CHAPTER 6
URGENT PLAN

CHAPTER 6. URGENT PLAN

6-1 Objective

The objective of the urgent plan is to conduct a feasibility study for the 7th berth construction project based on the Master Plan for Hodeidah Port proposed in Chapter 5. This project aims at solving port congestion expected as a result of increasing cargo volumes (due to the future economic growth of YAR) and as a result of modernization of shipping (due to the rapid progress of containerization in the Red Sea area).

6-2 Necessity of the 7th Berth

6-2-1 Present Conditions

It is said that the Port of Hodeidah was so congested in 1976/77 that Ships often had to wait a week or more for berthing. Recently, however, this congestion has decreased, with construction of additional berths at Ras Kathib in 1978, and as there has been a general stagnation of imports.

Furthermore congestion is expected to be considerably alleviated, because operation of the 5th and 6th berths commences from December, 1981.

According to waiting hours records from January to March 1981 as shown in Table 6-2-1, waiting hours of calling ships, on average, were alleviated one day ~ two days.

Table 6-2-1 Waiting Hours of Calling Ships

	Jan. 1981		Feb. 1981		Mar. 1981	
	No.	Waiting Hours (day-hours-mins)	No.	Waiting Hours (day-hours-mins)	No.	Waiting Hours (day-hours-mins)
Cargo Ship	41	1-02-51	40	1-06-42	41	2-18-16
Reefer Carrier	11	1-21-47	14	0-16-46	10	0-16-05
RO/RO Ship	5	0-07-40	7	0-19-13	5	0-05-36
Average	73	1-01-08	65	1-04-29	63	1-02-53

Source: Compiled from ship records furnished by PMAC.
Note: Waiting hours are difined to be a time difference between arrival and berthing.
In counting waiting hours, an arrival after 18:00 is regarded as an arrival at 06:00 in the next morning.

6-2-2 Analysis of Future Berth Occupancy

A change in berth occupancy rates has been studied assuming either the presence or absence of the 7th berth of Hodeidah Port. Berth occupancy hours are calculated by the following procedure:

Analysis of present unloading

1. Average unloaded lot by ship type
2. Unloading productivity by ship type

Forecast number of calling ships by type

Estimated berthing hours per ship by type

Berth occupancy hours

(1) Analysis of Present Unloading Lot per Ship and Productivity

Average unloaded lot per ship and/or unloading productivity are analyzed by processing actual unloading data. Unloading lot per ship and productivity processed from records for January 1981 are presented in Table 6-2-2, with further detailed data shown in Table A·6-2-1. A·6-2-1.

Table 6-2-2 Unloading Lot and Productivity

Type of ships	Average unloaded lot (tons/ship)	Unloading productivity (tons/hr)
Cargo ship for general cargo	1,586	27.5
Reefer ship	859	19.0
Bulk carrier for wheat	17,350	71.6
Cargo ship for cement	8,153	47.6
Cargo ship for flour	8,665	42.8

Note: Refer to Table 6-2-3 in detail.

(2) Forecast Number of Calling Ships

The number of ships calling at Hodeidah Port was forecast by using a yearly cargo projection, shown in Table 6-2-3, and an average unloaded lot per ship, shown in Table 6-2-2. The average unloaded lot per ship is assumed to increase by 2% per annum for general cargo and frozen cargo. Unloading containers per ship are ssumed to be 150 TEU for container ships; 50 TEU for RO/RO ships. Table 6-2-4 shows the number of ships calling at Hodeidah and Ras Kathib in 1986 and Table 6-2-5 shows the number of ships calling by year from 1982 to 86 at Hodeidah Port.

(3) Berth Occupancy Hours

Unloading productivity is assumed to maintain the same level by 1986 as the actual result in 1981 for unloading wheat, cement, and flour, but to rise by 10% for general and frozen cargoes. It is presumed that handling capacity will be 36 TEU/hour for loading/unloading containers to and from container ships, and 24 TEU/hour to and from RO/RO ships, requiring less than one day to handle the respective 300 TEU and 100 TEU containers. However, it is also assumed that a container ship or a RO/RO ship will always use a berth for at least one day including preparation for sailing. In addition to handling hours, one hour is respectively allotted for berthing and preparation for sailing, except for container ships and RO/RO ships.

Based upon the assumption above, results for berth occupancy hours and rates in 1986 are shown in Table 6-2-6. If the 7th berth is completed by 1986, it can be said that Hodeidah Port will maintain a relatively low berth occupancy rate of 50%.

If container cargoes in 1986 are handled only at the 6th berth, then berth occupancy by container ship shows a relatively high value of 68%. Therefore, containers in 1986 cannot be entirely handled at only one berth. However, one container berth is enough to handle container cargoes in 1985, because the berth occupancy rate will not exceed 58%, considered an appropriate figure for one berth (refer to Table 6-2-7).

The above analysis reveals the necessity for a new container berth (the 7th berth) by 1986 at the latest. In consideration of the length of the construction period, work on the 7th berth should be commenced in 1983.

Table 6-2-3 Yearly Cargo Projection

(Unit: 1,000 tons)

	1982		1983		1984		1985		1986	
	Hodeidah	Ras-Kathib	Hodeidah	Ras-Kathib	Hodeidah	Ras-Kathib	Hodeidah	Ras-Kathib	Hodeidah	Ras-Kathib
Cereal	275	30	290	38	295	45	300	53	310	60
Wheat	(210)		(240)		(260)		(280)		(310)	
Flour	(65)		(50)		(35)		(20)			
Rice		(30)		(38)		(45)		(53)		(60)
Sugar		78		81		84		87		90
Cement	120	220	90	180	60	146	30	100		55
Packed Petroleum		16		32		48		64		80
Fertilizer		15		14		13		12		10
Other Cargo	624	219	605	224	586	227	569	232	550	235
Wood	(184)		(195)		(206)		(217)		(230)	
Steel	(150)		(165)		(180)		(195)		(210)	
Frozenes		(160)		(137)		(112)		(89)		(65)
General and Mixed	(290)	(20)	(245)	(45)	(200)	(70)	(155)	(95)	(110)	(120)
Others		(39)		(42)		(45)		(48)		(50)
Containers	265		345		425		505		590	
Petroleum	700		785		880		990		1,120	
Total	1,984	578	2,115	569	2,246	563	2,394	548	2,570	530

Table 6-2-4 Projection of Number of Calling Ship (1986)

	Cargo Volume (1,000 tons)		Cargo Tonnage per Ship (tons)	Number of Calling Ship
Hodeidah Port				
Bulk Carrier (for wheat)	Wheat	310	17,350	18
Cargo Ship	General	550	1,755	314
Container Ship	Container	450	(150 TEU)	250
RO/RO	Container	140	(50 TEU)	234
Tanker	Petroleum	1,120	4,416	254
Total		2,570		1,070
Ras-Kathib Port				
Cement Carrier	Cement	55	8,150	7
Reefer Ship	Frozenes	65	950	69
Cargo Ship	General	410	1,755	234
Total		530		310
Grand Total		3,100		1,391

Table 6-2-5 Yearly Number of Calling Ship (Hodeidah Port)

Type of Ship	1982	1983	1984	1985	1986
Bulk Carrier (for wheat)	13	14	15	17	18
Bulk Carrier (for cement)	15	12	8	4	
Cargo Ship	394	372	352	333	314
Container Ship	111	145	179	212	250
RO/RO Ship	108	144	175	209	234
Tanker	172	189	208	229	254
Total	813	876	935	1,004	1,070

Table 6-2-6 Berth Occupancy Rate (1986)

	Cargo Volume (1,000 tons)		Number of Calling Ship		Berthing Hours	Berth Occupancy Rate (%)
Hodeidah Port						
No. 1–3B and No. 5B	General Cargo	440	Cargo Ship	251	15,311	44
No. 4B	Wheat	310	Bulk Carrier	18	4,374	50
No. 6B and 7B	General Cargo	110	Cargo Ship	63	3,843	56
	Container	450	Container Ship	250	6,000	
RO/RO Berth	Container	140	RO/RO Ship	234	5,616	64
Total		1,450		816	35,144	50
Ras Kathib Port						
No. 1–4B	Cement	55	Bulk Carrier	7	1,204	54
	Frozenes	65	Reefer Ship	76	3,572	
	Other	410	Cargo Ship	234	14,274	
	Rice	(60)				
	Sugar	(90)				
	Packed Pet.	(80)				
	Fertilizer	(10)				
	General & Mixed	(170)				
Total		530		317	19,050	54

Table 6-2-7 Yearly Berth Occupancy Rate (Hodeidah)

	1982			1983			1984			1985			1986		
	Cargo Volume (1000 tons)	Berthing Hour (hours)	Berth Occupancy Rate (%)	Cargo Volume (1000 tons)	Berthing Hour (hours)	Berth Occupancy Rate (%)	Cargo Volume (1000 tons)	Berthing Hour (hours)	Berth Occupancy Rate (%)	Cargo Volume (1000 tons)	Berthing Hour (hours)	Berth Occupancy Rate (%)	Cargo Volume (1000 tons)	Berthing Hour (hours)	Berth Occupancy Rate (%)
No.1 - 3B and 5B	G.C 589 Cement 120	22,204 2,580	70	G.C 575 Cement 90 Ro/Ro 20	21,228 2,064 816	69	G.C 556 Cement 60 Ro/Ro 63	20,069 1,376 2,520	68	G.C 559 Cement 30 Ro/Ro 100	19,764 688 4,008	70	G.C 440	15,311	44
No.4B	G.C 35 Wheat 210 Flour 65	1,342 3,159 1,632	70	G.C 30 Wheat 240 Flour 50	1,159 3,402 1,224	66	G.C 30 Wheat 260 Flour 35	1,098 3,645 1,020	66	C.C 10 Wheat 280 Flour 20	366 4,121 612	58	Wheat 310	4,374	50
No.6B	Container 265	Container 2,664 Ro/Ro 2,592	60	Container 325	Container 3,480 Ro/Ro 2,640	70	Container 362	Container 4,296 Ro/Ro 1,800	70	Container 405	Container 5,088 Ro/Ro 960	69			
No.7B													G.C 110 Container 450	3,843 Container 6,000	56
Ro/Ro													Container 140	Ro/Ro 5,616	64
Total	1,284	36,173	69	1,330	36,013	69	1,366	35,824	68	1,404	35,607	68	1,450	35,144	50

6-2-3 Analysis of Port Congestion

A simulation test has been carried out to forecast the future port congestion situation and to estimate benefits that will accrue through construction of the 7th berth. The simulation method was introduced in detail in section 6-4 on Economic Analysis. The simulation test was carried out under the following conditions.

1) 4th berth is excluded from the simulation test because it is used exclusibly for handling wheat.
2) Oil berths are excluded from the simulation test.
3) Ships can leave port any time but can enter only from the hours of 6:00 until 18:00 the following day.
4) Container vessels are given preferential access to container berths.
5) Average berthing hours by type and size of ship are, based on ships' calling data, as follows:

Cargo ship

Less than 5,000 G/T	72 hours
5,000 ~ 10,000 G/T	69 hours
10,001 ~ 15,000 G/T	64 hours
15,001 ~ 20,000 G/T	53 hours
Container and RO/RO vessel	24 hours

The simulation test has been carried out for two cases: case 1 – Where the 7th berth is not constructed; case 2 – where the berths are constructed in the following manner:

1986; 1 container berth (7th berth)
1993; 1 container berth and 1 general cargo berth
2000; 1 container berth and 2 general cargo berth

The average waiting time for waiting ships (general cargo ships and container ships) are shown in figures 6-2-1 and 6-2-2 respectively.

According to calculations for cargo ships, average waiting time will increase rapidly after 1986 if the 7th berth is not constructed by 1986 (case 1). In contrast to this, the average waiting time will maintain its present value of about 24 hours provided the 7th berth is constructed by the year 1986 (case 2).

Even so, ships' waiting time will increases rapidly if additional berths are not built by 1993. Therefore, the phased construction of berths as mentioned above is necessary.

On the other hand, waiting time for container ships will be 28 hours if the 7th berth is not constructed by the year 1986 (case 1).

In contrast to this case, waiting time for container ships will be only 10 hours if the 7th berth is constructed (case 2). The waiting time will then exceed 20 hours after 1993 if an additional berth is not constructed after 1986. Phased construction of container berths as mentioned above is required if a marginal waiting time of 20 hours is to be achieved.

Fig. 6-2-1 Waiting Time (Cargo Ship)

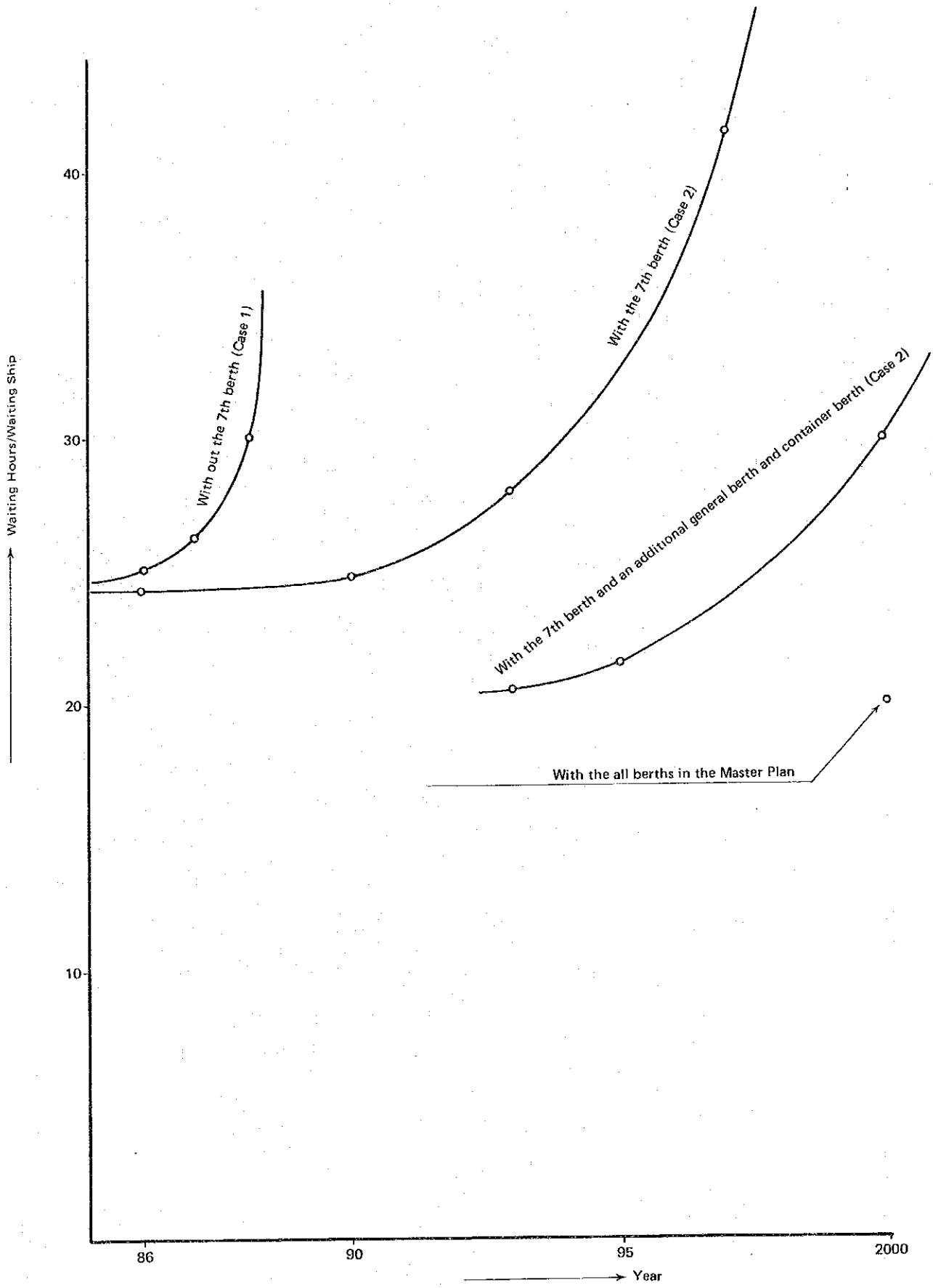
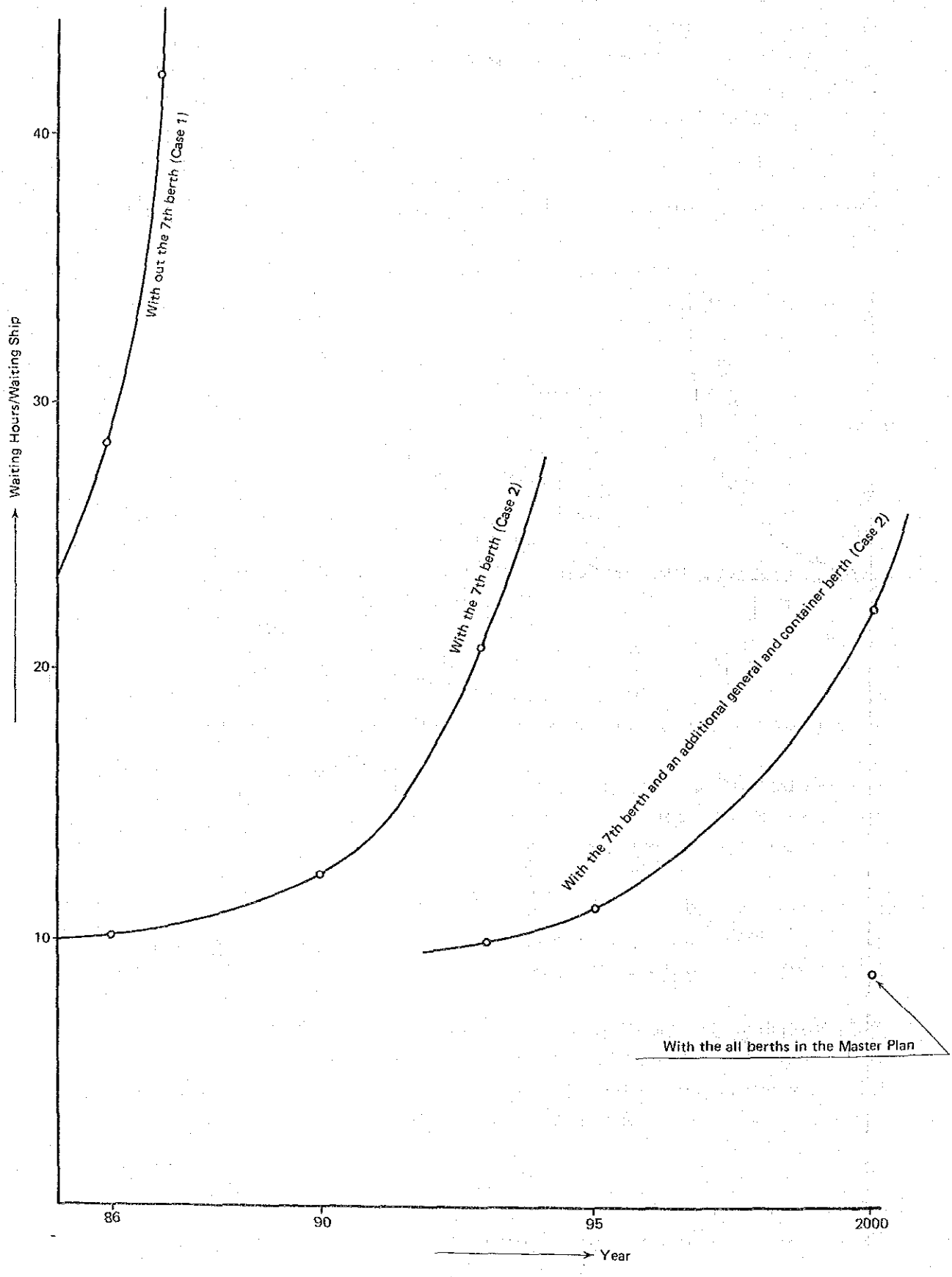


Fig. 6-2-2 Waiting Time (Container Ship)



6-3 Facility and Equipment Plan

6-3-1 The 7th Berth Container Terminal and Handling Equipment

The container terminal is the junction point between sea and land transport for sea borne containers. It is the site for the stevedoring and storing of containers and delivery/receiving of containers and container cargoes.

Its efficiency governs the overall efficiency of container transportation.

Consequently, arrangement of terminal facilities and equipment must be carefully planed and implemented to permit the quickest and most effective handling of large container volumes.

