tree planting near the treatment plant.

It is reported that Water Authority also collects wastewater from the remaining 20 % households with tank lorries and dispose of them to the above-mentioned treatment plant.

The wastewater plant consists of 3 ponds of 800 m x 300m and 4 evaporation ponds of 20m x 800 m. The planned treatment capacity is 9,000  $m^3/day$ . At present 5,000 to 5,500  $m^3/day$  are treated. The wastewater increases about 1,000  $m^3/day$  per year. In 4 to 6 years time, a new treatment plant will be required and it is planned next to the existing one to cope with the increase.

During winter time, of the treated 5,000  $m^3/day$ , 2,000  $m^3$  evaporates and remaining 3,000  $m^3$  is used for sprinkling water for trees within the treatment plant premises. In summer, all the 5,000  $m^3/day$  evaporates.

#### 6) Solid Wastes

Aqaba Municipality employs garbage collecting trucks and boxes. All the solid wastes are transported to the valley near Back Road, where they were disposed of disorderly and burnt in February 1995 and there was no government agency responsible for the solid wastes so that they were spreading over the desert. However, the municipality has developed an

asphalt-paved road to the disposal area and employed two bulldozers and watcheres. The situation has been much improved when observed in June.

#### 7) Sound Level

JICA Study Team observed the noise on the by-pass road detouring the city center and connecting the main port with the national highway. All the observation shows that the noise is less than 75 dB which is acceptable according to Japanese Standard.

#### 8) Industries

There is no large scale industry in Aqaba city proper, but huge power plant and chemical plants are located at the hinterland of Industrial Port. They are the power plant of Jordan Electricity Authority (260 MW), power plant for the fertilizer complex (2 units of 22 MW), sulfuric acid plant (2 units of 1,800 ton per day), phosphoric acid plant (1 unit of 1,250 ton of  $P_2O_5$  per day), granulation plant (2 units of 1,100 ton di-ammonium phosphate per day) and aluminum fluoride plant (1 unit of 20,000 ton of  $AlF_3$  per year). On July 4, 1995, JICA Study Team observed 7.5 p.p.m. of  $NH_3$  in the leeward of the plants' area, which exceeds 5.0 p.p.m. of ordinary Japanese standard. Expansions of both the power plant and the fertilizer plant has been commenced so that environmental issues will be more important in the future.

#### 9) Environment Particulars in Eilat

JICA Study Team paid a visit to Eilat to observe environmental aspects there, particularly regarding the sea water pollution.

At about 700 m from the border, there is an open channel running into the sea, about 1.5 m wide, 0.5 m deep and 1 m/sec speed discharge. The channel reportedly discharges all the wastewater collected in Eilat. The wastewater seemed to be further treated prior to discharging to the sea. In addition, wastewater was observed being disposed of directly from two small factories.

There is a stagnant water basin called "lagoon," being surrounded by three hotels and accommodating about 40 leisure boats. Wastewater is disposed of directly to the lagoon and oil/grease membrane is observed spreading over the water surface.

All the solid wastes, 160 ton per day, are disposed of into the excavation at the hill 7 km from the city. The disposal is to be covered with soil when the excavation is filled.

It is reportedly said that Eilat has three main environmental issues; (1) sewerage, (2) solid waste disposal and (3) dust from the phosphate loading.

Table 2.1.6 Water Quality Test Results: Aqaba Gulf Feb. 2 and 4/1995

Points	Time	Temp. °C	App	Clr.	Odor	Tbd mg/l	Do mg/l	pH	Cnd ms/cm	Sal %	Tra M	Day Climate
1	8:47	21.0	Clear Clea	Blue Blue	None None	4 4	5.7 6.0	7.90	60.6	3.87	8.8<	2 Fine 14 Fine
	8:47	23.2						8.14	61.9	3.96	8.0<	
2	8:58	21.0	"	"	"	3 3	5.7 6.0	7.86	60.4	3.86	10.2<	"
	8:57	23.2						8.15	62.0	3.97	10.0<	
3	9:07	20.9	"	"	"	4 2	5.8 5.9	8.02	60.5	3.86	16.7<	"
	9:07	23.2						8.16	61.8	3.95	16.0<	
4	9:20	21.0	"	"	"	4 4	5.7 5.8	8.07	60.8	3.88	15.0<	"
	9:14	23.3						8.16	61.5	3.93	15.0<	
5	9:35	21.0	"	"	"	4 4	5.7 5.7	8.04	60.3	3.87	23.5<	"
	9:22	23.3						8.16	61.4	3.93	23.0<	
6	9:44	21.1	"	"	"	4 4	5.6 5.8	8.05	60.9	3.89	30.0<	"
	9:30	23.2						8.17	61.5	3.93	25.0	
7	9:56	21.2	"	"	"	4 4	5.5 5.9	8.06	60.8	3.88	30.0<	"
	9:37	23.4						8.17	61.4	3.93	30.0	
8	10:09	21.2	"	"	"	4 4	5.6 5.8	8.07	60.8	3.88	24.1<	"
	9:46	23.4						8.18	61.6	3.93	27.0	
9	10:20	21.2	"	"	"	4 4	5.8 5.8	8.06	60.7	3.88	27.5<	"
	9:57	23.4						8.17	61.4	3.93	27.0	
10	10:47	21.7	"	"	"	4 4	5.5 5.8	8.04	60.8	3.88	30.0<	"
	10:12	23.5						8.16	61.4	3.93	25.0	
11	10:54	23.0	"	"	"	4 4	5.6 5.6	8.03	59.2	3.81	0.5<	"
	10:38	25.9						8.17	61.1	3.92	0.5<	
12	10:59	21.2	"	"	"	4 4	5.6 5.7	8.05	60.8	3.88	30.0<	"
	10:48	23.5						8.13	61.4	3.93	25.0	
13	11:25	21.2	"	"	"	4 4	5.5 5.7	8.05	60.8	3.88	15.0<	"
	11:12	23.5						8.12	61.3	3.91	15.0<	
14	11:42	21.2	"	"	"	5 4	5.6 5.9	8.03	60.4	3.85	18.0<	"
	11:28	23.8						8.04	61.2	3.91	18.0<	
15	12:38	21.2	"	"	"	4 6	5.6 5.7	8.03	60.4	3.86	23.0<	"
	11:48	23.6						8.03	61.1	3.90	20.0<	
16	13:08	21.2	"	"	"	4 4	5.6 5.8	8.03	60.6	3.87	20.0<	"
	11:59	23.7						7.87	60.9	3.82	20.0<	
17	13:20	21.2	"	"	"	4 4	5.6 5.7	8.03	60.1	3.84	13.5<	"
	12:15	23.6						7.87	60.8	3.88	15.0<	
18	10:00	21.2	"	"	"	3 4	5.9 5.9	8.03	59.7	3.81	15.0<	4 Fine 15 Fine
	9:25	23.7						7.70	60.0	3.81	15.0<	
19	10:15	21.1	"	"	"	5 5	5.6 5.7	8.02	59.9	3.81	27.5<	"
	9:34	23.6						7.81	59.8	3.81	25.0	
20	10:27	21.1	ST	"	"	5 5	5.6 5.7	8.03	60.0	3.83	16.0	"
	9:44	23.6						7.80	59.8	3.81	7.0<	
21	10:39	21.1	Clear	"	"	4 4	5.6 5.7	8.06	60.2	3.84	-	"
	9:56	23.8						7.81	59.6	3.80	6.0<	
22	10:50	21.4	"	"	"	4 4	5.9 5.6	8.06	59.8	3.81	5.0<	"
	10:03	23.9						7.77	59.7	3.80	3.0<	
23	10:59	21.6	"	"	"	4 4	5.9 5.8	8.05	60.1	3.84	-	"
	10:10	23.9						7.79	59.5	3.79	30.0	
24	11:10	21.2	"	"	"	4 5	5.6 5.6	8.04	59.8	3.81	23.0<	"
	10:20	23.8						7.76	59.5	3.79	20.0<	
25	11:20	21.3	"	"	"	4 3	5.6 5.6	8.06	60.8	3.88	-	"
	10:23	23.8						7.77	59.8	3.81	4.0<	
26	12:14	21.2	"	"	"	4 4	5.9 5.7	8.04	59.7	3.81	-	"
	11:21	24.0						7.68	59.6	3.80	30.0	

See Survey Points in Figure 2.1.1.

**NOTE**

Temp: Temperature

Tbd: Turbidity

Sal: Salinity

Upper: February 2 and 4, 1995

Lower: June 14 and 15, 1995

App: Appearance

Do: Dissolved Oxygen

Tra: Transparency

Clr: Color

Cnd: Conductivity

ST: Slight Turbid

Table 2.1.7 Water Quality Test Results: Aqaba Gulf Feb. 5/1995

Points	Time	Temp. °C	App	Clr	Odor	Tbd mg/l	Do mg/l	pH	Cnd ms/cm	Sal %	Tra M	Day Climate
A	9:26	21.1	Clear	Blue	None	7	5.7	7.98	59.9	3.82	3.0<	5 Fine
	8:35	23.5	Clear	Blue	None	3	5.6	7.72	59.4	3.79	2.7<	22 Fine
B	9:35	21.1	*	*	*	6	5.7	7.98	60.2	3.84	3.5<	*
	8:45	23.3	*	*	*	4	5.9	7.89	60.0	3.83	2.7<	*
C	9:45	20.9	*	*	*	4	6.0	8.01	60.2	3.84	1.0<	*
	9:06	23.1	*	*	*	4	5.6	7.86	60.5	3.86	1.7<	*
D	9:53	20.8	*	*	*	5	5.6	7.99	60.3	3.85	1.5<	*
	9:18	23.4	*	*	*	4	5.8	7.84	60.8	3.88	1.5<	*
E	10:00	20.9	S.T	Y.G	*	10	5.5	8.00	60.1	3.84	5.5<	*
	9:27	23.3	S.T	Y.G	*	4	5.3	7.86	60.7	3.88	5.5<	*
F	10:12	21.2	Clear	Blue	*	5	5.6	8.00	60.2	3.84	-	*
	9:39	23.4	Clear	Blue	*	4	5.3	7.84	60.7	3.88	1.5<	*
G	10:33	21.2	*	*	*	5	5.9	7.98	60.2	3.84	1.0<	*
	10:07	23.9	*	*	*	4	5.8	7.95	60.5	3.86	2.0<	*
H	10:41	21.2	*	*	*	5	5.9	7.99	60.4	3.86	-	*
	10:22	23.6	*	*	*	4	5.6	7.86	60.1	3.82	1.0<	*
I	10:50	20.9	*	*	*	5	5.5	7.98	60.3	3.84	3.0<	*
	10:31	23.5	*	*	*	5	5.5	7.90	60.5	3.85	3.0<	*
J	10:58	20.8	*	*	*	5	5.5	7.98	60.4	3.86	8.5<	*
	10:37	23.5	*	*	*	4	5.3	7.90	60.6	3.87	8.0<	*
K	11:05	20.9	*	*	*	5	5.5	7.99	60.5	3.86	-	*
	10:43	23.6	S.T	Y.G	*	4	5.4	7.89	60.8	3.88	7.0<	*
L	11:25	21.3	*	*	*	8	5.6	8.01	60.5	3.86	15 m	*
	10:59	23.7	Clear	Blue	*	3	5.5	7.93	60.6	3.87	16.5<	*
M	11:35	21.3	*	*	*	6	5.7	8.00	60.6	3.86	4.0<	*
	11:08	23.7	*	*	*	4	5.6	7.91	60.3	3.84	4.0<	*

See Survey Points in Figure 2.1.2.

**NOTE**

Temp: Temperature  
 App: Appearance  
 Clr: Color  
 Tbd: Turbidity  
 Do: Dissolved Oxygen  
 Cnd: Conductivity  
 Sal: Salinity  
 Tra: Transparency  
 ST: Slight Turbid  
 YG: Yellow Green  
 Upper: February 5, 1995  
 Lower: June 25, 1995



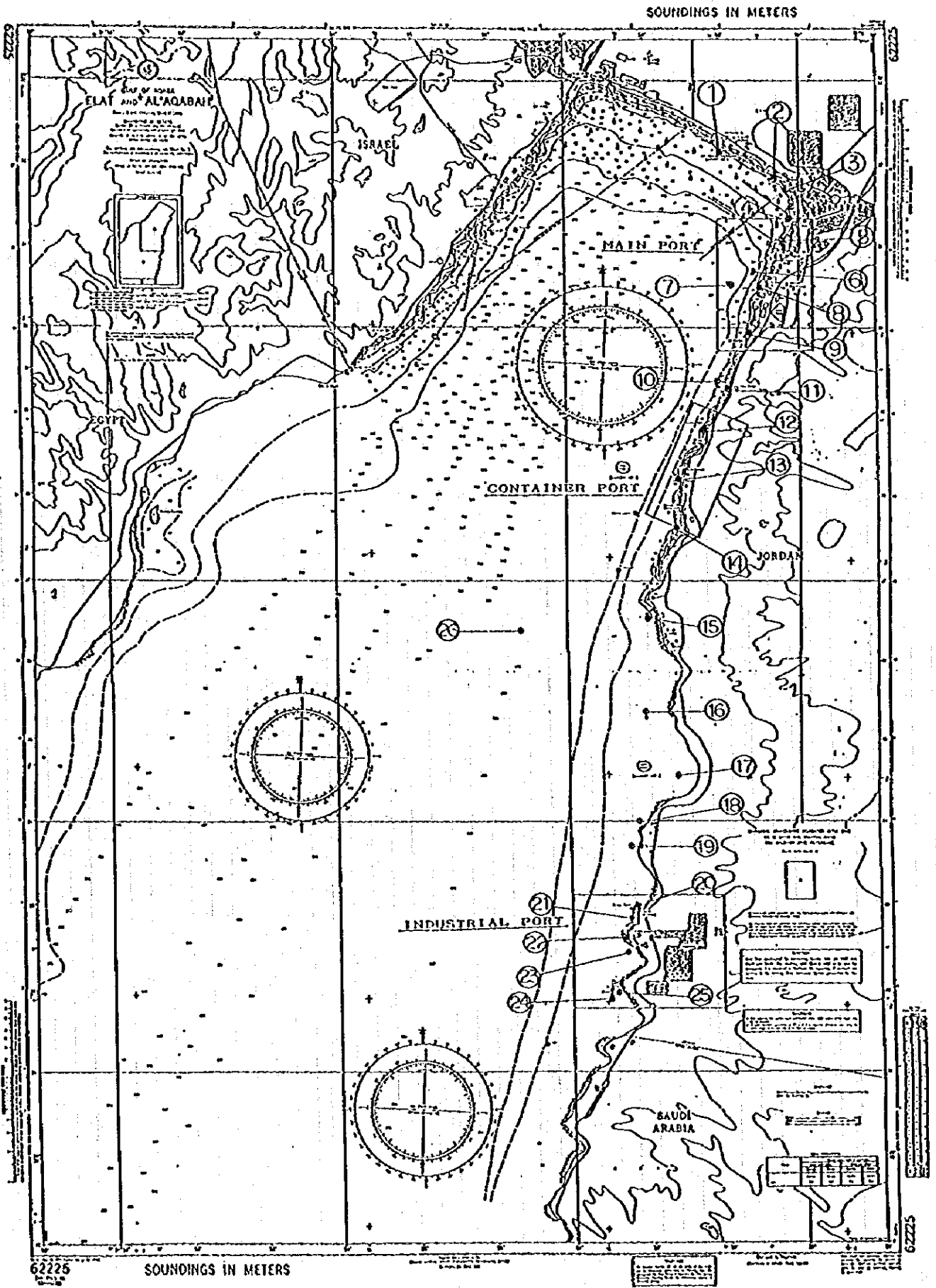


Figure 2.1.1 Sea Water Quality Survey



## 2.1.6 Land and Sea Area Use

### (1) Land Use

Land use in Aqaba is well organized. This is partly due to the fact that majority of the inhabitants is the employees of The Ports Corporation, Jordan Phosphate Mines Company, and other relatively large industries. It is also due to the fact that, without a development plan, construction of the service facilities for the people, particularly housing units, water supply and sewerage, as well as the industries themselves, would be much difficult because of the physical conditions in Aqaba.

The latest land use plan, up-dated in 1993, is prepared by Aqaba Regional Authority. The plan is designed for a balanced development between the industrial development and the tourism. The former depends on the port and natural resources, and the latter concerns preservation of natural environment.

In planning the development plan, Aqaba Regional Authority has five major strategic land use policies as follows:

- a) The concentration of all residential and related land uses within and around the exiting urban area.
- b) The creation of a new tourist zone in the middle of the south coast area.
- c) The concentration of all major industries in the Wadi I and Wadi II areas and adjacent to the Back Road.
- d) The establishment of an industrial port in Wadi II, mainly for the bulk cargo handling.
- e) The location of small scale and town related industries north of the town.

Figure 2.1.3 shows the land use plan Aqaba Regional Authority up-dated in 1993.

### (2) Sea Area Use

There is no indication of the sea area use on the development plan up-dated by Aqaba Regional Authority except the three coral reservations. It is intended, therefore, to describe the current usage of the sea area as interviewed with concerned personnel like a manager of a marina and government officials of several agencies, and observed by JICA Study Team.

A conceptual plan of the sea area use is attached as Figure 2.1.4.

#### 1) Fishery

After Saudi Arabia and Egypt banned fishing by Jordanian fishermen in their territorial waters, there has been no commercial fishing activities in Aqaba but only artisan fishing with small out-board-engine boats. The fishing ground is all along the Aqaba coast, particularly where sea bed has a complex morphology. This may be the reason for environmental activists to claim that fishing causes damages to the coral reefs.

There is a fishing port at the north of Main Port accommodating about 40 numbers of small municipal fishing boats.

## 2) Anchorage

The extreme northern part of Gulf of Aqaba is used as anchorage for ships. The anchorage area is indicated in the chart. Anchorage is rather narrow when compared with the total water area. This is due to the fact that the sea is too deep offshore for anchoring.

## 3) Marine Leisure Area

The beach of the northern part of Gulf is used for tourists to enjoy several marine sports like water skiing, swimming, snorkeling. Tourists use glass boats for observing corals at the coast between Main Port and Container Port and in front of Marine Science Station. Diving spots are the three coral reservations on the coasts of Tourism Development Area.

There is a marina called "Royal Yacht Club" near the hotel beach. The club has 150 members and 90 ships. High season is May, June, July and August. Cruisers reportedly will rarely go far down to the south but cruising only near the northern coast.

## 4) Others

All activities are banned at the sea areas near the border with Israel and in front of King's Palace. These areas are patrolled by Coast Guard.

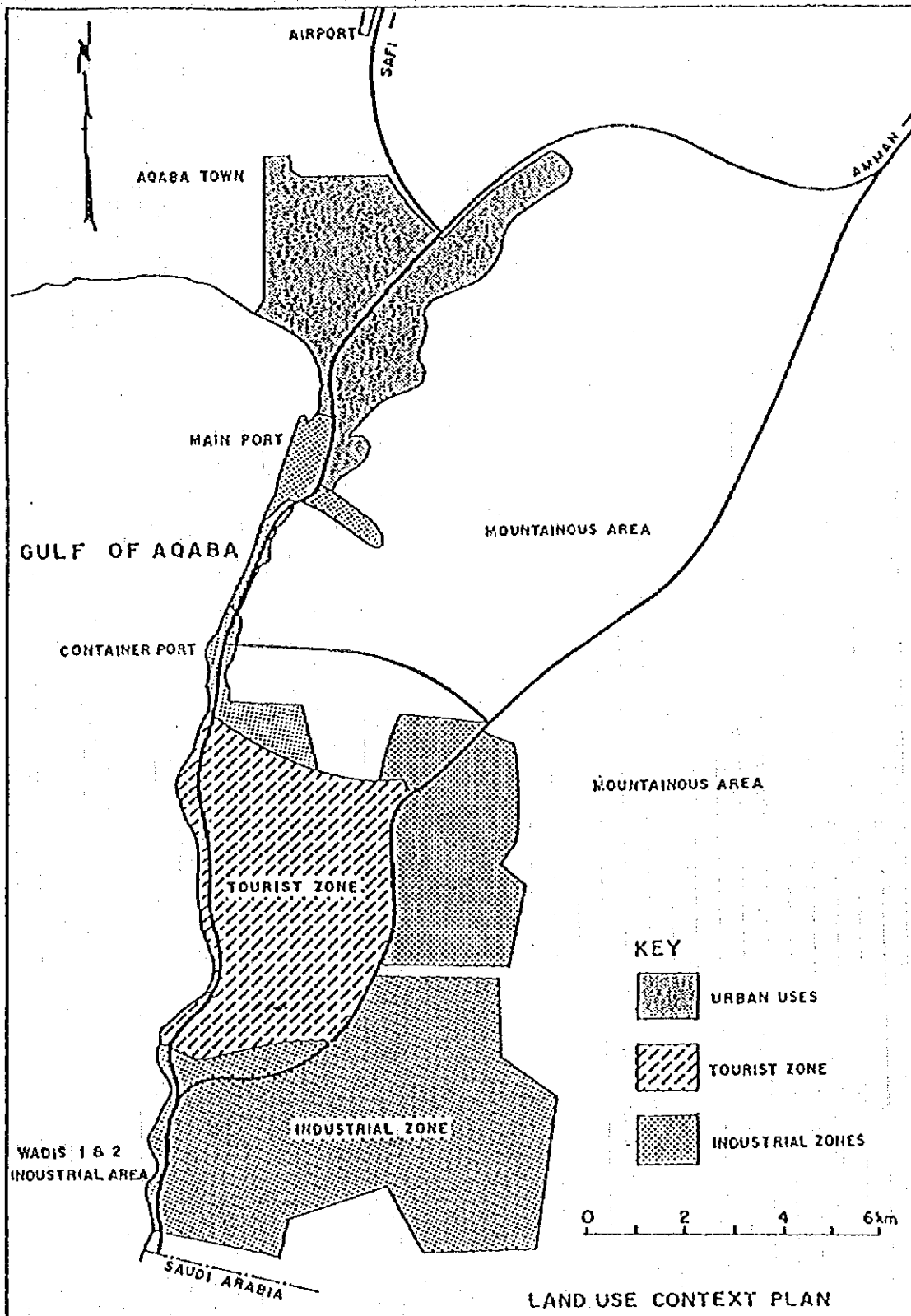


Figure 2.13 Land Use Context Plan

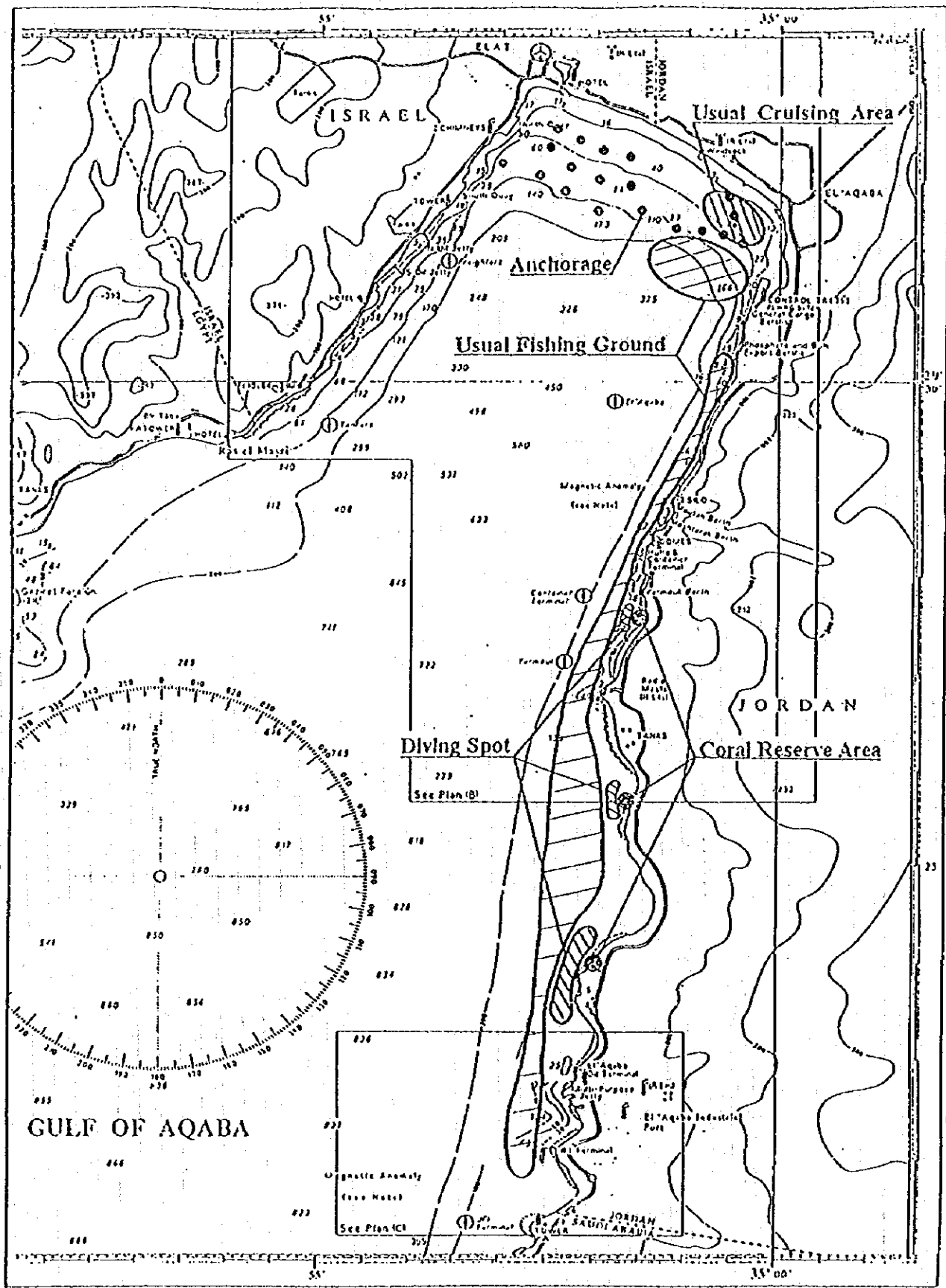


Figure 2.14 Conceptual Plan of The Sea Area Use

## 2.2 Port Facilities

### 2.2.1 Port Facilities

There are three ports in the Port of Aqaba. Main Port comprises six general cargo berths of draft alongside more than 10 meters, a general cargo berth of 7.8 meters draft alongside, a lighters berth of 4 meters draft alongside and two services berths of 5.8 meters draft, 150 meters in total length. Main Port also includes two exclusive berths for loading phosphate, erected at different times. Old berth named Phosphate Berth (A) is fitted with two breasting dolphins & three mooring dolphins, and new berth named Phosphate Berth (B) is equipped with a berth of 180 meters in length & two mooring dolphins. Drafts alongside of Berth (A) and (B) are 11 and 15 meters respectively.

