3.4.2 Transshipment

Though statistical data concerning transshipment of petroleum products has not been well-prepared in Djibouti, according to the data prepared by Etablissement Public des Hydrocarbures, the transshipment volume in 1992 was 141,741 kiloliters consisting of about 35% of the total volume of shipment. Gas oil was the largest product by volume in the transshipment.

3.4.3 Bunker Supply

According to the statistics of Port Autonome International de Djibouti, bunker supply of petroleum products to vessels calling at Djibouti Port has decreased year by year.

This is because the competing ports, such as Jidda and Aden located in oil producing countries with refining facilities have been well-equipped for bunkering services as previously noted.

3.5 Demand Forecast

Demand forecast was made for petroleum products shipped to Djibouti domestic market, bunker supply, and transshipment by the type of oil in 2010 based on the assumptions described below:

3.5.1 Basic Assumptions

In this forecast, Djibouti's social and economic framework is set up as in Table 3-4.

Table 3-4 Forecast of Economic Indicators

Year	1988	1995	2000	2010
Population(1,000)	500	615	713	958
GDP(million FD)	40,125	60,333	80,739	144,931
GDP per Capita(FD)	80,250	98,102	113,238	150,931
GDP per Capita(US$)	452	500	637	849

Djibouti's first petroleum refinery with a capacity of 120,000BD, to be built at Dorale west of Djibouti city, was planned to operate in 1994. But peace and order conditions in some parts of Djibouti have delayed considerably the start of this project. Somalia also is said to have a similar refinery project with a capacity of 200,000BD. These kinds of export-oriented refinery projects usually take considerable time to materialize and also have many financial and technical problems as well as political problems. We consider the export refinery project in Djibouti will be extremely difficult to be operable before 2010.

3.5.2 Oil Demand Forecast

The demand for petroleum products in 2010 is estimated by dividing the demand into three categories, viz. Djibouti's domestic demand, bunker supply, and transshipment. The detail of the forecast is compiled in Table 3-5.

In the domestic demand forecast, gasoline and gas oil for motor vehicles are estimated by multiplying the average annual fuel consumption per car between 1984 and 1991 (1,222 liters and 1,469 liters respectively) with the number of cars expected to be registered in 2010 respectively. Gasoline is assumed to be solely used for motor vehicles, and gas oil is assumed to be used for motor vehicles at the rates of 80 percent in 2000 and 90 percent in 2010 respectively.

Table 3-5 Oil Demand Forecast (2010)

(in kilo liter)

	1992	2000	2010
Domestic Consumption			
Gasoline	17,630	21,730	31,850
Kerosene/Jet Fuel	15,299	23,680	40,890
Gas Oil	31,871	65,300	85,090
Fuel Oil	50,025	85,950	146,800
Total	114,825	196,660	304,630
Bunker Supply			
Gasoline	412	500	700
Kerosene/Jet Fuel	82,238	96,350	117,460
Gas Oil	49,108	62,210	83,600
Fuel Oil	17,665	22,380	30,070
Total	149,423	181,440	231,830
Transshipment			
Gasoline	3,126	4,620	7,520
Kerosene/Jet Fuel	33,315	49,220	80,180
Gas Oil	86,498	127,800	208,170
Fuel Oil	18,802	27,780	45,250
Total	141,741	209,420	341,120
Grand Total	405,989	587,520	877,580
Equivalent to ton	341,140	495,280	741,300

Note: 1 kl = 0.737 metric ton for gasoline
1 kl = 0.814 metric ton for kerosene/jet fuel
1 kl = 0.843 metric ton for gas oil
1 kl = 0.9 metric ton for fuel oil
(according to IEA Conversion)

Kerosene and jet fuel for domestic consumption are estimated from the trends in the past (1981 ~ 1992: refer to Table 3-3) with the annual rate of increase of about 5.6 percent.

Base case estimation for electricity generation by EDD is adopted to forecast the consumption of fuel oil in 2000 and 2010 as shown in Table 3-6. Fuel oil is assumed to be used exclusively for electricity generation.