(1) Dimensions

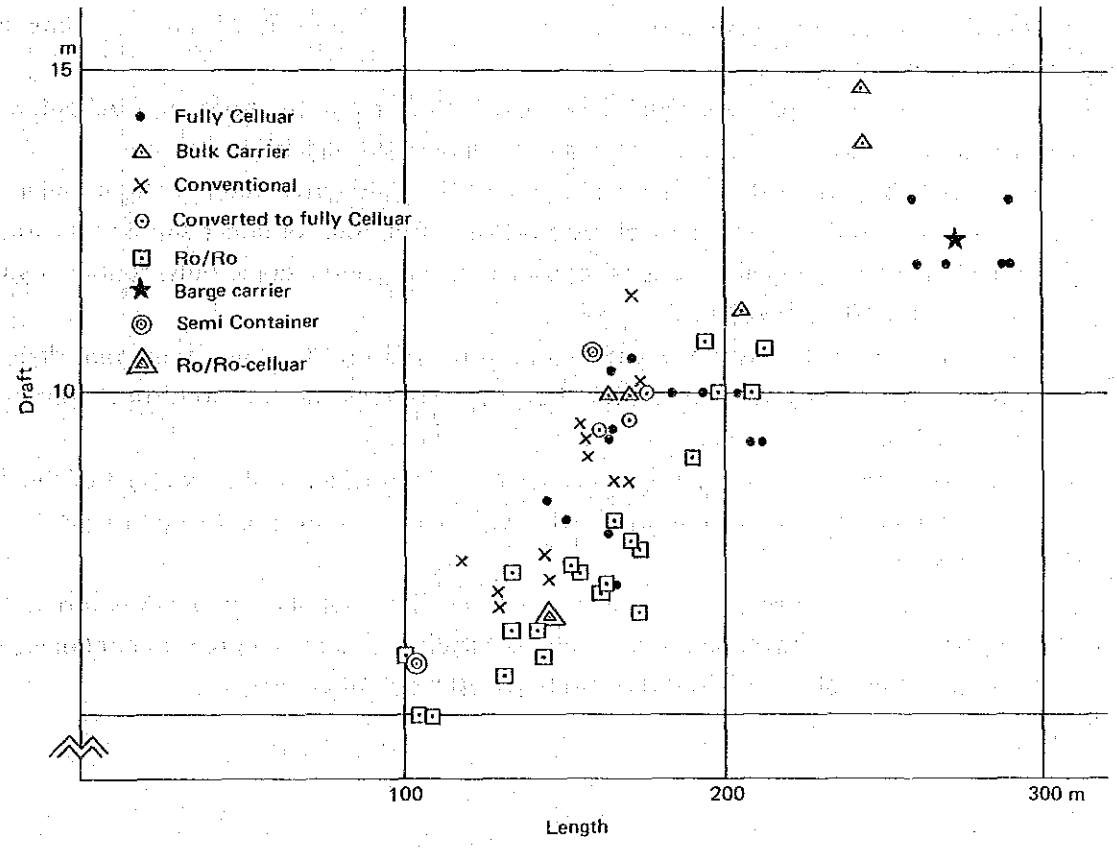
The maximum size container ships serving the Red Sea Area are of approximately the 60,000 G/T class, loading 3,000 TEU. Their main routes are between Europe/Mediterranean and the Far East; between Europe and the Far East; and between Europe/Mediterranean and the Mid-East.

Containerization is expected to develop rapidly in the YAR, but it is doubtful that the large-sized ships mentioned above will call at the Port of Hodeidah in the near future.

For the time being, 30,000 G/T class ships loading 1,800 TEU, with dimensions of 200 m in length and 10 ~ 11 m in draft are considered suitable as the maximum design container ship for planning the 7th berth. (Refer to Fig. 6-3-1 ship length and draft)

Fig. 6-3-1 Ship Length and Draft

(Served between Europe and middle east)



Even if 30,000 G/T class full container ships call at the Port of Hodeidah, it is considered that they will not enter the port drawing full draft because empty containers must be loaded.

From the above, it is suggested that the planned dimensions of the 7th berth be as follows;

Berth length : 250 m
Berth water depth: −10 m

(2) Layout of the main facilities

The 7th berth shall be constructed along the same lines as the 6th berth, and the two berths should be operated as a compound terminal and utilizing effectively the facilities of both berths together.

From the outset this compound container terminal should be planned to imagine a full scale terminal having sufficient capacity to handle forecasted future increase in container cargo volumes.

However, as stated in the preceding chapter, the total 1986 annual forecasted cargo volume for the No. 6/7 berths combined are 450,000 tons of container cargoes or about 37,500 TEU (12 tons per TEU), and the forecasted figures for the RO/RO berth estimates are 140,000 tons of container cargoes or about 11,700 TEU. Thus the number of handling containers are 75,000 TEU (37,500 TEU x 2) at the No. 6/7 berth and 23,400 TEU (11,700 TEU x 2) at the RO/RO berth including empty return containers.

According to our experience, the minimum required handling capacity to operate a full scale container terminal is at least 50,000 TEU per berth per annum.

However, for the time being, the No. 6/7 berth container terminal does not have sufficient demand to operate as a full scale terminal.

Therefore the No. 6/7 berth container terminal is to be started initially with a minimum scale of equipment, facilities and pavement.

The terminal may then later be expanded to cope with increases in annual throughput, and eventually attain the status of a full scale container terminal by around 1990.

Construction of the 7th berth facilities and equipment in the initial stage shall be similar to that of the 6th berth and the arrangement of main facilities from the container ship berth toward the depth direction of the terminal shall be as follows; quay and apron, crane rails, container yard and temporary control office building.

Concreate paving from the quay wall will extend back 135 m. Container crane rails shall be set at the same gauge as and connected with the 6th berth rails and one additional container crane shall be installed.

Refrigerated container electric receptacle stands are to be provided at the west end of the 7th berth and a temporary control office is also to be built at the entrance of 6th berth. (Refer to Fig. 6-3-2, Table 6-3-1).

As already mentioned above, the total number of handling containers in 1986 is forecast at about 98,400 TEU, and the required ground slots to handle the above number of containers by forklift are assumed to be about 3,800 slots including a 50% slot allowance.

Fig. 6-3-2 Layout of Urgent Plan

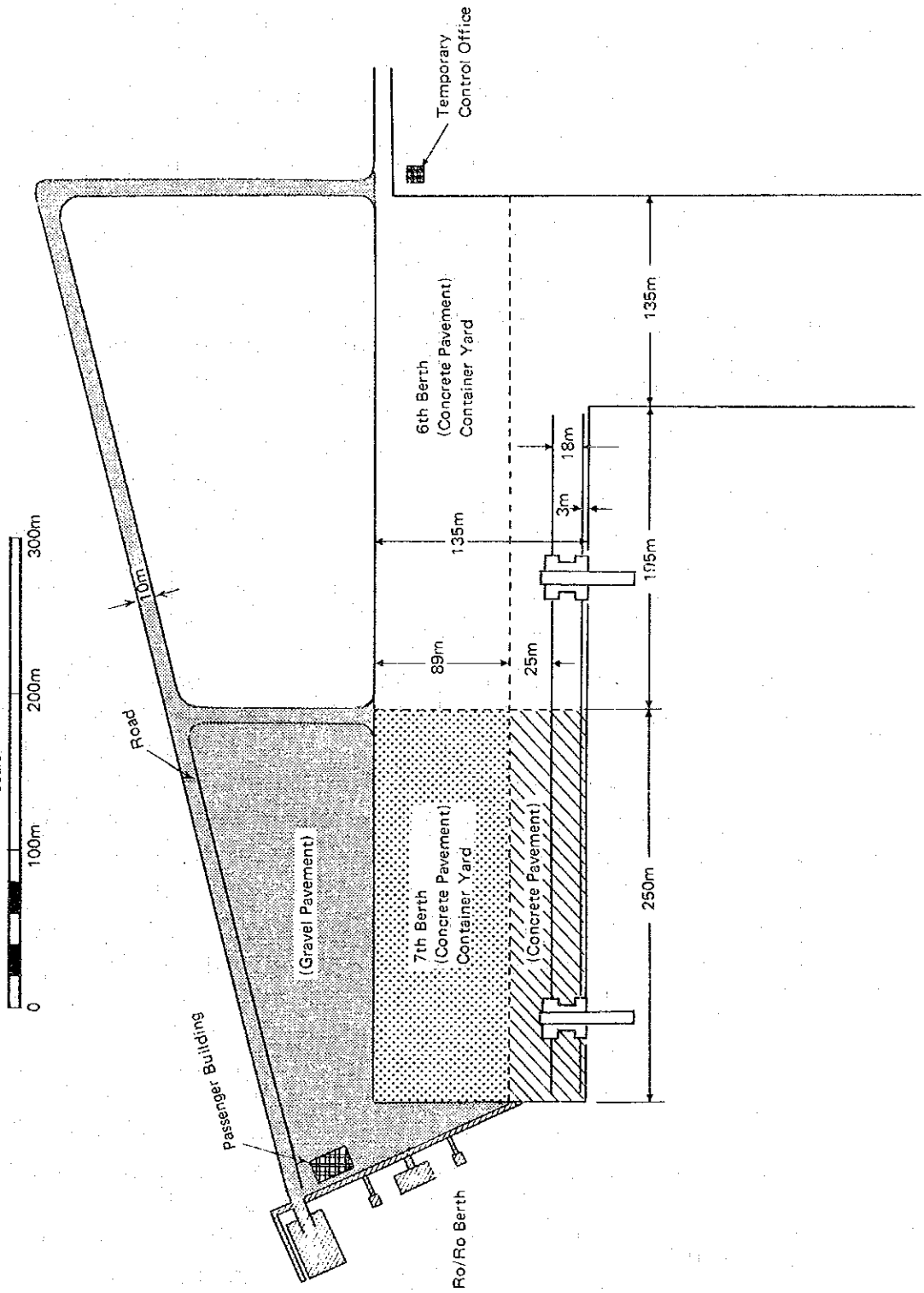


Table 6-3-1 Facilities of Urgent Plan

	Specification	
Wharf		
Length		250 m
Depth of Water		−10 m
Width of Apron		21 m
Handling Facilities		
Container Crane	Capacity 30.5 t	1
Forklifts	Capacity 35 t	to be provided by stevedore
Land Facilities		
Container Terminal Area	Concrete Pavement	33,750 m^2 (250 m × 135 m)
Container Yard	Concrete Pavement	22,250 m^2 (250 m × 89 m)
		about 900 TEU (as forklift system)
Open Storage Yard	Gravel Pavement	17,000 m^2
		about 300 TEU (as forklift system)
Administration Office		100 m^2 (10 m × 10 m)
Electric Facilities		1 set
Water Facilities		1 set

Remarks;

The number of required ground slots at the container terminal will be influenced by various factors such as intervals in container ship calls, the amount of containers loaded/unloaded by each ship, the duration of containers stay in the terminal, etc., and it cannot be precisely forecast.

However, it can be assumed by the following formula;

$$L = \frac{C \times D}{H \times W \times K}$$

Where; L = Number of container slots on the ground (TEU)
C = Number of containers handled TEU (Max)/Year
D = Days of container's stay in terminal
H = Number of stacking layers of container
W = Operational margin 0.7 ~ 0.8
K = Total days 365 days per year

Therefore, if C = 98,400 TEU, D = 14 days
H = 2 layers, W = 0.75
K = 365 days

$$L = \frac{98{,}400 \times 14}{2 \times 0.75 \times 365} = 2{,}516 \text{ slots}$$

2,516 slots × 1.5 ≒ 3,800 slots

Considering ship size, number of containers loaded/unloaded, degree of skill in ship planning and handling operation etc., a 50% slot allowance should be assumed for Hodeidah Port.

In order to secure 3,800 ground slots in the port area, an additional reclamation of soil, paved with a layer of gravel is required in order to extend by 17,000 m^2 of the open space behind the concrete pavement yard of the 7th berth, since the ground slots capacity for the forklift handling system is estimated about 950 slots at concrete pavement yard of the 6th and 7th berth, about 500 slots at behind concrete pavement of the 6th berth, and about 2,300 slots at the existing open storage yard. Accordingly, including reserve space for future increase of handling volumes, 300 slots must be provided at the new storage yard.

(3) Facilities

The following is a description of the role of the main facilities.

(a) Quay and Apron;

A Clearance of 3 m will be provided between the wharf edge and the container crane sea side rail.

This space will be secured for housing container crane power cables and container trailer stoppers, and for descending the ship's gangway ladder.

The distance between the seaside and landside rail of the container crane will be 18 m.

This space will be used for truck and trailer transit, temporary storage of containers before being loaded on ships and for housing of spare spreaders for the container cranes.

A 25 m space between the landside rail and the container storage yard will be used for

temporary storage of the container ship's hatch cover, and transit of trucks, forklifts and possibly straddle carriers.

(b) Container yard;

The container yard will be used for preparation of container ship operation, for storage of full and empty container and for receipt/delivery of containers from/to shipper/consignees.

The refrigerated container yard will be equipped with electric receptacle stands for the storage of full refrigerated containers and the precooling of empty refrigerated containers to be stuffed with frozen goods.

Sufficient lighting equipment will be provided for night containers operation.

(c) Temporary control center building;

This building will accommodate the planning and supervision staff for all work concerning terminal operation, and clerical and documentary work staff.

(4) Container handling at the 7th berth

(until completion of the full scale terminal)

During the course of full scale container terminal construction, (referred to hereafter as "phase I of the 7th berth") and operation system similar to the one in use at present at the port of Hodeidah is recommended.

As shown in Table 6-2-6, the 1986 figure for calling ships per annum at the 6th and 7th berth terminal is forecast at 250 container ships, and the number of container to be handled is forecast at 37,500 TEU x 2 = 75,000 TEU.

That is to say, an average of 2.4 container ships per week per berth, and an average of about 300 TEU of handling containers per ship, assuming the number of ship callings and containers handlings continue at the same rate, port roads and open storage areas (including new areas) are sufficient for such volumes.

Table 6-3-2 Summary of Facility and Equipment Plan for the Urgent Plan

Item	Unit	Quantity	Remarks
1. Container Terminal			
1) The 7th Berth	Berth	1	–10.0 m deep, 250 m long
2) Container Crane	Set	1	Lifting load 30.5 tons
3) Control Building	Bld.	1	Two-story building ($200\ m^2$ = 10 m x 10 m x 2 story)
4) Reclamation	$10^3\ m^3$	250	Terminal area $49,400\ m^2$
2. RO/RO Terminal			
1) RO/RO Berth	Berth	1	–7.5 m deep, 160 m long
2) Passenger Building	Bld.	1	One-story building ($450\ m^2$ = 15 m x 30 M0
3) Dredging	$10^3\ m^3$	85	–7.5 m deep, dredging area: $18,700\ m^2$
4) Reclamation	$10^3\ m^3$	21	Terminal area $5,800\ m^2$
3. Roads	m	850	10 m wide gravel surfaced road
4. Electric Facility	Set	1	Substation and cable
5. Communication System	Set	1	Paging system, radio communication system
6. Utilities			
1) Water Supply	Set	1	
2) Water Hydrants	Set	1	

6-3-2 RO/RO Berth

The location and dimensions for the new RO/RO berth have been decided as follows:

(1) Location

With consideration toward the future development of Hodeidah Port, the RO/RO berth is to be located on the west side of the 7th berth.

(2) Dimensions

The berth is designed to accommodate not only RO/RO ships, but passenger vessels as well. Table 6-3-2 shows the relation between the draft and overall length of passenger ships calling at Hodeidah Port during the first several months of 1981. RO/RO ship's drafts are mostly less than 7 meters and overall length less than 140 meters, as shown in Fig. 6-3-3.

Accordingly, the dimensions of the RO/RO berth were planned as follows:

Depth : –7.5 m

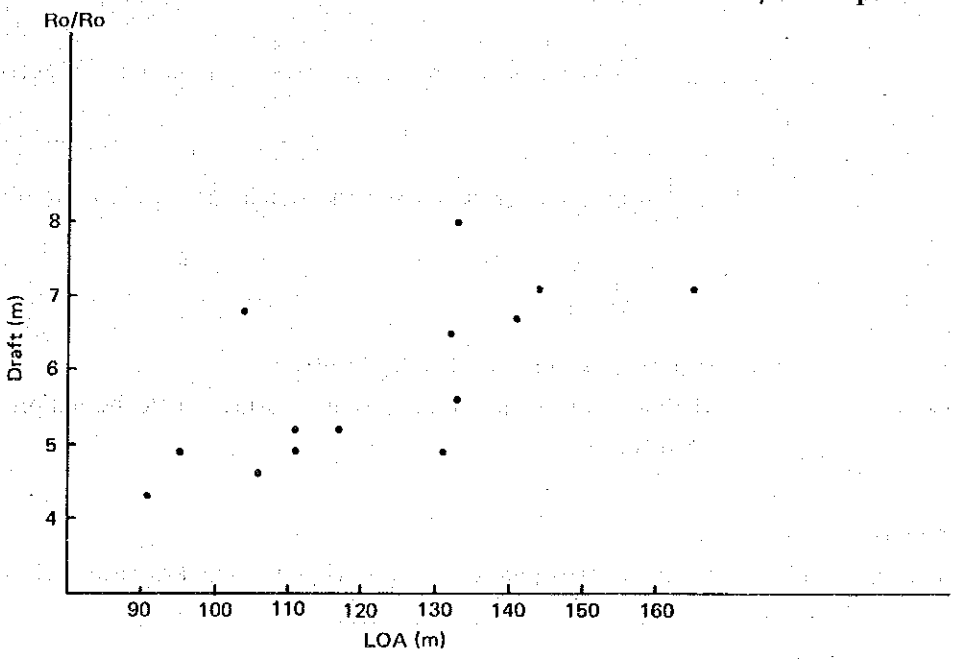
Length: 160 m

Table 6-3-3 Dimensions of Passenger Boats

Ship Name	Net Tonnage	Gross Tonnage	Dimensions (m)	
			Draft	Length (LOA)
AL-PASHA	2,797	5,308	5.2	109
EL-ARISH	2,162	4,609	5.2	105
REGINA MARIS	2,974	5,813	6.8	118

Source: Record of Calling Ships at Hodeidah Port (1981), PMAC.

Fig. 6-3-3 Relation between Draft and LOA of RO/RO Ships



(3) Passenger Terminal

As the RO/RO berth will also be used for passenger ships, a building shall be provided to accommodate passengers waiting to embark. The average number of passengers (according to our estimation) is expected to be about one hundred, so the building will be a one-story building with an area of 450 m^2 (150 m x 30 m).

The passenger building is to be located beside the RO/RO berth. A platform will also be provided, connecting the RO/RO berth to the passenger building.

(4) Basin for RO/RO Berth

To accommodate RO/RO and passenger ships, a basin is to be provided with an area of 18,700 m^2, dredged to −7.5 m in front of the berth.

6-3-3 Port Road

A 15 m wide road is planned in order to connect the 7th berth and the RO/RO berth to the existing port road. It will not require paving, as it will be used only temporarily.

6-3-4 Electric Power Supply

Facilities are required to distribute electric power to the following 7th berth equipment:

(1) Container crane

(2) Power outlet in the container yard for refrigerated containers

(3) Lighting for night work

A cable line is to be installed from the 6th to 7th berth, and a substation is required to transform voltage for reefer container outlets.

6-3-5 Communication System

The following communication systems must be installed in the 7th berth to enhance the safety of those who work in operation, maintenance, and management of berth equipment, as well as to improve the efficiency of port management and operation.

(1) Paging system

To provide mutual communication between the control room and all equipment stations of the 7th berth;

(2) Radio communication system

To provide mutual communication between mobile machines, equipment stations, and the control room.

6-3-6 Utilities

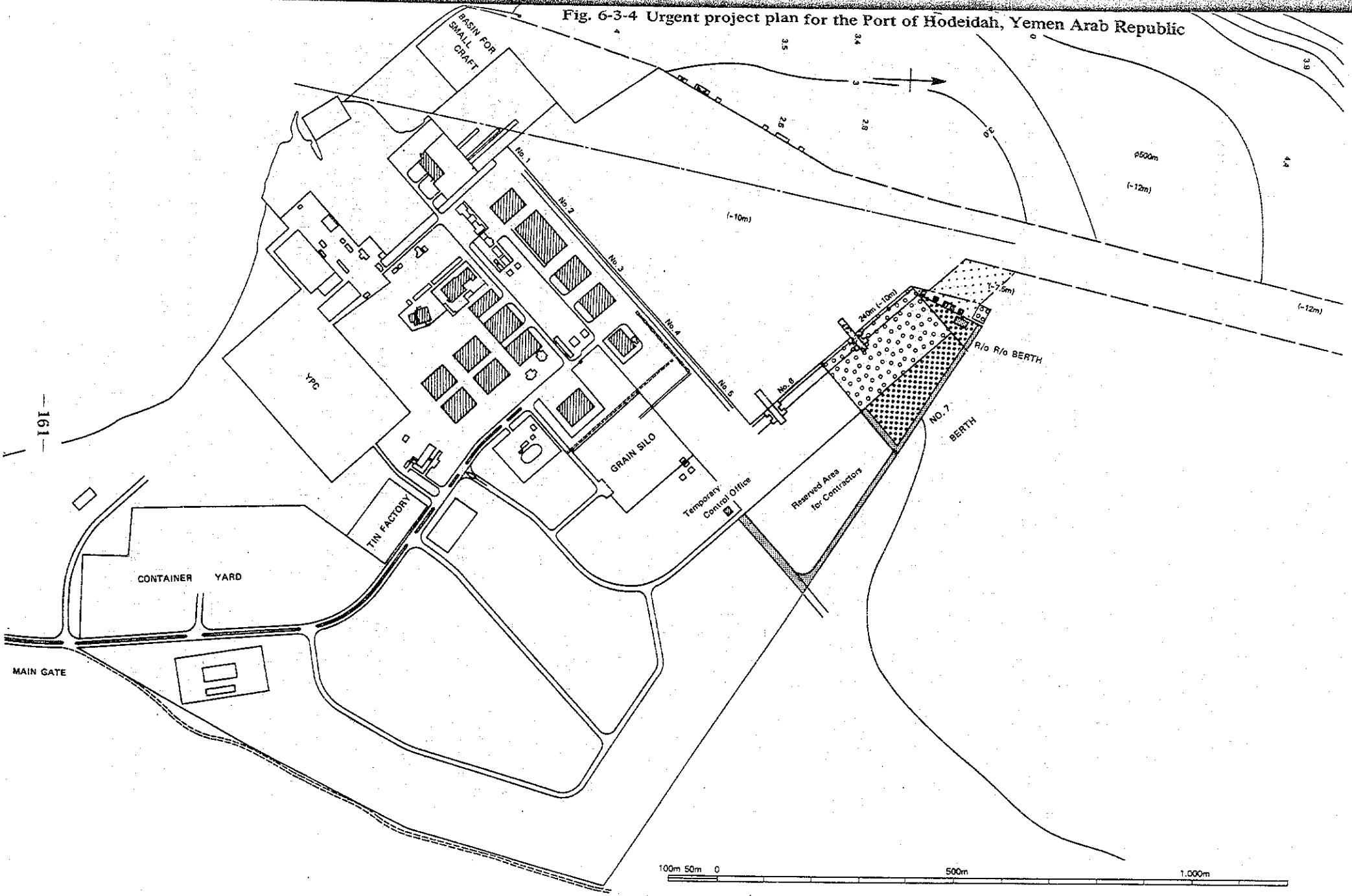
Utilities consist of a water supply system and fire hydrants.