Container Port is located between Main Port and Industrial Port. Container Port comprises a container terminal of draft alongside more than 14 meters, a RO-RO berth of 10 meter draft, and two floating berths are one for passengers and the other for rice and general cargo. The container terminal is equipped with two gantry cranes. The length of the berth is 540 meters identified by 3 berths of each 180 meters in length. The berths enable either three small scale container ships or two medium-size container ships to be accommodated at the same time.

Industrial Port comprises three berthing facility components whose berths are called by the name of industrial products. Oil Jetty of 25 meters draft alongside is composed of a jetty head, 4 units of berthing dolphins, 4 units of mooring dolphins and approach jetty. Industrial berth of 219 meters in length accommodates a bulk carrier of 11 meters full load draft, 190 meters overall length at inner berth, and of 15 meters full load draft, 230 meters overall length at outer berth. Timber Berth is located between Oil Jetty and Industrial berth, and it accommodates a cargo vessel of 6.8 meters full load draft. It is possible to berth barges, boats and RO/RO vessels with 9.0 meters draft on this berth.

#### (1) Berthing Facilities at Main Port

The Port of Aqaba was started with a small lighters berth in 1939 at the place where the barges berth and tugboats berth are existing. In 1959, Phosphate Exporting Berth (A) was erected with the first modern handling facility in the Port. The first general cargo berth No. 1 with adjacent open storage areas was erected in 1960. Another general cargo berth was erected with adjacent hangers & open storage areas in 1964. In 1966, Phosphate Berth (B) was built with two phosphate stores. Seven new general cargo berths with four new sheds were constructed in 1980 according to the new expansion plan. And the old lighters berth was altered into a basin to accommodate lighters.

General cargo berths No.1 to No. 6 are marginal wharves faced with the open sea. The berth No. 7 exists at the northern extremity but perpendicular to the wharf. Berth No. 8 and 9 are used for small ships and located at the rear of berth No. 6 and a part of berth No. 5. Barges berth and tugboats berth exist as a continuation of the berths. Phosphate Berth (A) and (B) run parallel with the marginal wharf to the south.

Outline of berthing facilities is shown on the table below.

Table 2.2.1(1) shows the dimension of berthing facilities of the Main Port.

Table 2.2.1(1) Berthing Facilities of the Main Port

Berth No. & Name	Scale of Berth		Allowed scale of vessel		
	***Water Depth (m)	Length (m)	Full Load Draft (m)	Length (m)	Displacement (tons)
No.1 General cargo berth	CD-11.2	160	10.8	200	45,000
No.2 General cargo berth	CD-11.5	180	10.0	180(220)	45,000
No.3 General cargo berth	CD-13.4	180	13.0	180(220)	53,000
No.4 General cargo berth	CD-12.5	180	11.5	180(220)	53,000
No.5 General cargo berth	CD-11.5	180	11.5	180(220)	53,000
No.6 General cargo berth	CD-11.7	180	11.5	180(220)	53,000
No.7 General cargo berth	CD -8.0	150	*8.0	150(170)	14,000
No.8 General cargo berth	CD -5.8	150	**5.8	110	5,000
No.9 General cargo berth	CD -5.8	150	**5.4	110	5,000
No.10 Barges & Tugboat berth	CD -4.0	210	1.5 - 3.5	60	500
PH.A Phosphate berth A	CD-11.0	210	11.0	100(200)	25,000
PH.B Phosphate berth B	CD-15.0	180	14.4	220	125,000

Remarks : \* There is a rock 7.60 m deep, 70 m north of the berth, and 60 m west of the eastern corner.

\*\* Shallow waters found 60 m east of the berth to the east, and span a length of 100 m.

\*\*\* Water depth of G.C. Berth No.1 to No.7 shows the result of sounding that was carried out by JICA Study Team in June-July, 1995.

The other water depth was given by Marine Department, P.C.

Structural types of each wharf and quay facilities are shown on Table 2.2.1(2). General cargo berths No.1 to No.6 are made of open-type piers with vertical piles, and No.7 general cargo berth and lighters berth are also of the same type.

The structural type of phosphate berths is dolphin with coupled batter piles.



Table 2.2.1(2) Quay Facilities and Structures of the Main Port

ITEM	DESCRIPTION	SCALE, NUMBER
Structural type	<b>No.1 &amp; No.2 General Cargo Berth</b> Open-type piers with vertical piles Width of piers	No.1 160m No.2 180m W = 27.27 m
Pier Structures	Foundation pile----- Krupp K.P.34 steel box pile Pile arrangement -- 3.1 m interval,3.0m at bulk head	section 9 nos. D = 750 mm
Super structure	Bulk head, & Deck In-situ concrete	15.0 m interval
Accessories	Bollard 60 ton Cast steel bollard Fender 12" Tubular Rubber dock fenders	2 rows
Retaining wall	Medium tensile steel sheet piling ,with coping wall 3" dia Tie Rods l=22.25m, with R.C. Anchor Wall	Frothingam section No.5
Structural type	<b>No.3 - No.6 General Cargo Berth</b> Open-type piers with vertical piles Width of piers	L = 180 m Width of deck W = 26.5 m
Pier Structures	Foundation pile --- 610dia,12.5mm steel pipe pile Pile arrangement -- 2.825m bulk head, 3.55 m the next Rear pile : coupled batter piles	section 8 nos. others;4.4m interval 23.5 degree
Super structure	Bulk head, & Deck beam : In-situ concrete Slab : Precast Prestressed concrete planks, Top concrete	D = 385 mm
Accessories	Bollard 75 ton Cast steel bollard Fender V-type rubber dock fenders	
Retaining wall	4N high yield steel sheet piling ,with coping wall	
Structural type	<b>No.7,8,9 General Cargo Berth</b> and No.10 barges & tugboats Berth Sheet pile type quaywalls	L = 150 m each L = 210 m
Structures	Frothingam section No.5 medium tensile steel sheet piling, with Bulk head coping concrete 3"dia tie rods with 1.0X2.25m R.C. Anchor Wall	
Structural type	<b>Phosphate Berth A</b> Dolphin with batter piles	L = 210 m
Facilities	Berthing dolphin : 25m X 20m with Fenders & Bitts Mooring dolphin : 10m X 10m with Bollard	2 units 3 units
Structural type	<b>Phosphate Berth B</b> Dolphin with batter piles	L = 180 m
Facilities	Berthing dolphin : 180m X 12.5m with Fenders & Bitts Mooring dolphin : 10m X 10m with Bollard	1 unit 2 unit

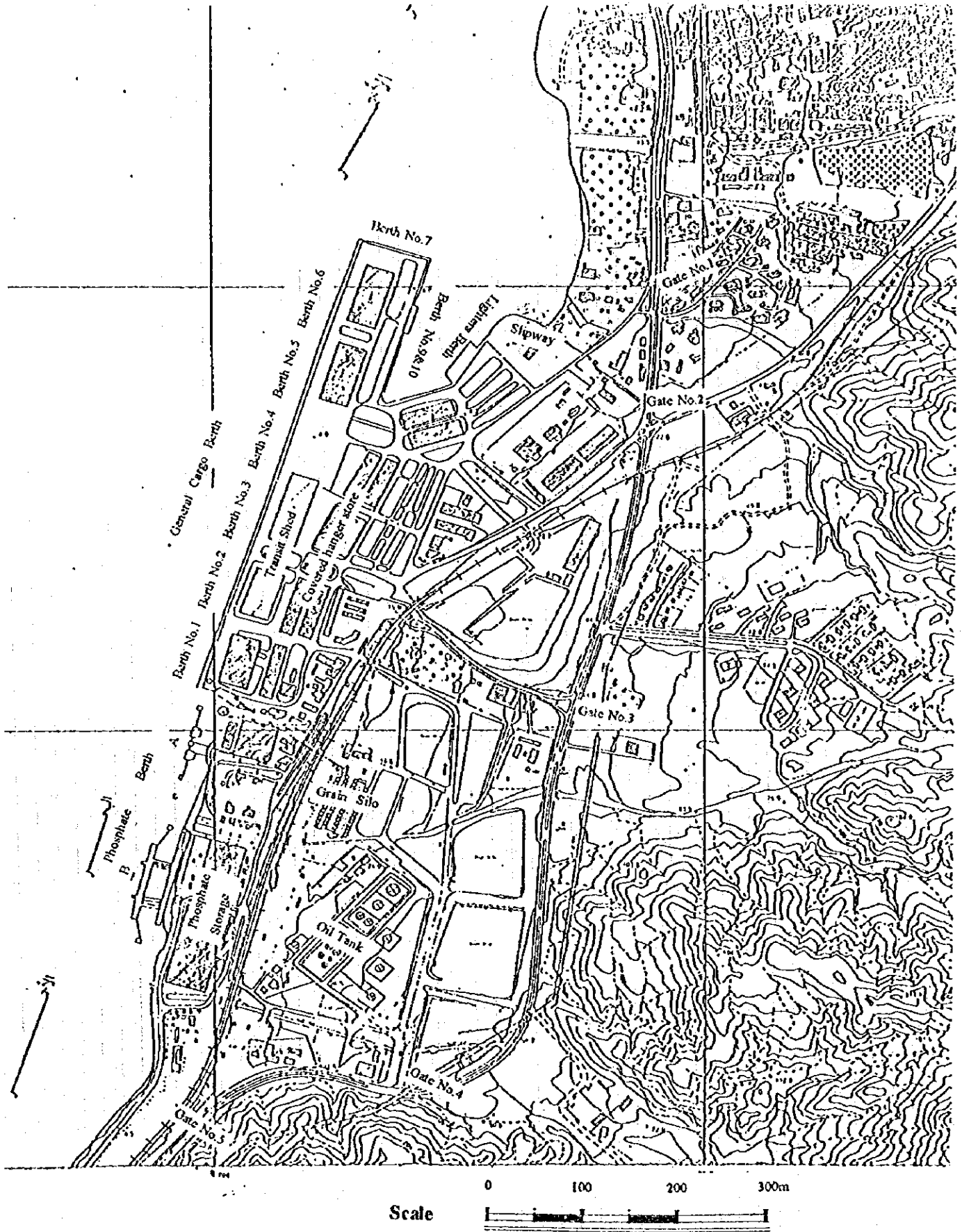


Figure 2.2.1 Layout of the Main Port

The surface of foundation piles for the wharves is preserved cleanly as well as a new structure. As the sea water of the Aqaba Bay seems to refuse seaweed breeding due to the absence of much organic life, corrosion of steel piles coated with bitumen paint is slow to progress even in highly salty sea water. The piles into soils which consist of inorganic matters may be the same conditions as in the water, splash zone and on air.

## (2) Berthing Facilities at Container Port

Permanent container terminal started with three berths of 540 meters and RO-RO berth of 40 meters in 1982. It was supplied with two gantry cranes. After the erection of the permanent container terminal, two floating berths which were erected in 1976 and used for temporary container berth since 1976 altered the role. In 1985 one of the floating pontoons was provided with a passenger berth to accommodate passenger ships for ferry services between Aqaba and Nuweibe. At the same time, two passenger halls were built. The other floating pontoon is provided with a bulk cargo berth to accommodate bulk rice and general cargo ships.

Table 2.2.1(3) shows berthing facilities of Container Port

Table 2.2.1(3) Berthing Facilities of the Container Port

Name of Wharf & Berth No.	Scale of Berth		Allowed scale of vessel		
	Water Depth(m)	Length(m)	Full Load Draft(m)	Length(m)	Displacement (tons)
Container Berth No.1, No.2,	CD-15.1	180	14.0	180(240)	84,000
	CD-15.2	180	14.0	180(240)	84,000
Container Berth No.3	CD-20.0	180	20.0	180(240)	84,000
RO-RO Berth	CD-12.0	40	10.0	180	35,000
Passenger floating Berth *	CD-15.0	150	9.0	150(170)	15,000
Mo'ta floating Berth **	CD-15.0	150	20.0	200	53,000
Bulk cement Berth	CD-11.0	120	11.8	250	50,000

Remarks : \* For northern side board, allowed draft & length are 7.5m. and 120m.

For southern board allowed 6.0m. draft and 120m. length of vessel

\*\* For northern side board, allowed draft & length are 9.0m. and 150m.

For southern board allowed 10.0m. draft and 150m. length of vessel

Structural types of container wharf is open type piers with vertical piles. Retaining wall of the wharf was made of steel sheet piling with anchor steel piles connected with tie rods. The size of floating pontoons for passenger & grain berths is 150 meters toward sea and 35 meters both boards. Height (molded draft) is 6 meters. Structural type of bulk cement berth is dolphin with coupled batter piles.

Table 2.2.1(4) shows quay facilities and structures of container port.

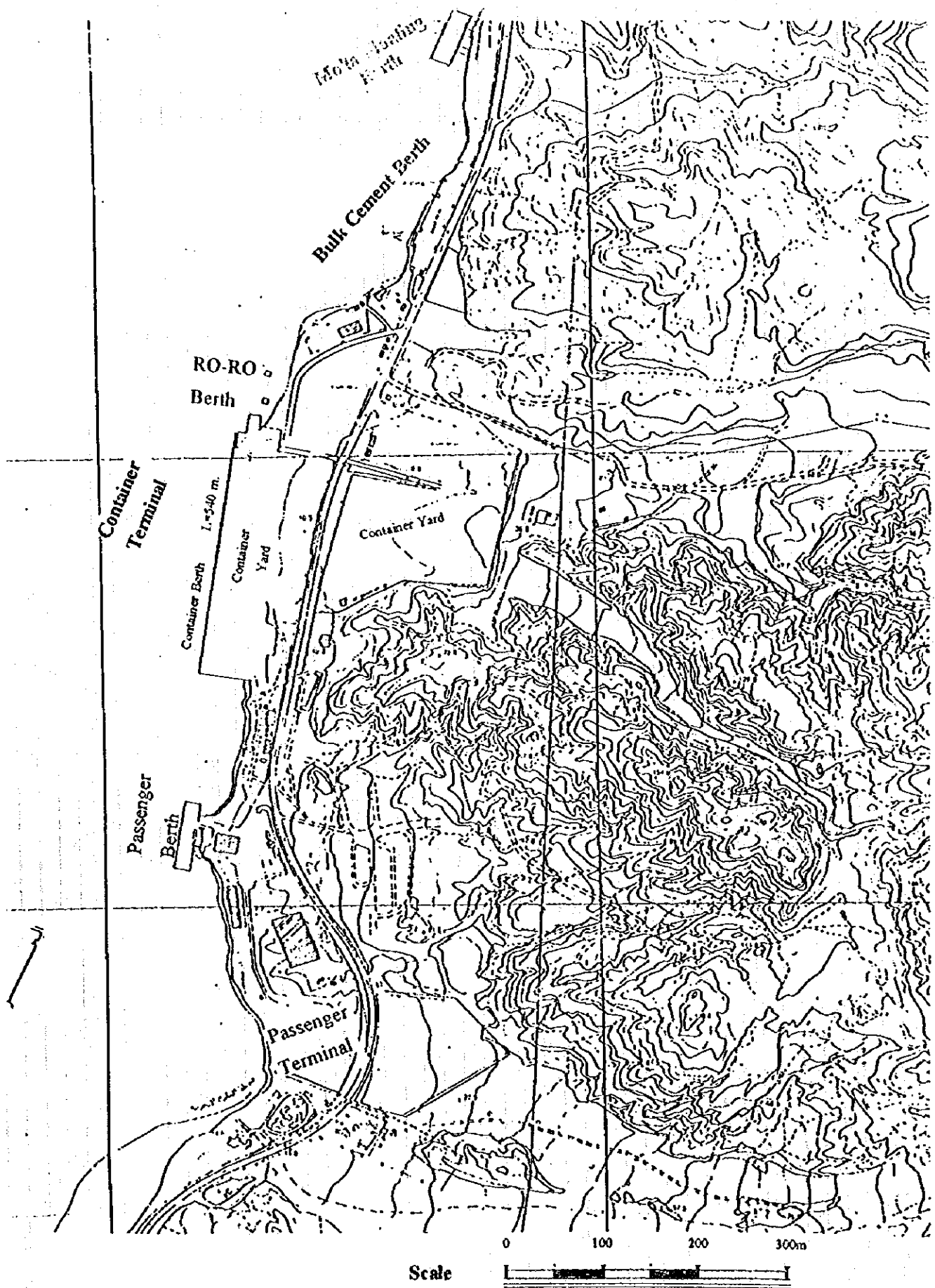


Figure 2.2.2 Layout of the Container Port

Table 2.2.1(4) Quay Facilities and Structures of the Container Port

ITEM	DESCRIPTION	SCALE, NUMBER
Structural type Pier structure Super structure Accessories Retaining walls	Container Wharf (3 berths) Open-type piers with vertical piles Foundation pile : Cylindrical steel pile Pile arrangement : 6.0 m interval Pile head, Longitudinal beam: In-situ concrete Bulk head, Deck : In-situ concrete Bollard : Fender : Steel sheet piling with coping wall Tie rods with steel sheet piling wall	180×3=540 m W = 30.0 m 5 nos/cross section
Structural type Location Structures	RO-RO Berth Open-type Ramp with vertical piles Northern extremity of container wharf The same as container wharf	40m×25m
Structural type Structures Structure's feature	Passenger & Mo'ta floating Berths Floating Piers Steel-fabricated pontoon with mooring accessories Mooring chains & Anchors Mo'ta floating pier equipped with a ramp at the northern board (the port side).	150×35×d=6m
Structural type Facilities Structure's feature	Bulk cement Berth Dolphin with coupled batter piles Berthing & Mooring dolphins Mass-concrete resistance block on land Dolphin and two resistance blocks are combined with steel strut in a horizontal truss.	2 units 4 units

### (3) Port Facilities at Industrial Port

There are three wharves in the industrial port. Fertilizer jetty is located at the southern end near the border of Saudi Arabia. The jetty is exclusively used for exporting fertilizer and/or potash. The jetty is equipped with two bulk loading berths seaward & landward and two sets of mechanical loader and belt-conveyor with a machinery tower. New oil jetty was erected for exporting oil in 1988, which is the latest erection of a wharf in the Port of Aqaba concerning The Port Corporation. Facilities of the jetty are composed of jetty heads, four berthing dolphins, four mooring dolphins and an approach jetty. The jetty is equipped with oil loader and pipelines and hydrant. Table 2.2.1.5 shows berthing facilities of Industrial Port

Table 2.2.1(5) Berthing Facilities of the Industrial Port

Name of Berth	Scale of Berth		Allowed Scale of Vessel		
	Water Depth(m)	Length (m)	Full Load Draft(m)	Length (m)	Displacement (tons)
Industrial Berth seaward	CD-15.0	200	15.0	230	70,000
Industrial Berth landward	CD-11.0	190	11.0	190	40,000
Oil Jetty	CD-25.0	140	24.0	370	406,000
Timber Berth	CD -6.8	80.6	6.8	80(120)	14,000

Structural types of fertilizer wharf and timber wharf are open-type piers with vertical piles. Fertilizer wharf is a sea berth type, so that wharf is capable of accommodating dry or liquid bulk carriers on both sides. The approach jetty is made of open-type piers with mostly vertical piles but partially coupled batter piles. The part of the jetty connected to the land is made of causeway, the slopes of which are protected with rubble and armor stones. The structural type of new oil jetty is dolphin with coupled batter piles. The mooring dolphins, which are the most important structure in view of design for safety and stability, are composed of 12 batter piles driven outward inclination in a circle arrangement and reinforced massive concrete where seebeck quick release mooring gear & anchor are installed.

Wharves and jetty in the Industrial Port belong to The Ports Corporation, but facilities and equipment for cargo handling belong to the factories themselves. Therefore when a strong request is made from the factory to improve, extend or construct newly marine facilities, The Ports Corporation will examine and promote the requested project. Table 2.2.1(6) shows port facilities of Industrial Port.