Potable water and firefighting water available at a high pressure are to be supplied through installations at the 7th and RO/RO berth.

6-3-7 Summary

Facilities and equipment to be provided under the Urgent Plan are summarized in Table 6-3-3. Fig. 6-3-4 show the layout of the Urgent Plan facilities.

Fig. 6-3-4 Urgent project plan for the Port of Hodeidah, Yemen Arab Republic



6-3-8 Construction Cost

Construction cost and the yearly investment for Urgent Plan are shown in Table 5-6-1 and Table 5-6-2, Chapter 5.

6-4 Economic Analysis

6-4-1 Method of Analysis

The followings are the basic principles used in analyzing the effects of developing the 7th berth.

(1) The project which this economic analysis covers is the Urgent Plan to be operated from 1986, i.e., construction of the new 240 m wharf and its terminal facilities.

(2) The internal rate of return is computed and used to evaluate this project. The internal rate of return is obtained by the following formula:

$$\sum_{i=0}^{n} \frac{Bi - Ci}{(1 + IRR)i} = 0$$

Bi: Benefit in the 'i – th' year
Ci: Cost in the 'i – th' year
IRR: Internal Rate of Return

The IRR that statisfies the above formula is the internal rate of return.

6-4-2 Benefits

(1) Benefits That Were Analyzed

As stated already, the 6th berth Construction Project was completed at the end of 1981 and the Port of Hodeidah is expected to function more effectively as the port for foreign trade. Especially, the capacity of handling container cargo will make great strides. But to stabilize and develop the economy of the YAR in the future, the Port of Hodeidah must be further improved so as to meet the increase of cargo volumes and be able to cope with new forms of transportation including containerization. This further improvement of the Port of Hodeidah can be expected to reduce ship-waiting cost. It will also induce regional development in the vicinity of the port and the increase of demand for related industries and the increase of employment through the continuation of port construction. But the benefits that effect a wide range of the society and economy can not be easily measured in specific terms. So, the reduction of ship-waiting cost which can be measured is taken into consideration as the benefit for the economic analysis.

(2) Reduction of Ship-Waiting Cost

To compute the reduction of ship-waiting cost, ship waiting time must be measured as exactly as possible. The simulation test was done for this purpose. As a prior premise for the simulation test, the following cases are considered.

Case 1 In the event that the 7th berth Construction Project is not carried out, how much

would be the waiting time for the berthing of general cargo ships and container ships?

Case 2 In the event that the 7th berth Construction Project is carried out, how much would be the waiting time for the berthing of general cargo ships and container ships?

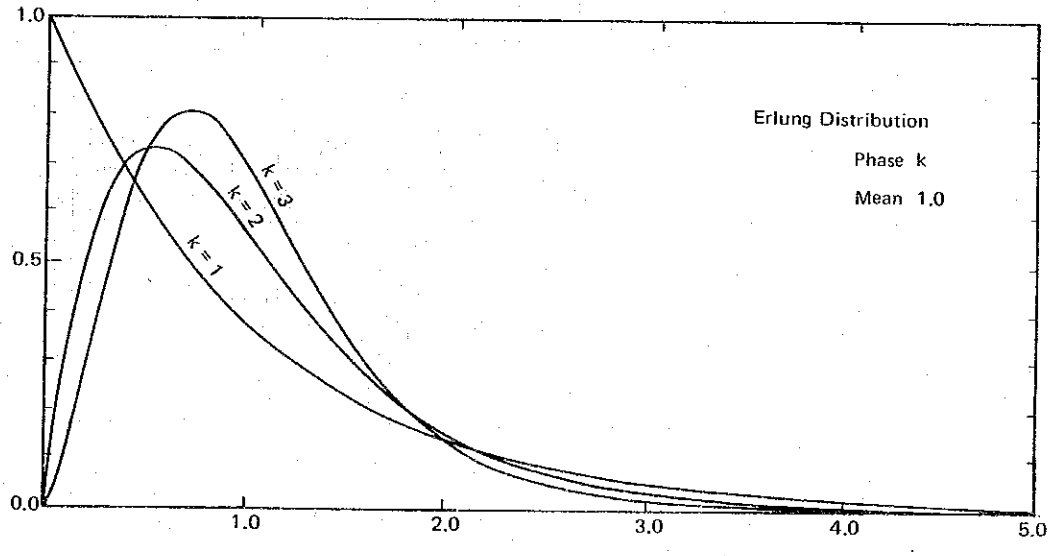
6-4-3 Measurement of Waiting Time by Simulation Test

(1) Application of Queuing Theory to Ports

Ships having entered a port, berth in their designated berths according to the order to arrival for cargo handling. But if these berths are occupied, ships have to wait until ships having arrived earlier leave their berths. This phenomenon of ships arriving and leaving a port can be applied to a queuing theory, as can similarly the situation at problem similar to that a bank, where variables include the number of windows and the time each customer takes at the windows. Using this example of a bank, if the arrival of customers, the number of windows and the service time for customers at the windows are compared respectively to the arrival of ships, the number of berths and the berthing time by ships, the model of ship arrivals and departures at a port is basically, the same as the model used for the phenomenon of window service at a bank, etc. Yet, in spite of this similarity between ships waiting at a port and the above phenomenon at a bank, etc., a queuing theory unique to ports must be developed for two reasons: the difference between the arrival of customers and the arrival of ships, and the difference between the service time for customers by clerks and the berthing time by ships. To this end, the pattern of ship entries and the pattern of the berthing time must be found out. Great efforts are being exerted to clarify these patterns at ports. As for the pattern of ship entries, normally it is random for other than container ships and ferry boats for which regular service is available; Poisson arrivals, namely, entry time intervals are often of exponential distribution in Japan as in other countries.

In the pattern of the berthing time by ships, normally there is one peak expressed by a histogram that is rather on the left side and it often conforms to the Erlung distribution in Phase 2 or Phase 3. (See Fig. 6-4-1)

Fig. 6-4-1 The Erlung Distribution



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

1. Distribution of arrivals of customers to be served
2. Distribution of service times
3. Number of service windows
4. Methods of service

Factor 4 concerns such matters as service in the order of arrival or preferential service. Normally, service in the order of arrival predominates but, in the case of a port, preferential service is considered for full-container ships.

(2) Methodology of the Simulation Test

Ships entering the port take a berth according to their order of arrival and then start loading/unloading work. If the berths are occupied, the ships wait until preceding ships disembark. Queing theory has been used to make a projection concerning the situation of ships calling at or leaving the port. However, theoretical analysis alone cannot cope with the complicated reality of port activities. For this reason, a computer is used to follow the movement of ships chosen at random as they arrive at the port and while they are entering – berthing – loading/unloading and leaving. The computer thus examines waiting and berthing conditions at the Port of Hodeidah.

Fig. 6-4-2 ~ 4 show the flow and structure of the simulation model executed for the current study. In the above flow, the number of ships entering the port and their berthing hours are given, and the number of waiting ships and their waiting time and berthing hours are calculated and the cost for ships' waiting, etc.

Fig. 6-4-2 Structure of Simulation Model

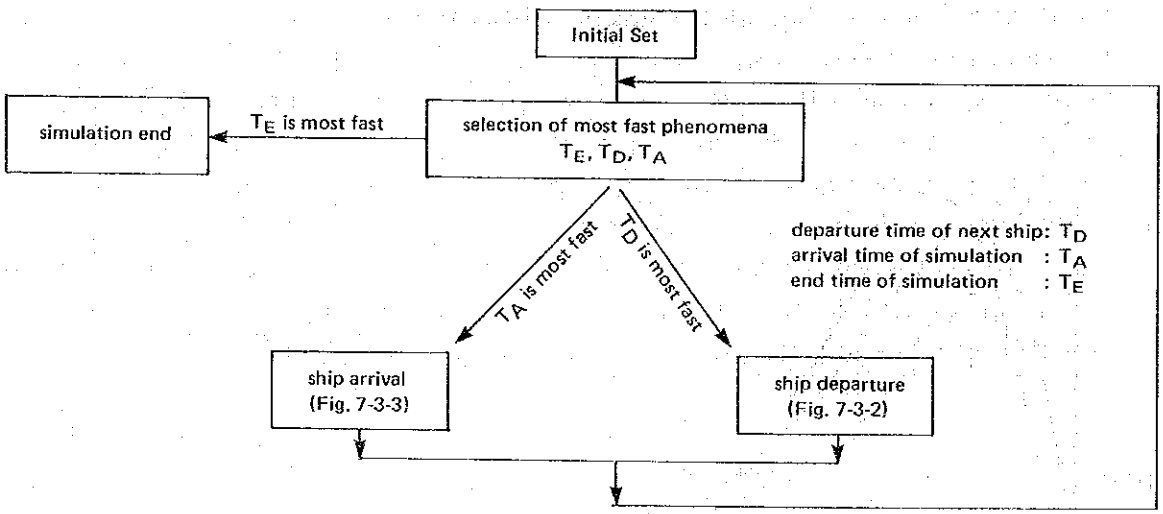


Fig. 6-4-3 Departure

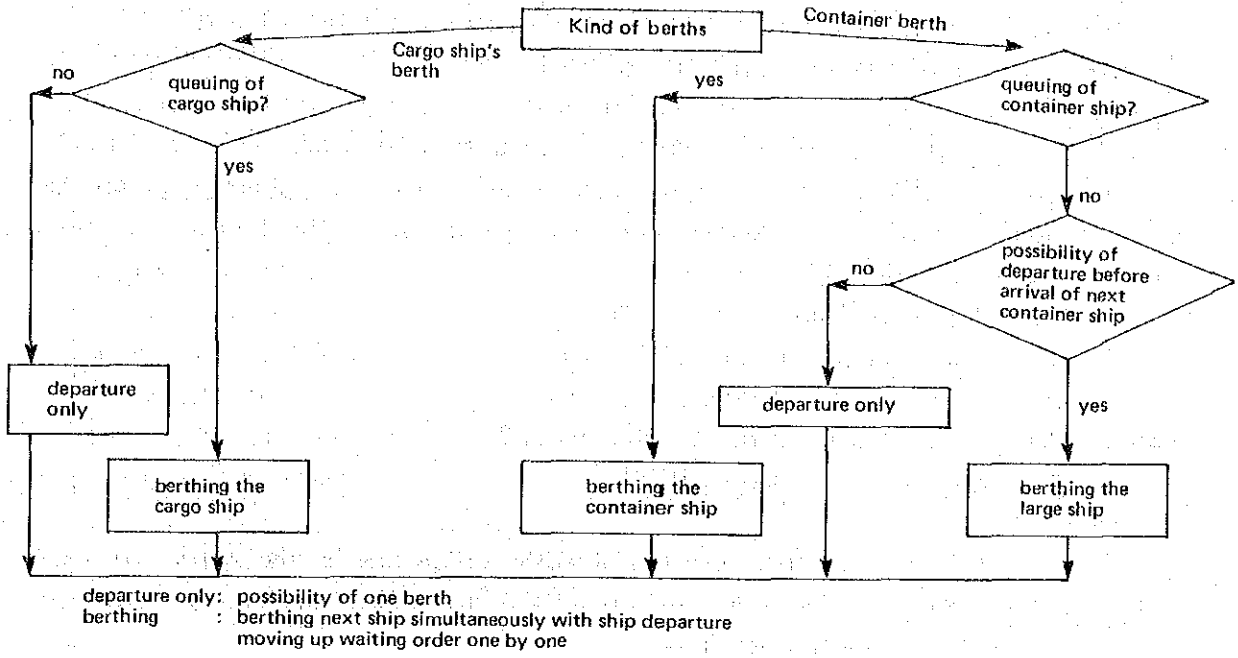
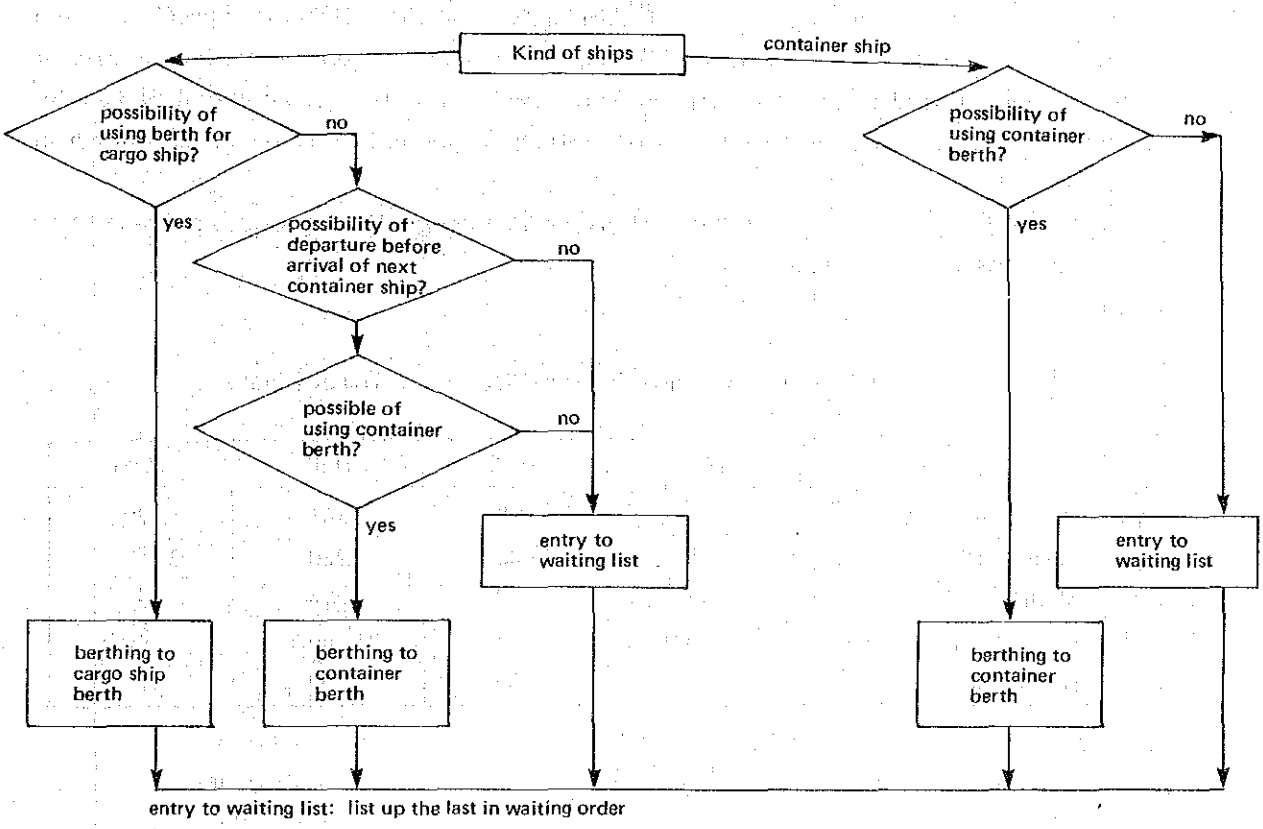


Fig. 6-4-4 Arrival



(3) Simulation Test

1) Simulation Case

Simulation was made every year from 1981 to 2001 for the following cases:

1 case after the completion of the 6th berth Construction, i.e. without 7th berth

2 case of an additional berth to case 1, i.e. with 7th berth

In each case, however, the 6th berth (and 7th berth in case 2) is used for container ships preferentially and the 4th berth and RO/RO berth will be nearly exclusively used for bulk cargo ships and RO/RO ships. Moreover, oil tankers come alongside the oil berths. Accordingly, bulk cargo ships, oil tankers, RO/RO ships and the ships entered the Port of Ras Kathib are excluded from the simulation tests.

The berths and ship types simulated are as follows:

Case 1	General Cargo Ships	Berth 1, 2, 3, 5 and 6
	Container Ships	Berth 6
Case 2	General Cargo Ships	Berth 1, 2, 3, 5, 6 and 7
	Container Ships	Berth 6 and 7

2) Input Data

For simulation it is necessary to estimate the number of ships entering the port and berthing hours for every year. The number of ships entering the port and berthing hours are estimated for general cargo ships and container ships.

2)-A General Cargo Ships

The number of ships can be obtained by deviding cargo volume forecast in Chapter 4 with average cargo tonnage handled per ship. Berthing hours also can be obtained by deviding average cargo handled with handling capacity (tons/hour).

Actual cargo tonnage in average was 1,586 tons in January 1981. But it is expected that the figure will increase at a ratio of about 10% every five years by considering the increase of cargo volumes. It is also expected that handling capacity will grow at an extent of 10% by attaining proficiency. The number of ships, berthing hours and other figures are shown in Table 6-4-1.

As for the berthing time of general cargo ships, Phase 3 Erlung Distribution is assumed to be employed in the simulation test.

Table 6-4-1 The Numbers of Ships, Berthing Hours and Other Figures

Year	1986	1990	1993	2000
Cargo Volumes (1,000 tons)	550	698	561	1,220
Cargo Tonnages per Ship (tons)	1,755	1,900	2,020	2,440
Numbers of Ships	313	367	278	492
Handling Capacities (tons/hour)	30.0	33.0	36.5	40.0
Average Berthing Hours	69	69	69	69

2)-B Container Ship

The average number of containers unloaded at the port is assumed 150 TEU in 1986 and 200 TEU in 2000. Handling productivity is also assumed 18 containers per hour in 1986 and 20 after 1991. The numbers of ships, berthing hours and other figures are shown in Table 6-4-2. As for the berthing hours of container ships is assumed to be employed in the simulation test.

Table 6-4-2 The Numbers of Ships, Berthing Hours and Other Figures

Year	1985	1990	1993	2000
Cargo Volumes (1,000 tons)	450	888	1,158	1,884
Numbers of Containers	37,500	74,000	96,500	157,000
Average Numbers of Containers Unloaded	150	163	170	200
Numbers of Ships	250	455	568	785
Handling Capacities (No./hour)	18	20	20	20
Average Berthing Hours	22	22	22	22

Note: 1 TEU is 12.0 tons;
Average Berthing Hours are computed as follows;

$$\text{Ave. B. Hrs.} = \frac{\text{Ave. No. of Containers Unloaded} \times 2}{\text{Handling Productivity}} + 2 \text{ hours}$$

3) Output Data

Output data are shown in Table 6-4-3 and 6-4-4. The unit costs of ship waiting are assumed 31,500 YR per day for a general cargo ship (average size: 7,500 G/T) and 90,000 YR per day for a container ship (average size: 15,000 G/T).

Table 6-4-3 Case 1, Without 7th Berth

		Cargo Ship	Container Ship	Total
1986	Waiting Time (Days)	78.2	185.4	
	Waiting Costs (1,000 YR)	2,463	16,686	19,149
1987	Waiting Time	83.7	502.4	
	Waiting Costs	2,637	45,216	47,853
1988	Waiting Time	135.1	1,794.1	
	Waiting Costs	4,256	161,469	165,725

Table 6-4-4 Case 2, With 7th Berth

		Cargo Ship	Container Ship	Total
1986	Waiting Time (Days)	73.6	11.2	
	Waiting Costs (1,000 YR)	2,318	1,008	3,326
1987	Waiting Time	78.9	27.4	
	Waiting Costs	2,485	2,466	4,951
1988	Waiting Time	83.2	41.9	
	Waiting Costs	2,621	3,771	6,392

(4) Reduction of staying cost

According to the result of simulation test, in the event that 7th berth is not constructed, the average waiting time for the berthing of arriving ships will greatly increase from 1988. Therefore any increase of this benefit from the previous year cannot be expected, it is assumed that the staying cost is the same from 1987.