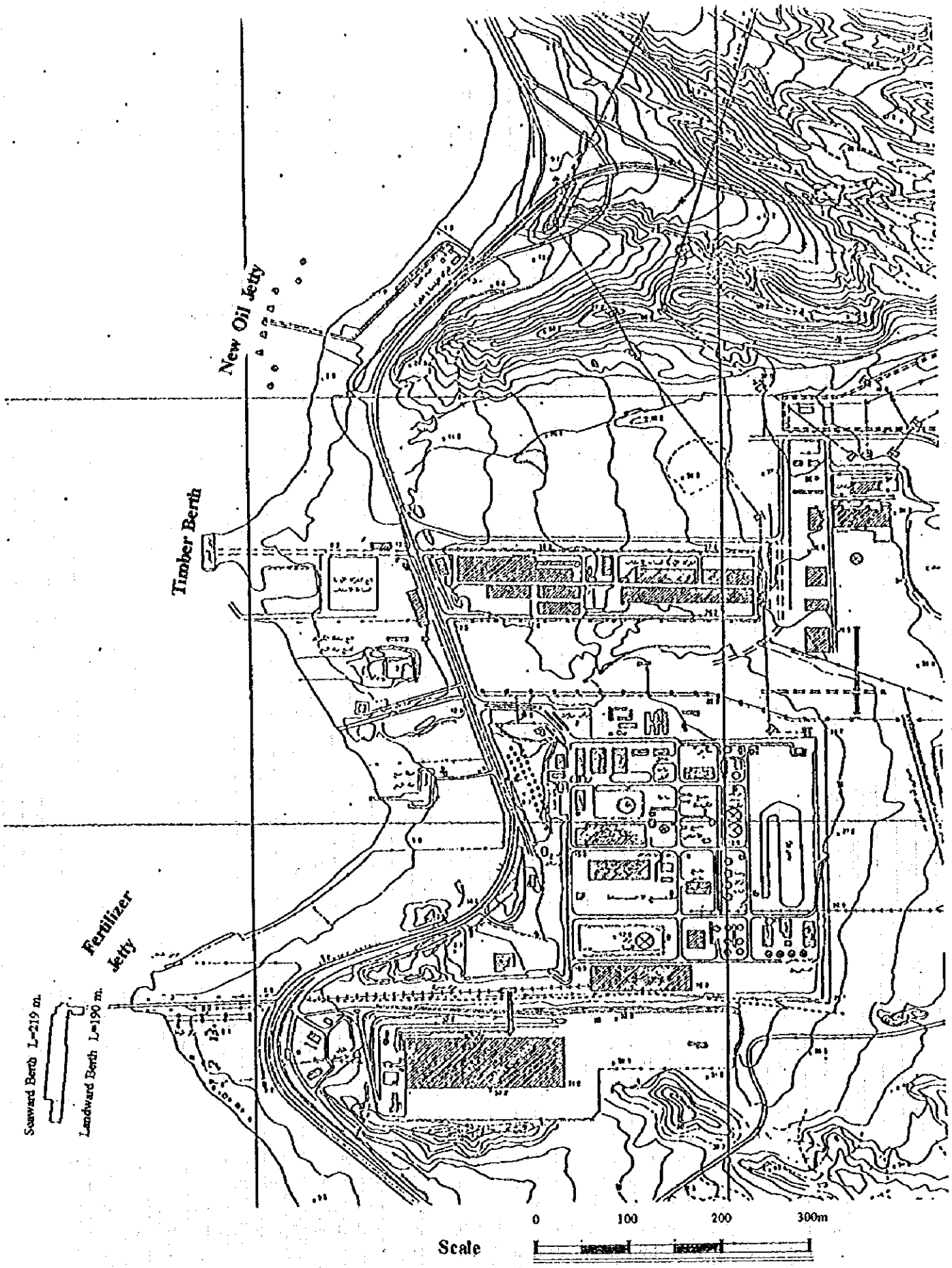


Figure 2.23 Layout of the Industrial Port

Table 2.2.1(6) Port Facilities of the Industrial Port

ITEM	DESCRIPTION	SCALE, etc.
Name of Berth Structural type Foundation pile Super structure Accessories Other port facilities Approach jetty Cause way Inner basin	<b>Industrial Berth</b> Seaward Berth Landward Berth Open-type piers with vertical piles 762 dia tubular steel pile Arrangement R.C.pile beam 1200 wide X 1200deps. Deck : Reinforced in-situ concrete spreading precast R.C. mats. Bollard : 100 tons/pulling cap. both wards Fender : Cell-type rubber fender Structural type : open-type piers with mostly vertical piles, partially coupled batter piles Abutment : Precast concrete blocks. Cause way slopes are protected by stones. Dredging activities up to CD -11.0 m were made at the shallow area close to the berth in 1978	231.6*27.0 m 192.2*14.2 m section 7 nos. span: 5 m longi. Sc=500 kg/sq.cm
Name of Berth Structural type Facilities Jetty head Mooring dolphin Berthing dolphin Approach jetty Walkway bridge Technical remark	<b>Oil Jetty</b> Dolphin with coupled batter piles - 1 unit:right square : piles - right angle. 4 units:hexagonal shape, 12 batter piles driven to outward, arranged by circle. Seebock quick release mooring gear 4 units: square but a parallel line Bridge beam with vertical pile, RC slab Steel truss type with handrail All foundation piles are provided with cathodic protection for corrosion control	140m for berthing 280m for mooring  150m*75m 9.50m*10.25m Pile D=813*16t 2No.100t hooks 12m*(5+15)m 110m*5m 4 units
Name of Berth Structural type Other facilities Purpose of berth	<b>Timber Berth</b> Double-wall cofferdam type quaywalls Steel sheet piles with tie-rods Approach jetty : Double-wall cofferdam The berth is used for animals disembarking when it isn't occupied by timber vessel.	80.6m*24.8m

#### (4) Other Port Facilities at Main Port

The main port is the oldest commercial port for handling cargos in Aqaba Port. Commodities handled in the port are mainly general cargo, solid bulk, liquid bulk and break bulk likely grains. The layout of facilities such as storage yards and port roads has been designed to ensure that those cargos can be handled smoothly.

##### 1) Storage Facilities

There are 6 transit sheds behind aprons designated by number of each shed corresponds to that general cargo berths except transit shed No.4 which is located behind lighters berth. Total area of the transit sheds is approximately 3.95 ha. In further deeper area of berth No.1 to No.4 & lighters berth, 9 covered hanger storage warehouses of approximately 2.6 ha in total area are available. There are 12 open storage areas with a total



area of approximate 8.7 ha, and open area of 12 ha exists at 7 places. Total area of storage facilities is 28.14 ha.

## 2) Pavement

The periphery of the storage area is paved by reinforced concrete of 230 mm thickness with a thin layer of hot mix asphalted wearing course. There are 5 port entrance gates facing Aqaba coastal road which is classified into Primary Roads. The gates No.1 to No.3 are mainly used for traffic of general cargo and employees of The Port Corporation whose offices are mostly located near the gates or alongside the roads connecting the gates. Gate No.4 & No.5 are mainly used for cargo traffic of phosphate, oil and grains.

Access roads inside port together with Aqaba coastal road are classified into Primary Roads, typical section by thickness is as follows (See Figure 2.2.4):

50 mm	Asphalt Surface Course
80 mm	Asphalt Binder Course
200 mm	Crushed Base Course; Minimum C.B.R. 80%
300 mm	Granular Sub-base Course ; Minimum C.B.R. 40%
200 mm	Approved Selected Fill ; Minimum C.B.R. 20%
400 mm	Rock fill

## (5) Container terminal

Area of container terminal gives following approximate dimensions.

Longitudinal section ;

At the wharf alongside : (Line A)	540 m
Alongside Aqaba coastal road seaward : (Line B)	800 m
Alongside Aqaba coastal road landward: (Line C)	500 m
Tip of hill slope (boundary) (Line D)	300 m

Cross section ;

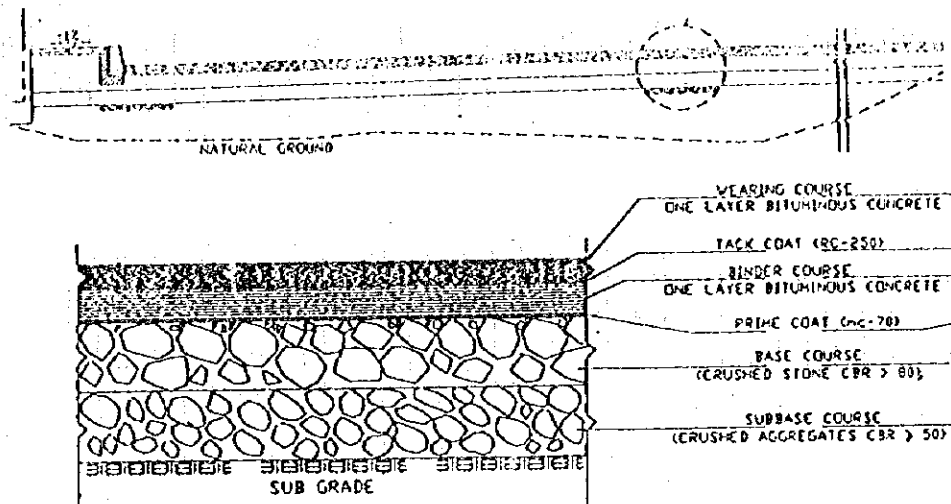
Line/height	Line A	Line B	Line C	Line D
Distance				
Northern corner grade	+ 3.8m	A ~ B 220m 1.00%	+ 6.0m C ~ D +10.0m	320m +22.0m 3.75%
Center of wharf grade	+ 3.8m	170m 1.30%	+ 6.0m +10.0m	350m +19.0m 2.57%
Southern corner grade	+ 3.8m	170m 1.30%	+ 6.0m + 7.0m	50m +10.0m 6.00%

At the cross section of the center of the wharf, total width is approximately 550 meters. As the range of heights is approximately 15 meters, the gradient of the section will be about 2.73%. Subject to removal of existing Aqaba coastal road in future, formation of container terminal will be prepared to one level instead of the current two levels. As the gradient of, on an average, 2.5 ~ 3.0% is about twice the tolerable level of the value given in design, the design for cutting and disposal soil works shall be required.

In 1982, permanent container terminal started with three berths of 540m instead of the temporary floating berth. At that time, original paved surface from original foreshore to about 30 meters in width was demolished, then new paved surface from edge of quay apron to demolished area was constructed. Therefore the pavement of container yard has two histories, but no inconsistency can be observed.

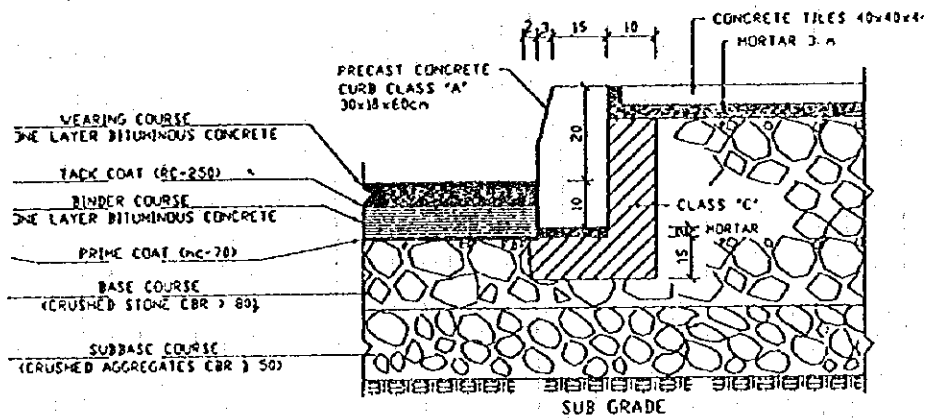
Some parts of asphalted surface where the legs of container boxes are usually stacked are broken out. One reason might be that containers are stacked in an inclination due to as built ground conditions.

Figure 2.2.5 shows pavement structure at the container east yard.



**IN FILL :** Approved material placed and compacted in 20 cm layers to 95% MDD. One layer minimum.

**IN CUT :** If CBR of natural soil is  $\geq 15$ , The top 15cm shall be scarified, waterd and compacted, in one layer to 95% MDD. If CBR of natural soil is less than 15, the soil shall be excavated to a depth of 30cm replaced by approved material and compacted in two layers to 95% MDD.



### CURB & SIDEWALK DETAILS

Figure 2.2.4 Pavement Structure (Primary Roads)

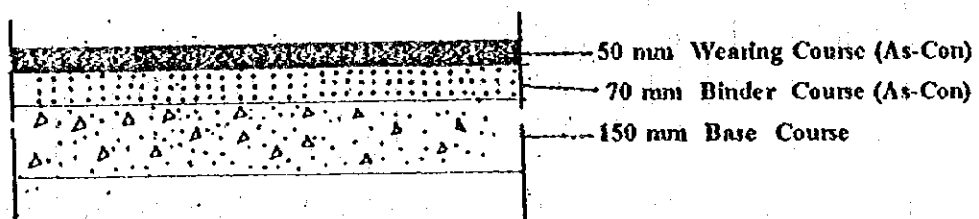


Figure 2.2.5 Pavement Structure at the Container East Yard

Regarding the foundation of gantry crane, the gauge span is 18 meters which is a standard span for panamax-type or original gantry of container cranes. When a wider gauge span is required in future, the gauge span of 24 meters which is the next run of foundation piles will be examined in design.

There are four storage facilities in the Container Port: two transit sheds and two covered hanger storages. The transit sheds (each 6,600 square meters in area) are possible to use of container fleet stations. Two covered hanger storages near the sheds are available. They are located behind passenger floating berth about a half km. from the container wharf.

## 2.2.2 Utilities

### (1) Main Port

Jordan Electricity Authority supplies electric powers not only to Port of Aqaba but to all of Jordan. Water Authority under Ministry of Water and Irrigation supplies fresh water to Port of Aqaba. Water Authority also collects and treats waste water and sewage.

#### 1) Power supply

Jordan Electricity Authority supplies electric power of 6600 /380 Volt to the Main Port. Therefore Jordan Electricity Authority constructs facilities for power transmissions and substations. There are eleven substations in the Main Port. The locations, capacity of power and purpose of use are shown as follows;

Location	Power KW	Purpose of use
At Gate No.2	1,000 KW	Offices, etc
Military cold store	1,000 KW	Work shop
Military cold store	750 KW	Slipway, etc
Marine tower	1,000 KW	Marine tower, Transit shed
Between covered storage	1,000 KW	Covered storage, Berth
Grain silo	1,000 KW	Grain silo, offices, shops
Oil tank farm	1,000 KW	Oil tank, Rail intake, etc
Phosphate store No.4	1,000 KW	Phosphate stores & intake
Phosphate store No.3	1,000 KW	Phosphate stores, Berth A,B
Phosphate store No.6	1,000 KW	Phosphate stores, sewage plant
Near Gate No.4	1,000 KW	South-East area of Port

A generator station for emergency use is available in the center of port offices complex lot.

#### 2) Water supply

The Main Port is fully served with water supplied by Water Authority. A water main pipeline of 24" diameter runs along Aqaba coastal road. There are two water intakes of the pipeline to use for the Main Port. One is located near Gate No.2. The water pipeline of

8" diameter is served from the intake to Gate No.2. Then size of the diameter changes to 6", and the pipeline is served up to the Berth. The other one is located at a hill slope between Gate No.4 and Gate No.5. The water pipeline of 4" diameter is served from the intake to a phosphate storage area. The pipeline is exclusively used for industrial purposes in the Main Port such as Phosphate, Oil tanks and Grain silos.

The water pipeline of 6" diameter is distributed by 1" pipe to all offices, the other buildings and public services such as toilets in the port area. General cargo berths are served with both drinking and fire hydrant water. The hydrant water pipeline (6" diameter) is equipped with 24 hydrant outlets along the berths. The hydrant outlet employs a valve with 4" pipe and water pressure of 250 tons per square meters.

A water valve of 110 mm diameter for urgent use is located near the central workshop. Two reserved water tanks for emergency use are available at the offices complex lot.

### 3) Sewerage

The Ports Corporation maintains two sewerage systems in the Main Port. A septic tank system has been adopted for main offices of general management, lavatories, stores and offices in offices complex. Other offices and buildings along Aqaba coastal road are served by a pump up system that takes waste water and sewer pool in the reserve tank of each building and pumps it up to a city pipe via main manholes.

There is a sewage treatment plant in the port located in the southern area of the port along the coast. Although this plant has not been in operation for five years, it is useful a spare in case there is excessive demand from the Aqaba region.

### (2) Container Terminal

#### 1) Power supply

There are three substations in the Container Terminal. The substations receive high tensioned power from transmission cables erected by Jordan Electricity Authority, and distribute it to port facilities and equipment. A substation distributes 1000 KW power among two gantry cranes. The other two substations distribute power to offices, reefer-containers and so on, but they have much in reserve. Therefore no new substation could be necessary if an additional gantry crane were to be installed.

#### 2) Water supply

A water pipeline of 4" diameter is laid between an intake from main pipe and container berth. And two lanes of 4" pipelines parallele to the berth alongside are extended to the extremities of the terminal. A hydrant pipeline of 8" ductile with three outlets is laid along the berth.

#### 3) Storm water drainage

As there are cliffs and steep hills behind the new container yard, rain water quickly enters the yard during intense rainfalls.

Gally of 450 mm in width with grating cover is located 78.2 meters behind the berth alongside. The gally collects rainwater and is drained through drain pipe at the same time.

## 2.3 Port Related Industries

### 2.3.1 Factories located around the Port

Major factories in Aqaba are located in the industrial area, which is expanded in the southern part of Aqaba coastal zone. This area is located adjacent to the Saudi Arabia border.

Existing factories operated in this area are listed as follows:

- 1) Jordan Fertilizer Industry
- 2) Jordan Electricity Authority
- 3) Arab Potash Company
- 4) Jordan Timber Products Industry
- 5) Solvochem Holland B.V.
- 6) Aqaba Packing Co.
- 7) Jordan Petroleum Refinery Company(JPRC)

#### (1) Jordan Fertilizer Industry(JFI)

This is a fertilizer complex established by Jordan Phosphate Mines Co. Ltd.(JPMC). Main objectives of the company are producing of phosphoric acid and phosphatic fertilizers, and exporting them.

In 1982 the construction of Aqaba Fertilizer Complex was completed and the annual nominal capacities of the complex are as follows:1,188,000 tons sulphuric acid, 412,000 tons phosphoric acid, 740,000 tons di-ammonium phosphate(DAP) and 20,000 tons aluminum fluoride.

Volumes of production and export of phosphoric acid, DAP and aluminum fluoride during 1982-1992 are shown in Table 2.3.1. According to the statistics of the Ports Corporation, export volume of fertilizer in 1993 and 1994 amounted to 412,245 tons and 517,781 tons respectively.

JPMC adopted a policy to manufacture phosphoric acid, phosphatic fertilizer and other products aiming at utilizing the abundantly available rock phosphate and improving the marketing position of JPMC.

Japan-Jordan fertilizer joint venture project has commenced construction work besides the existing JFI factory. Planned annual production volume is 300,000 tons and the entire product will be exported to Japan. Operation is planned to start in 1997.

India-Joint venture project is also planned to produce phosphoric acid, with annual production targetted at 300,000-400,000 tons.

Table 2.3.1 Production and Export by JFI

(unit:000 tons)

Year	Phosphoric Acid		DAP		Al-Fluoride	
	Production	Export	Production	Export	Production	Export
1982	66	-	118	70	-	-
1983	188	18	337	367	-	-
1984	294	31	569	458	3	1
1985	260	32	495	509	6	
1986	282	22	551	559	10	13
1987	283	10	605	566	11	
1988	303	14	615	629	15	16
1989	303	22	602	579	16	
1990	297	18	596	613	15	16
1991	271	6	600	578	13	
1992	281	19	554	570	15	13

Source: JORDAN PHOSPHATE MINES CO.LTD.

## (2) Jordan Electricity Authority(JEA)

Jordan Electricity Authority(JEA), a Government entity, is responsible for generation and transmission of electricity in the country. The general energy for the purpose of local consumption amounted to 4,715 GWh in 1993, compared to 4,355 GWh in 1992, representing an annual growth of 8.3% compared to 16.9% in 1992. JEA produced 4,389 GWh in 1993 compared to 4,018 GWh in 1992 representing an annual growth of 9.2%. It is worth mentioning that during 1993 JEA exported 46 GWh to Syria. Irbid District Electricity Company(IDECO) and industrial companies produced 369 GWh, the other part was produced from other companies. The share of each power station in the generated energy is as follows:

1. JEA	92.19 %
2. IDECO	0.19 %
3. Industrial companies	7.56 %
4. Others	0.06 %

From the above percentages, it is clear that JEA cover the largest part of Jordanian electric demand since it participated in more than 92% of the generated energy. Table 2.3.2 shows electrical energy consumption and future demand in Jordan and production of Aqaba thermal power station.

**Table 2.3.2 Electrical Energy Consumption and Future Demand**

(Unit: GWh)

Year	Consumption & Forecast in Jordan	Production Aqaba thermal
1988	3,263	1,151
1991	3,724	1,352
1993	4,715	1,598
1996	5,911	
2000	7,220	
2005	8,614	
2010	9,813	

Source: JEA annual report 1993

Two thermal power generators, with 2x130MWh, are operating in Aqaba industrial area and another two are planned with same capacity. Current oil consumption is about 360,000 tons. Oil is transported by tank truck from Iraq(Syrian border). Between main port and container port, there is a small thermal plant. Total oil annual consumption for the power station in the future is estimated at about 720,000 tons.

### (3) Arab Potash Company(APC)

The capital of the Arab Potash Company Limited is 72.45 million JD. It has a concession from the government to exploit, manufacture, and market the mineral resources of the Dead Sea.

APC has a total production capacity of 1.8 million tons in 1993. The final product can either go to the plant product storage warehouse of 60,000 tons capacity, or it can be conveyed to shipping bins from which it can be loaded into specially made bottom-dump trucks for delivery to the storage warehouse at the port of Aqaba.

The fleet of more than seventy trucks with a capacity of 50 tons each, daily transport potash via the Safi-Aqaba road, to the storage and loading facilities at Aqaba for ocean shipment. There is capacity for a further 160,000 tons in Aqaba. The design capacity of loading facilities is 2,000 ton/hour.

Production volumes of potash during 1989-1993 reached around 1.4 million, and details are shown in Table 2.3.3.

Export of potassium crude salts natural and potassium chloride/fertilizer in 1993 are shown in Table 2.3.4.



**Table 2.3.3 Production Volume of Potash during 1989-1993**

Year	1989	1990	1991	1992	1993
,000 tons	1,320	1,403	1,364	1,346	1,370

Source: Statistical Yearbook 1993(Department of Statistics)

**Table 2.3.4 Export Volume of Potash by Kind in 1993**

Kind	Potassium Crude Salts Natural	Potassium Chloride/Fertilizer
Volume	1,476,667 tons	3,210 tons

Source: External Trade Statistics 1993(Department of Statistics)

**(4) Jordan Timber Products Industry(JTPI)**

The Jordan Timber Products Industry occupies a site of 16 hectares between JEA and the coast road. The timber berth is not used for handling of timber but used for unloading of livestock.

Timber that is imported to Jordan through the port of Aqaba is managed by another private company.

**(5) Solvochem Holland B.V.**

Solvochem Holland B.V. is situated between JEA power plant and Aqaba coastal road. Headquarters of Solvochem Holland B.V. are in Holland and branch offices are located in Egypt, Cyprus, Beirut, etc. Main objectives of this branch are to import solvent, tallow, lube oil, etc. and to distribute them to domestic market.

Outline of this plant is as follows:

land area : 17,000 sq.m(100x170 m)  
 storage capacity :  
     Jan.1995 - 9 tanks and capacity of 13,000 tons  
     Feb.1995 - increasing of 8 tanks  
     Dec.1995 - increasing of 14 tanks  
 cargo handling : 15 vessels/year  
                   3,000-12,000 ton/vsl  
 operating history: record of 2 years' operation

**(6) Aqaba Packing Co.**

Aqaba Packing Co. is located between main port and container port and north of the cement storage yard. This was built in 1988 under a BOT scheme in which ownership of facilities and equipment shall be transferred to PC after 15 years' operation.

Main role and function of this factory is to import rice (95% of whole handling volume) and wheat as a bulk cargo and to export them after bagging. Standard importing

volume per vessel is 15,000 tons and 5 vessels are chartered. Discharging capacity of belt conveyer is 500 tons per hour and daily discharging volume is about 4,000-5,000 tons.

Storage facility consists of 7 silos. Average storage capacity of silo is 7,500 tons, so total existing storage capacity is about 53,000 tons.