6-4-4 Project Costs

The followings are project costs.

(1) Construction cost

(2) Operation cost

(3) Costs of maintenance and repair

1) Construction Cost

The construction cost is 192,128 thousands YR as shown Section 5-6. Yearly investments are as follow.

Year	1983	1984	1985	
Investments	68,594	73,980	49,554	(1,000 YR)

2) Operation Cost

Cargo handling and shipping are performed by private shipping agents at the port. The number of the employees of PMAC is estimated not to increase after construction of the 7th berth. Accordingly, the increase of operation cost is negligible.

3) Costs of Maintenance and Repair

These costs were calculated mainly on the basis of the construction cost. They were assumed 2% of the construction cost.

6-4-5 Calculation Prices

Methods of Determining Calculation Prices

Calculation prices evaluated by border prices (international prices) are used for all benefits and costs. Methods of determining calculation prices are in principle as follows:

(1) Determination of Standard Conversion Factor, Consumption Conversion Factor and Other Conversion Factors

A standard conversion factor is calculated by the following formula because there is no direct export subsidizing system:

$$\text{SCF: } \frac{\text{Total amount of imports and exports}}{\text{(Total amount of imports + total amount of import taxes) + (total amount of exports − total amount of export taxes)}}$$

Statistics concerning exports and imports are shown in Table 6-4-5. The following results are obtained from calculations using these figures;

Table 6-4-5 A List of Statistics on YAR Export and Import

Import

(Unit: Million YR)

Item	78/79	1979	1980
Food and live animals	1,304.8	1,629.7	2,212.6
Beverage and Tobacco	110.3	126.3	103.6
Fuels and Lubricants	134.5	161.6	609.2
Classified Man. Goods	1,267.7	1,648.0	2,140.1
Transport and Mach Equipment	1,584.0	2,277.7	2,348.0
Miscellaneous Manuf.	313.3	425.6	456.8
Chemicals	302.1	448.5	432.2
Others	58.8	89.1	151.8
Total	5,075.5	6,806.5	8,454.3

Export	78/79	1979	1980
Total	28,541	61,681	103,133

Table 6-4-6 YAR Customs Statistics

(Unit: Million YR)

Item	78/79	1979	1980
Import tax	1,670,000	1,709,000	1,617,000
Export tax	4,852	10,486	17,533

1979 0.802

1980 0.843

From this, the standard conversion is set as follows;

SCF = 0.82

(2) Consumption Conversion Factor

It was assumed that the consumption conversion factor equals the standard conversion factor.

(3) Evaluation of Skilled Labor

It is considered that in Yemen Arab Republic, the market mechanism is functioning in regards to the skilled labor force and the market wage rate correctly reflects the contribution of labor to production. It seems therefore, that the present nominal wage truly represents its economic value. Converted into an international price, it is as follows;

Conversion factor of skilled labor = (nominal wage rate)

x (consumption conversion factor)

= 1 x 0.82

= 0.82

(4) Evaluation of Unskilled Labor

Generally in developing countries, the nominal wage paid by a project often exceeds the opportunity cost of labor as far as unskilled labor is concerned.

First, the shadow wage rate was evaluated, and then the conversion factor for unskilled labor was determined.

1. Shadow wage rate

There are, in general, two kinds of formulations for determining a shadow wage rate. Here, the following formulation is used for calculations:

$SWR = C - (C - m)/s$

SWR: Shadow wage rate

C: Wage in market price

m: Opportunity cost

s: Premium on saving (or investment)

1 Estimate of Opportunity Cost

The opportunity cost was estimated from the per-worker agricultural GDP. It is 8 YR/day assuming 26 work days in a month since the agricultural GDP in 1981 is 2,177 million YR and the number of agricultural workers is 830,000.

2 Estimate on the Premium S of Saving/Investment

The premium S is estimated by the following equation:

$$S = \frac{(1 - \theta)\gamma}{i - \theta\gamma}$$

θ: Rate of saving/investment

γ: Rate of return of marginal investment

i: Social discount rate

For θ, 13% of the 1981 value shown in Table 6-4-7 is used.

For γ, 13.5% is used, in consideration of the present level of interest rates for savings in the YAR. Then assuming that i = 4%, the premium S is given as 4.22.

2. Conversion factor for unskilled labor.

The conversion factor for unskilled labor is as follows:

Conversion factor for unskilled labor

= Ratio of shadow wage rate x Conversion factor for consumption

= 0.781 x 0.820

= 0.640

Table 6-4-7 Rate of Saving in YAR

(Unit: Million YR)

	79/80	80/81	81
Government final consumption expenditure	2,190	2,539	2,970
Private final consumption expenditure	12,154	12,812	12,707
Saving	3,466	2,224	2,465
Total	17,810	17,575	18,142
Rate of Saving	19.5%	12.7%	13.3%

Table 6-4-8 Conversion Coefficients of Construction Cost

Type of work	Division component	Foreign currency	Domestic currency					Total Conversion factor 2	1 × 2
			Portion corresponding to trade goods	Unskilled	Skilled labor	Balance	Non trade goods		
	Conversion factor / 1 Composition rate %	1,000	1,000	0.643	0.820	0	0.820		
Breakwater	29.1	(77.8) 0.78	(10.3) 0.10	(4.2) 0.03	(5.8) 0.05	0	(1.9) 0.02	0.98	0.285
Dredging and reclamation	9.9	(32.7) 0.33	(38.2) 0.38	(5.2) 0.03	(20.5) 0.17	0	(3.4) 0.03	0.94	0.093
Pavement	12.0	(31.5) 0.32	(34.7) 0.35	(8.9) 0.06	(11.0) 0.09	0	(13.9) 0.11	0.93	0.112
Crane	10.5	(100.0) 1.00	–	–	–	–	–	1.00	0.105
Building	0.7	(18.8) 0.19	(42.8) 0.43	(13.0) 0.08	(16.6) 0.14	0	(8.8) 0.07	0.91	0.006
Ro/Ro Wharf	4.3	(84.7) 0.85	(7.2) 0.07	(2.8) 0.02	(3.5) 0.03	0	(1.8) 0.01	0.98	0.042
Road	0.2	(15.4) 0.15	(33.8) 0.34	(11.8) 0.08	(16.9) 0.14	0	(22.1) 0.18	0.89	0.002
Others	33.3	(84.0) 0.84	(8.2) 0.08	(2.5) 0.02	(4.0) 0.03	0	(1.3) 0.01	0.98	0.326
Total	100.0	–	–	–	–	–	General conversion factor 0.971		

Note: 1. Figure in ( ) is composition ratio (%) by component of each type of work.
2. Conversion factor by type of work =
Σ { composition ratio by component in ( ) } × (conversion factor of each component)
3. General conversion factor =
Σ (composition ratio of each type of work 1) × (conversion factor by type of work 2)

6-4-6 Economic Profitability

The economic profitability of this project is evaluated by the internal rate of return and in accordance with the above results.

The internal rate of return is the IRR determined by the following formula:

$$\sum_{i=0}^{n} \frac{Bi - Ci}{(1+\gamma)^i} = 0$$

n: Period of calculation

Bi: Benefit in 'i – th' year

Ci: Cost in 'i – th' year

γ: Rate of discount

25 years was employed as the lifetime of the project. The period of calculation for benefits was counted from 1986, when use of the 7th berth will commence, until the year 2010.

The result is 15.6% in calculated price 15.2% in market price. Benefits and IRR calculation sheets are shown in Table 6-4-11 and 6-4-12.

Table 6-4-9 Internal Rate of Return

Calculated price	15.6%
Market price	15.2%

6-4-7 Evaluation

Many views exist concerning the percentage of an internal rate as an index in making judgements as to whether a project is feasible or not. A prominent view is that feasibility requires at least a rate of 15%. From this, it can be seen that this project is quite feasible from a economic view point.

Table 6-4-10 Benefits (Differences of Waiting Costs)

Year	I Without 7th Berth	II With 7th Berth	I – II Differences (Benefits)
1986	19,149	3,326	15,823
87	47,853	4,951	42,902
88	↓	↓	↓
89	↓	↓	↓
90	↓	↓	↓
91	↓	↓	↓
92	↓	↓	↓
93	↓	↓	↓
94	↓	↓	↓
95	↓	↓	↓
96	↓	↓	↓
97	↓	↓	↓
98	↓	↓	↓
99	↓	↓	↓
2000	↓	↓	↓
1	↓	↓	↓
2	↓	↓	↓
3	↓	↓	↓
4	↓	↓	↓
5	↓	↓	↓
6	↓	↓	↓
7	↓	↓	↓
8	↓	↓	↓
9	↓	↓	↓
10	↓	↓	↓

Table 6-4-11 IRR Calculation Sheet (1)
(market price)
15.2%

Year	A			B	B – A
	Investments	Maintenance Costs	Total	Benefits	Net Benefits
1983	68,594	0	68,594	0	–68,594
84	73,980	0	73,980	0	–73,980
85	49,554	0	49,554	0	–49,554
86	0	3,843	3,843	15,823	11,980
87	0	3,843	3,843	42,902	39,059
88	↓	↓	↓	↓	↓
89					
90					
91					
92					
93					
94					
95					
96					
97					
98					
99					
2000					
1					
2					
3					
4					
5					
6					
7					
8					
9					
10	↓	↓	↓	↓	↓

Table 6-4-12 IRR Calculation Sheet (2)
(Calculated Price)
15.6%

Year	A			B	B — A
	Investments	Maintenance Costs	Total	Benefits	Net Benefits
1983	66,605	0	68,594	0	–66,605
84	71,835	0	73,980	0	–71,835
85	48,117	0	49,554	0	–48,117
86	0	3,843	3,843	15,823	11,980
87	0	3,843	3,843	42,902	39,059
88	↓	↓	↓	↓	↓
89					
90					
91					
92					
93					
94					
95					
96					
97					
98					
99					
2000					
1					
2					
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10					

6-5 Financial Analysis

6-5-1 Purpose of Financial Analysis

The purpose of financial analysis is to study its past and present financial situation to analyze how the costs and profits of the project affect the financial position of the management body, and to propose measures to make it financially more sound.

6-5-2 Financial Position of PMAC

The financial position of PMAC is generally satisfactory. Detailed financial statements for the year 1978 – 1980 are shown in Table 6-8-1. As referring in the preceding chapter, PMAC administrates and manage the Ports of Hodeidah, Ras Kathib and Mocha. So the financial statements include the data of these Ports.

6-5-3 Methods of Analysis

The profitability of the 7th berth construction project of the Port of Hodeidah is evaluated by analyzing costs and revenues.

(1) Revenue

Only the revenues being expected from the 7th berth was used for this analysis. Revenues consist of goods' income and ships' income. Whereupon, the revenue was estimated as follows;

1 It is considered that the 7th berth will handle general cargoes besides containers while the berth is not used by a container ship. However in this financial analysis, the 7th berth is assumed to handle only containers. And it is regarded to handle 60% of them.
2 An average container ship size was assumed to be 15,000 GT, 190 m in length and loading 800 containers.
3 In calcurating revenues, the present tariff was used.
4 RO/RO Berth, will be constructed by 1986 at west corner of the 7th berth. The new RO/RO berth is expected to be operated together with 7 berth. So revenues which will be obtained from the new RO/RO berth was added to those from the 7th berth. An average RO/RO ship size was assumed to be 5,000 GT, 160 m in length.
5 Forecast of the number of calling ships and volume of unloading cargoes for the 7th berth is shown in Table 6-5-2.
6 Detail of revenues caluculation shows in Table A 6-5-1.

Table 6-5-1(1) Statement of Profit and Loss

Unit: YR

	1977/79	1978/79	1979/80	1980/6 ∿ 12	1981
1. Operating Revenue 2+6	*65,007,470.50	73,791,447.22	84,116,822.46	44,774,897.49	84,555,701.74
2. Income from current activities		70,374,750.18	70,313,513.99	32,644,625.44	69,702,931.99
3. Income of goods (warehouse, forklifts)		49,270,487.13	48,002,555.55	26,073,193.30	44,323,919.14
4. Income of ships		18,171,048.16	20,279,695.87	1,189,018.69	21,598,786.97
5. Income of outer (electric, repairing)		2,933,214.89	2,031,262.57	5,382,413.45	3,780,225.88
6. Different income		3,416,697.04	13,803,308.47		
7. Other income (entrance of people, cars)		3,416,697.04	13,803,308.47		
8. Operating Expenses 9 + 15 + 19	20,994,177.07	28,197,495.29	39,663,759.00	24,697,481.34	65,563,929.47
9. Salary and Wage		14,043,253.29	17,913,700.23	10,597,565.39	24,144,759.25
10. Salaries cash payment		6,603,205.89	7,928,326.17	4,772,864.99	9,787,921.92
11. Reinvestment and allowances		4,595,250.68	6,008,459.43	4,053,231.40	8,603,443.37
12. Advantage		171,984.42	243,017.80	134,264.30	279,005.58
13. Over time, Bonus, Special Salary		1,204,561.00	1,862,313.27	615,264.18	2,920,126.47
14. Salaries for foreign experts		1,468,251.30	1,871,583.56	1,021,940.52	2,454,261.91
15. Materials		3,730,720.76	6,319,896.14	4,196,065.09	10,266,481.88
16. Fuel for engine		2,564,672.80	4,387,018.18	3,504,686.51	8,314,130.00
17. Spare parts		1,054,695.92	1,734,411.55	602,553.18	1,827,379.37
18. Material for stationary		111,352.04	198,466.41	88,825.40	124,972.51
19. Other Expenses		10,423,521.24	15,430,162.63	9,903,850.86	31,152,688.34
20. Maintenance and repairs		455,209.63	370,508.50	79,609.00	237,106.34
21. Public Relation and Advertisement		91,202.43	68,072.40	41,389.47	99,882.31
22. Transportation		352,005.49	361,326.22	91,500.92	538,321.54
23. Payment for rental machine		5,800.00	0.00		
24. Government Service		145,020.00	219,948.00	98,010.00	188,975.00
25. Pension		40,000,00	40,000.00	35,000.00	50,000.00
26. Depreciation	(4,947,669.75)	8,721,448.44	13,719,113.72	9,254,943.87	28,954,971.14
27. Rent		232,384.62	277,866.00	129,000.00	260,050.00
28. Rewards for part-time		7,650.00	7,953.16	9,968.00	182,161.50
29. Other		372,800.63	365,374.63	164,429.60	641,220.51
30. Net Operation Income 1 - 8 (Before Depreciation)	44,013,293.43 (48,960,963.18)	45,593,951.93 (54,315,400.37)	44,453,063.46 (58,172,177.18)	20,077,416.15	18,991,772.27
31. Other Income		2,490,186.11	5,070,477.52	4,668,219.81	11,261,061.39
32. Interest from creditor, bank		1,086,440.84	3,569,264.22	3,664,898.50	6,011,493.17
33. Rental land		1,401,458.00	1,138,659.00	860,054.00	1,490,395.00
34. Income for previous year	(134,922.20)	2,287.27	328,040.31	143,267.31	3,450,237.52
35. Profit		0	34,513.99	0.00	308,935.70
32. Other Expenses	4,759,096.20	1,874,510.47	8,495,026.08	4,148,562.58	17,109,499.36
33. Commission and Interest	-	105,626.54	2,462,716.60	3,272,282.96	11,103,318.36
34. Forfeit	-	49,600.00	691,197.45	0.00	
35. Expenses of previous years	151,556.28	221,214.99	857,922.97	161,686.16	392,437.25
36. Loss dividend	4,607,539.92	4,254.00	0	4,899.20	0.00
37. Loss from initial price	-	0.00	938.26	0.00	
38. Reserve for pension	-	1,493,814.94	4,475,850.80	687,394.26	5,577,923.75
39. Other		0	6,400.00	22,300.00	35,820.00
Net Profit 30 + 31 - 32	39,254,197.23	46,209,627.57	41,028,514.90	19,557,758.92	13,143,334.30

* Include other income 31

Table 6-5-1(2) Balance Sheet

	1978/5.30	1979/6.30	1980/6.30	1980/12.31	1981/12/31	
Fixed Assets	137,861,596.93	159,729,214.95	285,971,414.74	326,097,799.34	402,419,926.11	
Land	11,795,200.00	11,795,200.00	11,795,200.00	11,795,200.00	5,897,600.00	
Building	10,175,491.75	20,006,352.25	24,442,310.03	24,960,975.73	58,982,680.40	
Berth of Hodeidah	38,752,231.89	53,934,285.80	103,891,020.30	103,697,350.30	124,140,904.26	
Basin and Channel	23,070,000.00	23,070,000.00	59,224,001.10	59,308,102.10	63,672,492.11	
Open Area	5,708,866.20	6,350,674.20	23,079,578.54	26,673,173.04	24,957,369.24	
Roads	221,300.00	221,300.00	221,300.00	221,300.00	290,567.50	
Cold Strage	3,291,743.00	3,291,743.00	3,291,743.00	3,291,743.00	3,407,941.00	
Tele Station	45,432.00	45,432.00	45,432.00	45,432.00	185,890.30	
Water pump	10,170.00	10,170.00	10,170.00	10,170.00	0.00	
Water net work	848,773.82	848,773.82	1,031,273.82	1,031,273.82	970,651.64	
Handling Equipment	2,220,383.33	3,572,266.33	4,318,872.23	4,319,172.23	15,460,998.17	
Tug Boat	11,333,438.05	11,333,438.05	29,881,115.42	29,881,115.42	37,898,137.53	
Dreger	3,930,000.00	3,930,000.00	4,858,143.57	4,858,143.57	5,641,357.91	
Generator	3,600,000.00	5,214,686.55	5,289,686.55	5,289,686.55	6,951,002.05	
Outside and Inside Port Electricity	1,286,116.28	1,286,116.28	1,286,116.28	1,286,116.28	3,639,690.12	
Carpenter shop and Equipment	5,624.00	5,624.00	5,624.00	5,624.00	11,463.20	
Maintenance Shop	55,746.00	400,885.86	55,746.00	55,746.00	414,610.40	
No.4 Berth Construction Material	2,070,673.66	0.00	0.00			
Transport Means	1,095,969.69	1,706,141.28	1,920,478.02	2,167,478.02	2,021,622.55	
Furnitures	552,895.00	769,285.43	957,549.43	1,041,747.43	1,788,682.92	
Becons and Lighting	0	0	1,899,815.89	1,899,815.89	5,897,212.98	
Under Construction	14,374,232.32	8,853,976.41	4,010,154.74	38,745,580.88	15,724,241.61	
Stock (Spare Parts)	3,417,309.94	3,082,863.69	4,456,083.82	5,512,853.08	6,215,073.25	
					18,249,736.97	(Floating Crane)
Floating assets	39,408,729.42	99,160,419.83	61,109,291.22	92,037,443.78	168,925,904.57	
Letter of credit	25,300,259.21	82,425,467.16	10,320,191.10	13,452,892.56	12,247,546.64	
Agent	6,676,603.59	5,650,998.15	5,686,137.88	7,459,968.46	12,740,445.19	
Account of Branch	0.00	40,194.52	217,102.80	685,781.99	915,041.75	
Other indebt	256,449.58	994,264.98	265,426.10	530,247.74	291,892.74	
Importer	5,220,177.25	5,616,141.92	42,598,179.18	69,477,082.77	135,633,158.35	
Ministry of Finance	1,955,239.79	4,483,353.12	2,022,254.16	431,470.26	7,097,819.90	
Borrowing and guarantees	458,422.23	674,279.30	648,801.23	860,035.88	814,267.41	
Terminal Borrowing	90,042.71	110,699.81	101,032.34	128,823.69		
Borrowing for the staff	256,691.63	386,769.58	434,081.00	617,524.30	793,783.41	
Gurantee for others	111,687.89	176,809.91	113,687.89	113,687.89	20,484.00	
Carried forward	247,751.00	1,209,707.30	1,966,364.41	6,567,357.92	6,627,778.42	
Payable income	232,851.00	1,206,384.66	1,879,433.95	6,421,288.42	6,351,437.46	
Expenses inadvance	14,900.00	3,322.64	86,930.46	146,069.50	276,340.96	
Cash in Banks	11,789,758.16	40,918,513.71	55,290,852.14	59,769,857.80	49,504,843.26	
Treasury	49,379.50	75,820.98	128,663.21	239,982.41	206,273.64	
Banks	11,740,378.66	40,842,692.73	55,162,188.93	59,529,875.39	49,298,569.62	
Total	189,766,257.74	301,692,135.11	404,986,723.74	485,332,494.72	628,292,719.77	