Rice is imported from USA, India, Pakistan, China, Thailand, etc.. Ratio of imported volume from USA is more than 95 percent. Exporting countries of bagged rice and wheat are Syria, Turkey, Italy, etc.. Before UN sanctions on Iraq, annual volume of 400,000 tons was exported to Iraq. Domestic distribution is required the permission of the Ministry of Supply.

#### (7) Jordan Petroleum Refinery Company(JPRC)

Jordan Petroleum Refinery Company(JPRC) currently occupy a site of 8.8 hectares in the main port with the storage capacity of 32,000 m<sup>3</sup>.

In industrial area new tank farm has commenced construction by the plan of total capacity of 180,000 m<sup>3</sup> of oil and 3,000 tons of gas. Detailed plan is as follows:

##### Storage facility

2×30,000 m <sup>3</sup>	-	crude oil tank
2×20,000 m <sup>3</sup>	-	kerosine tank
2×20,000 m <sup>3</sup>	-	diesel oil tank
2×20,000 m <sup>3</sup>	-	fuel oil tank
2×1,500 m <sup>3</sup>	-	butane gas

##### Pipe line

1×24"	-	crude oil
1×18"	-	light products oil
1×18"	-	fuel oil

Handling of oil is assigned existing oil berth. This construction will be completed in 1997.

Furthermore, new refinery is expected to be established in industrial area in the future.

### 2.3.2 Major Industries related to the Port Activities

Marine transportation is the main mode in world trade. According to External Statistics 1993, marine transportation covered 86.7 % of exports and 38.9% of imports by weight (refer to Table 2.3 4 and Figure 2.3.1).

Major industries perform trade activities through the port of Aqaba. Their export and import goods are mainly handled at the main port. Existing major industries related to the port activities (excluding those already mentioned in 2.3.1) are listed as follows:

- 1) Ministry of Supply
- 2) Jordan Phosphate Mines
- 3) Jordan Cement Factories Co.
- 4) The Free Zones Corporation
- 5) Jordan Industrial Estates Corp.
- 6) Livestock Industry

Table 2.3.5 Total Export and Import by Mode in 1993

Mode	Value (,000 JD)		Gross Weight (,000 tons)	
	Export	Import	Export	Import
Trains	187.5	28.6	0.1	0.0
Trucks	412,119.8	951,142.2	973.7	4,933.7
Airplanes	124,483.7	334,625.4	10.7	36.4
Ships	327,870.6	1,167,066.7	6,405.6	3,165.4
Parcel Pos	-	761.9	-	0.2
Total	864,661.6	2,453,624.8	7,390.1	8,135.7

Source: External Trade Statistics 1993

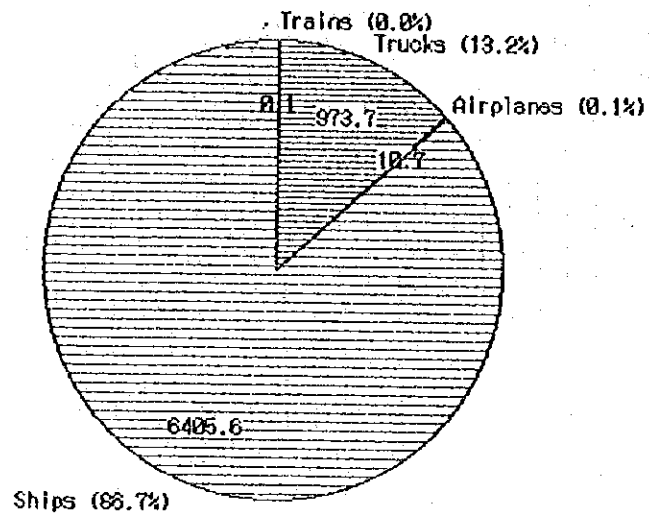
#### (1) Ministry of Supply(MOS)

Ministry of Supply(MOS) has a monopoly on the import of grains, sugar(bag type), rice(bag type), milk(small size) and cigarettes. And MOS also imports frozen chicken, frozen meat in case of whole body.

Exports of foodstuff are dealt with by the private sector and some imports by the private sector are seasonally allowed. Import of canned foods and other supermarket items like frozen cut meat is done by the private sector.

Ministry of Supply(MOS) imports grains for human and livestock consumption. Main grain imports are wheat, barley, maize, sorghum, etc.. MOS owns and operates three main grain storage complexes in Amman, Aqaba and Irbid. The storage types are vertical concrete silos which were constructed in two stages. The first stage was completed and put into operation in late 1979 with a total capacity of 50,000 tons in Amman and 50,000 tons in Aqaba. The Aqaba site included the ship unloading facility. The second stage was completed in 1983 with addition of 100,000 tons in Aqaba, 85,000 tons in Amman and a new site of 50,000 tons in Irbid. Thus the total storage capacity since 1983 is as follows:

Export Cargo Weight (,000 tons)  
by Means of Transport in 1933



Import Cargo Weight (,000 tons)  
by Means of Transport in 1933

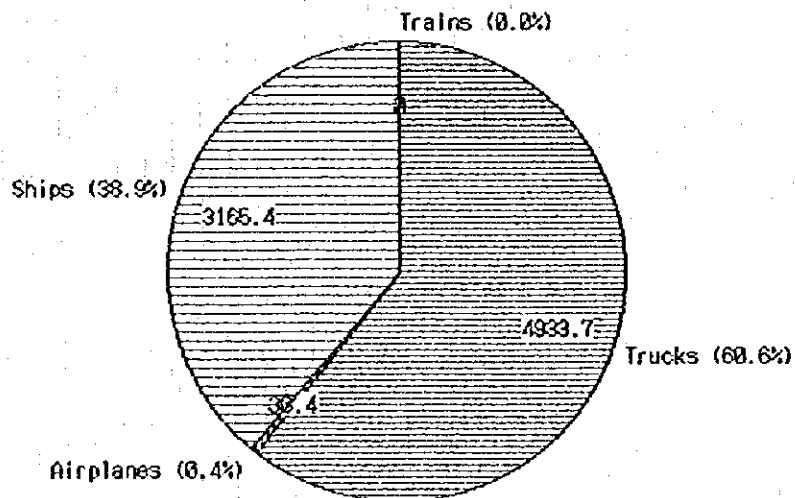


Figure 2.3.1 Distribution of Trade Cargo by Mode

Amman	135,000 tons
Aqaba	150,000 tons
Irbid	50,000 tons

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Total	335,000 tons
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Imported volume of grains, rice and sugar in 1994 at the port of Aqaba reached 937,368 tons, 97,367 tons and 289,617 tons respectively. Past annual records of these cargoes are shown in Table 2.3.6.

Table 2.3.6 Cargo Volume imported by MOS

Year	1989	1990	1991	1992	1993	1994
Grains	667,374	1,158,714	1,267,602	1,244,890	1,278,106	937,368
Rice	61,408	114,405	235,276	143,851	208,583	97,367
Sugar	143,211	188,656	230,107	352,359	225,434	289,617

Source: Statistics by the Ports Corporation

## (2) Jordan Phosphate Mines Co.

Jordan Phosphate Mines Co.(JPMC) was founded in 1934 as a private firm to exploit the phosphate reserves at Ruseifa area, 15 km north east of Amman, and later on, in 1953, JPMC was incorporated as a public shareholding company jointly owned by the Jordanian government and the private sector. Through 1953-1988 three other production sites were developed in south Jordan. The overall production of JPMC is currently 7 million tons of various phosphate rock.

Jordan phosphate rock mining started in the early thirties on a small scale using manual methods at Ruseifa area. Systematic production applying advanced machinery and modern techniques started as of 1953.

With new phosphate deposit discoveries and increased investments, production boomed considerably with the start up in 1962 of Alhassa mine(located 135 km south of Amman, 200 km north of Aqaba port), Alabiad mine(located 115 km south of Amman) in 1979 and Eshidiya mine(located 280 km south of Amman) in 1988.

Production at Eshidiya mine will be increased to 3.25 million tons by 1995 and 10 million tons by the year 2000, when production will be concentrated mainly at Eshidiya mine.

The designated capacities of the three operating mines are as follows:

Alhassa	: 3.5
Alabiad	: 2.5
Eshidiya	: 3.25 (as of 1995)

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Total	: 9.25 million tons
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Jordan is presently the world's third largest exporter of phosphate rock after Morocco and USA. JPMC phosphate rock is being exported to over 25 countries around the world.

Phosphate rock from the mines is transported to Aqaba port by trucks and railway. Aqaba port has two phosphate loading berths which have been developed to receive vessels up to 100,000 MT DWT. Berth "A" can load 1.7 million tons per year and can accommodate vessels up to 25,000 MT DWT and Berth "B" can load 7.8 million tons/year and can accommodate vessels up to 100,000 MT DWT. Six warehouses with a total capacity of 340,000 tons are available for storing and loading several grades of phosphate rock at Aqaba.

Table 2.3.7 Production and Export Volume of Phosphate Rock from 1982-1993

Year	Production (,000 tons)	Export (,000 tons)
1982	4,390	3,562
1983	4,748	3,701
1984	6,260	4,695
1985	5,920	4,610
1986	6,246	5,198
1987	6,801	5,544
1988	5,620	5,811
1989	6,910	6,411
1990	6,082	4,874
1991	4,850	4,245
1992	5,227	4,264
1993	4,210	3,565 <sup>1</sup>
1994	n.a.	3,825 <sup>1</sup>

Source: Jordan Phosphate Mines Co. Ltd.

Note: <sup>1</sup>-Statistics by the Ports Corporation

Table 2.3.7 shows volumes of annual production and export from 1982-1994. Trend of production has not increased satisfactorily because of over-production and less-consumption in the world market in recent years. Therefore higher value added fertilizer should be produced.

(3) Jordan Cement Factories Co.

Jordan Cement Factories Co. is a private company with two factories. One is Al-Recede and the other is Al-Fhais. Each factory has a similar production capacity. Production volume of cement in 1993 is 3,437,000 tons, which is an increase of 786,000 tons over the volume record (2,651,000 tons) in 1992 (source: Statistical Yearbook in 1993). However, volume of export in 1993 decreased from the previous year because of increasing domestic consumption.

Table 2.3.8 Production of Clinker and Consumption of Cement  
(unit: ton)

Year	Product of clinker	Local consumption of cement	Export of cement
1986	1,523,731	1,582,367	16,217
1987	2,106,851	1,633,871	738,920
1988	1,492,944	1,583,953	206,916
1989	1,595,895	1,486,400	434,250
1990	2,693,284	1,499,100	1,401,024
1991	2,751,493	1,521,871	1,279,970
1992	2,746,104	2,276,656	1,041,333
1993	3,073,931	2,776,252	744,976

Source: Jordan Cement Factories Co.

Table 2.3.9 Export Volume by Country in 1993

Country	Export Volume (tons)
Yemen	2,100
Saudi Arabia	583,665
Bangladesh	12,600
Singapore	12,000
Mauritius Islands	134,197
Others	414
Total	744,976

Source: Jordan Cement Factories Co.

#### (4) The Free Zones Corporation

##### 1) Existing Aqaba Free Zone

Before the establishment of the Free Zones Corporation in 1976, the Aqaba Free Zone was established in 1973 with the aim of serving foreign trade as well as the transit trade of goods shipped by sea via the port of Aqaba. In a brief time, the area allocated for the free zones was expanded until it reached about one million square meters. The Free Zones were provided with essential services such as water, electricity, road networks, telephone and similar services. The following installations were built in the free zone:

- a) Huge warehouses with an area of 25,000 square meters
- b) Tiled storage yards with an area of 300,000 square meters
- c) Cold storage facilities with a capacity of 6,000 tons

To minimize the distance between the free zones in Aqaba, the corporation adopted the following measures to establish integrated free zones in Aqaba:

- a) Allocating 5 million square meters as an industrial free zone located on the back road.
- b) Allocating 2.5 million square meters for setting up an integrated commercial zone directly located on the beach with a front of well over 500 meters with the aim of constructing a pier in the future for the free zone.
- c) Furthermore, a total of 600,000 square meters of land parallel to the container port with the aim of providing yards and warehouses for storing containers that are sent to the free zone.

Estimated number of workers in Aqaba Free Zone is about 1,000.

##### 2) Zarqa Free Zone

The Zarqa Free Zone is a commercial and industrial free zone, 35 km north east of the capital Amman, where there are several international crossroads. The state had allocated 5.5 million square meters for this purpose so that the free zone could be developed.

The first, second and third stages of the free zone in Zarqa have been completed and they include the following sections:

- a) The industrial investment sector  
It consists of 28 blocks with a total area of 125,000 square meters.
- b) The commercial investment sector  
It consists of 200 blocks with a total area of one million square meters allocated for building warehouses and trade fairs.
- c) The free market for cars  
It consists of 109 fairs with a total area of 125,000 square meters.
- d) The general storage sector  
It consists of 18 small warehouses with a total area of 10,000 square meters, nine large warehouses with a total area of 18,000 square meters, and open and tiled storage yards with a total area of 200,000 square meters.

In the existing area, there are 900 registered enterprises of which 32 are registered as a manufacturing factories. However, only 11 factories are currently in operation.



Future plan consists of extension area of 1.2 million square meters and new manufacturing area of 0.3 million square meters. Estimated number of workers in Zarqa Free Zone is about 4,000.

### 3) Amman International Airport Free Zone

This area is now under construction with a area of 120,000 square meters. Commercial sector and light industry is the main focus of this area.

### 4) Future Aqaba Free zone

New Free Zone located on the Israeli border is being planned by Jordan and Israel. This free zone can be accessed from both countries. This plan is one of the most interesting themes mentioned in the Peace Treaty between Jordan and Israel, when future cargo traffic is estimated.

### 5) Cargo statistics in free zones

Table 2.3.10 shows volumes of arriving/out going cargo.

Table 2.3.10 Cargo Statistics of Free Zones

(unit:tons)

Year	Aqaba		Zarqa	
	Arrive	Leave	Arrive	Leave
1990	65,215	59,146	99,655	105,932
1991	241,042	212,164	584,677	564,710
1992	676,472	660,643	376,141	381,535
1993	407,007	410,904	367,059	358,255
1994	290,138	320,735	n.a.	n.a.

Source: The Free Zone Corporation

### (5) Jordan Industrial Estate Corporation(JIEC)

The Jordan Industrial Estate Corporation(JIEC) was established in 1980. The objectives of JIEC are to:

- Study, plan, establish and manage all industrial estates in Jordan
- Encourage the establishment and relocation of Industrial projects in the industrial estates
- Encourage the distribution of industrial projects to various regions of Jordan
- Take appropriate measures that lead to the development and integration of industries within industrial estates and overcome any difficulties facing them

JIEC has established two projects. The first project is Amman Industrial Estate at Sahab(AIE) with an area of 2.5 million square meters, and the second project is Al-Hassan Industrial estate/Irbid Governorate with an area of 427,000 square meters.

Table 2.3.11 shows number of industries, size of investment and number of workers of above two projects.

Table 2.3.11 Outline of JIEC Projects in August 1993

	Amman I.E.	Al-Hassan I.E.
Number of Industries	302	41
Size of Investment (million JDs)	204.3	33.4
Number of Workers	9,138	1,400

Source: Jordan Industrial Estates 1993

#### (6) Livestock Industry

Three livestock farms were newly established in Aqaba governorate. Two are located in Al-Quwayra and one is located on the back side road of the port of Aqaba. Each farm has a storage capacity of about one million heads.

As a result of new farms' operation, large sized livestock vessels have started calling at the port of Aqaba. Origin ports of these vessels are Australian ports and main imported livestock is sheep. But a large number of small Turkish livestock vessels were also discharging sheep in 1994.

Importers plan to establish slaughter houses and produce fresh and frozen meat. They are also aiming at the establishment of a canning industry. Jordan and Saudi-Arabia would be the targeted markets. Table 2.3.12 shows cattle cargo volume through Aqaba.

Table 2.3.12 Imported Volume of Cattle

Year	(Unit: tons)	
	Local Import	Transit to Saudi-Arabia
1992	10,176	132
1993	15,395	38,591
1994	15,704	55,124
1995 (to end of July)	n.a.	14,547

Source: The Ports Corporation

## 2.4 Port Activities

### 2.4.1 Cargo Handling Volume and Commodities

#### (1) Historical trend of port cargo

Generally speaking, the volume of cargo handled between 1952 and 1975 tended to slightly increase though there were many fluctuations. The following year(1976), however, the cargo volume exploded, and this trend continued until 1988. Since then, the cargo volume has been on the decline(See Figure 2.4.1 and Table 2.4.1). Checking port traffic trends, average increasing volumes and rates of port cargo record 68,000 tons and 24.5% from 1954 to 1975, 1,426,000 tons and 23.8% from 1976 to 1988 and -1,587,000 tons and -9.9% from 1989 to 1994. Figure 2.4.1 indicates these trends. And Table 2.4.1 shows historical cargo volumes from 1952 to 1994.

An annual increasing cargo volume can be recognized in Figure 2.4.2. From 1975 to 1988, the decline in the import volume is remarkable. Regarding the decreasing trend of cargo, a radical decrease of a transit cargo to Iraq was the main reason(refer to Figure 2.4.3).

From the economic point of view, Jordan's external trade value is still increasing even though it has a huge amount of debt. Jordanian external trade depends on not only sea transport but also land transport. So the reduction of cargo does not match the reduction in trade. Figure 2.3.1 shows that a large portion of import cargo is transported by trucks.

#### (2) Historical trend by commodity

Main exported commodities of Aqaba port are recognized as phosphate, potash, chemical fertilizer, cement and empty container. Phosphate has a share of more than half of export cargoes. But unfortunately the cargo volume shows a tendency to decrease in line with the decline in world consumption. Potash is the second main commodity to be exported, and the volume has been increasing slightly. Chemical fertilizer has maintained the same volume for the last 6 years. The export volume of cement has decreased because of increased local consumption, even though the production volume has been increased. The volume of empty containers has maintained a level of about 100,000 tons, and the main destinations of empty containers are ports in Saudi Arabia. This explains why the Port of Aqaba is a feeder port of Saudi Arabian ports. Figure 2.4.4. indicates this trend.

Main imported commodities of Aqaba port are recognized as general cargo, grains, steel/iron, sugar, ammonium/sulphur, other bagged cargo, vegetable oils, etc.. Figure 2.4.4 shows a decreasing trend of total volume corresponding to a reduction of grains. Other food stuffs and steel/iron show the same tendency. General cargo has slightly increased. The volume of ammonium/sulphur has not changed.

#### (3) Present situation of cargo traffic

Regarding main commodities of export and import cargoes except general cargo, these origin and destination ports or countries are usually fixed. But as to general cargo, it has relation to many ports and countries as an other objective port. A distribution of the traffic of goods through the port of Aqaba in 1992 and 1993 is shown in Figure 2.4.5. Especially as to container cargoes, Figure 2.4.6 indicates that there is heavy traffic between Western Europe and the Far East, both for imports and exports. In case of export 27% of boxes is transferred to Saudi Arabia as empty container.

#### (4) Historical trend of external trade

Past trend and present situation of external trade generally reflect the level of maritime transportation. Figure 2.4.7 shows a historical trend of Jordanian external trade in value. In spite of the decreasing trend of the port traffic from 1989, external trade value in 1993 reached 2.4 times of that in 1988. So basically an increasing trend of external trade is expected by new investments after the Peace Treaty.

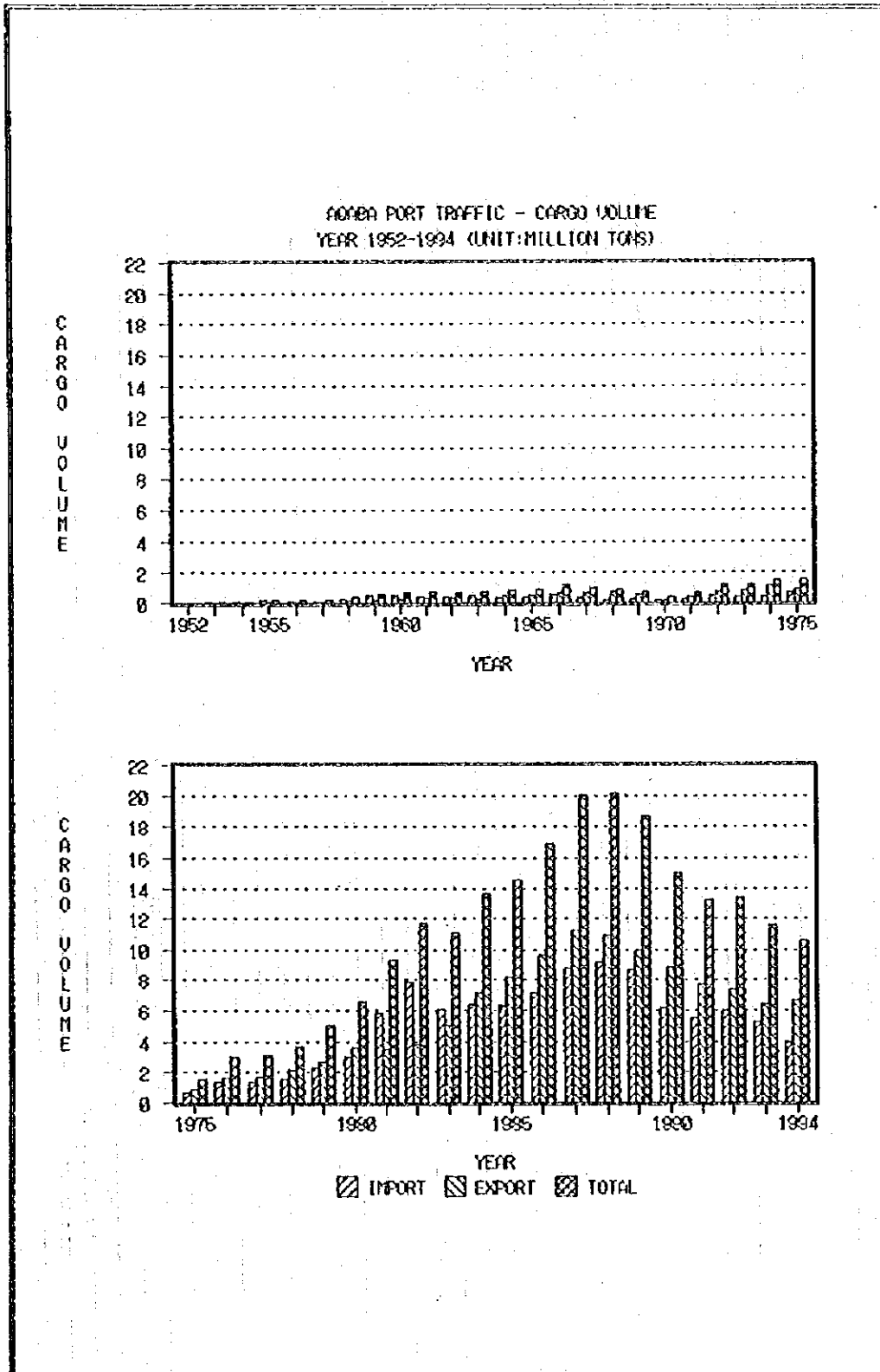
#### 2.4.2 Passenger Traffic

Two types of passenger arrive at the port of Aqaba. One is a foreign tourist who rides on a ocean going passenger boat. The other is an Arabian passenger, usually Egyptian, who rides on a ferry boat between Aqaba and Nuweibe. As to the former case, there are approximately 15,000 foreign tourists registered in the Statistical Yearbook of 1993. From the latter case total number of arrivals and departures at the Port from 1989-1993 reached 708,000, 806,000, 868,000, 1,212,000 and 1,260,000 respectively. Figure 2.4.8 shows the increasing trend of ferry passengers.