	1978/6.30	1979/6.30	1980/6.30	1980/12/31	1981/12/31
Capital	36,801,200.00	36,801,200.00	36,801,200.00	36,801,200.00	36,801,200.00
Reserves	63,363,365.16	95,596,322.60	132,563,966.60	176,596,776.03	219,064,004.13
Legal reserves	5,330,913.52	9,256,333.24	13,877,296.24	17,980,148.14	19,935,924.03
General reserves	14,647,523.55	14,647,523.55	23,889,449.55	24,146,577.55	39,036,017.28
Reserves for loans	10,444,646.70	25,444,646.70	43,928,438.70	54,185,566.70	60,052,894.38
Port expansion reserves	14,659,901.80	14,659,901.80	19,280,864.80	37,486,466.80	27,486,466.80
Currency	1,693,332.02	2,193,332.02	2,193,332.02	2,193,332.02	2,193,332.02
Currency for assets	3,970,005.50	3,970,005.50	3,970,005.50	13,169,405.19	15,125,181.08
Currency for emergency	719,975.37	719,975.37	719,975.37	2,730,675.21	7,153,644.68
Currency to land project	11,897,066.70	24,704,604.42	24,704,604.42	24,704,604.42	24,704,604.42
Deposit	16,928,121.17	32,284,695.09	55,191,690.28	60,106,973.19	87,937,679.42
Depreciation	403,918.24	5,590,827.79	10,509,923.71	5,523,902.75	5,531,657.04
Total of depreciation	8,383,960.93	17,279,695.41	30,895,197.68	40,150,141.55	62,527,049.49
Reserve for Pension	8,140,242.00	9,181,135.00	13,553,532.00	14,199,892.00	19,645,936.00
Provaiding of debts	0	233,036.89	233,036.89	233,036.81	233,036.89
Other Grediters	32,240,587.13	89,437,340.56	136,682,115.82	189,747,545.25	267,129,612.49
Agent	292,498.89	187,807.02	49,240.84	31,479.50	130,914.32
Tax department	132,498.74	235,311.33	377,939.46	637,079.46	1,447,106.65
Other debters	301,420.69	98,181.63			
Iranian Loan	12,000,000.00	12,000,000.00	21,655,634.73	41,364,824.72	57,984,252.42
Bank Central	18,641,161.58	74,388,677.27	112,336,777.26	145,842,980.00	199,190,410.95
Rossian loan	873,007.23	620,460.94	2,258,716.69	1,867,761.00	8,374,084.36
Borrowing from staff and ports	0.00	2,678.25	3,806.84	3,420.57	2,843.79
Other	0.00	1,904,224.12	0.00		
Deposit for other creditors	1,178,787.05	1,362,949.29	2,719,236.14	2,522,241.33	4,216,889.43
Payable expense	792,032.93	922,438.69	1,398,159.77	1,010,216.01	2,345,406.80
Insurance and guarantee	347,276.32	423,510.60	1,197,278.87	1,410,340.32	1,839,797.63
Payment for board members	39,477.80	17,000.00	31,685.00	101,685.00	31,685.00
Income payed inadvance	0.00	0.00	92,112.50	0.00	
Net Profit	39,254,197.23	46,209,627.57	41,028,514.90	19,557,758.92	13,143,334.30
Total	189,766,257.74	301,692,135.11	404,986,723.74	485,332,494.72	628,292,719.77

Table 6-5-2 Forecast of the Number of Calling Ship and Volume of Unloading Container Cargo

Year	Ship	Container Cargoes
1986	150	410
87	180	475
88	↓	↓
89		
90		
91		
92		
2010		

From the above-mentioned conditions, the revenues were calculated as shown in Table 6-5-3.

Table 6-5-3 The Revenue of 7th Berth

(Unit: 10^3 YR)

Year	Ship	Cargo	Total
1986	6,760	16,239	22,999
87	7,738	18,849	26,587
88	↓	↓	↓
89			
90			
91			
2010			

(2) Operating Expenditure

The following are operating expenditure.

1) Construction cost
2) Operation cost
3) Costs of maintenance and repair
4) Depreciation

1) Construction cost, 2) Operation cost and 3) Costs of maintenance and repair.

The same costs as those employed in 6-4-4 were also used as the costs for 1) ~ 4).

4) Depreciation

Depreciation is made by the fixed instalment method. The period of depreciation is shown Table 6-5-4.

Table 6-5-4 Depreciation Rates and Periods by Facility

Name of Facility	Depreciation	Period of Depreciation
Building	0.02	50
Wharf	0.02	50
Road	0.03	30
Container Crane	0.05	20

6-5-4 Financial Rate of Return

A financial rate of return (FRR) can be calculated by the following formula:

$$\sum_{i=0}^{n} \frac{Bi - Ci}{(1+r)i} = 0$$

Bi: Benefits in i – th year

Ci: Costs in i – th year

r: Rate of discount

A rate of discount which satisfy above formula is called FRR.

25 years was adopted to calculate FRR of the project. The result is 7.7% under the present tariff.

6-5-5 Evaluation

The result, 7.7% of FRR, is considered to be allowable taking the public role of the project into consideration and comparing with past lending rates.

Judging from the results, the financial position of PMAC is expected to be satisfactory even in executing the project. Therefore, it can be said that this project in feasible from a financial view-point.

Table 6-5-5 FRR Calculation Sheet
7.7%

(Unit: 10^3 YR)

Year	Construction Cost	Operation Cost	Revenue	Net Profit
1983	68,594			△68,594
84	73,980			△73,980
85	49,554			△49,554
86		7,151	22,999	15,848
87			26,587	19,436
88				
89				
90				
91				
92				
93				
94				
95				
96				
97				
98				
99				
2000				
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

6-6 Port Management and Operation

6-6-1 Operation System during Phase I of No. 7 berth

As mentioned in the previous section, during phase I of the 7th berth, it is predicted that container volume will be relatively small. Accordingly, a similar container handling system to the one in use at present is recommended during this period.

The following is an outline of the proposed container terminal operation system.

(1) Container flow (refer to Fig. 6-6-1)

(a) All import container are unloaded from the ship in accordance with the "unloading sequence list" prepared by the ship planner.

(b) All import containers are transferred from the wharf apron to the open storage yard and stacked in accordance with the "import yard decking plan" prepared by the yard planner.

(c) Cargoes to be delivered to consignees as break bulk are unpacked in the open storage yard. Emptied containers remain in place until time of shipment.

(d) Door-to-door service containers are delivered to consignees as packed container directly from the open storage yard.

(e) Containers with mixed load cargoes are moved to their respective transit sheds, where cargoes are removed from the containers and sorted by consignee, then delivered to each consignee.

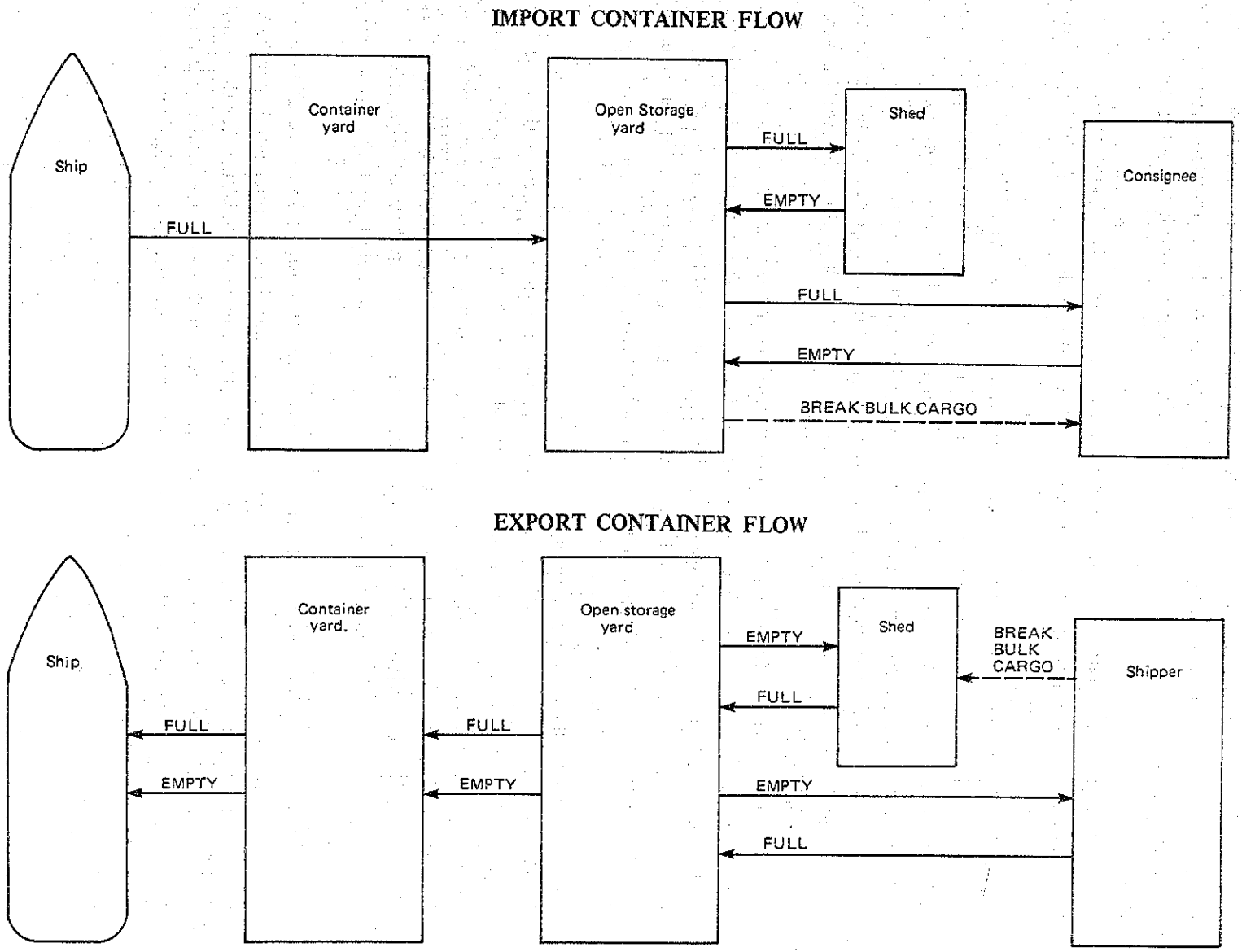
(f) Containers are emptied at transit sheds or on consignee's premises and export containers are received at the open storage yard and stored until time of shipment.

(g) Prior to ship arrival, all export (full and empty) containers are transferred to the container yard immediately behind the berth apron and stacked in accordance with the "export yard decking plan" prepared by the yard planner.

Note: these transfer operations are aimed at providing sufficient space for incoming ship loads of import containers in the open storage yard.

(h) All export (full and empty) containers are loaded on the ship in accordance with the "loading sequence list" prepared by the ship planner.

Fig. 6-6-1 Container Flow



(2) Import container operation procedure

Containers unloaded from ship are loaded directly onto trucks or trailers, according to the "unloading sequence list" (Refer to Table 6-6-1) drawn from the "import stowage plan", (Refer to Fig. 6-6-3) and transferred to the open storage yard. Containers are then unloaded from the trucks or trailers by forklift, and piled two high, in stacks two 20-foot containers (or one 40-foot container) long by four containers wide, the door of each container facing out to enable unpacking of cargo.

When a consignee requests to receive the cargoes as break bulk, the consignee's truck shall be permitted to drive up in front of container's door and devan the cargoes onto the truck for delivery.

In the case of door to door service, packed containers are to be loaded onto the trucks.

The container stacks at the yard should be arranged regularly, at intervals of approx. 6 m long and approx. 15 m wide, to allow for maneuvering of forklifts and trucks. The containers should be stacked according to the "yard stacking plan" prepared by the yard planner.

The yard stacking plan is required in order to constantly monitor the yard to ensure that space is available for each container as it arrives, and to monitor the container location and inventry at all times.

Schematic representations of the yard stacking plans (refer to Fig. 6-6-2) are usually available in the terminal control center. They are used to display the locations of containers in the stacking yard. The exact locations of the various containers are recorded by using colored cards, stickers, etc., the position of these cards or stickers being adjusted constantly to reflect movement of containers within the yard, receiving/delivering, loading/unloading, etc..

(3) Export container operation procedure

Full containers for export are received at either the open storage yard or the container yard directly behind the berth apron, although it should be understood that full export containers leaving the YAR are very few in number, and that the majority of containers exported are empty.

Prior to ship arrival, all export containers for that ship are transferred to the container yard directly behind the berth to make space for import containers in the open storage yard.

Export containers are unloaded from trucks or trailers by forklift and piled in blocks one or two high.

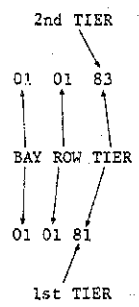
All export containers should be stacked in the container yard, again in accordance with the yard stacking plan, to confirm the number of containers and the container number to be loaded, and to allow drafting of the "loading sequence list" (Refer to Table 6-6-2). After the completion of the ship's container unloading operation, the export containers are moved under the gantry crane's lifting spreader according to "loading sequence then loaded on ship according to the export stowage plans" (Refer to Fig. 6-6-4).

Table 6-6-1 Unloading Sequence List

Vessel. M/S "Hodeidah Maru" Voy No. 1
Bay No. 12 (O/D) U/D

No.	Container Number	Vessel Location	Weight	Yard Location	Remark
1	SHWU 2021746	12-08-84	11.0	01-02-81	FCL
2	UFCU 227353	12-06-84	21.1	01-02-83	LCL
3	SSIU 3038744	12-04-84	22.4	02-02-81	
4	SSIU 2206421	12-02-84	22.7	02-02-83	
5	NYKE 4267	12-00-84	24.2	03-02-81	
6	SLDR 4860299	12-01-84	22.2	03-02-83	
7	SHWU 2002377	12-03-84	21.3	04-02-81	
8	NYKU 6753741	12-05-84	19.8	04-02-83	
9	SHWU 2003427	12-07-84	13.6	05-02-81	
10	SLRF 4860109	12-08-82	23.6	05-02-83	
11	NYKU 7820572	12-06-82	23.6	06-02-81	
12	NYKU 7722492	12-04-82	23.2	06-02-83	
13	SLRF 4860292	12-02-82	22.8	07-02-81	
14	NYKU 7820736	12-00-82	23.7	07-02-83	
15	NYKU 7816757	12-01-82	25.1	08-02-81	
16	NYKU 7821630	12-03-82	9.0	08-02-83	
17	NYKU 7725153	12-05-82	24.4	09-02-81	
18	SLRF 4860407	12-07-82	23.2	09-02-83	
19					
20					
21					
22					

Fig. 6-6-2 Yard Stacking Plan

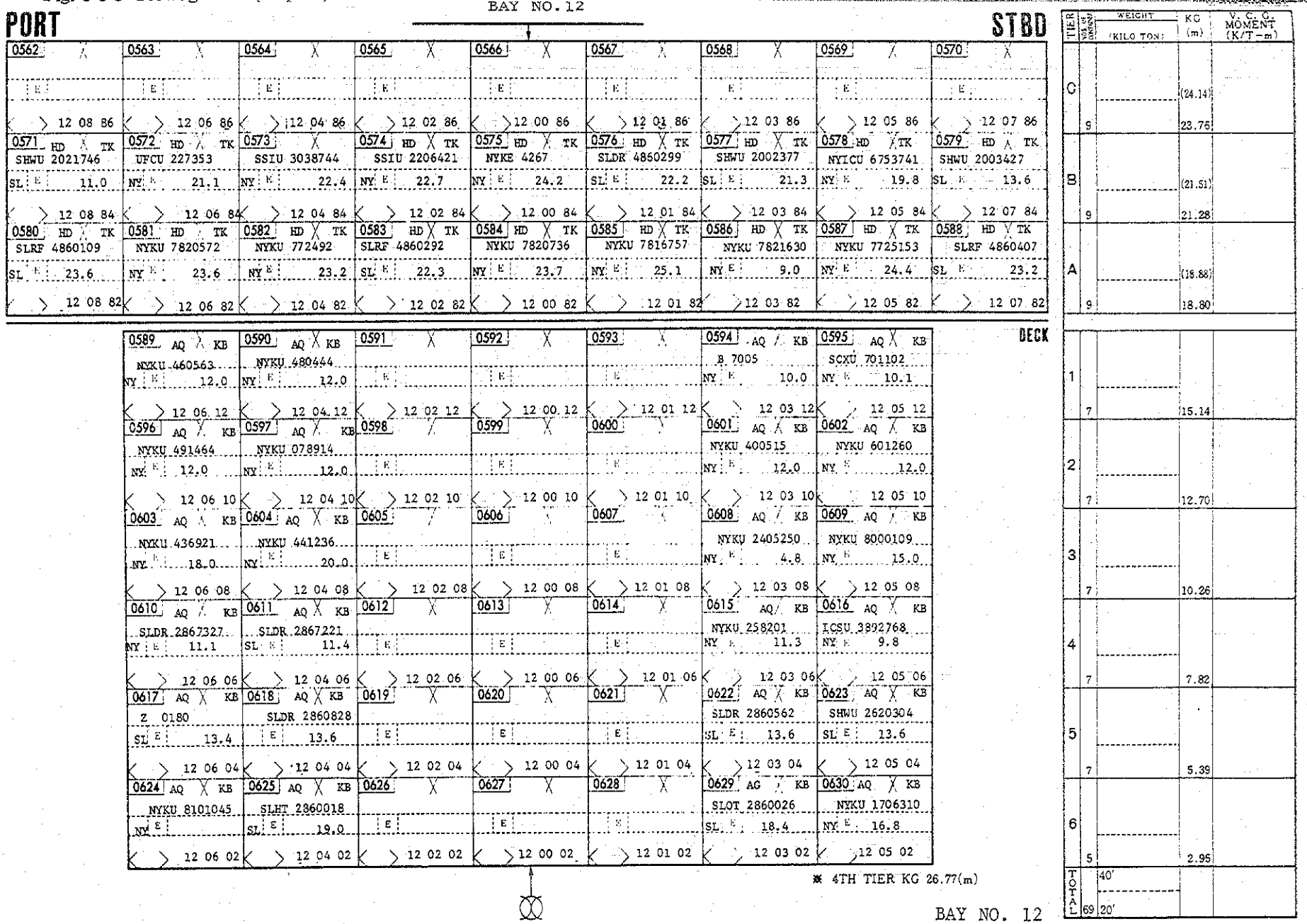


40' ROW
..even number

LOCATION OF
JCTU 4812416
is
030283

	01	03	05	07	09	11
01	NYKE6423215 E 010183	010383	010583	010783	010983	011183
	TEXU 2651633 17.6 010181	010381	010581	010781	010981	011181
02	SCXU 2874951 10.0 020183	020383	020583	020783	020983	021183
	NYKU 2041323 020181	020381	020581	020781	020981	021181
03	JCTU 4812416 40' E 030183	030383	030583	030783	030983	031183
	JCTU 4811852 40' E 030181	030381	030581	030781	030981	031181
04	040183	040383	040583	040783	040983	041183
	040181	040381	040581	040781	040981	041181
05	050183	050383	050583	050783	050983	051183
	050181	050381	050581	050781	050981	051181
06	060183	060383	060583	060783	060983	061183
	060181	060381	060581	060781	060981	061181
07	070183	070383	070583	070783	070983	071183
	070181	070381	070581	070781	070981	071181
08	080183	080383	080583	080783	080983	081183
	080181	080381	080581	080781	080981	081181

Fig. 6-6-3 Stowage Plan (Import)