Table 2.4.1 Cargo Traffic of the Port of Aqaba during 1952-1994

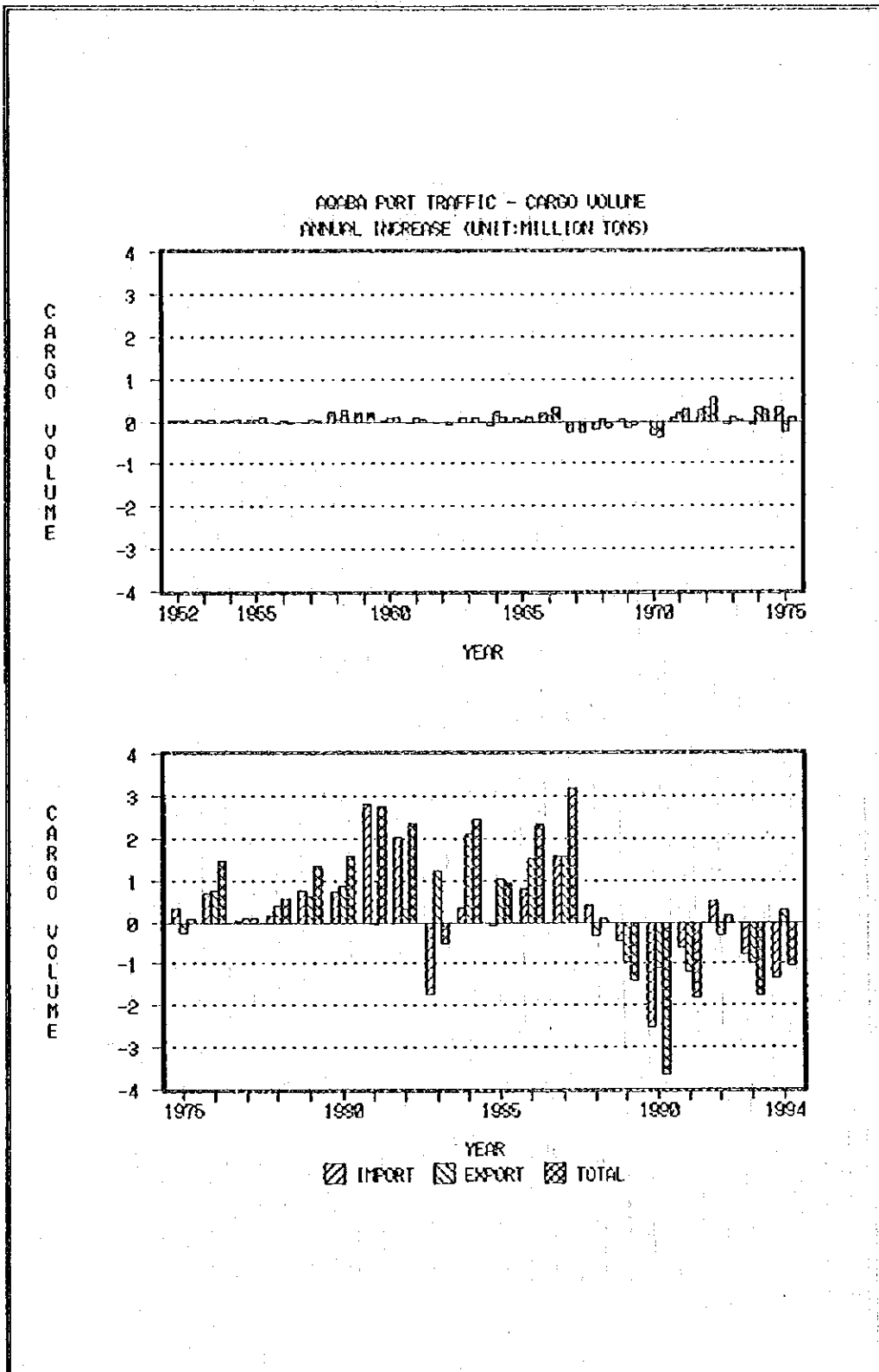
YEAR	IMPORT TON	EXPORT TON	TOTAL TON	NO. OF SHIPS	AVE. VOL. PER SHIP
1952	6,588	84	6,672	12	556
1953	56,178	4,010	60,188	117	514
1954	80,142	12,339	92,481	173	535
1955	134,625	66,251	200,876	219	917
1956	76,795	67,336	144,131	138	1,044
1957	47,604	99,172	146,776	95	1,545
1958	272,405	137,812	410,217	305	1,345
1959	453,672	136,634	590,306	370	1,595
1960	461,303	223,617	684,920	407	1,683
1961	420,295	311,436	731,731	440	1,663
1962	368,642	286,493	655,135	435	1,506
1963	451,695	275,189	726,884	500	1,454
1964	340,333	493,127	833,460	542	1,538
1965	408,201	521,634	929,835	570	1,631
1966	590,281	657,218	1,247,499	666	1,873
1967	353,793	650,929	1,004,722	452	2,223
1968	161,415	694,749	856,164	275	3,113
1969	205,007	538,542	743,549	269	2,764
1970	195,567	186,328	381,895	220	1,736
1971	278,059	387,164	665,223	254	2,619
1972	518,614	704,939	1,223,553	327	3,742
1973	433,794	811,237	1,245,031	304	4,095
1974	367,423	1,116,174	1,483,597	299	4,962
1975	682,795	870,613	1,553,408	516	3,010
1976	1,368,661	1,631,842	3,000,503	1,064	2,820
1977	1,389,390	1,722,283	3,111,673	944	3,296
1978	1,550,781	2,108,273	3,659,054	1,197	3,057
1979	2,301,369	2,708,731	5,010,100	1,238	4,047
1980	3,024,135	3,574,456	6,598,591	1,466	4,501
1981	5,804,686	3,530,062	9,334,748	1,744	5,352
1982	7,837,244	3,835,459	11,672,703	2,599	4,491
1983	6,098,755	5,059,108	11,157,863	2,454	4,547
1984	6,448,343	7,158,108	13,606,451	2,329	5,842
1985	6,370,104	8,177,607	14,547,711	2,671	5,447
1986	7,153,240	9,697,388	16,850,628	2,677	6,295
1987	8,743,749	11,271,622	20,015,371	2,555	7,834
1988	9,143,165	10,952,973	20,096,138	2,583	7,780
1989	8,694,675	9,985,974	18,680,649	2,446	7,637
1990	6,164,599	8,871,857	15,036,456	2,222	6,767
1991	5,547,998	7,677,470	13,225,468	2,075	6,374
1992	6,021,703	7,361,798	13,383,501	2,430	5,508
1993	5,252,689	6,381,181	11,633,870	2,491	4,670
1994	3,923,903	6,648,377	10,572,280	2,485	4,254

SOURCE: The Ports Corporation Year Book 1993  
Monthly Statistics /DEC. 94



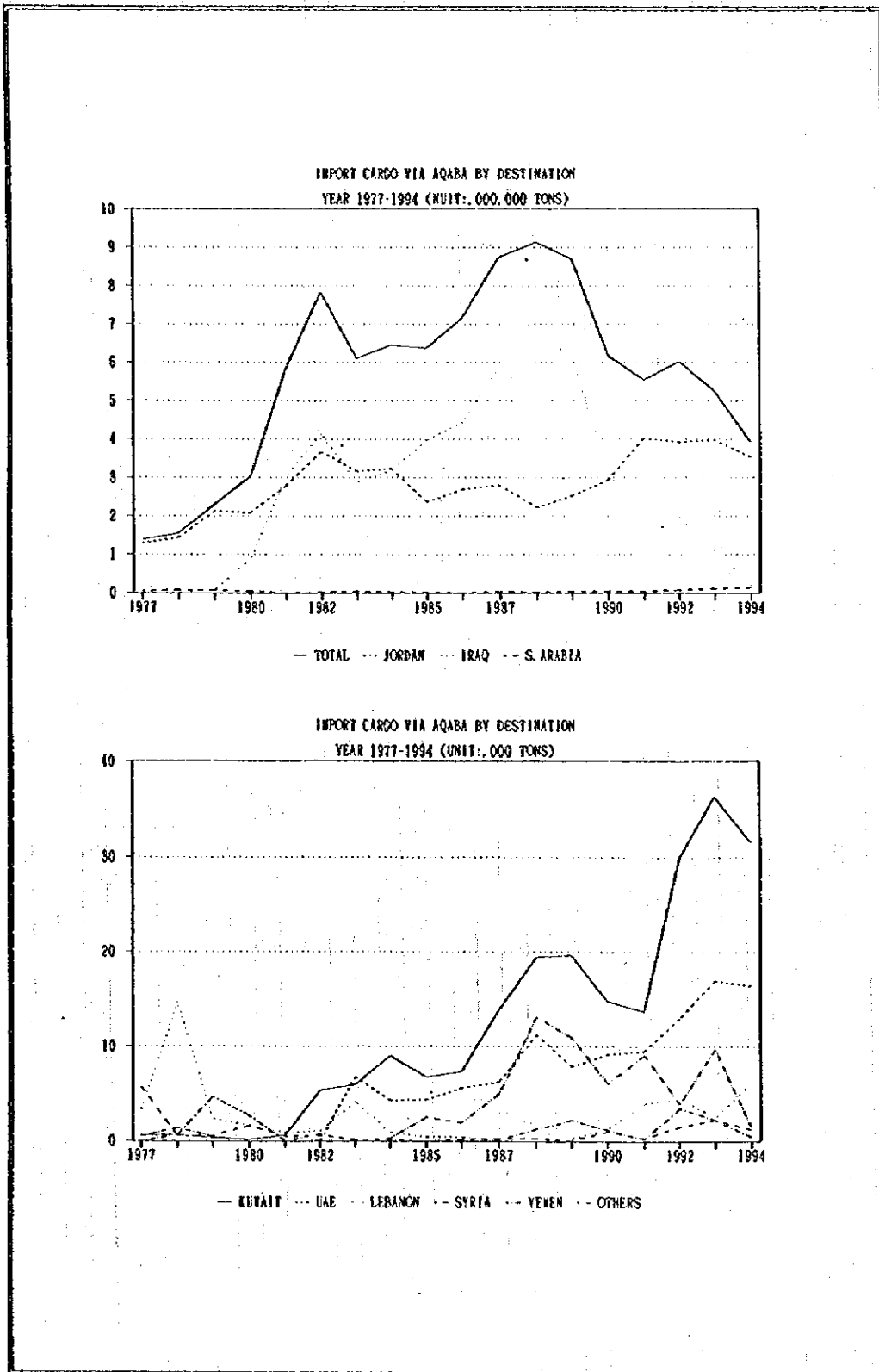
Source: The Ports Corporation Year Book 1993 and Statistics

Figure 2.4.1 Aqaba Port Traffic during 1952-1994



Source: The Ports Corporation Year Book 1993 and Statistics

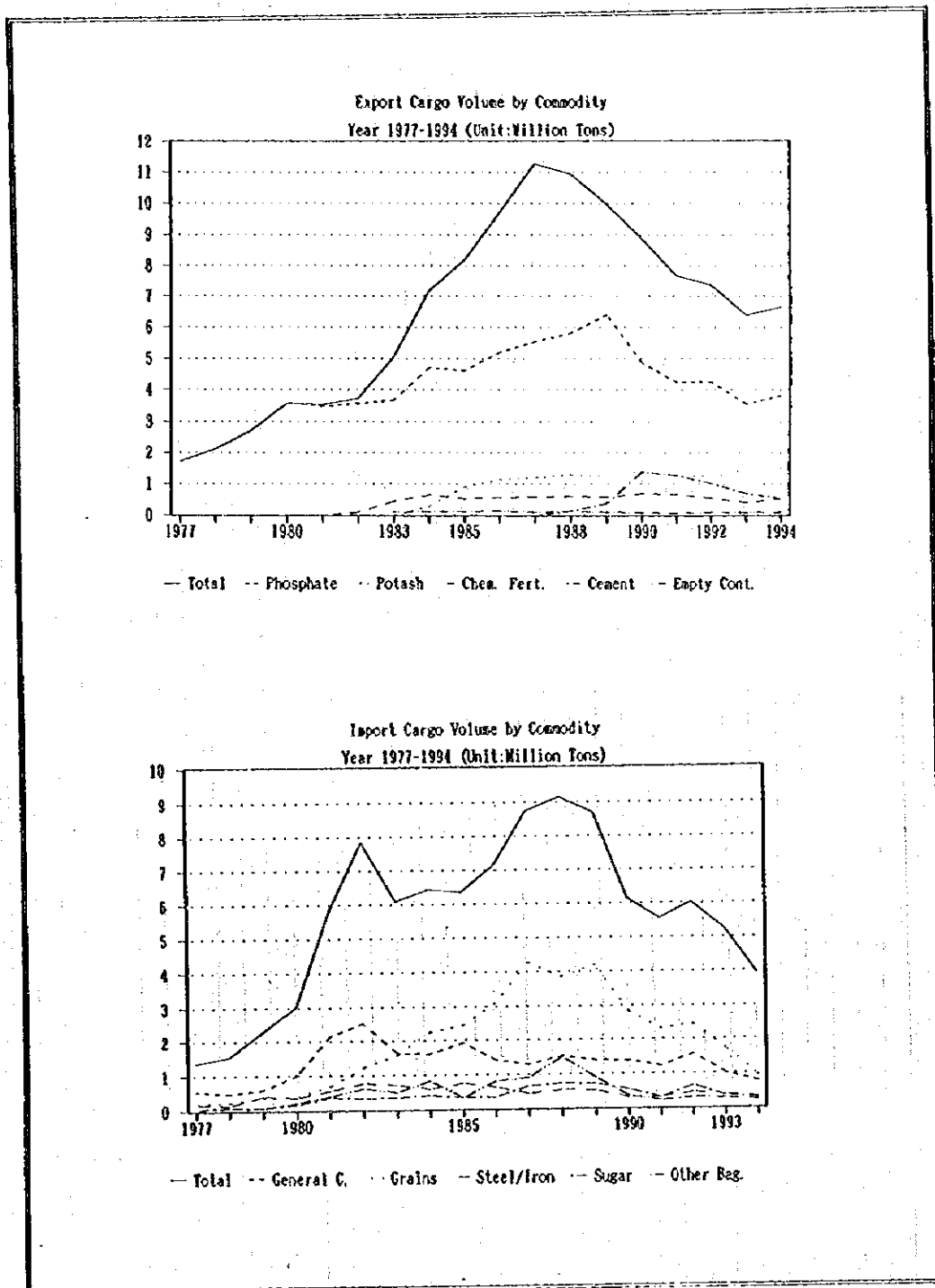
Figure 2.4.2 Annual Increasing Volume of Port Traffic during 1952-1994



Source: The Ports Corporation Year Book 1993 and Statistics

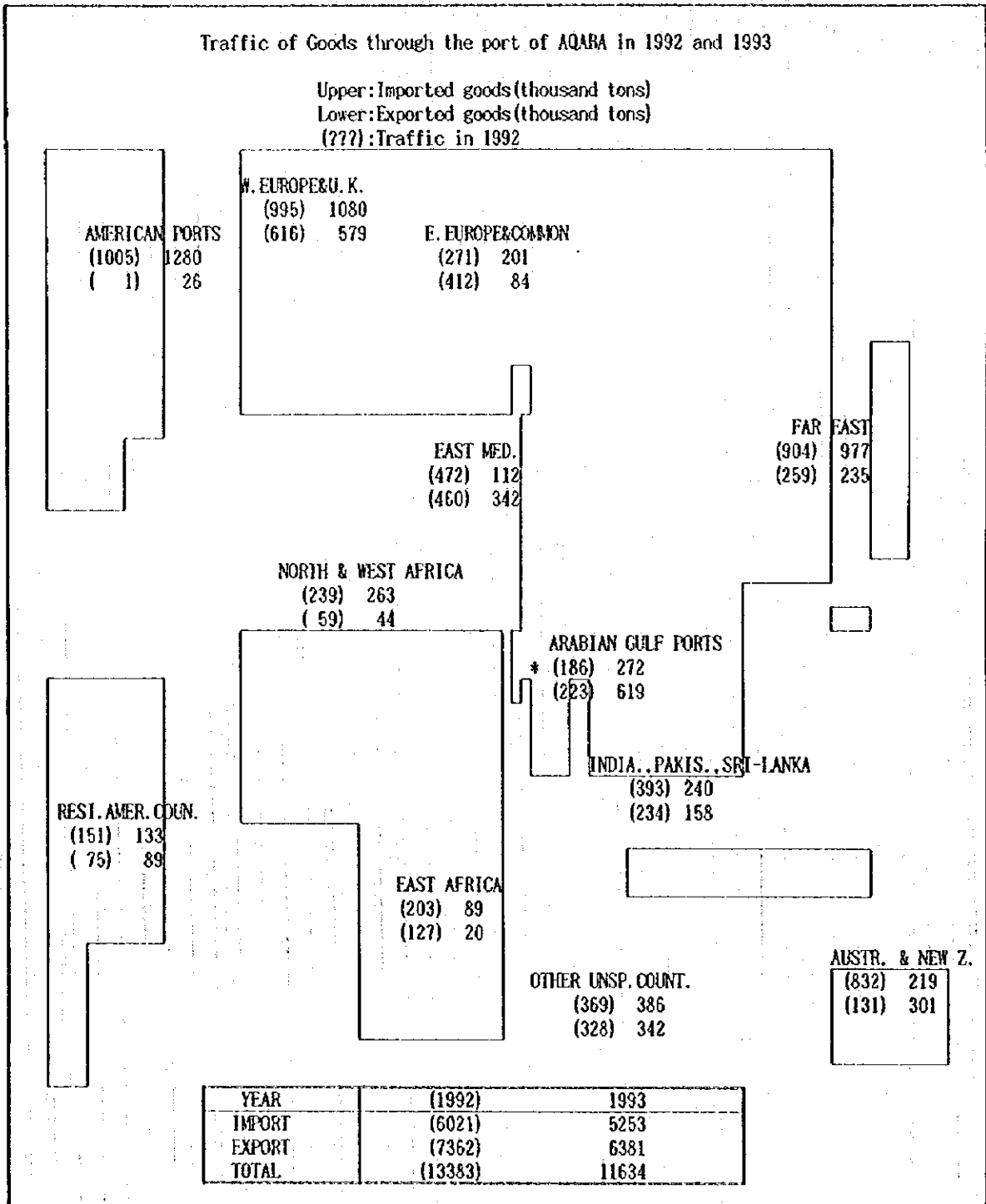
Figure 2.4.3 Import Cargo via Aqaba by Destination during 1977-1994





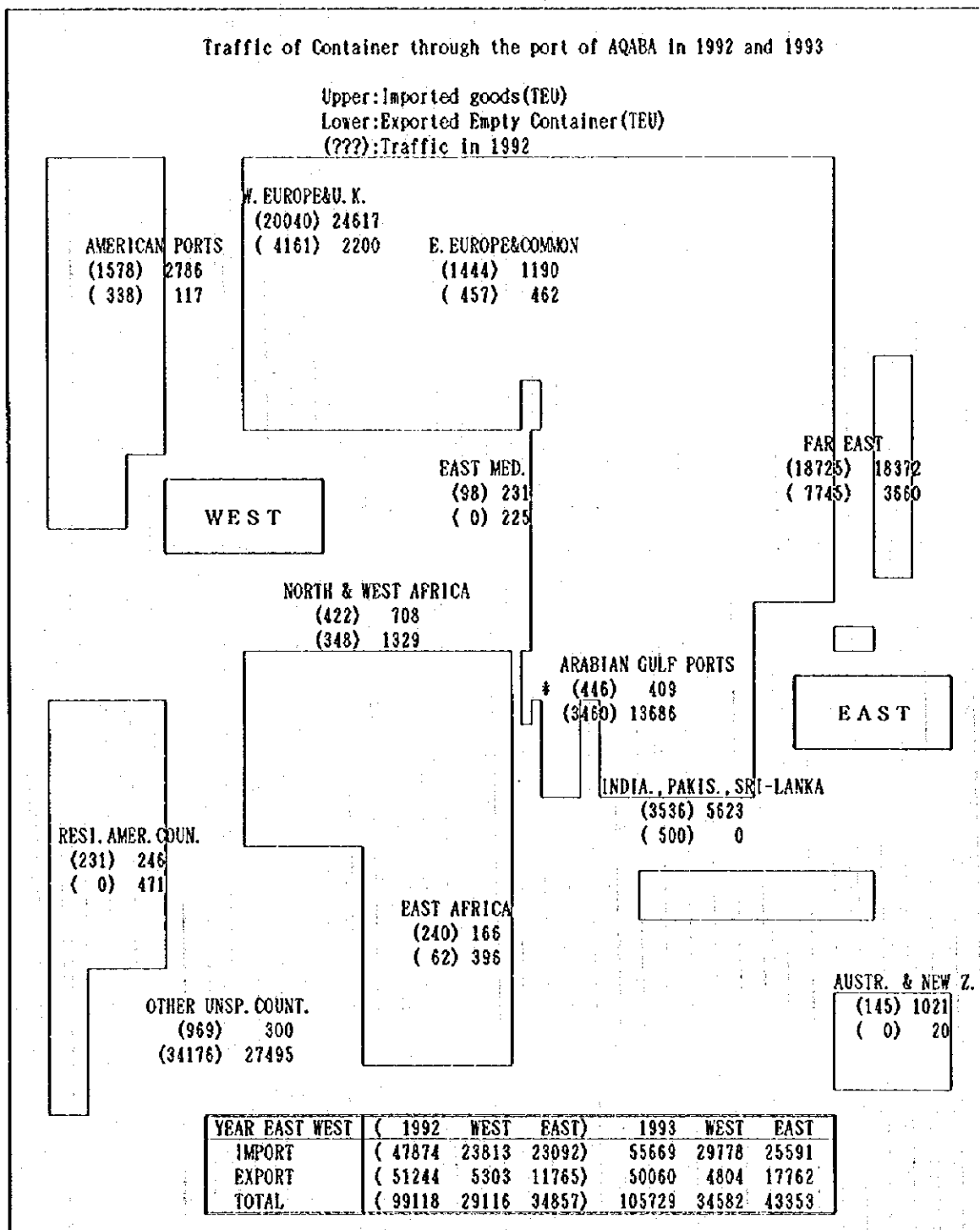
Source: The Ports Corporation Year Book 1993 and Statistics

Figure 2.4.4 Export and Import Cargo Volume by Commodity during 1977-1994



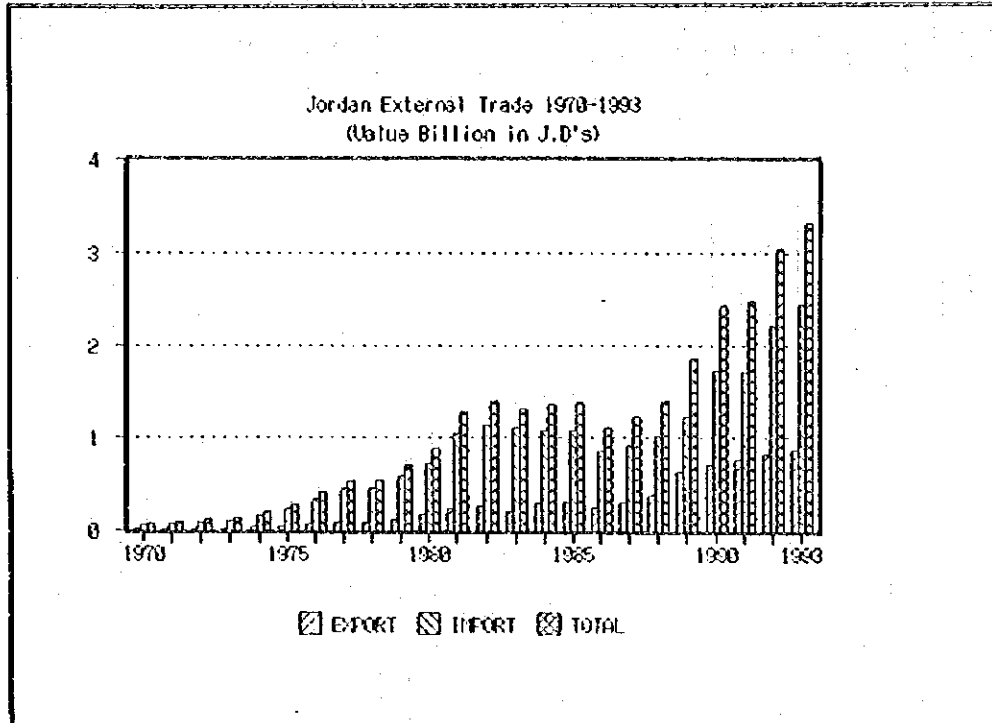
Source: The Ports Corporation Year Book 1993

**Figure 2.45 Traffic of Goods through the Port of Aqaba in 1992 and 1993**



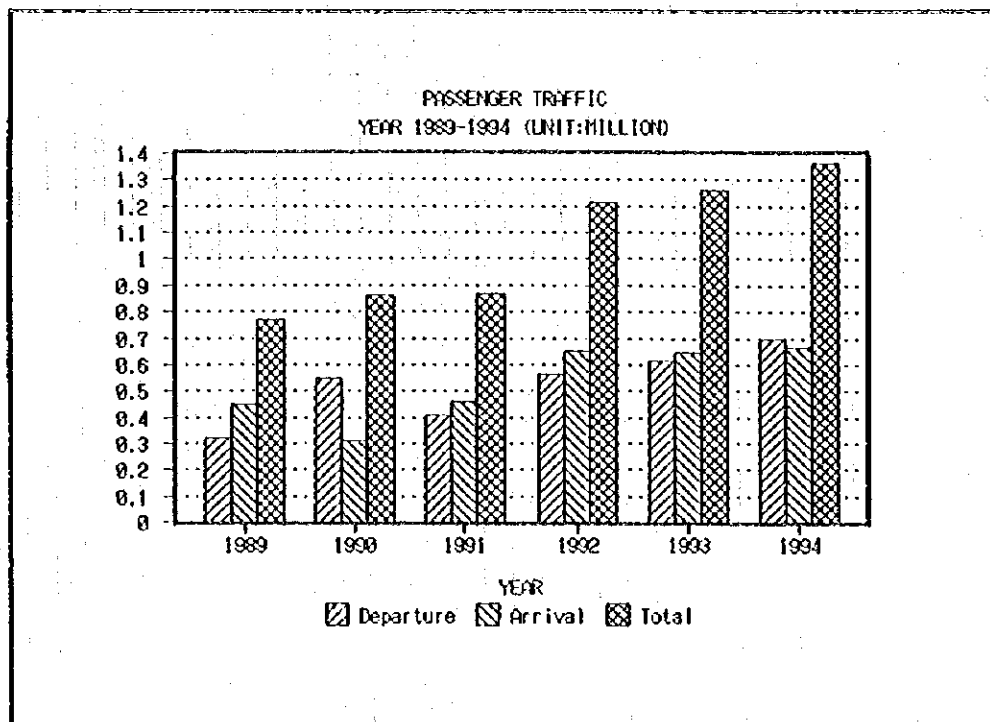
Source: The Ports Corporation Year Book 1993

Figure 2.4.6 Traffic of Container through the Port of Aqaba in 1992 and 1993



Source: External Trade Statistics 1993

Figure 2.4.7 External Trade during 1970-1993



Source: The Ports Corporation Year Book 1993 and Statistics

Figure 2.4.8 Aqaba Passenger Traffic during 1989-1994

### 2.4.3 Calling Vessels

#### (1) General

Many kinds of vessels call at the Port of Aqaba as the sole port of this country. These vessels are classified into passenger boats, general cargo ships, container ships, bulk cargo ships for loading phosphate and discharging grain and so on.

Features of calling vessels are analyzed on the basis of "Year Book 1993", "Monthly Statistics" in 1994 and the data of Maritime Dept, which are all presented by the Ports Corporation.

#### (2) Number of calling vessels

Average number of calling vessels during six years from 1989 to 1994 was 2,358 vessels per annum. The yearly fluctuation was not great. The lowest was 2,075 vessels in 1991 while the highest was 2,491 in 1993. In 1994, 2,458 vessels called.

#### (3) Kinds of calling vessels

Calling vessels were categorized into passenger boat, container ship, general cargo ship, RO / RO ship, LASH ship and others which include grain ship, bulk ship for loading phosphate, car carrier, live stock carriers and chemical tankers etc.

Each kind of vessel changed year by year in terms of its number and proportion out of the total.

Passenger boats made 894 calls in 1989, 949 in 1990, 1,009 in 1992, 1,032 in 1993 and 997 in 1994. Almost all passenger boats were ferry boats servicing between Aqaba and Nuweiba with two calls every day during the high season. Number of calls are likely to increase. Passenger boats shared more than 40 percent out of the total from 1990 / 1994.

Container ships made 354 calls in 1989, 300 in 1990, 149 in 1991, 233 in 1992, 328 in 1993 and 337 in 1994. Number of container ships does not seem to increase while size of the ship seems to become larger, because container throughput is growing year by year. Container ships shared 13.2 percent out of the total in 1993 and 13.6 in 1994.

General cargo vessels made 322 calls in 1989, 233 in 1990, 198 in 1991, 267 in 1992, 231 in 1993 and 212 in 1994. Calling number of general cargo ships has a similar trend as that of container ships. General cargo vessels account for around 10 percent out of the total through the past six years.

#### (4) Size of vessels

Vessel size calling in 1994 regarding dead weight ton (DWT) was analyzed.

54 vessels of more than 40,000 DWT called at this port in 1994. Maximum number of their calls a month was 11 in November and Minimum was 2 in March. About 90 percent out of 54 vessels consisted of bulk ships to discharge grain and/or to load phosphate, otherwise ships to load potash, MOP and fertilizer or lash ships.

Vessels of more than 10,000 DWT seemed semi-regularly to call. About 730 vessels called throughout the year and shared 50 percent out of the total excluding passenger boats.

Maximum sized ship was the bulk ship of 76,767 DWT which called in May and discharged grain at Berth 1 & 3 and then loaded phosphate at New Phosphatic Berth.

Maximum sized bulk ship for loading phosphate was 76,767 DWT, which loaded 47,000 tons and berthed for 55 hours and average size called at the berth was 24,000 DWT. Average quantity of loading phosphate per ship in 1994 is 18,478 tons, as the total quantity of exported of phosphate were 3,825,000 tons and the number of phosphate ships was 270 throughout the year.

Maximum sized container ship called at Container Berth was 30,450 DWT and the second was 28,000 DWT which called regularly.

#### (5) Ship nationalities

The assortment by nationalities of calling vessels was made from 1989 - 1993 which categorized countries into the following regional groups: Far East, South and West Asia, Australia and New Zealand, Arabian Gulf Countries, East Africa, North and West Africa, West Europe, East Europe and Communist, East Mediterranean, USA and Canada, other American countries and others.

Maximum number of ship nationalities for the past five years is of "Other American countries" mostly from Panama. Number of these ships occupied 40 percent out of the total. It may be considered that Panamanian ships are Flag of Convenience.

"East Mediterranean countries" ranked second, consisting mainly of ships from Jordan, Caprin, Malta and Turkey countries. These ships occupied 18 percent out of the total through the past two years, of which 65 percent was Jordanian Flag ship, because Jordanian flag ferry boat called at least once a day from 1992. Less than 100 vls per year were from other "East Mediterranean countries" in the past two years, in order of Caprin, Maltese and Turkish flag.

All regions other than the above two shared less than 10 percent out of the total, in order of " West European " ( 9.6 % ) ( mainly, Greek and German ), " North and West African " ( 9.0 % ) ( mainly Egyptian and Liberian ), " East European " ( 7.2 % ) ( Russian, Yugoslavian, Romania and Polish ), " Far East " ( 4.7 % ) ( Singaporean, Philippine, Chinese, Korean and Japanese ), " South West Asian " ( 3.9 % ) ( Indian, Srilanka and Bangladeshi), and " Arabian Gulf " ( 2.0 % ) ( Iraqi, Saudi Arabia, Arab Gulf States ).

#### (6) Frequency of calling vessels

Average number of calling vessels from 1993 to 1994 per month was 208 vls in 1993 and 207 vls in 1994. In 1993, the lowest was 185 vls in April and the highest 239 in September. In 1994, the lowest was 173 in June and the highest 254 in July. From the above figures, about 200 vessels are calling at the port every month within a change of about 20 percent. The main reason of the change seems to be caused by number of ferry boats which have additional calls by increased passengers and cargoes. Accordingly, number of calling vessels except passenger boats per month is relatively constant.

## (7) Mode of discharging imported cargoes

The mode of discharging imported cargoes is categorized into on quays and by lighters ( barges ). Cargo weight discharged by lighters considerably decreased every year from 1989 to 1993. The weight was 326 thousands tons in 1989, 167 thousands tons in 1990, 154 thousands tons in 1991, 140 thousands tons in 1992 and 69 thousands tons in 1993.

Meanwhile, the cargo quantity discharged on quays is 8.368 million tons in 1989, 5.998 million tons in 1990, 5.394 million tons in 1991, 5.882 million tons in 1992 and 5.184 million tons in 1993. Accordingly, the rate of the mode by lighters out of the total is 3.8 % in 1989, 2.7 % in 1990, 2.8 % in 1991, 2.3 % in 1992 and 1.3 % in 1993.

The main reason of decreasing rate by lighter seems to be due to decrease of imported cargoes and more room on quays.

Cargoes are handled by lighters not only in anchorage, but also from sea side of berthing ship on quays to ensure high productivity.

## (8) Berthing occupancies

### 1) The Main Port

Berthing occupancies from No.1 to No.7 were 73 percent with average from 1989 to 1993, excluding No.2 in 1989 due to double bunking. The occupancy of Phosphate Berths of New Berth (" B " Berth) and Old Berth (" A " Berth) were 55 percent with average from 1989 to 1993. The highest was 79 percent of Berth No.1 and the lowest was 47 percent of Phosphate "A" Berth. Berth No.1 is exclusively used for discharging grain by Ministry of Supply. Phosphate " A " Berth cannot accommodate over 20,000 DWT due to its shallow depth.

Generally speaking, the above berth occupancies are rather high. In fact, vessels waiting in anchorage can be seen. However, that does not always mean shortage of berth. It is thought that low cargo handling productivity makes berth occupancy high.

### 2) The Container Port

Container Terminal consists of three container berths and one RO/RO berth. Berthing occupancies from 1989 to 1993 were 15 percent for RO/RO Berth, 39 percent for Container No.1, 46 percent for Container No.2, and 68 percent for Container No.3 respectively. Container Terminal sometimes accommodates car carriers, general cargo ships, live stock ships and big passenger ships unless container ships occupy the berth. In this sense, these rates are not high. There have been the differences of berth occupancies among three container berths. According to the statistics from 1990 to 1993, the rates were in order of No.3, No.2 and No.1 without exception. It is guessed that vessels other than container ships were mainly assigned to No.3.

Yarmouk floating berth is used for passenger boats. The berth can simultaneously accommodate three ferry boats, on north, south and west side. The west side berth is in usual use and its berth occupancy is 44 percent on average for the past five years.

### 3) The Industrial Port

There are different kinds of berths in The Industrial Port: Oil jetty, Timber Berth and Jordan Fertilizer Industry Berths (JFI Berths). They are used in a different way corresponding to the characteristics such as commodities, handling equipment, delivery condition etc. In relation to port activities in future, JFI Berths should be given most attention to in terms of berth occupancy.

JFI Berths is comprised of two berths, i.e. West (sea side) and East (shore side). Both of them are operated by JPMC under contract with PC.

According to the JPMC's record, the berth occupancy of JFI West Berth show a high value, about over 60 %, while that of East Berth a big fluctuation, ranging from 32.6 % to 99.6 %. It is said that West Berth will improved by maintenance of equipment in near future. This will lead to a reduced berth occupancy. It is thought that utilization of East Berth is mainly affected by transport of potash. It is necessary for the parties concerned to make an appropriate berthing schedule.



## 2.5 Port Management

### 2.5.1 Outline of Port Management

The Ports Corporation (PC) was formed from a merger between Aqaba Port Department and Maritime Establishment in 1978 in order to cope with the increase of cargo volume and competition with neighboring ports. PC is a government body which belongs to Ministry of Transportation, however, PC is the only organ which is responsible for management, operation and development of port in Jordan.

The main duties of PC are as follows;

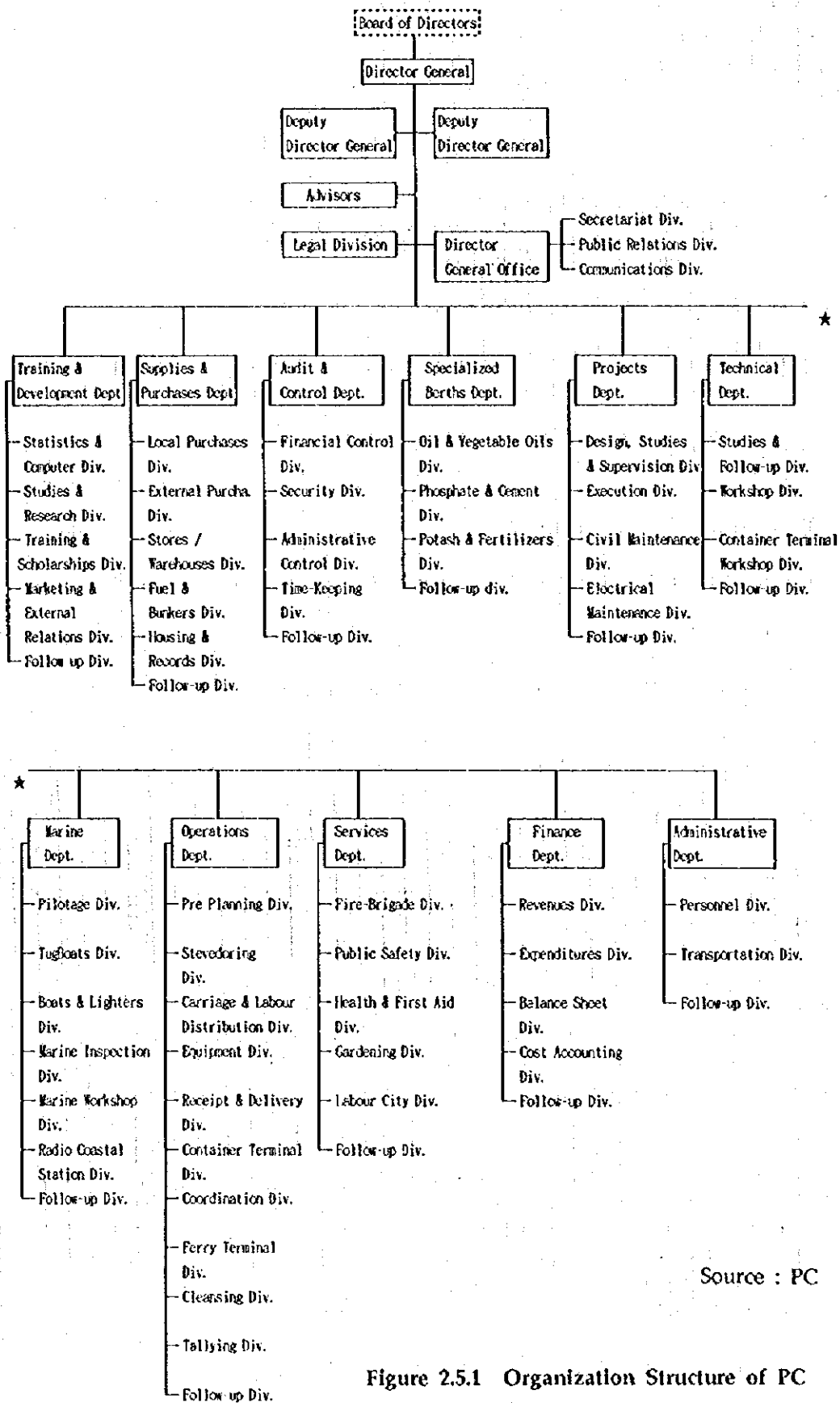
- 1) To execute establishment, management and operation, promotion, development and environmental preservation of the port
- 2) To receive the calling vessels and conduct them to anchorages or berth and control these activities.
- 3) To handle cargoes on the berths or anchorages and control these works
- 4) To keep cargoes in sheds or storage areas and load cargoes on the trucks
- 5) To provide services of maritime traffic and water supply to the calling vessels
- 6) To keep a watch on and cope with the sea pollution
- 7) To study personnel training and development of the organization in order to improve services which are provided to maritime companies and so on
- 8) To study and prepare annual business plan

### 2.5.2 Organization

#### (1) Organization Structure

The organization structure is shown in Figure 2.5.1. PC is headed by Director General and below him, there are two Deputy Director Generals, Advisors, Legal Division, Director General Office, 11 Departments and 61 Divisions. However, decision and controlling the policies of port management and operation are executed by the Board of Directors, which is comprised the following members.

- Minister of Transport (Chair Man)
- Director General of The Ports Corporation
- President of Aqaba Region Authority
- Director General of Custom Department
- Director General of Jordan Phosphate Mines Company
- President of Shipping Association
- Private Sectors



Source : PC

Figure 2.5.1 Organization Structure of PC

## **(2) Functions and Duties**

### **1) Director General**

- To set up general policies for the management and operation of the port
- To supervise and manage port administrations, activities and personnel
- To establish contacts with local and international maritime institutions and to represent PC in meetings, conferences, etc

### **2) Deputy Director General**

- To execute the duties entrusted by Director General
- To execute the duties authorized by Director General during his absence
- To take part in decision making process relating to port activities
- To supervise and manage port administration

### **3) Advisors**

- To advise on matters at the request of Director General
- To participate in investigations or committees
- To represent Head of Department during his absence

### **4) Legal Division**

- To prepare drafts of contracts or agreements
- To participate in investigation concerned with accident and fines
- To follow up claims, legal cases in the court

### **5) Director General Office**

- To coordinate general affairs related to Director General
- To transfer telephone call
- To control public relations and incoming/outgoing mail

### **6) Training and Development Department**

- To prepare statistics
- To train workers
- To collect information concerned with marine affairs
- To promote port services and publish brochures
- To conduct studies and research on port activities, work, productivity, etc

### **7) Supplies and Purchases Department**

- To purchase, store and deliver spare parts for machines, stationery, furniture and fuel. (PC has 12 stores)
- To prepare tender documents and arrange for tender invitations in coordination with the tendering committee

#### 8) Audit and Control Department

- To audit revenues and expenses
- To inspect the activity and quality of administration and productivity of port activities
- To control the gates and issue the port entry permits
- To control and administrate working time of all employees

#### 9) Specialized Berths Department

- To conduct phosphate exporting and manage these port facilities( Main Port)
- To manage Industrial Port facilities for following cargoes;  
Fertilizer, Potash and Cement (Export)  
Oil Product (Export/Import) and Vegetable Oil, Sulphur and Ammonium (Import)

#### 10) Projects Department

- To prepare studies, designs, drawings and bill quantity and make arrangements for tendering
- To execute some projects and supervise those done by contractors
- To carry out maintenance, civil and electrical works for all port facilities

#### 11) Technical Department

- To plan, organize, control and follow up all technical studies and plant workshops
- To carry out plant works such as maintenance, repairs, rebuilding and scrapping in addition to personnel technical training
- To execute all metal works, tendering and commissioning, parts requests and electro-mechanical projects supervision

#### 12) Marine Department

- To carry out all marine activities including pilotage, towage, ship inspection, salvage and control of environmental and marine pollution
- To carry out marine purchases, maintenance and repair
- To take part in port planning
- To supply ships with potable water and follow up their requirements

#### 13) Operations Department

- To prepare pre-planning for ships and allocate them to the suitable berth
- To operate and control handling, transferring and storing operations of the general cargo and containers
- To follow up delivery and coordinate trucks for transporting cargo to the consignees
- To control the storage of cargoes and ship movement
- To ensure the availability of equipment and cargo gear needed for handling

#### 14) Services Department

- To manage and operate Fire-Brigade, Clinic and Labor Residences
- To supervise and control storage of dangerous, hazardous and toxic cargo and administrate labor safety

## 15) Finance Department

- To collect revenues and pay expenses
- To make balance sheet and profit/loss statement and estimate budget
- To analyze costs for services and refer them to the management

## 16) Administrative Department

- To administrate personnel affairs
- To transport workers and school children

## (2) Personnel

### 1) Classification of employees

Employees are classified into three categories, Staff, Worker and Casual Labor by law.

- Staff : They are appointed to positions which are classified into four classes. Permission of civil service commission is required.
- Worker : They are appointed to various kinds of jobs. They can be promoted to the staff.
- Casual Labor : They are employed on a daily basis by the port.

### 2) Number of employees

In the period 1990-92, annual number of employees increased gradually, however since 1993 the number of employees has decreased (see Table 2.5.1). Since the cargo volume has decreased, PC sees no need to increase manpower further, in fact, given the present cargo volume, the labor force is excessive.

In order to decrease number of employees PC has taken the measure not to adopt any new employees. However, as a government organization with a responsibility to minimize unemployment, PC cannot actively decrease the number of its employees and must rely instead on attrition.

Table 2.5.2 shows the number of staff and workers by department and age as of February, 1995. Operations Department has more than one thousand staff members (41.5% of the total) and 436 workers (34.1%). The share of staff under age 40 represents 72.8%.

Table 2.5.1 Number of Employees from 1990 to 1994

Year	Staff	Worker	Casual Labor	Total (Rate)	Cargo Volume <sup>(1)</sup>
1990	2,666	1,300	1,030	4,996 ( - )	15,036 ( - )
1991	2,321	1,514	1,273	5,108 (1.02)	13,225 (0.88)
1992	2,416	1,340	2,005	5,761 (1.13)	13,384 (1.01)
1993	2,491	1,300	1,474	5,265 (0.91)	11,634 (0.87)
1994	2,413	1,300	1,393	5,106 (0.97)	10,572 (0.91)

Note : (1) Unit = Thousand Ton

Source : PC

Table 2.5.2 Number of Staff and Workers by Department and Age as of February, 1995

	Staff					Worker (Rate)
	under 30	30-40	40-50	50-60	Total (Rate)	
Director General Office	12	22	14	7	55 (2.3%)	4 (0.3%)
Legal Division	2	1	2	1	6 (0.3%)	- (-)
Training & Devel. Dept.	4	12	10	2	28 (1.1%)	6 (0.5%)
Supplies & Purc. Dept.	14	44	10	9	77 (3.1%)	8 (0.6%)
Audit & Control Dept.	15	68	13	6	102 (4.2%)	44 (3.4%)
Specialized Berths Dept.	32	100	20	18	170 (6.9%)	237 (18.6%)
Projects Dept.	29	70	33	14	146 (6.0%)	48 (3.8%)
Technical Dept.	60	158	35	10	263 (10.7%)	128 (10.0%)
Marine Dept.	51	126	41	14	232 (9.5%)	200 (15.7%)
Operations Dept.	59	680	177	101	1,017 (41.5%)	436 (34.1%)
Services Dept.	10	95	41	28	174 (7.1%)	85 (6.7%)
Finance Dept.	8	59	18	10	95 (3.9%)	3 (0.2%)
Administrative Dept.	8	44	19	12	83 (3.4%)	78 (6.1%)
TOTAL (Rate)	304 (12.4%)	1,479 (60.4%)	433 (17.7%)	232 (9.5%)	2,448 (100.0%)	1,277 (100.0%)

Note : Devel. = Development Dept. = Department Purc. = Purchases  
Source : PC

### 3) Promotion

Staff appointed to class 1,2,3 are promoted every five years while staff appointed to class 4 are promoted when their salary reaches the maximum of their class through annual raises.