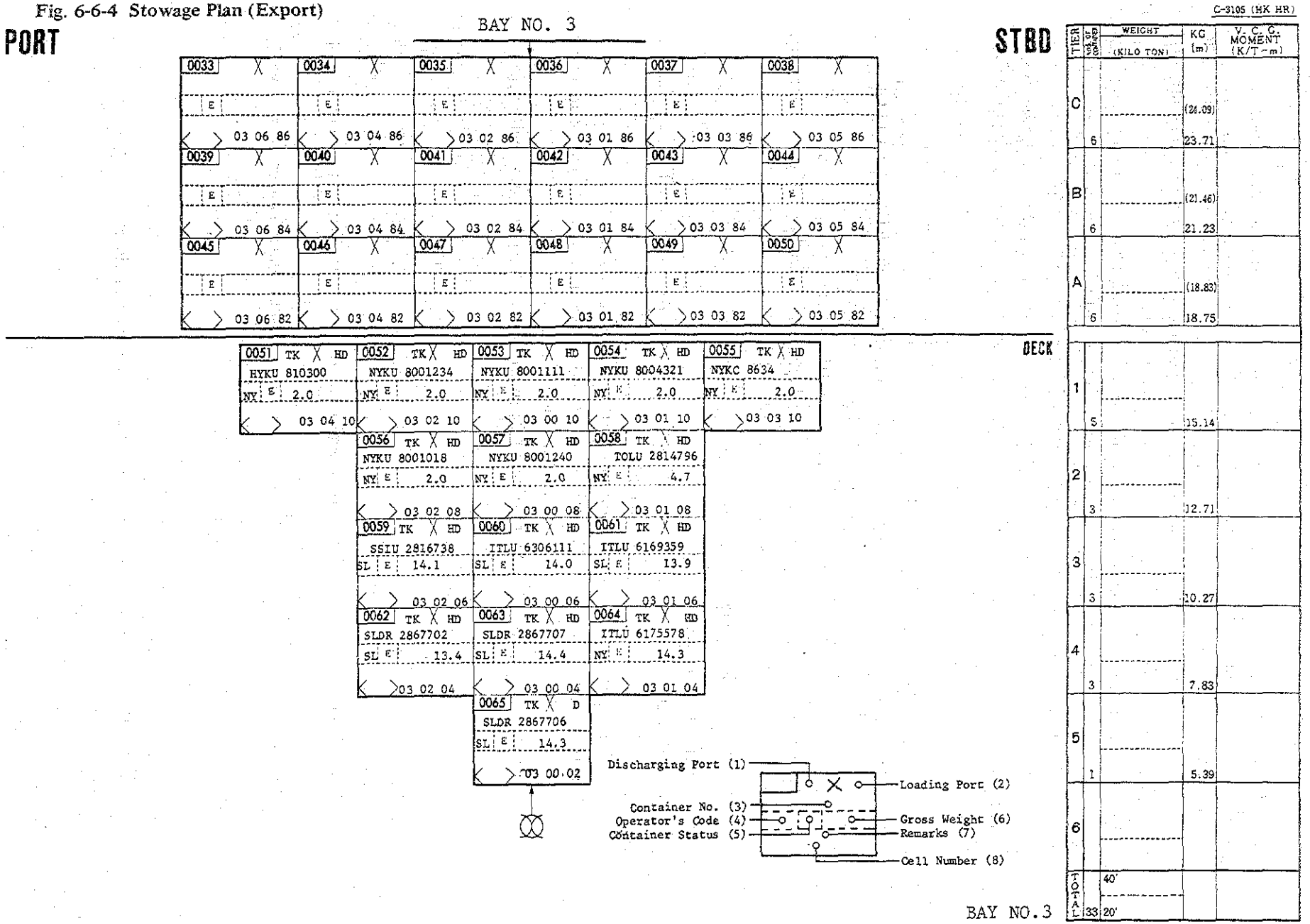
TIER	NO. (WEIGHT)	WEIGHT (KILO TON)	KG (m)	V. C. G. MOMENT (K/T − m)
C			(24.14)	
	9		23.76	
B			(21.51)	
	9		21.28	
A			(18.88)	
	9		18.80	
1	7		15.14	
2	7		12.70	
3	7		10.26	
4	7		7.82	
5	7		5.39	
6	5		2.95	
TOTAL	69	40' 20'		

Table 6-6-2 Loading Sequence List

Vessel. M/S "Hodeidah Maru" Voy No. 1
Bay No. 3 O/D (U/D)

No.	Container Number	Yard Location	Weight	Vessel Location	Remark
1	SLDR 2867706	01-05-83	14.3	03-00-02	
2	SLDR 2867702	01-05-81	13.4	03-02-04	
3	SLDR 2867707	02-05-83	14.4	03-00-04	
4	ITLU 6175578	02-05-81	14.3	03-01-04	
5	SSIU 2816738	03-05-83	14.1	03-02-06	
6	ITLU 6306111	03-05-81	14.0	03-00-06	
7	ITLU 6169359	04-05-83	13.9	03-01-06	
8	NYKU 8001018	04-05-81	2.0	03-02-08	
9	NYKU 8001240	04-05-83	2.0	03-00-08	
10	TOLU 2814796	04-05-81	4.7	03-01-08	
11	NYKU 810300	05-05-83	2.0	03-04-10	
12	NYKU 8001234	05-05-81	2.0	03-02-10	
13	NYKU 8001111	06-05-83	2.0	03-00-10	
14	NYKU 8004321	06-05-81	2.0	03-01-10	
15	NYKC 8634	07-05-83	2.0	03-03-10	

Fig. 6-6-4 Stowage Plan (Export)



6-6-2 Management

(1) Organization and personnel during phase I of No. 7 berth

The number and assignment of workers required to perform the operations efficiently will depend on various factors, such as choice of operation systems, labor regulations and contracts, and work schedules, as well as the abilities of the workers employed.

However, as it is recommended that present operation procedures be continued during phase I of the 7th berth, each individual stevedore will furnish key staff and cargo-handling equipment (forklifts, trucks tractors and chassis), while the central labor office supplies workers.

A tentative structure of the minimum worker requirements and their responsibilities in terminal operations during phase I of the 7th berth is schematized as follows (although the final decision must be left to the stevedores):

a) The 7th berth container yard

Operation management department

Ship planner :	1	Preparation and execution of ship loading/unloading plan; supervision of entire operation.
Yard planner :	1	Preparation and execution of container yard plan.
Yard clerk :	1	Receiving and delivering of containers at yard; necessary documentation work.
S. Total	3 men	

ii) Operation department

Crane driver :	2	Operation of container crane to load/unload containers to/from ship.
Forklift driver:	2	Operation of forklift to move containers.
Tractor driver:	6	Transfer of containers between container yard and open storage yard or wharf apron.
Worker :	8	Lashing/unlashing of containers stowed on deck and miscellaneous work
S. Total	18 men	

b) Open storage yard

i) Operation management department

Yard planner :	1	Preparation and execution of yard plan and supervision of operation.
Yard clerk :	1	Receiving and delivering of containers and cargoes at yard; necessary documentation work.
S. Total	2 men	

ii) Operation department

Forklift driver:	2	Operation of forklift to move containers.
Worker :	2	Miscellaneous work.
S. Total	4 men	
Grand Total	27 men	

As opposed to the current work assignment system, under which gangs are rotated to equalize incomes, the management staff and all workers must be on fixed schedules. This is because efficient container handling can be achieved only by well-trained, skilled worker able to operate highly complex industrial machinery.

6-6-3 Training

As mentioned in the previous section, a truly efficient container handling operation can be achieved only by well-trained, skilled workers. Accordingly, the training of workers is of great importance in terminal operation.

As training for the container crane operator, it is recommended that the individuals who are to operate the crane of the 7th berth, first master the basic operation technique of the Italian-made crane on the 6th berth.

Once the crane on the 7th berth has been installed, the operator can refine his skills and familiarize himself with the new crane.

TABLES A · FIGURES A

Table A3-6-1 The Regulation of the Port due and the Taxes in Yemen

Article 1. Definitions

(1) This regulation is called the regulation of the port due and the tax in Yemen.

(2) The corporation is (called) the General Corporation of the Port and Marine Affairs.

(3) The port means any port in Yemen connected with the administration of the General Corporation of the Port and Marine Affairs.

(4) The vessles: every floating – objects ready for sailing by the special means or others for the purpose of transportation or communication or excursion.

(5) Steamer – manifest: it is the complete index of the load capacity of the steamer, which contains the index of merchandise – shipment all to it's extent explaining the specification of the shipment; the weight and the size. It is necessary to be issued from the responsible side at the cargo-port.

(6) The weight of Ton is equal to 1,000 kilogram, and the cubic meter is length x width x height, and is equivalent to 35, 314 cubic feet.

(7) The total weight or the total size is considered the weight or the size of the substance (net) with the covering (packings).

(8) The total (gross) tonnage: it is dead weight tonnage not changeable. (D.W. Tonnage)

(9) The net-tonnage: it is to indicate volume capacity of the vessel. (Net Tonnage)

Article 2.

The due and the charges for the cargo services, which takes place for shipping, unloading, or staring in the warehouses and open-field under the control of the corporation, is paid in accordance with the rules of this regulation.

Article 3.

The due and the charges for the quay and storage services in the harbour is paid for the goods except the empty containers sent back to the loading port in accordance with the following classification.

Quan service due (due of ton)	Unit of count	Riyal
(A) First group including; various kinds of car, motorcycles, tractors, trailors, lifts and the likes, explosive materials, inflammable materials such as 'TINAR ASSIT' and match, firing devices, all other inflammable gas, petroleum materials, and by-products of petroleum, iron rods and bars, iron sheets and wires, metallic sheets and copper sheets, tubes, zinc, and electric poles.	cubic-meter or ton	8
(B) Second group including; all other materials apart from what mentioned to be limited or what is in the first group	cubic-meter or ton	7/0
(C) Third group including; living animals sheep, goat	by one (by head)	2/0
cows, camels, horses, mules Charges for the storage services	〃	6/0

Charges for the storage services

covered storage	cubic-meter or ton	1/2
open storage (field)	〃	0/25

Article 4.

With the consideration of the rules of this regulation, the merchandises are free from the charge for the storage services for only two days from the date of the beginning of unloading vessel, and this period is pointed out in this regulation that it is the exemption period. So that the merchandises which will leave directly is excluded and exempted from the storage-charge.

Article 5.

The charges for the storage services fixed in the Article 3 in this regulation in accordance with the following;

Rule

	Unit of count	Covered storage	Open storage
3 days after exemption period	cubic meter or ton	1/2	0/25
next three days		2/40	0/50
following three days		3/60	0/75

If continued more, the charge of 4, 8 Riyals for each day is paid in return for storage in the covered stores, and 1 Riyals each day is paid for storage in the open stores. After the end of 90 days following after the exemption period, the charge is counted at the amount of 5 Riyals each day per every ton or cubic meter in return for storage in the covered warefhouses, and 1 Riyals each day per every ton or cubic meter in return for storage in the open stores.

Article 6.

(A) For the realization of the aims intended in the Note 2, the dues and the charges of the harbour service for the merchandises is counted on the basis of the weight or the size which is bigger than other.

(B) In the whole condition which is estimated the due or the charge on the basis of the weight or size, it is desired that the calculation on the basis of the entire weight or the entire size should be completed.

(C) The writter weight and the volume in the acceptable manifest is accepted, and in the case of doubt, the corporation has the right to ask the certificate of insurance or adjustment as it is.

(D) The minimum unit of any policy is regarded as one ton or one cubic meter, and so is the part of ton or part of cubic meter regarded as one ton or one cubic meter.

(E) The minimum fee of any receipt issued from the corporation is regarded 10 Riyals each even if the original value is less than that.

Article 7.

The due and the charges of the quay and storage services for the goods replaced from the vessels to the quays in order to facilitate. Unloading and shipping of the goods is paid as follows:

(A) The due for the quay services according to the Article 3 is paid on the condition that this due should be calculated twice as the expence of unloading and shipping.

(B) The charges of the storage services is paid in accordance with the Article 3, 4, and 5 in this regulation.

Article 8.

The personal luggages belonging to the passenger is free from the due of quay services, and so is the food-stock prepared for the food supply in the ships.

Article 9.

The chairman of the executive board, with the proposal of the director general, has the right to reduct the charges of the storage services for any cargo to the extent of his judgement, not less than 50% of the value of the cargo estimated by the custom authority. And also the executive board has the right to reduct this charge to the extent which is judged reasonable by the board and provided in the both cases that the amount of the custom duty and storage charges had already exceeded it or that this amount is on the same level of the value of the cargo.

Article 10.

The due of the quay services is paid for the cargoes which arrive at the port and are not registered in the original manifest, in accordance with the following conditions:

(A) On arrival of the vessel, with the expression of the request from the captain or the deputy in order to unload the cargo, if the vessel had already paid the due of the other harbour, and the vessel has the original manifest attached to the complimentary manifest, then, when finished the official procedure with the agreement of the concerned authority, the cargo is handled as the ordinary one.

(B) On arrival of the vessel, with the expression of the request from the captain in order to unload the cargo, if the cargo was not registered in any original manifest, the unloading is permitted only after offering the list of this cargo and with the agreement of the concerned authority, and with the extra charge of 100% of the fixed due.

(C) If it becomes clear that the vessel has the cargo to be unloaded without previous notification, this cargo is considered to be subject to confiscation and is subject to the local laws and the fines.

Article 11.

For the realization of the aims intended in this regulation and the observance of the law, it is desired that the captain of the vessel or the deputy should present to the port-authority the copy of the original manifest, and also the like offered to the custom authority or its photograph at least. In the case of not offering it, immediately the vessel shall be moored at the quay and unloading will not be allowed. And if the deputy asks to unload at the dock of the port without delivering the manifest, but offers the promise to send it out the following day, the fine will be imposed for the case of non-fulfillment of the promise. This is according to Article 42 in this regulation.

Article 12.

The following instructions is to the calculation and the collection of the dues and charges of the corporation services for the containers, the refrigerator, the trailers, the vehicles at the site, etc. for the means of assistance used for the transportation of the arriving cargo at the port.

(A) Due of the quay services

1. The owner of the cargo should pay the due of the quay services according to the whole volume of the container or the refrigerator, and also be should pay the due for the trailers,

the vehicles at the site, and the handling expense according to the volume in addition to the volume or the weight of the merchandise in accordance with Article 6 in this regulation. In both cases re-calculation of the due of the quay services for the cargo does not occur.

2. As for the joint containers with two or more destination, the maritime agents should unload them to the warehouses of the corporation which is ready to store the cargo for not more than 9 days after unloading from the vessel.
And the owners of each cargo should pay the due of the quay services in respect to their cargo and the collected joint-cargo respectively. In the case of non-unloading these containers by the above mentioned agents, then the concerned authority will warn the maritime shipping agents, and the corporation has the right to adopt the proper fines for the penalty and will count every situation.
3. In the both two cases above mentioned, the due of the quay services is paid according to the sort of the cargo, and so is paid the fixed due for this sort indicated in Article 3 in this regulation.
4. The vessels should pay the export due; the amount is 100 Riyals to all containers of 20 feet in size, 150 Riyals to all of 30 feet, and 200 Riyals to all of 40 feet. And also the due for the trailers, the vehicles at the site, etc., is paid regarding the volume of the container and according to the fixed due in the group B of Article 3.
(B) Charges of storage services (at the quay)
1. The owner of the cargo should pay the charges of storage services till the date of unloading or leaving to the outside of the port according to the fixed mode in this regulation.
2. During 15 days from the date of unloading the cargo or the date of return when unloading is outside the harbour the due of the containers, the trailers, etc. is exempted.
3. The charges of storage services is paid after the exemption period in accordance with the followings:
   a. 50 fils per every cubic meter a day until 15 days after the exemption period.
   b. 1 Riyal per every cubic meter a day for more than the period fixed in the Article a.
4. As for the containers which the agent wants to transfer from the harbour, and to store outside (the harbour) after unloading the cargo, the corporation will receive fully the due of quay services on leaving the port in addition to the deserving charges of storage, and also the corporation will receive the due of quay services and any deserving charges upon the storage on returning of the container to the port for export, and in the same way to the other cargo, but except the fixed exemption period.

Article 13.

The corporation will receive 10 fils from each calculation as due for neatness.
(Due of the harbour services to the vessels)

Article 14.

The vessel should pay the due of the services of enlightenment, lighthouses, and nautical indications to the amount of 5 fils per every ton of the net tonnage of the vessel on entering to the harbour, and the like on the departure.

Article 15.

(A) The vessel should pay the due of traffic in the navigational canals and the passages indicated by the navigational instruction upon every operation of entering and departure, and according to the following chart:

Draft of a vessel	foot		due per every foot	
	from	to	riyal	fils
	0	5	10	0
	6	10	18	0
	11	15	22	0
	16	20	30	0
	21	over	36	0

(B) The draft of the vessel is the largest port of the vessel on entrance or on departure on the scale of foot, though the part of foot is regarded one perfect foot.

Article 16.

The corporation will receive the due for the anchorage of the vessel in the docks in accordance with followings:

(A) The anchorage due is paid to the amount of 5 fils per each ton of the tonnage (gross tonnage) for every 24 hours or part of this time while the stay of the vessel in the dock for any reason.

(B) In the case of unloading of the whole cargo (tonnage) by means of the crane or any other means, the corporation will receive 16 fils per every ton of the gross tonnage for every 24 hours or part of that time. This due is calculated from the time of actual unloading fixed from the time of the beginning until the time of the finishing, though the anchorage due is also counted for the previous period before the unloading operation and the period followed to it according to the fixed due in the item (A) in this Article.

(C) The calculation of the duration of the anchorage in the dock is started from the time when the vessel casts the anchor into the dock on arrival and until the time when the vessel lifts the anchor up, with regard to the rule in the article (B) in this Article.

Article 17.

The corporation will receive from the vessel the due of the G.R.T. to the amount of 30 fils per every GRT, and the corporation will demand this due to every vessel who enters the port region.

Article 18.

The pilotage at the harbours is compulsory to all vessels of different sizes on entrance and on departure, or on shifting.

Article 19.

The region of the pilotage in Yamani (of Yeman) harbours is where the vessel is waiting with the anchor and decided in the (nautical maps) charts.

Article 20.

The fees of the pilotage services is paid to the amount of 15 fils per every GRT for all pilotage operation.

Article 21.

When the vessel changes its anchorage place, 15 fils per every GRT is paid for this change, in addition to this, the charges of launch for assistance, if it is used, is asked in accordance with Article 28 in this regulation, and also the fee of mooring, unmooring operation is added to the total charges in accordance with the Article 30 in this regulation.

Article 22.

The vessel should pay the fee of full pilotage operation in either case as follows:

(A) When the pilot is called to let the vessel enter to the quay, but finds out that the vessel has not arrived yet or that it was impossible to let her enter for any reason arising from the vessel or her agent.

(B) When the pilot is called to guide out the vessel from the quay, and it was impossible to guide her out for any reason arising from the vessel or her agent.

Article 23.

The time of pilotage is limited to only 2 hours counted from the time of pilots embarkment to the time of descending from the vessel. In case of delay of the pilot to wait on board more than 2 hours, 200 Riyals should be paid for every waiting hour or part of it.

Article 24.

The corporation does not undertake the pilotage of the vessel outside the pilotage region, and in the case of demanding assistance in this region, the agreement of the board should be gained.

Article 25.

The pilot and the corporation have no responsibility for what happens to the vessel or to the utilities of the corporation or to the other damage during pilotage operation.

Article 26.

If damaged any utilities of the harbour or any machinery, or occurred any accident to them during operation of pilotage, then the pilot is abliged to present the board a official report signed by the captain of the vessel and scaled with his stamp.

Article 27.

The pilot uses a launch for the pilotage during the performance of pilotage operation in the manner as follows:

(1) Launch for 2 hours for all pilotage operation, entry or sortie, to the quays of Port Hodeidah.

(2) Launch for 1 hour for all pilotage operation, entry or sortie, to the quays of Port Ras Kathib and Port Mocha.

(3) The charges of the pilot launch is counted on the basis of the charge of the transportation launch (720 H.P.), whatever kinds of launch is used, and on the calculation of the fixed charges in Article 37 in this regulation according to the cases of employment.

(4) If the pilotage operation is increased to the definite time, it is necessary to calculate the added time. The calculation of the charge is as mentioned in the item (3) in this article.

Article 28.

The assistance charges for the vessel by the sea-launch is paid according to the basis as follows:

(1) Assistance of the launch (1800 H.P.) is regarded as compulsory to all vessels whose total tonnage is 400 ton and over, and the fee is paid for all operation, mooring and unmooring, for the vessel at the quay, whether this launch is used or not, and except only the case of non-using the compulsory launch on shifting in the quays.

(2) Assistance charges are fixed to every work hour for any launch according to the following chart:

Total tonnage of the vessel	Fee (Riyal)
from 400 to 3,000	550
〃 3,001 〃 5,000	600
〃 5,001 〃 8,000	700
〃 8,001 〃 12,000	800
〃 12,001 〃 15,000	900
15,001 and over	1,200

Article 29.

The charges of quay services for the stay of the vessel moored to the quay is paid to the amount of 40 fils per meter of the total length of the vessel per hour or part of hour; and the time is counted from mooring the first rope at the quay to unmooring the last rope on departure.

Article 30.

The vessel moored or unmoored at any quay in the harbour should pay the fee of mooring, unmooring services to the amount of 6 fils per G.R.T.

Article 31.

The towage fee is paid on anchorage of the vessel while entering to the quays or leaving them on the basis of fixed double fee for using the launch to assist; but except the case of inclining of the vessel and that the fee of towage operation is decided by the special agreement of the board.

Article 32.

On using the tug-boat for the towage of cranes between the quays and the inside docks and among the waiting areas for the vessels, the towage fee is paid to the amount of 800 Riyals per hour for each working hour, and this fee is doubled in case of towage outside the waiting area for the vessels.

Article 33.

The due for all larges working constantly in the harbour or lash-barges according as follows;

(1) 4 Riyals and 50 fils per registered net tonnage of the working barge at the harbour constantly for every trip.

(2) 4 Riyals and 50 fils per ton or cubic meter of the effective tonnage for all barges and owing to the manifest of the vessel, or on the basis of the registered net tonnage of the lash-barge whatever is bigger.

Article 34.

The vessel should pay the due of passenger services, on embarking and on disembarking, to the amount of 10 Riyals per person, but exempted for a crew on official duties.

Article 35.

The price of fresh water supplied at the harbour is as follows:

(A) Water supply for the vessel at the quays with the pipe, the charge is paid to the amount of 30 Riyals per ton.

(B) Water supply for the vessel by the barge to the inside dock, the charge is 45 Riyals per ton, and also 90 Riyals is paid in case of supply to the outside dock and Port Ras Kathib.

(C) The minimum order of the supply by the barge is to be 50 tons, and so is the supply at the quay by means of pipe to be 10 tons.

Article 36.