### 4) Retirement System

In principle PC has the right to retire class 1,2,3 employees who have worked more than 20 years. Conversely employees who have worked more than 30 years can retire of their own volition but for those who have worked 40 years, retirement is mandatory.

As to employees appointed to class 4, the mandatory retirement age is 60. But they can continue to work if their evaluation by personnel affairs is good and permission is granted by PC.

### 5) Pension System

Employees appointed to class 1,2,3 can draw their pension from the Ministry of Finance and the employees appointed to class 4 can draw their pension from Social Security after retirement.

### (3) Welfare

Welfare system of PC is very complete. PC has formulated a public health system and helps employees with their heating and lighting expenses. Moreover PC takes the employees and their children to and from the office and school by cars.

In addition, PC provides some other services as shown below;

#### 1) Labor Residences

PC provides 2,000 residences for single employees and 600 residences for those families. PC takes responsibility for the maintenance of these residences.

#### 2) Port Club

Port Club has some large and small rooms, a large garden and playgrounds. The employees can use the Port Club for conference, conversation, as a place to dine or play sports.

### 2.5.3 Administration and Management of the Port

#### (1) Vessel Entry and Departure in/from the Port

The Marine Department is responsible for the safe navigation of vessel entry and departure to/from the Port.

#### 1) Port Tower

In the top of the Port Tower which is about 70 meters high in Main Port they keep watch on vessels and listen to VHF to provide for emergency call 24 hours a day. However they do not have radar for port control.

It is also their duties to inform vessel's particulars to the related sections and to keep berthing records.

## 2) Port State Control

The Marine Inspection Division is in charge of port state control to the vessels entering the port. They inspect oil pollution, bilge record books, safety equipment, fire equipment of vessels according to the international regulations such as SOLAS, MARPOL etc. They recommend improvement of vessel condition or suspend departure from the port.

## (2) Main Port

All cargoes (grain, phosphate, general cargo and etc) are operated by PC and all facilities and equipment except grain silos are owned by PC in Main Port. Grain silos are owned by Ministry of Supply and used for imported grain. These grain and facilities and equipment are also operated and managed by PC.

Phosphate Rock produced by JPMC (Jordan Phosphate Mines Company) is exported through Phosphate Berth A and B. PC charges JPMC for cargo operation and usage of the berths and equipment.

## (3) Container Port

There is a Container Berth, Passenger Berth and other two berths for rice and cement in the Container Port. These facilities are owned and managed by PC.

In the Container Terminal cargo handling is operated by PC, the same as in Main Port.

Passenger Berth is used for ferry boats which ply between Aqaba and Nuweib (Egypt). Arab Bridge Maritime Company services this line twice daily. Arab Bridge Maritime Company has made an agreement regarding port charge with the Jordanian and Egyptian Governments. For passengers using this line there is a passenger terminal managed by PC about 500 meters away from the Passenger Berth.

## (4) Industrial Port

There are three berths owned by PC, Fertilizer and Potash Berth, Oil Jetty and Timber Berth. PC manages these berths and equipment.

Fertilizer produced by JPMC and Potash produced by Arab Potash Company are exported through Fertilizer and Potash Berth. PC charges both companies for usage of the berth and its equipment. However, Fertilizer and Potash Berth is operated and maintained by the JPMC so PC pays 450 thousand JD/1994 to JPMC in compensation for operation and maintenance of berth.

Oil Jetty is used for fuel oil stockpiling tanker "AL AZRAQ" which is owned and operated by Jordan National Shipping Lines Company, in which the government has a 50% interest.

Timber Berth is used mainly for small livestock ships.

## (5) Customs

There is a Aqaba Customs Office belonging to the Ministry of Finance in Main Port. They control not only port but also airport in Aqaba and levy customs duties on imported goods. They inspect goods based on B/L, Invoice, Certificate of Origin, Import Permission,



Agreement of Approval and Delivery Order from agents. Their working time is from 7:00 to 14:00.

(6) Quarantine

There is a Quarantine Office and Agriculture Office belonging to the Ministry of Health and Ministry of Agriculture in the same building of Customs Office. They inspect livestock and reefer vessels on the anchorages. The inspection takes about 2 to 3 hours, after which vessels are permitted to berth.

(7) Accidents

Table 2.5.3 shows the number of employees who suffered an accident from 1992 to 1994. The main causes of accidents were as follows;

- 1) Slipping and falling from a vessel during discharging/loading operation
- 2) During workshop activities

Table 2.5.3 Number of Employee Accidents

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
1992	58	67	83	64	77	46	65	52	61	56	39	40	708
1993	42	40	42	59	35	22	60	32	56	50	41	51	530
1994	45	36	33	34	42	50	39	37	32	28	27	38	441

Source : PC

(8) Others

1) Fire-brigade

PC has its own fire brigade which includes three water and foam engines, one dry powder engine, one ladder engine, one water and rescue engine, three ambulances and two tugboats with foam, plus a variety of equipment such as breathing apparatus, etc. But PC does not have an exclusive ship for fire fighting. They are in charge of fire in the port area however they cooperate with Aqaba fire authority of the Ministry of Interior in fire fighting either in or out of port when the need arises.

2) Gates Control

Security Division belonging to Audit and Control Department is responsible for control of all gates (Main Port : 5, Container Port : 5, Oil Terminal : 1) in port. These gates are controlled by not only PC but also police. They inspect entrance and exit of persons and documents of trucks carrying cargoes in and out. Gates control is conducted 24 hours a day using three shifts.

2.5.4 Finance

(1) Financial Condition

PC covers expenditure from revenue which is earned by port activities and does not

receive a subsidy from the Central Government. Conversely, PC contributes to the Ministry of Finance.

Finance Department makes annual budget based on the requirements from each department. Director General of PC presents annual budget to Board of Directors for study and confirmation. And then PC presents it to Minister of Transport for final ratification.

Table 2.5.4 shows the Profit and Loss Statement in recent five years and mentions working ratio, operating ratio of port operation and personnel expense. Working ratio means the proportion of operation expense excluding depreciation versus operating income, operating ratio means the proportion of operation expense versus operating income and personnel expense ratio means the proportion of operation expense excluding depreciation versus personnel expenses.

In 1993 operation revenue increased in spite of the decreasing of cargo volume. This was because PC raised the port tariff and rate of general cargo, which earns more revenue than other cargoes, increased.

Concerning working ratio and operating ratio, both ratios are at favorable level, less than 60% and 70% respectively.

Table 2.5.5 shows the Balance Sheet in recent five years. Assets of PC remained almost constant from 1990 to 1994 due to the contribution to the Ministry of Finance.

This contribution is the balance of annual revenue and expenditure and transferred to the national account (representing 1% of the central government domestic revenues; See Table 2.5.6).

Table 2.5.4 Profit and Loss Statement

	(Unit : 1,000 JD)				
	1990	1991	1992	1993	1994
Operation Revenue	31,799	28,773	36,335	40,802	37,406
Ship Service	2,531	2,495	3,440	4,069	3,934
Handling Service	21,094	18,391	16,502	19,939	16,632
Passenger Service	341	493	877	346	924
Phosphate Loading Service	7,833	7,394	7,498	6,239	6,642
Industrial Berth Service	-	-	8,018	9,709	4,274
Operating Expense	16,485	17,847	21,067	22,832	23,228
Personnel	9,934	10,976	12,499	13,679	13,644
salaries, wages, allowances	9,079	10,051	11,558	12,645	12,304
others	855	925	941	1,035	1,341
Maintenance	982	1,262	1,857	2,101	2,441
Training	9	8	21	96	26
Industrial Berth Operation	603	558	579	450	439
Articles of Consumption	111	141	148	149	151
Administration	1,185	1,258	1,899	2,041	1,667
Others	61	124	179	202	422
Depreciation	3,600	3,521	3,884	4,114	4,437
Net Operating Income	15,314	10,926	15,268	17,970	14,178
Non-Operation Revenue	-3,033	545	2,128	1,938	-979
Interest	192	5	58	202	199
Currency Adjusting	-3,946	-56	843	948	-2,104
Others	721	596	1,228	788	927
Non-Operating Expense	1,951	1,866	2,296	1,817	2,166
Interest on Loans	1,923	1,848	1,812	1,587	1,586
Previous Years Expenses	22	18	112	59	407
Others	6	0	372	171	173
Non-Operating Income	-4,984	-1,322	-167	122	-3,145
Net Income before contribution	10,330	9,605	15,101	18,092	11,034
Contribution to MOF	15,289	6,000	11,500	14,966	12,471
Net Income after contribution	-4,959	3,605	3,601	3,126	-1,437
Working Ratio (%)	41	50	47	46	50
Operating Ratio (%)	52	62	58	56	62
Personnel Expense Ratio (%)	77	77	73	73	73

Source : PC

Table 2.5.5 Balance Sheet

(Unit : 1,000 JD)

	1990	1991	1992	1993	1994
(Assets)	86,543	88,988	88,558	87,728	86,561
Current Assets	11,692	16,659	17,773	17,711	16,710
Cash & Deposit	2,748	7,252	6,670	5,346	4,836
Other Current Assets	8,944	9,407	11,104	12,366	11,874
Fixed Assets	67,820	68,808	69,313	67,619	67,274
Net Depreciate Assets	67,820	68,808	69,313	67,619	67,274
Other Assets	7,032	3,522	1,472	2,397	2,578
(Liabilities and Capital)	86,542	88,988	88,558	87,728	86,561
Liabilities	37,563	36,382	32,351	28,395	28,407
Current Liabilities	5,909	7,463	7,020	6,643	7,507
Short-term Loans	3,537	3,042	2,773	2,717	2,800
Other Current Liabilities	2,372	4,421	4,247	3,926	4,707
Fixed Liabilities	31,654	28,919	25,331	21,752	20,900
Long-term Loans	31,420	28,720	25,145	21,571	20,732
Other Credits	234	199	185	181	167
Capital	48,979	52,606	56,207	59,333	58,155
Capital	20,228	20,250	20,250	20,250	20,508
Net Income	-4,960	3,605	3,601	3,126	-1,437
Retained Earnings	33,711	28,751	32,356	35,957	39,083

Source : PC

Table 2.5.6 Central Government Revenue in 1994

( Unit: Million JD )

Income & Profits Taxes	137
Custom Duties	452
Extra ordinary Taxes	95
Other Taxes	21
<b>Tax Revenues Total</b>	<b>705</b>
Licences	65
Fees	123
Post, Telegr. & Teleph.	161
Interests & Profits	53
Other Revenues	160
<b>Nontax Revenues Total</b>	<b>562</b>
<b>Domestic Revenues Total</b>	<b>1,267</b>
Financial Aids	162
Repaid Loans	55
Technical Grants	5
<b>Foreign Aids Total</b>	<b>222</b>
<b>TOTAL</b>	<b>1,489</b>

Contribution Central Government  
to MOF Domestic Revenues

12.5 million JD / 1,267 million JD = 0.99%

Source: Ministry of Finance

## (2) Method for Depreciation of Fixed Assets

The policy of depreciation of fixed asset is based on annual depreciate percentage, as follow;

Table 2.5.7 Annual Depreciate

Item	Percentage
Road and Yard	25 - 2 %
Berth	5 - 2 %
Building and Construction	25 - 2 %
Equipment and Machinery	12 - 5 %
Equipment for Operation	25 - 7 %
Furniture and Implement	25 - 10 %

## (3) Goods Purchasing System

Decision for goods purchasing will be made as follows;

- Under 10,000 JD per affair...Tendering Committee (chairman : Director General)
- Under 100,000 JD per affair...Approval of Director General
- Above 100,000 JD per affair...Board of Directors

## (4) Port Tariff

Port tariff is set based on The Ports Corporation Service Charge Regulations and Ministerial Council has the right to amend these dues. Such an amendment will be published in the official gazette.

Under these regulations following main charges are charged by PC to ship agents or consignees.

### 1) Ship Agents

#### a) Pilotage and Towage Fees

The navigation of the ship from the limits of Jordanian territorial waters to the anchorage area or berth or on her exiting from port.

The following are exempted from pilotage and towage fees:

- Naval ships
- Boats and yachts used for pleasure and not for any commercial business with a maximum capacity of 50 NRT.

#### b) Port Entrance Fees .... 0.06 JD/NRT

Ships entering the port area to load or discharge or to embark or disembark passengers.

### c) Wharfage Dues

Berthing or tying the floating ship including lighters alongside the berth or any part of the land.

An additional 20% is to be added for vessels or craft carrying inflammable materials and berthing alongside quay or any part of the land.

PC shall charge a sum of JD 30 for every operation tying ship's ropes (mooring) to the berth or the land or untying of ships ropes (un-mooring) from berth or land.

Fifty percent of the wharfage dues shall be reduced for vessels working at anchorage. The following ships shall be exempted from port entrance, anchoring and wharfage dues;

- Naval ships
- Ships owned by the Government, which do not carry out any commercial activities.
- Boats, sailing boats and yachts which are used for pleasure and not used for any commercial purposes which are less than 50 NRT and not berthed alongside port's berths.

### d) Loading and Discharging Services (Stevedoring) Charges

To be increased by 40% of the charges if goods to be loaded or discharged are dangerous, explosive or highly inflammable materials as per (IMO) classifications.

## 2) Consignees

### a) Lighterage, Porterage, Quay and Storage Charges

- Lighterage...Receiving the cargo from ship's derricks or by any other means onto the lighters or on the quay and moving the lighters alongside the berth and lifting the goods from the lighters and stowing them on the quay. Or delivering the cargo from the quays onto the lighters and moving to alongside the ship and engaging them to the ship's tackle for stowing operation.

- Porterage...Transporting the goods from the berths to inside or outside the warehouses and stowing them within PC's area and subsequently loading same from their place onto trucks.

- Quay Charge...All goods and containers stuffed with goods to be stripped on the port quays or loaded from quays.

- Storage Charge...Stored in the warehouses, hangers and yards or any other area subject to the control of PC.

## 2.5.5 Training System

PC has a Maritime Training Center which belongs to Development and Training Department for the purpose of developing cargo handling and operative facilities.

This Center was established in 1979 and was part of the Administrative Department. PTC (Port Training Center; German Company) consulted and assisted the establishment of this Center.

Training Center has twelve basic training courses (See Table 2.5.8). In addition to above courses, Training Center provides following courses for beginners in order to qualify them for service in the port as part of the work-force.

- Tally Clerks Course : Two months
- Crane Operators : Two months
- Derrick Operators : Six months

These courses are designed for PC's employees. Six instructors belong to Training Center as instructors of each training course.

As the Training Center does not have sufficient facilities or equipment for the training courses, these courses often involve OJT (on-the-job training) so that trainees can gain practical experience. OJT in field is very risky for unexperienced trainees and there are some restrictions on flexibility of time and place of the course for trainees.

Training Center is aware of the need for sufficient facilities, equipment and simulator so that trainees of each course can practice.

Text books for each course are also insufficient, as some were prepared by PTC in 1979 and have not been revised since. A copy of UNCTAD text book and the original text book prepared by instructors are also used.

Almost all instructors are not sufficiently qualified, relying instead on their own experience and knowledge. The instructors rarely have the chance to study and introduce the latest knowledge and technology. They realize it is important to keep abreast of the latest knowledge.

Finally, the Training Center only offers basic courses; advanced courses should be introduced.

Table 2.5.8 Training Courses of the Maritime Training Center

No.	Training Course	Main Contents	Starting Year	Usual No. of Trainees	Training Period
1	Container Port Management	Basic principals, Previous planning, CFS operation	1987	50/year	3-4 weeks
2	Improvement of Port Performance	Ships operation, Berth storage, Receipt/delivery operation	1986	30/year	4 weeks
3	Safety & Health in the Port	Importance of public safety, Safety work, Dangerous cargo handling	1990	50/year	3 weeks
4	General Cargo & Foundation of Container	Cargo handling, Storage, Public safety	1983	60/year	4 weeks
5	Forklift, Mobile Crane	Daily inspection, Bagging, Dangerous cargo, Operating	1981	100/year	4 weeks
6	Ship's Crane	Dangerous cargo, Bagging, Operating	1981	100/year	10 weeks
7	Ship Supervisor	-	1980	45/year	3 weeks
8	Labor Qualifying	Cargo handling, Storage, Palleting	1981	150/year	3 weeks
9	Foundation of Mechanics	Basic mechanics	1980	25/year	3 weeks
10	Electric	Electric & connections	1980	25/year	3 weeks
11	Basic Course of Computer	Programming, System & analyzing	1992	50/year	2 weeks
12	English Language	-	1992	120/year	4 weeks

## 2.6 Port Operation

### 2.6.1 Port Service

#### (1) Anchorage

Vessels awaiting discharge may anchor in the anchorages which can accommodate about 60 ships. The further most point of anchorage is not more than 3 kilometers from the shore.

Anchorage 1-4 are used for ships discharging cargo into barges. Anchorages 5-7 are used for ships waiting while anchorage 8 is used for small ships.

The gulf of Aqaba has a maximum width of 8 kilometers and slight weather turbulence, so it is considered safe to load or discharge cargo by means of barges. Lighterage for discharge or loading at anchorage is for consignee's and shipper's respective account.

#### (2) Navigational Aids

Three new navigational lights have been fixed along the Jordanian Coast on January 1995 as follows;

##### 1) Control Tower Light

PSN 29 30.83 N

34 59.80 E

Character : White Light

Flash (3) Every 10 seconds

$(0.167 + 1.033) \times 2 + 0.167 + 7.333 = 10 \text{ sec.}$

Range : 17 Nautical Miles

Height : 72 meters (Concrete Structure)

##### 2) West Cardinal Mark

PSN 29 26.80 N

34 58.09 E

Character : White Light

Flash (9) Every 15 seconds

$(0.4 + 0.6) \times 8 + 0.4 + 6.6 = 15 \text{ sec.}$

Range : 7 Nautical Miles

Height : 9 meters (White Metal Structure)

##### 3) Southern Beach Light

PSN 29 23.60 N

34 57.80 E

Character : Green Light

Flash (2) Every 15 seconds

$1 + 1 + 1 + 12 = 15 \text{ sec.}$

Range : 10 Nautical Miles

Height : 8 meters (White Metal Structure)

#### (3) Pilotage (Marine Dept./ Pilotage Div.)

Pilotage is compulsory for all vessels above 150 NRT for berthing, un-berthing and

entering the anchorage area. However, vessels can leave anchorages without pilot.

- Number of Pilot : 8
- Number of Pilot Boat : 4
- Number of Piloted Vessels (1994) : Calling Vessels : 2,485  
Leaving Vessels : 1,765

#### (4) Towage (Marine Dept./ Tugboats Div.)

The use of tugs is compulsory for all berthing operations.

- Number of Tug Boat : 7
  - 3,200 HP (CPP Bow Thruster From 1992) ..... 2
  - 800 HP (From 1990) ..... 2
  - 1,500 HP (From 1983) ..... 2
  - 1,300 HP (From 1977) ..... 1
- Number of Towing & Mooring Boat : 7

#### (5) Water (Marine Dept./Pilotage Div.)

Fresh water is available but in very limited quantities.

- Number of Ships supplied (1994) : 778

#### (6) Bunkering (Marine Dept./Pilotage Div.)

Bunker fuel type 600-1000-1200 per second (Redwood Viscosity) is available but in limited quantities and PC does not have a bunkering barge. The vessels can be supplied with bunker fuel at Phosphate A Berth or Oil Jetty.

#### (7) Waste Matter

PC collects garbage by barge or truck at anchorages or berths if required.

#### (8) Radio

The radio station belonging to PC works for 24 hours and can receive all types of communications (Telegraphic, Telephonic, Telex, etc.) And they provide vessels with the following information;

- Weather forecasts : twice daily at 7:30 and 15:30
- Traffic report : every 2 hours from 5:30

#### (9) Health

The clinic of PC provides all medical services required and responds to any urgent call by radio before arrival. Two doctors and 24 nurses supply first aid.

#### (10) Working Hours (Stevedores)

Regular working hours are from 7:00 until 14:00. Compulsory overtime begins at 17:00 and extends until 1:00. For ships requiring one or two hours for completion of loading or discharging, work may be continued by the last shift. All work after 16:00 is considered overtime.

No work is done on the first day of Eid-el-Fitr and Eid-el-Adha; however, work may



be arranged by special request on all other holidays at extra overtime rates. During Ramadan, work is carried out from 7:00 to 13:00 and from 21:00 to 3:00.

Friday is the official holiday, however work may be continued at overtime rates if requested.

## 2.6.2 Cargo Handling Equipment and Facilities

### (1) Equipment and Main Gears

The existing equipment and main gears for cargo handling owned by PC are shown in Table 2.6.1 and Table 2.6.2. This equipment is maintained and repaired at two workshops in Main Port and Container Terminal. And the gears are controlled by Supply Department. Using data from PC, the Study Team calculates the working rates of equipment to be more than 90 %.

### (2) Storage Facilities

The existing facilities for cargo storage owned by PC in Main Port are shown in Table 2.6.3. PC has additional storage facilities for phosphate (340,000 ton) and grain silos (150,000 ton).

### (3) Slip Way

PC has a slip way (winch capacity 300 ton, area 10,000 m<sup>2</sup>) to maintain and repair boats owned by PC except two PPC tug-boats (400 ton). CPP tug-boats are sent to Suez Dock because the weight of these boats exceed slip way capacity. Boats are inspected periodically, every 18-24 months for tug-boats and every four years for barges.