The cable charges through the wireless station belonging to the corporation is paid to the amount of 4 Riyals 50 fils per word, and is doubled in case of urgent cable.

And also the charges of telephone-call by means of VHF system is paid to the amount of 12 Riyals 50 fils per each call.

Article 37.

The utilization of machinery, equipment, means of transportation, and communications belonging to the corporation is to be according to the following principles and rules;

(A) The charges of these machinery and facilities according to the following two charts:

Diagram 1 (Chart No. 1)

Kind and the power		Charge per hour (Riyal)
Launch	1,800 H.P.	875
	1,200 "	600
	750 "	500
	300 "	300

This charge is to be for the operation of launch between the quays and pilotage regions, and for other place except above the charge is doubled.

(B) As for any equipments or machinery or means for transportation and communication of which fees are not fixed in this regulation, a decision will be issued by the chairman of exective board.

(C) The work time of any of those machinery and means is counted from the beginning of operation time at the location to the time of returning to that location, or to the site fixed by the concerned authority.

(D) The long delay of use of the machinery, equipments, and the means of transportation and communication is to be handled with the special agreement of the board, and the decision of the charges for the big and important operation is to the agreed by the board.

Article 38.

The charges of floating crane of 75 ton-capacity is calculated as follows:

(1) The amount of 1,000 Riyals, per hour of waiting and communications from the beginning of moving crane to its return to the location, is paid except the effective working time.

(2) The amount of 600 Riyals is paid per each units of total weight from 0 to 20 tons for one lifting.

(3) The amount of 3000 Riyals is paid per each unit of total weight over 20 tons up to 40 tons for one lifting.

(4) The amount of 6000 Riyals is paid per each unit of total weight over 40 tons as one ranking.

(5) The crane demand for operations, the board will check and decide the charges with agreement of demander.

Article 39.

The due of issuing permission of work inside the harbour is paid to the marine and custom agencies, and to the persons.

And the permission of machinery and means of transportation is according to the chart attached to this regulation.

Article 40.

The period of every permission is effective for one whole year.

Article 41.

In return for the benefit for the companies specialized in work of shipping, unloading, and transportation inside the harbour, and for the work permission in this field in place of the corporation, the corporation will receive the dues in year in proportion of 5 fils per ton of unloading, and also by month regarding to the preceeding report of unloading from authority side and the date of manifest.

1. The violation by the vessel and the penalties

Article 42.

The fixes is regarded recompense to the corporation for the loss caused from perpetration of violation and the penalty to the causers for the offences against the order and the regulation of the corporation; and these fixes are to be decided according to the following:

(1) The violation by the vessel and the penalties

A) Fine is imposed to the vessel in proportion to 500 Riyals for the first time, and 2000 Riyals for repeating in case of failing to hoist the flag of the Yemen Arab Republic on the highest mast of vessel.

Table A-6-2-1 Detailed Unloading Information

Cargo Ship for Flour

Ship	Sailing Time	Berthing Time	Arrival Time	Cargo Tonnage
1	9:30 1/9	18:35 1/3	13:55 1/3	8,741
2	15:20 3/31	16:45 3/23	6:30 3/23	9,166
3	18:40 5/30	13:20 5/19	17:30 5/17	9,682
4	14:00 7/12	11:00 7/4	5:00 7/3	7,774
5	Not available	12:00 7/28	17:00 7/26	8,989
6	9:00 9/14	10:00 9/5	13:00 9/4	7,636
Total				51,988
Average	Total Berthing hrs = 41-20-50 = 1,004.8 (days hrs mns hrs)			@ 8,665
	Handling productivity (except 5)			
	(51,988-8,989)/1,004.8 = 42.8 tons/hrs			

Reefer Ship

Ship	Sailing Time	Berthing Time	Arrival Time	Cargo Tonnage
1	15:25 1/5	9:50 1/4	15:10 1/3	497
2	8:30 1/9	16:30 1/5	7:25 1/4	1,108
3	8:10 1/10	14:40 1/8	8:50 1/5	714
4	Not available	15:20 1/15	8:05 1/8	1,663
5	10:30 1/11	12:50 1/10	7:25 1/9	300
6	15:25 1/5	9:05 1/4	15:10 1/3	497
7	8:30 1/19	12:45 1/11	11:30 1/11	665
8	9:20 1/17	16:00 1/15	8:00 1/15	708
9	Not available	10:30 1/19	8:00 1/16	420
10	8:00 1/24	9:15 1/22	7:00 1/19	1,200
11	11:45 1/27	11:00 1/25	7:00 1/25	714
12	15:45 1/29	14:35 1/26	7:15 1/26	1,822
Total				10,308
Average				@ 859
	Total Berthing Hrs: 16-13-20 = 397^3 (except 4, 7 and 9)			
	Handling productivity (except 4, 7 and 9)			
	(10,308-1,663-665-420)/397^3=19.0 tons/hr			

Table A·6-2-1 Detailed Unloading Information (cont'd)

Bulk Carrier for Wheat

Ship	Sailing Time		Berthing Time		Arrival Time		Cargo Tonnage
1			10:10	1/30	10:50	1/27	19,185
2	8:00	3/29	11:45	3/18	22:58	3/7	17,300
3		5/31	15:30	5/21	17:00	5/14	18,400
4			10:30	6/24	11:20	6/10	19,259
5	14:05	7/29	10:35	7/23	17:55	7/14	15,105
6	8:10	9/2	10:15	8/20	18:00	8/11	15,750
7					12:20	8/22	15,400
8	11:20	10/27	16:40	10/18	11:00	10/15	18,400
Total							138,799
Average							@17,350

Total Berthing Hours: 38-17-20 = 929^3 (except 1, 3, 4 and 7)

Handling Productivity (except 1, 3, 4 and 7)

(138,799 - 19,185-18,400-19,259-15,400)/929^3=71^{6} tons/hr.

Cargo Ship for Cement

Ship	Sailing Time		Berthing Time		Arrival Time		Cargo Tonnage
1	17:30	1/15	11:05	1/9	7:15	1/8	8,660
2	16:35	1/27	18:30	1/12	8:25	1/10	13,100
			11:18	1/18	10:50	1/14	8,500
4	15:05 13:00	1/27 1/26	10:20 16:40	1/27 1/19	17:00	1/18	7,600
5	7:55	2/8	12:45	2/3	9:00	2/3	6,800
6			10:00	2/9	8:29	2/6	4,910
7	18:30	2/17	18:35	2/11	14:30	2/8	7,500
Total							57,070
Average							@8,153

Total Berthing Hours: 38-05-00=917 hrs (except 3 and 6)

Handling Productivity (except 3 and 6)

(57,070-8,500-4,910)/917 = 476 tons/hr

Table A-6-2-1 Detailed Unloading Information (cont'd)

Cargo Ship for General Cargo (cont'd)

Ship	Sailing Time		Berthing Time		Arrival Time		Cargo Tonnage
1	8:15	1/5	18:30	1/3	19:00	1/12	329
2	12:30	1/7	10:05	1/5	11:10	1/4	948
3	8:00	1/8	16:50	1/5	10:00	1/5	927
4	8:20	1/10	10:35	1/9	15:14	1/8	141
5	7:45	1/10	10:00	1/9	18:34	1/8	1,424
6	8:00	1/14	12:20	1/12	10:00	1/12	477
7	16:30	1/14	10:30	1/14	9:30	1/14	26
8	8:10	1/19	10:20	1/16	10:36	1/15	1,300
9	17:45	1/17	10:00	1/17	11:15	1/16	1,327
10	8:45	1/19	10:00	1/17	16:35	1/16	2,081
11	8:00	1/23	10:00	1/19	02:00	1/17	1,249
12	8:05	1/28	10:00	1/18	03:00	1/17	2,282
13	12:30	1/22	10:50	1/19	06:05	1/19	3,500
14	13:05	1/25	17:50	1/22	07:00	1/22	2,357
15	16:50	1/27	9:40	1/24	9:00	1/24	2,621
16	7:50	1/26	17:05	1/24	15:00	1/24	1,758
17	16:10	1/26	16:30	1/25	7:22	1/25	593
18	7:30	1/27	17:45	1/26	17:45	1/25	622
19	15:40	1/28	18:40	1/27	20:45	1/25	589
20	16:00	1/27	18:40	1/26	16:10	1/26	442
21			11:00	1/30	7:19	1/30	6,708
22			9:55	1/31	10:00	1/30	3,182
Total							34,883
Average							@1,586

Total Berthing Hours: 34-09-25=825[3] (except 12, 21 and 23)

Handling Productivity (except 12, 21 and 22)

(34,883-2,282-6,708-3,182)/825[3] = 27.5 tons/hr.

Diagram (Chart No. 2) the Equipments of Shipping and Unloading

Kind of Machinery	Culculation — basis	Shipping, unloading, transportation of cargo (riyal)	Shipping, unloading, transportation of heavy cargo (riyal)	Operation at the field and the warehouse (riyal)
Fixed crane of 5 tons capacity	hour	200	0	0
Fixed crane of 10 tons capacity	〃	200	400	0
COLES crane 35 tons	〃	150	450	450
Jones mobile crane 20 tons	〃	150	450	450
Other mobil crane from 5 to 15 tons	〃	150	400	150
Tadano crane and Johnes No. 5 for shifting wood	〃	〃	0	75
Tadano crane and Johnes No. 5 for moving wood	bundle	0	0	10
Lifts with various capacity	hour	125	0	100
(Rooks and drags) of 20 feet	〃	20	0	0
(Rooks and drags) for shifting containers of 20 feet	container	80	0	0
(Rooks and drags) for shifting containers of 40 feet	〃	160	0	0

Table A6-5-1 Assumptions Used in Financial Forecasts

1. Per-ship's tariff	
(1) enlightment lighthouses	5 fils/net tonnage
(2) the due of traffic navigational cannals	36 Riyal/feet
(3) the due for the anchorage of the vessel	0.16 Riyals/gross tonnage
(4) the due of G.R.T.	0.30 Riyals/gross tonnage
(5) fees of pilotage	0.15 Riyals/gross tonnage
(6) a lunch for the pilotage	1,000 Riyals/one vessel
(7) assistance charge for vessels	900 Riyals/one vessel
(8) the charges of quay services	0.4 Riyals/feet x 24 hours/one vessel
(9) the fee of mooring	0.06 Riyals/gross tonnage
(10) the price of water	30 Riyals/ton
2. Cargo	
(1) away service	7 Riyal/t
(2) export due	100 Riyal/one container
(3) strage service	0.5 Riyals/m^3/day
(4) due for neatness	10 fils/t

Fig. A2-2-1 Boring Log (BH No. 1)

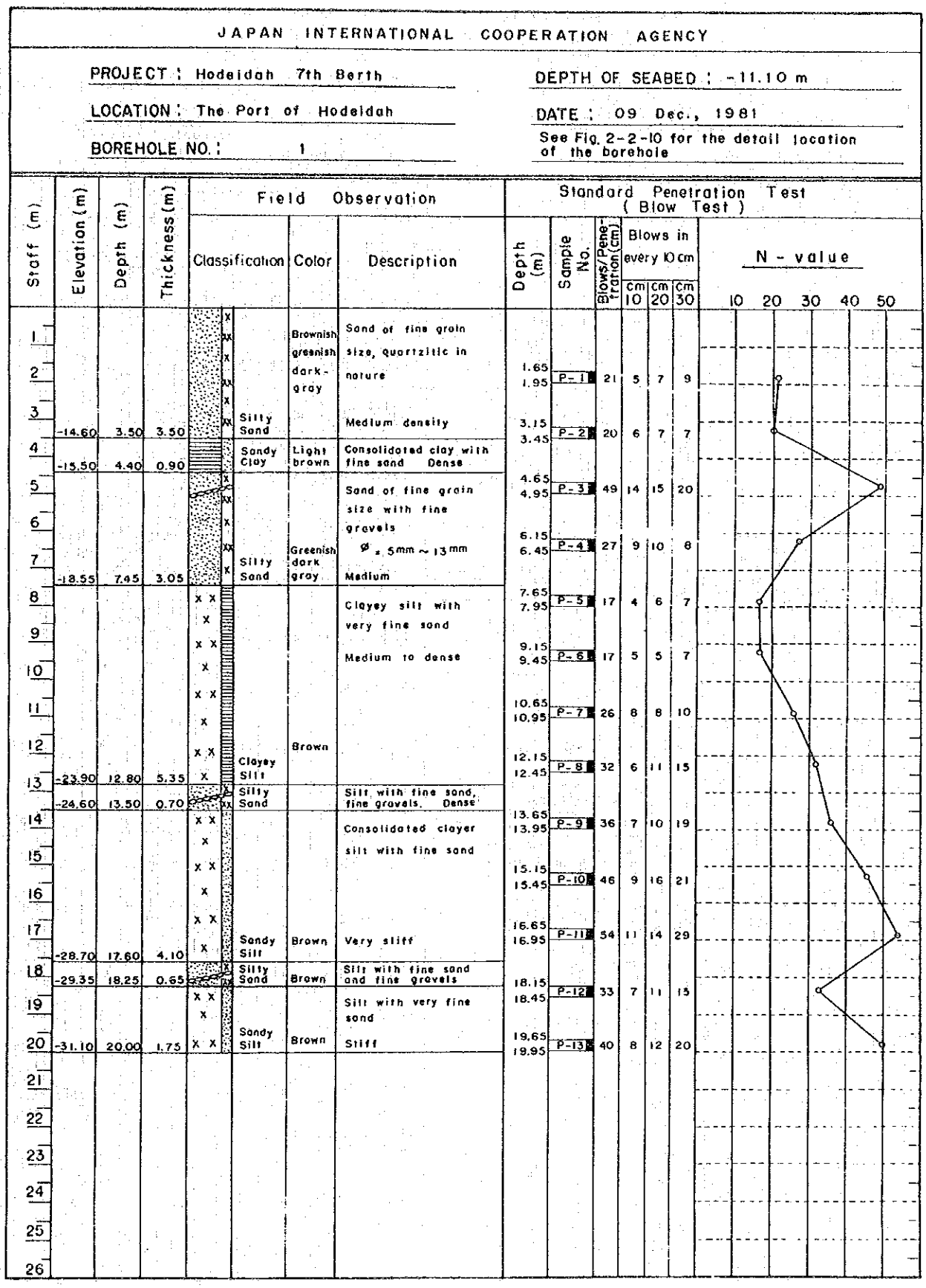


Fig. A2-2-2 Boring Log (BH No. 2)

JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT : Hodeidah 7th Berth

LOCATION : The Port of Hodeidah

BOREHOLE NO. : 2

DEPTH OF SEABED : -5.60 m

DATE : 16 and 17 Dec., 1981

See Fig. 2-2-10 for the detail location of the borehole.

Staff (m)	Elevation (m)	Depth (m)	Thickness (m)	Field Observation: Classification	Color	Description
1	-6.30	0.70	0.70	Sandy Silt	Dark gray	Very soft sea bed mud
2					Dark brownish gray	Particles consist with inuniformed clod of silt with frogments of shell
3						
4	-9.60	4.00	3.30	Silty Sand		Loose
5						With fine gravels
6					Dark brownish gray	
7	-12.60	7.00	3.00	Silty Sand		Medium
8	-13.35	7.75	0.75	Silty Sand		With fine gravels Dense
9						
10						
11	-16.80	11.20	3.45		Grayish brown	With fine gravels Very stiff
	-17.00	11.40	0.20			
12	-18.00	12.40	1.00	Sandy Silt	Brownish gray	With clayey silt. Hard
13	-19.10	13.50	1.10	Silt	Gray	Silt with clay, with fine sand. Stiff
14	-19.95	14.35	0.85	Sandy Silt	Brownish gray	Sandy silt with fine gravels. Stiff
15					Gray	Sandy silt with
16						sandy clay.
17	-22.30	16.70	2.35	Silt		Stiff
18					Brownish gray	Sandy silt with
19						fine gravels.
20						Very stiff
21						
22						
23						
24	-29.60	24.00	7.30	Sandy Silt		Hard
25						
26						

Standard Penetration Test (Blow Test)

Depth (m)	Sample No.	Blows/Penetration (cm)	Blows in every 10 cm: cm 10	cm 20	cm 30
1.15 1.45	P-1	7	2	2	3
2.65 2.95	P-2	8	2	3	3
4.15 4.45	P-3	12	4	4	4
5.65 5.95	P-4	18	4	6	8
7.15 7.45	P-5	35	10	13	12
8.65 8.95	P-6	20	6	7	7
10.15 10.45	P-7	26	6	7	13
11.65 11.95	P-8	36	9	12	15
13.15 13.45	P-9	22	6	6	10
14.65 14.95	P-10	21	6	7	8
16.15 16.45	P-11	22	7	7	8
17.65 17.95	P-12	34	9	12	13
19.15 19.45	P-13	35	9	11	15
20.65 20.95	P-14	44	10	14	20
-22.15 -22.45	P-15	32	7	12	13
-23.65 -23.95	P-16	42	11	14	17

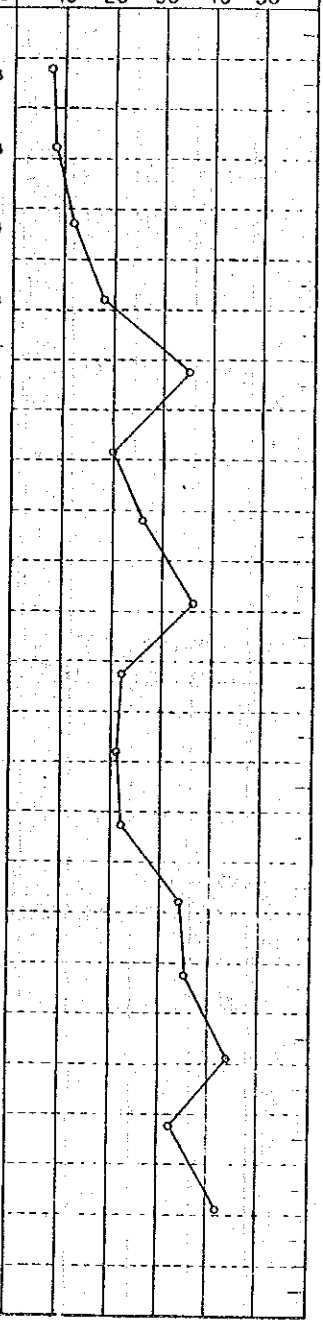


Fig. A2-2-3 Boring Log (BH No. 3)

JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT : Hodeidah 7th Berth

LOCATION : The Port of Hodeidah

BOREHOLE NO. : 3

DEPTH OF SEABED : -11.80 m

DATE : 13 Dec., 1981

See Fig. 2-2-10 for the detail location of the borehole.