Table 2.6.1 Cargo Handling Equipment

Equipment	Capacity	Number
Mobile Cranes	90 - 120 T	2
	35 - 45 T	4
	15 T	17
	10 T	21
	1 - 5 T	27
	Total	71
Fork Lifts	15 - 25 T	5
	7 - 14 T	31
	1.5 - 5 T	83
	Total	119
Tug Master	60 - 70 T	27
Towing Tractors		39
Gantry Cranes	40 T	2
Straddle Carries	25 - 31 T	9
	30 - 40 T	6
Container Top Lift Handler	7 - 14 T (Empty Container)	10
	Total	16

Source : PC

Table 2.6.2 Cargo Handling Gears

Kinds of Gear	Number
Caterpillar Jacks Grabs	4
Barrels Holder Grabs	23
Paper Roll Grabs	30
Barrels Grab (lifted by Jack) 1.5 tons	2
Barrel Block Holder	4
Roll Spreaders (short) 8 tons	10
Iron Roll Spreaders (short) 10 tons	15
Container Spreaders 20'	6
Container Spreaders 40'	6
Container Grabs with Sides Twist Locks 20', 24 tons	3
Container Grabs with Sides Twist Locks 40', 36 tons	2
Container Automatic Spreaders 20', 36 tons	1
Container Automatic Spreaders 40', 36 tons	1
Heavy Equipment Spreaders 60 tons	2
Stretcher	29
Chain with Hook 12.5 tons, 20 m	8
Chain with Hook 15 tons, 22 m	18
Wires Scissors (to Scissor Wires)	1
Scissors Blades	12
Ladder of pulled moving Barns for Sheep	80
Livestock Discharging Ramp	95
Evacuator 100 tons	13

Source : PC

Table 2.6.3 Storage Facilities

NO	STORAGE	AREA (m <sup>2</sup> )	CONTENTS OF USE
1	SHED	NO.1	6,248 G.C., LCL
2		NO.2	6,248 DITTO
3		NO.3	<sup>(1)</sup> 7,904 CARTOONS, BOXES, OTHER G.C.
4		NO.4	3,270 G.C., LASH GOODS
5		NO.5	7,907 G.C., PAPER REELS, PALLETS
6		NO.6	7,907 G.C., PAPER REELS, PALLETS, BAGGED CARGO
SUB-TOTAL		39,484	
7	COVERED HANGER	NO.1	2,912 CARGO DWELLED OVER 6 MONTHS
8		NO.2	2,537 PAPER REELS, PALLETS, BAGGED CARGO
9		NO.3	3,250 DITTO
10		NO.4	2,809 DITTO
11		NO.5	3,024 DITTO
12		NO.6	3,051 DITTO
13		NO.7	2,968 DITTO
14		NO.8	2,912 G.C. CASES, BAGGED CARGO
15		NO.9	2,464 PAPER REELS, PALLETS
16		CH. NEW A	2,464 CHEMICALS IN BAG
17		CH. NEW B	2,464 DITTO
18		CH. OLD	3,640 CHEMICALS IN BAG, PKGS, BARRELS(DRUMS)
SUB-TOTAL		34,495	
19	OPEN STORAGE	NO.3	765 EMPTY CONTAINERS, EMPTY PALLETS
20		NO.3-C	3,737 DITTO
21		NO.3-D	4,976 DITTO
22		NO.4	4,928 STEEL PRODUCT
23		NO.4-A	2,828 DITTO
24		NO.5	1,875 DITTO
25		NO.6	2,444 BIG CASES, VEHICLES, LASH GOODS, PAPER REELS
26		NO.7-B	4,560 STEEL PRODUCT
27		NO.8-B	6,000 BIG CASES, VEHICLES, LASH GOODS, PAPER REELS
28		NO.9	4,122 DITTO
29		NO.13	13,000 LIVE STOCK
30	D.G.	38,000 CHEMICALS	
SUB-TOTAL		87,235	
31	OPEN AREA	NO.1-A	13,994 ANIMAL FOOD IN BAGS (new hanger established)
32		NO.1-B	13,355 ANIMAL FOOD IN BAGS
33		NO.1-C	13,541 VEGETABLE OIL, COAL IN BAGS
34		NO.14	25,982 TIMBER, WOOD, PLYWOOD, VEHICLES
35		NO.15	37,363 CARS, VEHICLES
36		NO.16	15,975 RUBBISH WOOD, TRUCKS PARKING, BAGGED CARGO
SUB-TOTAL		120,210	
TOTAL		281,424	

NOTE : (1)include Cold Storage (500 m<sup>2</sup>) which have been not used for six years  
G.C.= GENERAL CARGO CH.= CHEMICAL D.G.= DANGEROUS CARGO

Source : PC

## 2.6.3 Cargo Handling System

### (1) Documentation for Cargo

The following documents are required:

- Freight manifests stating all details.
- Un-freighted manifest stating all details.
- Non-negotiable bills of lading.
- Separate manifest for free zone cargoes must be included in the general cargo manifest.
- Dangerous and hazardous cargo lists showing IMO class and UN number must be sent at least 48 hours prior to the vessel's arrival.
- The master stowage plan and hatch lists are to be received at least 48 hours prior to the vessel's arrival to enable PC to program its work.

All manifests must either be received in Aqaba at least 48 hours before the arrival of the vessel or a set must be delivered to the agent by the Master. A customs fine of up to JD 200 will be imposed if this rule is not complied with. Further, PC will not permit discharging.

### (2) Berth Allocation

Berth allocation meeting is held by Pre-Planning Division twice daily (12:00 and 18:00) with related sections. The allocation of berth is decided based on the following procedures;

According to the quantity of cargo to be stored, the most suitable berth should be allocated for the vessel taking into account the distance of transferring the cargo from the ship side to the storage area. And also the capacity of berths (see Table 2.6.4 to 2.6.6) and berths occupancy at the time of ship arrival should be considered.

In case of full load of direct delivery mode, available berth should be allocated to cope with the ship's draft on arrival.

A conventional ship which loads containers and general cargo on board together can be allocated a container berth if discharging more than 15 containers. After which it shifts to the Main Port to discharge general cargoes.

All specialized berths are allocated upon request sheet from the Phosphate Company or Fertilizer and Potash Company according to their loading program, Mushtarak berth for Cement Company as well.

Berth No.1 is allocated to all ships chartered by the Ministry of Supply (bulk cargo) because equipment for grain is on this berth.

Table 2.6.4 Use of Berth by Kind of Cargo or Vessel (Main Port)

NO.	Kind of Cargo or Ship	D.W.T.	D.T. <sup>(1)</sup>	L.O.A. (m)	Draft (m)	Remarks
1	Bulk Cargo for Ministry of Supply	35,000	45,000	200	10.8	
2	General Cargo, Bagged or Heavy Cargo	35,000	45,000	180-200	10.0	
3	General Cargo, Bulk Cargo	40,000	52,000	180-220	13.0	For deep, draft Ship
4,5,6	General Cargo, Steel Product	40,000	52,000	180-220	11.5	
7	General Cargo	8,000	14,000	150-170	8.0	Including Reefer Ship
8	Small Ship	3,000	5,000	110	5.8	
9	Ditto	3,000	5,000	110	5.4	Ditto
10	Tug Boat, Barge	400	500	60	1.5-3.5	
Ph. A <sup>(2)</sup>	Phosphate, Bunker, Vegetable, Oil Tanker	20,000	25,000	100 (200)	11.0	
Ph. B	Phosphate	100,000	125,000	220	14.4	

Note : (1) D.T. = Displacement Tonnage  
(2) Ph. = Phosphate

Source : PC

Table 2.6.5 Use of Berth by Kind of Cargo or Vessel (Container Port)

NO.	Kind of Cargo or Ship	D.W.T.	D.T. <sup>(1)</sup>	L.O.A. (m)	Draft (m)	Remarks
1,2	Container, Car, Livestock	55,000	84,000	180 (240)	14.0	
3	Ditto	55,000	84,000	180 -240	20.0	
Ro-Ro	Ro-Ro	10,000 25,000	35,000	189	10.0	
Yarmouk (floating)	Ferry, Passenger Ship	10,000	15,000	150 -170	9.0	
Mo'ta (floating)	Rice in Bulk,	40,000	53,000	200	20.0	
Mosh	Cement in Bulk	70,000	120,000	120	11.0	

Note : (1) D.T. = Displacement Tonnage  
Source : PC

Table 2.6.6 Use of Berth by Kind of Cargo or Vessel (Industrial Port)

NO.	Kind of Cargo or Ship	D.W.T.	D.T. <sup>(1)</sup>	L.O.A. (m)	Draft (m)
Oil Jetty	Oil Tanker	406,000 300,000	300,000	370	24.0
JFL1	Small Livestock Ship	8,000	14,000	80-120	6.8
JFL.E	DAP in Bulk or Potash <sup>(2)</sup>	30,000	40,000	190	11.0
JFL.W	DAP in Bulk or Potash, Sulphur, Ammonia Gas	50,000	70,000	230	15.0

Note : (1) D.T. = Displacement Tonnage  
(2) DAP = Diammonium Phosphate

Source : PC

### (3) Cargo Flows

Cargo flows of each cargo type described below. Table 2.6.7 shows Gang Structure by cargo type.

#### 1) General Cargo

After PC confirms ship arrival and receives the Cargo Plan, the Hatch List and the Alphabetical Index in addition to original manifest from the ship agent, the Receipt and Delivery Division determines the suitable storage area taking into account the kinds of cargo.

All requirements for discharging and transferring are reserved six hours before ship arrival or one shift earlier through berth allocation meeting. After ship comes alongside the berth, the cargoes are transferred from ship side to the storage area according to these requirements.

Some sorting clerks direct workers, trailer and forklift drivers where to stack the cargoes following the Alphabetical Index in the reserved storage.

After all cargoes have been stacked in the storage area, the agent representative starts to deliver the cargoes to the shed master by counting the packages and checking whether the cargoes are in good condition or not. If there is some damage it must be remarked on the Alphabetical Index against the number of B/L showing the actual state of the cargo before storing.

It is necessary to request the committee's presence in case of a large number of cargoes like bagged cargoes or small cartons and delivering cargoes to the clearing company. The committee consists of PC, Customs, Ship Agent and Clearing Company. This committee records all remarkable information concerning the quantity and the state of cargoes during the delivery of cargoes on trucks.

After that the Clearing Company prepares the necessary number of equipment, trucks and workers for loading cargoes through the Coordination Division.

The shed master audits the documents.

Trucks must pass through gate No.4 going in/out the PC. Staff belonging to the Coordination Division weigh the trucks on the scale before/after loading. And staff belonging to Audit and Control Department check the documents which are signed by PC and Customs to make sure the documents are correct.

## 2) Dangerous Cargo

All manifests are also required like general cargoes in case of dangerous cargoes. But all manifests are proceeded by a letter including a copy of dangerous cargo manifest from the ship agents to the PC. This manifest should contain the IMCO Class Number and the UN. Number of the material.

The operation manager transfers this letter to the Public Safety Division which belongs to the Service Department and is advised whether the cargoes can be stored or must be delivered directly.

## 3) Reefer Cargo

Reefer cargoes are delivered directly by the reefer trucks after documentation by PC and Customs is finished. The reefer trucks have to be reserved by the Clearing Company through the Coordination Division.

## 4) Container

Container operations are mentioned in Section 2.6.4.

## 5) Phosphate

Phosphate rocks are transported by train (60%) and trucks (40%) from mines to the Main Port. The train is usually comprised of 32 wagons and capacity of each wagon is 42 tons (Total capacity is about 1.3 thousand ton).

Phosphate rocks are carried by belt conveyers to six warehouses which can store 340,000 tons and later exported using Berth A or B.

PC has solved the problem of phosphate dust within loading to ships through setting up two special loading machines (Choke Feeder) on Berth B. But other dust raised from storage or belt-conveyer remains an issue. They are studying ways to settle this matter.

Table 2.6.7 Gang Structure by Cargo Type

Commodity	Workers		Tally Man	W.M. & S.M.	Total
	On Deck	On Land			
General Cargo	4	3	1	3	11
Small Cartons	6	4	1	3	14
Bagged Cargo	8	5	1	3	17
Frozen Goods	16	12	1	3	32
Container(Ship Gear)	3	2	1	3	9
Container(Gantry Crane)	2	2	1	3	8
Ro-Ro, PCC	4	-	1	-	5
Livestock	4	-	1	-	5
Bulk Cargo by Grabs	2	-	1	3	6
Bulk Cargo by Vacuum	2	-	1	-	3

Notice : W.M.= Winch Man S.M.= Sign Man PCC = Pure Car Carry

Source : PC

## 2.6.4 Container Terminal

### (1) Location and Layout

Container terminal, berth length 540m, is located about 5km south of main port, and divided into two areas separated by a main road. One is inland side, and the other is sea side area, there is a problem in that the land elevation is not consistent.

The difference of land level is about 5m between No.3 and No.4 storage area, and few meter at the southern end of No.1 and No.2 storage area.

Back side of the terminal is obstructed by hills and low mountains, making it difficult to expand the container terminal in the inner direction. Instead the container terminal including CFS, has expanded alongside the shore line.

To facilitate traffic between inland side and sea side area, a tunnel under the main road has been built trucks loaded with container can pass through the tunnel, but straddle carriers can't pass this tunnel due to the height restriction.

On the other hand, No.8 area, which is called the truck waiting area, is located outside the container terminal. At this area, initial document procedures are undertaken by terminal staff and truck drivers before container pick up/ delivery.

Container yard is divided to 4 areas, such as

#### Sea side

- No.1 Area (Full Discharged/Loading Container)
- No.4 Area (40' Empty Container)

#### Inland side

- No.2 Area (Full Discharged Container)
- No.3 Area (20' Empty Container)
- Free Zone (Free Zone Container)
- Inspection Area

The capacity of container storage of each area is as follows;

No.1 Area	1,500 TEU	2 Tier	=	3,000 TEU
No.2 Area	1,500 TEU	2 Tier	=	3,000 TEU
No.3 Area	705 TEU	3 Tier	=	2,115 TEU
No.4 Area	800 TEU	3 Tier	=	2,400 TEU
Free Zone	312 TEU	2 Tier	=	624 TEU
Total			=	11,139 TEU

(Note:)

Regarding to the total capacity of container terminal, the data of 13,977 TEUs were obtained from PC, but the actual data of yard storage drawing shows 11,139 TEUs.

Electric receptacles for reefer containers are equipped in the following places.

- No.2 Area South side : 12 Receptacles
- No.3 Area West side : 16
- No.4 Area East side : 22



CFS Area S.East side : 32  
 Total : 82 Receptacles

To control the storage area, a container location is addressed to 3-dimensional figures in an ordinate, an abscissa and a perpendicular, the same as with other terminals.

Row  
 Block  
 Cell  
 Tier

There are 4 CFS is in the southern part of container terminal on the sea side area.

2 big CFSs, total storage capacity ; 37,128 ton  
 (108m x 60m = 6,480 sq.m, 18,564 ton/ CFS)  
 2 small CFSs, total storage capacity ; 14,083 ton  
 (39m x 86m = 3,354 sq.m, 95m x 19m = 1,805 sq.m)

Inside No.1 gate, there is a terminal control office where container location, documents and container weight are controlled. This office is located on the sea side of the road, and controls sea side storage area of No.1 and No.4.

Cargo documents of No.2 and No.3 area are controlled by another office which is located inside No.3 gate, and a storage address is controlled by the other control tower.

The office building for the head of container terminal and assistants is next to the south side of No.2 storage area, but it is outside of the fenced container terminal.

Beside No.2 storage area, there is a maintenance shop for equipment, straddle carrier, forklift, container top lift handler, etc. This facility belongs to Technical Dept. including equipment and labors.

In 1994, the container terminal handled the following containers.

Import		54,759 TEU		
Export Full	20'	4,720 TEU		
	40'	1,600 FEU		
Empty	20'	23,426 TEU		
	40'	12,356 FEU		
Total		110,817 TEU		
		FCL		LCL
	20'	21,747 TEU		1,837 TEU
	40'	9,998 FEU		769 FEU
		41,743 TEU		3,375 TEU
		Transit		Free Zone
	20'	1,309 TEU		2,378 TEU
	40'	1,597 FEU		1,163 FEU
		4,503 TEU		4,704 TEU

Average dwelling days in terminal	
Import container	21 days
Export container	22 days

Dwelling days of containers in the terminal are high compared with other ports, though deficient terminal operations may not be the reason. From the economic point of view and for good port sales, it is recommended to analyze and research the reason why containers dwell such a long time in the terminal.

## (2) Operation of Container Terminal

Container terminal has two gantry cranes (40 and 45 ton), 9 straddle carriers (25 and 40 ton), 6 container top lift handlers (35 ton), 10 empty container top lift handlers, forklifts and tug masters.

This terminal adopts a straddle carrier and tug master/tractor combined system for container operation. As mentioned above, since a straddle carrier can't pass through the tunnel under the road, this terminal is unable to operate containers only using straddle carrier.

Terminal operation is much influenced by the tunnel and the difference in land levels. Regarding the traffic system, in spite of a straddle carrier system, the terminal has no other alternative but to use a combination of a tug master, tractor and straddle carrier for a terminal operation.

As to the traffic direction of the tug master, the tunnel takes two way system from inland and sea side. A tug master which loaded a discharging container goes to inland side from sea side, while a lading container goes in the opposite direction.

In the discharging operation, containers are discharged by gantry crane onto the terminal ground directly, and then lifted up by top lift handler on a towing tractor. Due to the limited number of tug masters, containers are usually not loaded on the towing tractor directly.

The tug master tows the chassis to a storage area of No.1, No.3, transit, LCL or free zone area depending on the kind of container such as FCL container, LCL container, reefer container, transit container, etc.

At each storage area, a straddle carrier picks up a container and stacks it in the yard according to the driver's preference. The driver of a straddle carrier reports the location of the container to the control tower by radio using 4 figures of row, block, cell and tier. There is one container control tower on each sea and inland area, but both are controlled and supervised by one manager.

After receiving the location, the terminal records the address on a location record sheet, and makes a "T card". The address of the container is also recorded on a "T card". The address of the container will be renewed when the container is re-stowed.

In this system, the last two digits of the container number are used to control the yard. Container control tower has 100 pieces of stacking racks on the wall from 00 to 99, and the "T card" is distributed into them according to the last two digits.

When a container is picked up for delivery, the last two digits of the container, and from the stacking rack which showed the last two digits, they are first checked "T card", on which full container numbers are written, is sought.

In the loading operation, the procedure is reversed. Almost all export containers are empty, and the storage area of empty containers are assigned to shipping agent-wise. Thus, terminal usually doesn't marshal loading container in a marshalling yard of a ship's side, but loading containers are brought directly from a storage area to a ship's side.

In the delivery operation of a container from the terminal, a truck driver first comes to No.8 terminal to settle the documents and procedures. After receiving necessary documents and information to pick up the container, the driver proceeds to No.1 gate.

At No.1 gate, the truck is weighed initially and proceeds to delivery area of No.1 or No.2 storage yard. The truck driver receives the container at the place from a straddle carrier, and total weight of the container is taken at exit gate. No.3 gate is used for imported containers, and Yarmouk gate is used for transit container.

The delivery operation is reversed for export containers. The truck driver comes to No.8 terminal with documents, and proceeds to No.1 gate. After delivering container, it is usually an empty container, the truck exits from No.3 gate.

## 2.6.5 Computerization

### (1) General

PC intends to introduce a computer system into their operation and works, but generally speaking, the level of computerization of PC is still low. Mini/personal computer have just been introduced. At present, PC has no computer system to support the management and operation in the port.

In 1993 Dec., the main host computer was installed into the office to computerize their operations and works, but the necessary software is lacking.

The specification of the main host computer is as follows:

Hewlett Packard HP-9000 Series 800/827  
Operating system: HP-UX 9.0 UNIX Operating  
32 Bit machine  
53 MIPS Dhrystone  
Clock speed : 48 MHZ  
Main memory : 32 MB ECC Memory  
Magnetic tape storage : 2.0 GB digital data storage  
Direct access storage : 1.3 GB Hard disk storage  
32 RS-232 Port on MUX

ADI/SEDCO (WYSE) Terminals 10 Units  
Main Printer CI-500/1000 1 Unit  
LO Printer Epson 1070 2 Units

The main host computer has not yet been used effectively due to lack of suitable application software and operators. PC has a strong wish and desire to operate the main host computer effectively for their operation and works.

The details of mini/personal computers of each department are as follows;

(2) Marine Department

Marine Department has a personal computer in the control tower, ostensibly used for collecting and computing statistics of vessel movement. However, all data is collected and calculated manually by hand, and only final results of the calculation are input into the computer are printed out. This is an extremely wasteful system.

(3) Operation Department

Operation Department has the main host computer in their office which as mentioned above. Computer Sec. is keeping and in charge of maintenance of this computer, but using for printing some formats as trial.

Personal computer isn't used for their operation work. All jobs and works are processed manually and made in writing.

(4) Technical Department

Technical Department has a personal computer in their office for a inventory control of their equipment, motor vehicles, and so on.

"QUANSAN" 40 MB  
O/S: Microsoft EXCELL  
Printer: EPSON LQ-1070

But Technical Department doesn't have enough application software for effective use of the computer. They currently have a plan, however, to purchase the following software.

History of equipment control  
Running cost of machine  
Machine availability control  
Past requisition control  
Working hour of equipment control

(5) Supply and Purchasing Department

Supply and Purchasing Department has a mini-computer in their office for inventory control of spare parts.

"MicroVAX 3100"  
Magnetic tape drive 90-95 MB  
24 MB RAM  
Two hard disk  
33 MHZ  
Operating system: VMS vertical memory system

Display: C.I.T.O.H CIT 2245 8 Sets  
Printer: CI 400  
Keyboard: AL-ARABI 301

Total number of spare parts is over 48,000 units and these spare parts are stored in their 12 stores by commodity-wise.

All spare parts are controlled in their central office by computer. Inventory data of each store are renewed every day based on daily in/out reports from each store. On the other hand, inventory control of each store is done by manual card system and not computerized.

This means that the over 4,800 spare parts are all managed by manual card system in each store, and managed by personal computer in the main office according to a daily report which comes from each store.

#### (6) Finance Department

Finance Department uses the same mini-computer as the Supply and Purchasing Department.

"MicroVAX 3100"  
24 MB RAM  
33 MHZ  
Operating system: VMS vertical memory system  
Magnetic tape drive 90-95 MB  
Display: CIT 2245  
Printer: CI 400  
Keyboard: AL-ARABI 301

Finance Department in 1993 started their mini-computer system for calculation of the annual wage increase of workers, and in 1993 for calculation of workers payroll. And in 1994, the Department commenced calculation of the balance sheet by the computer, and puts that system to practical use.

#### (7) Administration Department

Administration Department has a personal computer and is using for personnel data control. All data is input and renewed according to up it-dated data as occasion demands, and all data is strictly confidential.

#### (8) Development & Training Department

Development & Training Department has 3 personal computers and 2 instructors for a computer training course. There are not enough computers or instructors are not enough to have a lecture to all computer operators and offices.

This Department commenced a computer training course in Feb. 1993. In the last 2 years, 30 groups have participated in this program with 6 to 12 persons per each course. This course is for administration, Marine, Operation (container terminal), and Finance Department.

A term of the course is 2 weeks, and the program is as follows;

2 days general information  
2 days analysis of a problem  
10 days actual computer training

An instructor gives a subject to a group each time, and a trainee analyzes a problem of their job. After analysis of the problem, an instructor makes a special program for treating and dealing with a problem by a computer. A trainee uses the special program for their practical training for 10 days.

Specifications of 3 computers are as follows;

IBM compatible computer  
Type: 80486-DX2-66VL  
Speed: 66 MHZ  
RAM: 4 MB  
HDD: 260 MB  
FDD: 3.5" 1.4 MB  
Keyboard: 101 Key (Arabic/Latin)  
SVGA Card 1024 KB Memory  
SVGA Color Monitor 14"

IBM compatible computer  
Type: 80386 SX  
Speed: 25 MHZ  
RAM: 2 MB  
HDD: 50 MB  
FDD: 3.5"  
Keyboard: 101 Key (A/L)  
VGA Card 512 KB Memory  
VGA Color Screen 14"

IBM compatible computer  
Type: 80286  
Speed: 12 MHZ  
RAM: 1 MB  
HDD: 20 MB  
FDD: 5.25" 1.2 MB  
Keyboard: 101 Key (L)  
Monochrome Screen 12"

This Department is also in charge of preparing all kinds of statistics of port activity and to personal computers are installed in their office for this purpose.

(9) Office of Director General

Office of Director General is using a personal computer for controlling a telephone use records. All records of telephone use are stored in the personal computer and printed on real time.

## Chapter 3 Urgent Improvement Measures

### 3.1 Identification of Problems

#### 3.1.1 General Concept

##### (1) Port Management and Operation in Future

The Ports Corporation is a government enterprise who has two kinds of functions, one is of Port Authority and the other is of Service Sector. As a government enterprise, the former can be easily executed, but the latter may be difficult.

Cargoes will move to the optimum transport route and the number of international competitors lying for these cargoes will increase.

Ports will be required, more and more, to provide efficient and economic services. Efficient port management and operation should be pursued in the international context, especially in the ports for international trade. Cargo handling practices and the quality of port service in international trade may need to be reassessed.

It should be noted that better service will not be achieved simply by increasing the number of personnel but by increasing productivity through the introduction of new ship/cargo handling system and the deployment of competent operators.

In this context, an extensive training/education program should be highlighted.

The objectives of these programs are to foster competent personnel at the managerial level as well as workers level.

##### (2) Identification of Problems

In order to identify current and future problems of the Port of Aqaba, the following was undertaken;

- a) Collection of data and information for the improvement of current port management and operation system to secure efficiency and high productivity of the port.
- b) Frequent interviews with the persons concerned in the Ports Corporation, private sectors and captains of calling vessels at this port.
- c) Several meetings with members of the counterpart team to discuss the current and future expected problems.