Staff (m)	Elevation (m)	Depth (m)	Thickness (m)	Field Observation: Classification	Color	Description
	-12.30	0.50	0.50	Sandy Silt	Greenish gray	Sludge, Very soft
1	-13.40	1.60	1.10	Sand	Brownish gray	Sand of fine grain size with silt and fragments of shell. Medium
2–6	-18.10	6.30	4.70	Sandy Silt	Brownish greenish dark-gray	Sand of fine grain size with silt. Trace of shell fragments with fine gravels are also present. Partially sandy layers are also present. Dense
7–8	20.40	8.60	2.30	Clayey Silt	Grayish brown	Consolidated clayey silt. Very dense Medium to stiff
9–19	31.10	19.30	10.70	Sandy Silt	Grayish brown	Silt with very fine to midium quartzitic sand with fine gravels Ø = 4mm Dense to stiff
20–26						

Standard Penetration Test (Blow Test)

Depth (m)	Sample No.	Blows/Penetration (cm)	Blows in every 10 cm: 0–10 cm	10–20 cm	20–30 cm
0.95–1.25	P-1	23	7	7	9
2.45–2.75	P-2	29	7	9	13
3.95–4.25	P-3	35	8	12	15
5.45–5.75	P-4	37	9	11	17
6.95–7.25	P-5	21	6	7	8
8.45–8.75	P-6	41	9	12	20
9.95–10.25	P-7	33	9	12	12
11.45–11.75	P-8	45	11	14	20
12.95–13.25	P-9	43	10	15	18
14.45–14.75	P-10	52	12	18	22
15.95–16.25	P-11	39	8	13	18
17.45–17.75	P-12	36	10	12	14
18.95–19.25	P-13	38	9	13	16

N - value: 10 20 30 40 50

Fig. A2-2-4 Boring Log (BH No. 4)

JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT : Hodeidah 7th Berth
LOCATION : The Port of Hodeidah
BOREHOLE NO. : 4

DEPTH OF SEABED : -1.77 m
DATE : 19 and 20 Dec., 1981
See Fig. 2-2-10 for the detail location of the borehole

Staff (m)	Elevation (m)	Depth (m)	Thickness (m)	Field Observation: Classification	Color	Description
1	-2.57	0.80	0.80	Sandy Silt	Dark greenish gray	Sludge. Very soft
	-3.27	1.50	0.70	Silty Sand	〃	High water content with fragments of shell
2	-3.97	2.20	0.70	Silt	〃	〃 Very soft
3						Sandy silt with fragments of shell φ 2~10m/m
4						High water content
5						
6	-7.57	5.80	3.60	Sandy Silt	Dark gray	Very soft
7	-9.12	7.35	1.55	Peaty Silt	Brownish black	Medium
8						
9						
10						
11	-12.57	10.80	3.45	Silty Sand	Brownish gray	Very stiff
	-13.27	11.50	0.70	Sand	Dark brownish gray	Fine sand with a little silt. Dense
12	-13.47	11.70	0.20	clay	〃	Sandwitched clay, Dense
13						
14						
15	-16.47	14.70	3.00	Sandy Silt	Brownish gray	Hard
16	-17.62	15.85	1.15	Silty Sand	Brownish gray	Silty fine sand with gravel fragments. Very dense
17						Sandy silt with Sandwitched clay fragmental gravels
18						
19	-20.77	19.00	3.15		Brown	
	-21.07	19.30	0.30	Clay		Very stiff
20						
21	-23.07	21.30	2.00	Sandy Silt		
	-23.27	21.50	0.20			
22						
23						
24						
25						
26	-27.77	26.00	4.50	Sandy Silt	Brown	Very stiff

Standard Penetration Test (Blow Test)

Depth (m)	Sample No.	Blows/Penetration (cm)	Blows in every 10 cm: cm 10	cm 20	cm 30
1.50	P-1	0/60			
2.10					
3.15					
4.00	S-1				
4.50	P-2	0/50			
5.00					
5.50	P-3	0/50			
6.65					
6.95	P-4	7	2	2	3
8.15					
8.45	P-5	22	6	7	9
9.65					
9.95	P-6	25	7	8	10
11.15					
11.45	P-7	32	9	10	13
12.65					
12.95	P-8	28	8	8	12
14.15					
14.45	P-9	37	10	10	17
15.65					
15.95	P-10	52	12	16	24
17.15					
17.45	P-11	25	6	9	10
18.65					
18.95	P-12	26	6	8	12
20.15					
20.45	P-13	34	8	10	16
21.65					
21.95	P-14	37	9	13	15
23.15					
23.45	P-15	42	10	12	20
24.65					
24.95	P-16	37	9	10	18

N - value: 10 20 30 40 50

Fig. A2-2-5 Boring Log (BH No. 5)

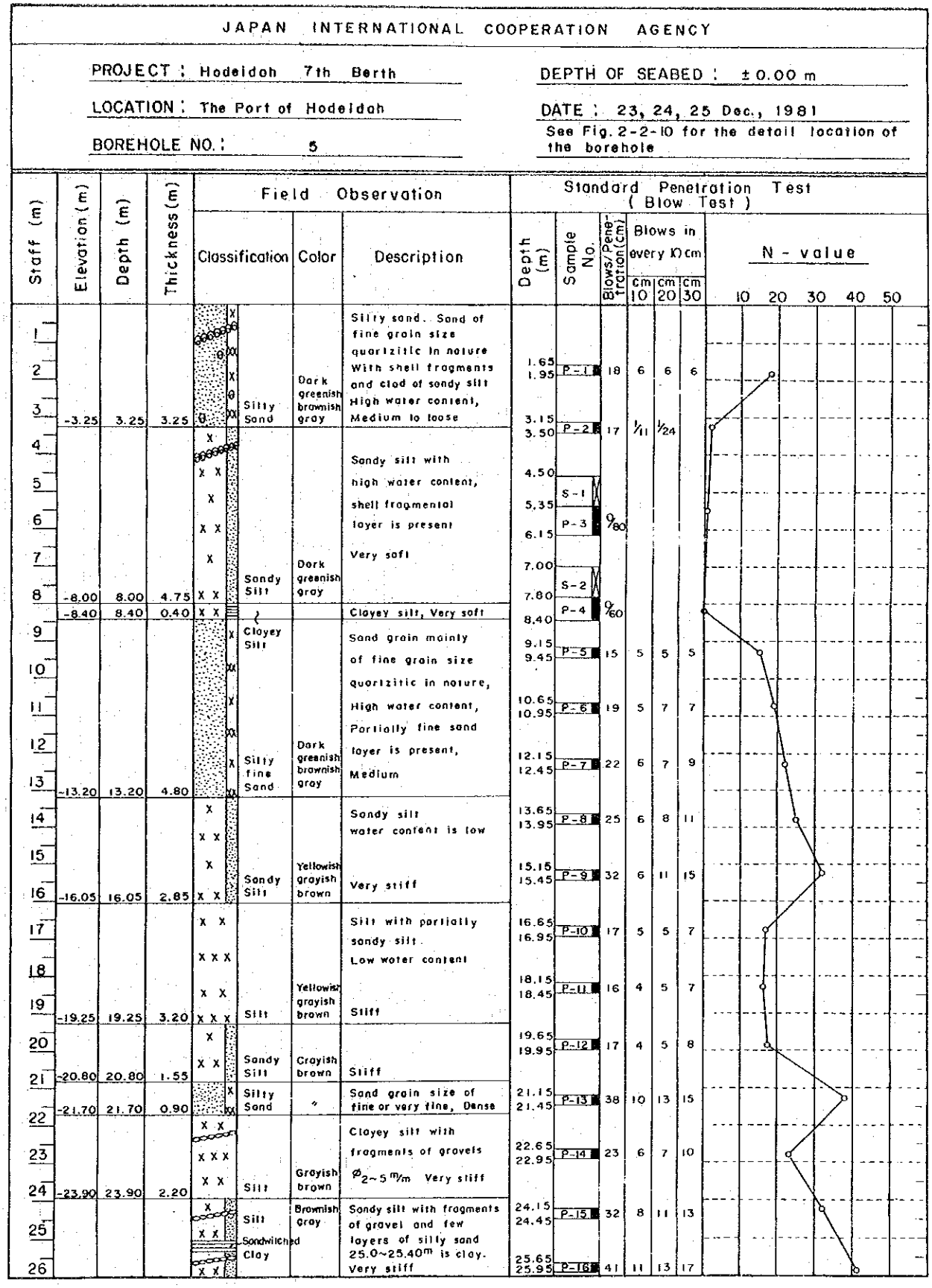


Fig. A2-2-6 Boring Log (BH No. 6)

JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT : Hodeidah 7th Berth

LOCATION : The Port of Hodeidah

BOREHOLE NO. : 6

DEPTH OF SEABED : +0.80m

DATE : 26, 27 Dec., 1981

See Fig. 2-2-10 for the detail location of the borehole.

Staff (m)	Elevation (m)	Depth (m)	Thickness (m)	Field Observation: Classification	Color	Description
1					Dark greenish brownish gray	W.T. +0.30 Silty sand with shell fragments, grain size mainly quartzitic in noture with grain size varying from fine to medium, Loose
2						
3						
4	-3.05	3.85	3.85	Silty Sand		
5					Dark greenish gray	High water content Sandy silt with shell fragments, partially with layer of fine sand, Very stiff
6						
7						
8				Sandy Silt		
9	-7.80	8.50	4.65			
10					Dark gray	Silty sand with shell fragments high water content, Loose to medium
11						
12						
13				Silty Sand		
14	-12.70	13.50	5.00			
15					Dark brownish gray	Fine to very fine quartzitic sand, Medium to dense
16						
17				Fine Sand		
18	-16.80	17.60	4.10			
19				Sandy Silt	Grayish brown	Sandy silt with thin layers of fine sand, Very stiff
20	-18.50	19.30	1.70		Grayish brown	Very stiff
21				Silt		
22	-20.00	20.80	1.50			Sandy silt with fine gravels at 23.5 m, a thin sandwitched layer is present, Hard
23						
24						
25				Sandy Silt		
26	-24.80	25.60	4.80			

Standard Penetration Test (Blow Test)

Depth (m)	Sample No.	Blows/Penetration (cm)	Blows in every 10 cm: 10 cm	20 cm	30 cm
2.15	P-1	5	1	2	2
2.45					
3.15	P-2	7	2	3	2
3.45					
4.00	P-3	0/50cm			
4.50					
5.00	S-1				
5.85	P-4	0/50cm			
6.35					
7.00	S-2				
7.85					
8.00	P-5	1/42cm			
8.42					
9.15	P-6	8	2	3	3
9.45					
10.65	P-7	16	4	5	7
10.95					
12.15	P-8	26	8	9	9
12.45					
13.65	P-9	38	8	13	17
13.95					
15.15	P-10	40	10	12	18
15.45					
16.65	P-11	34	10	11	13
16.95					
18.15	P-12	31	9	10	12
18.45					
19.65	P-13	17	5	6	7
19.95					
21.15	P-14	35	9	11	15
21.45					
22.65	P-15	36	9	12	15
22.95					
24.15	P-16	23	5	8	10
24.45					
25.65	P-17	25	8	9	8
25.95					

N - value: 10 20 30 40 50

Fig. A2-2-7 Boring Log (BH No. R-1)

Prepared by RINKAI CONSTRUCTION CO., LTD.

PROJECT : 6th Berth Construction

LOCATION : The Port of Hodeidah

BOREHOLE NO. : R - 1

DEPTH OF SEABED : +0.90 m

DATE : 7 ~ 10 Mar., 1981

Location is shown in Fig: 2-2-10

Staff (m)	Elevation (m)	Depth (m)	Thickness (m)	Field Observation: Classification	Color	Description
1						
2						
3						
4						
5				Fine sand with shell	Dark brown	Very loose
6	-4.70	5.60	5.60			
	-5.60	6.50	0.90	Fine sand	Dark gray	Very loose
7	-6.50	7.40	0.90	Silty sand	Dark gray	Alternate silt and very fine sand. Very loose
8				Very fine sand	Dark gray	Mixed silty sand Medium
9	-7.80	8.70	1.30			
10				Very fine sand	Dark brown	Medium Dense
11	-9.70	10.60	1.90		Dark brown	Medium
	-10.30	11.20	0.60			
12				Very fine sand		Dense
13						
14						Medium
15				Very fine sand	Dark brown	Dense
	-14.70	15.60	4.40			
16						
17						Dense Sand is very fine. Placed clay partially.
18				Clayey sand	Dark gray	Medium
	-17.60	18.50	2.90			
19						
20						
21						Dense
22						
23						
24				Very fine sand	Dark brown	
	-23.00	23.90	5.40			
25	-23.80	24.70	0.80	Clayey sand	Dark brown	Placed sandy clay partially, Dense
26				Sandy clay	Dark brown	Placed clayey sand partially, Very stiff

Standard Penetration Test (Blow Test)						
Depth (m)	Sample No.	Blows/Penetration (cm)	Blows in every 10 cm: cm 10	cm 20	cm 30	N - value
1.00						
1.30		4	2/18		2/12	
2.00						
2.30		4	2	1/8	1/12	
3.00						
3.30		1	1/30			
4.00						
4.32		3.8	2/18		2/14	
5.00						
5.30		4	2/16		2/14	
6.00						
6.30		3	1/8	1/8	1/14	
7.00						
7.48		1.3	1/25		1/23	
8.00						
8.30		13	4	5	4	
9.00						
9.30		27	8	9	10	
10.00						
10.30		30	9	10	11	
11.00						
11.30		17	4	5	8	
12.00						
12.30		33	8	12	13	
13.00						
13.30		25	8	8	9	
14.00						
14.30		30	10	8	12	
15.00						
15.30		38	12	13	13	
16.00						
16.30		33	5	12	16	
17.00						
17.30		33	6	12	15	
18.00						
18.30		24	6	8	10	
19.00						
19.30		35	8	12	15	
20.00						
20.30		49	13	19	17	
21.00						
21.30		46	10	16	20	
22.00						
22.30		48	10	17	21	
23.00						
23.30		42	10	15	17	
24.00						
24.30		33	10	9	14	
25.00						
25.30		28	9	9	10	

Fig. A2-2-8 Boring Log (BH No. K-6)

Prepared by KAMPSAX INTERNATIONAL A/S

PROJECT : YAR, PORT DEVELOPMENT STUDY
LOCATION : The Port of Hodeidah
BOREHOLE NO. : K - 6

DEPTH OF SEABED : + 1.30 m
DATE : 17 20 Mar., 1981
Location is shown in Fig. 2-2-10

Staff (m)	Elevation (m)	Depth (m)	Thickness (m)	Field Observation: Classification	Color	Description	Standard Penetration Test (Blow Test): Depth (m)	Sample No.	Blows/Penetration (cm)	Blows in every 10 cm: cm 10	cm 20	cm 30	N-value
3	-1.70	3.00	3.00	Sand	Dark gray	Medium - coarse, rich in shell fragments	3.00	1					
6	-4.70	6.00	3.00	Sand	Dark gray	Medium - coarse rich in shell fragments	6.00	2					
9	-7.70	9.00	3.00	Sand	Gray-brown	Fine - medium, very few shell fragments	9.00	3					
12	-10.70	12.00	3.00	Sand	Gray brown	Mostly medium, very few shell fragments	12.00	4					
15	-13.70	15.00	3.00	Sand	Gray brown	Mostly medium, o few shell fragments	15.00	5					
18	-16.70	18.00	3.00	Sand	Brown	Fine, silty in places clayey very few shell fragments	18.00	6					

N-value scale: 10 20 30 40 50

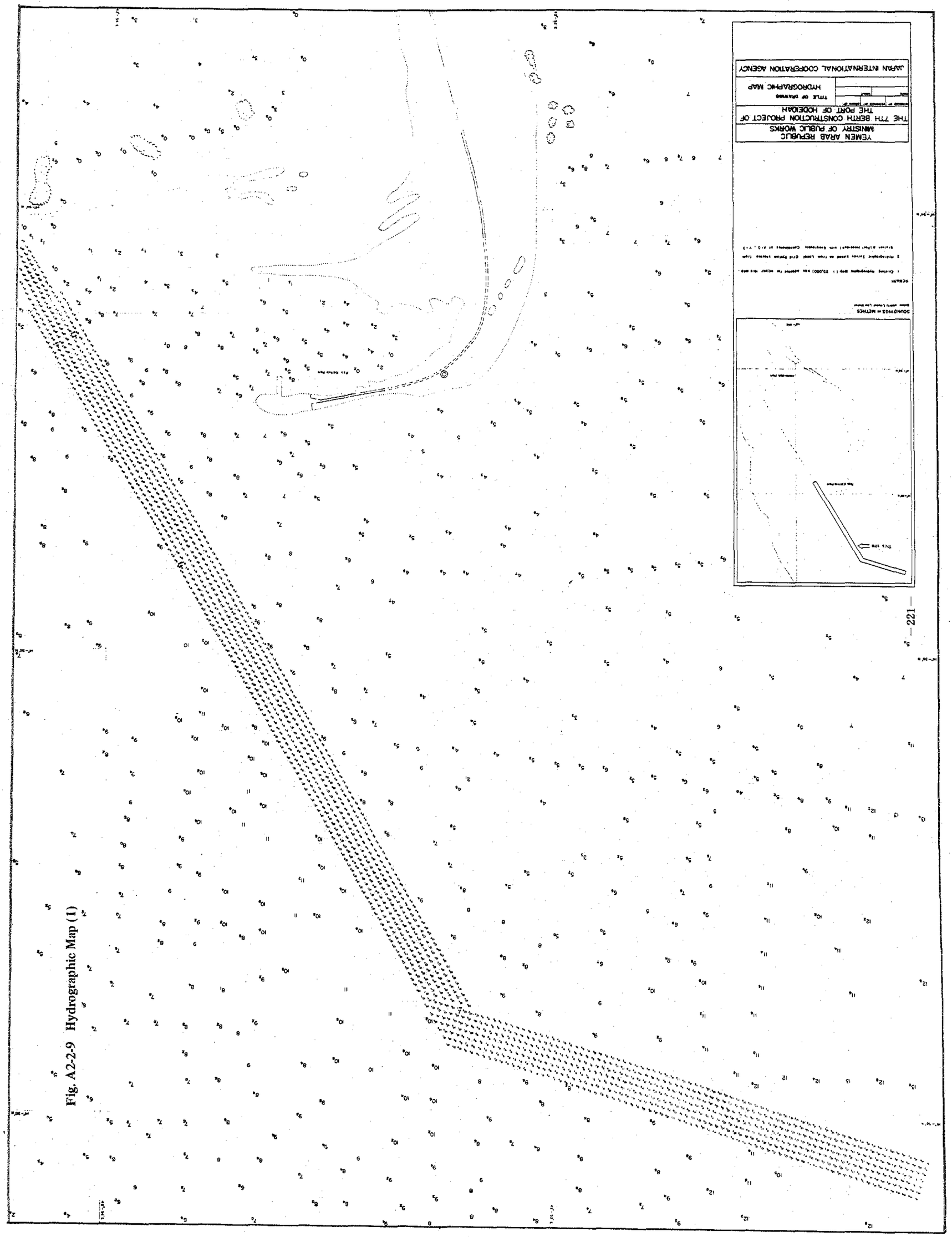
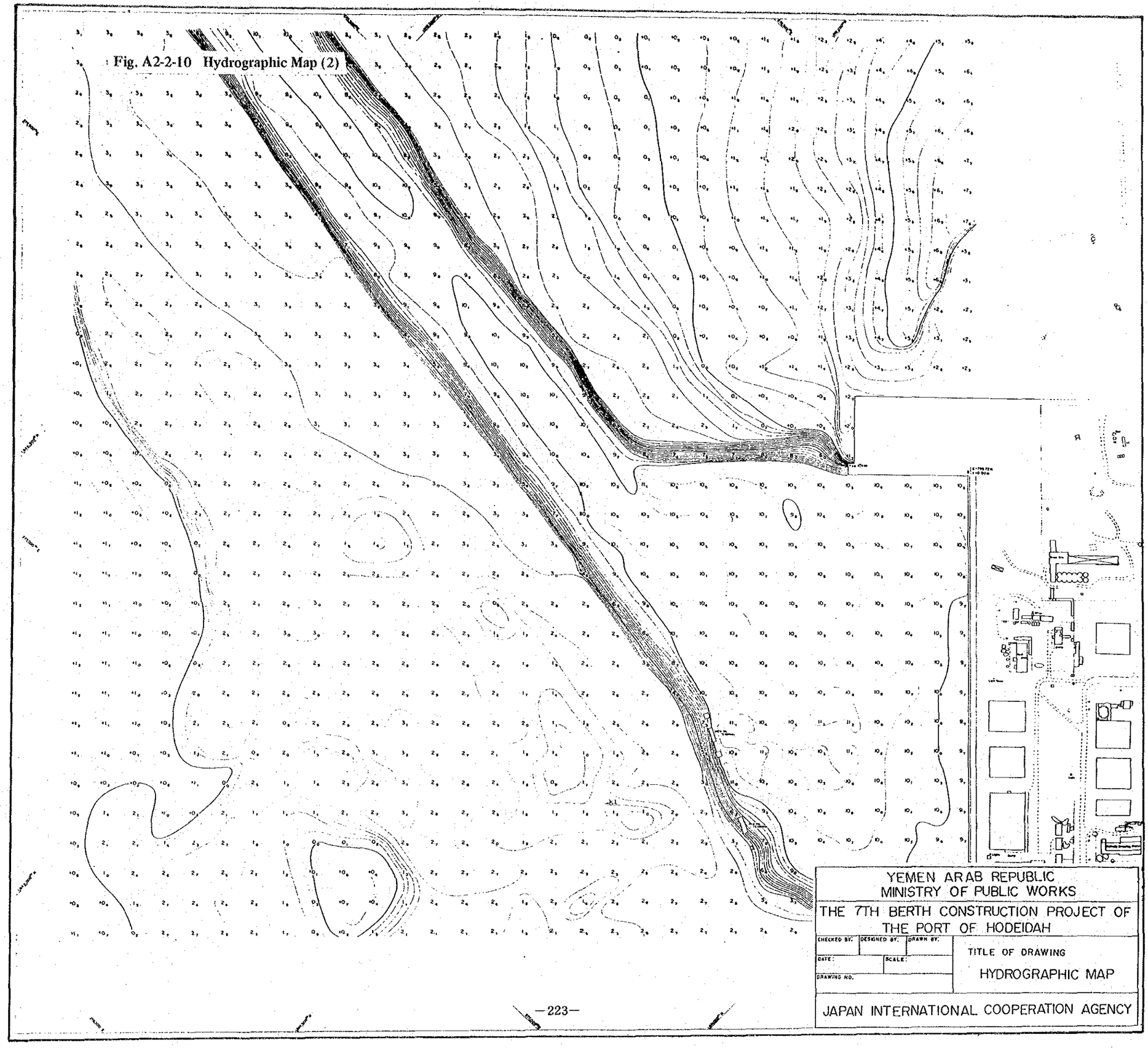


Fig. A2-2-9 Hydrographic Map (1)

Fig. A2-2-10 Hydrographic Map (2)



YEMEN ARAB REPUBLIC
MINISTRY OF PUBLIC WORKS

THE 7TH BERTH CONSTRUCTION PROJECT OF THE PORT OF HODEIDAH

CHECKED BY:	DESIGNED BY:	DRAWN BY:	TITLE OF DRAWING
DATE:	SCALE:		HYDROGRAPHIC MAP
DRAWING NO.			

JAPAN INTERNATIONAL COOPERATION AGENCY