Table 3-6 Electricity Generation Forecast (forecast by EDD)

(Low=4%, Base=5.5%, High=7%)

		1992 (Actual)	1995	2000	2005	2010
Electricity Generation (Gwh)						
	Low Case	206.0	227.7	277.1	337.1	410.1
	Base Case	206.0	259.1	338.6	442.5	578.3
	High Case	206.0	294.2	412.6	573.6	811.6
Fuel Consumption (MT)						
Gas Oil	Low Case		689	838	1,019	1,240
	Base Case	623	784	1,024	1,338	1,749
	High Case		890	1,248	1,735	2,454
Fuel Oil	Low Case		52,022	63,308	77,016	93,693
	Base Case	47,064	59,196	77,359	101,096	132,122
	High Case		67,215	94,265	131,048	185,423
Local Consumption (MT)						
Gas Oil*		1,791	2,252	2,944	3,847	5,028

* Estimated by Base Case
Source: EDD

As for bunker supply for aviation and marine use, demand for gasoline is set at 500 kl and 700 kl in 2000 and 2010 respectively, and that for jet fuel is assumed to increase 2 percent annually from the past trends, and both gas oil and fuel oil for marine bunker are estimated to stop decreasing and recover at the average annual rate of 3 percent from 1992 taking results of consultations with the oil companies and other institutions into consideration.

Since there is no reliable statistical data regarding transshipment of fuel oils, we estimate growth rate of the volume of transshipments at 5 percent based on the potential economic growth rate in Ethiopia.

3.5.3 Comparison of Forecasts

This oil demand forecast is compared with that of the National Energy Plan (NEP) prepared by ISERST in cooperation with Volunteers in Technical Assistance of USA in

July 1987 and also to that of the Port Master Plan prepared by BCEOM, France, in February 1993. The result is as shown in Table 3-7:

Table 3-7 Comparison of Oil Demand Forecasts

Unit: Metric Ton

	JICA Study Team	NEP		BCEOM	
		Reference Case	Growth Case	Low Case	High Case
2000					
Domestic Demand	167,693	140,957	178,335	136,486	139,150
Bunker Supply	151,382	-	-	207,766	234,202
Transshipment	176,207	-	-	131,973	131,973
Total	495,282	-	-	424,721	505,324
2010					
Domestic Demand	260,609	-	-	179,896	187,005
Bunker Supply	193,666	-	-	256,183	290,880
Transshipment	287,021	-	-	90,948	145,101
Total	741,296	-	-	527,027	622,986

The difference between our oil demand forecast and that of the New Energy Plan is very small, and our forecast falls between Reference case and High Growth case of the NEP in 2000. However, this oil demand forecast exceeds even that of the High case in BCEOM's Port Master Plan. BCEOM's oil demand forecast was made before February 1993 when the actual demand for petroleum products in 1992 was not known. Moreover, accuracy of the statistical data for the petroleum products movements in Djibouti has been much improved due to the efforts made by the departments concerned after April, 1993. BCEOM's oil demand forecast is considered to be too low except for bunker supply taking the recent development of the oil demand in Djibouti.

Chapter 4 Reconstruction Plan of the Oil-Berths

CHAPTER 4 RECONSTRUCTION PLAN OF THE OIL-BERTHS

4.1 Present Trends in Oil-Berths Utilization

To determine the existing port activities such as existing oil cargo handling, oil tankers call, and bunkering at Berth Nos. 11 and 12, five available sources of data were examined.

The past port activities at Berth No. 10 which was under construction during this study period were also taken into consideration simultaneously so that the allocation of oil tankers and oil cargo among Oil Berth Nos. 10, 11, and 12 could be well coordinated.

4.1.1 Oil Tankers

(1) Number of Calls of Oil Tankers

The number of ship calls of oil tankers per annum at Port of Djibouti, relevant total tonnage and average tonnage are summarized in the following Table 4-1.

Table 4-1 Number of Calls of Oil Tanker, Total Tonnage & Average Tonnage

Year	1988	1989	1990	1991	1992
Total tonnage (1,000 G.T./annum)	1,775	1,702	2,586	2,186	1,302
Number of Calls	89	86	428	98	78
Average Ship size (G.T./Vessel)	19,944	19,791	23,944	22,306	16,692

Source : "Statistiques Portuaires" PAID

Further detailed review was made hereunder for data of the year 1992 as an example.

The sizes of dominant ships are at below 5,000 DWT, 30,000 to 35,000 DWT, and 40,000 to 45,000 DWT.

(2) Oil Cargo Handling

The average quantity of oil cargo per each oil tanker handled at Port of Djibouti and the related berthing time per call are given in Table 4-2.

Table 4-2 Average Handling Volume and Berthing Time per Call

Year	Average handled volume per ship	Average time per call
	(MT)	(hr min.)
1990	NA	39 h 15 m (83)
1991	5,496 (65)	NA
1992	6,839 (48)	30 h 23 m (48)
Average	6,050 (113)	36 h 23 m (131)

NOTES 1) Source : i) "Fiche de renseignements concernant"
ii) "Manifest"
2) Figures in parentheses show the number of specimens

The efficiency of handled volume: 168 MT./hr equivalent to approx. 200 cu.m/hr of berthing time obtained from the above results is much lower than ordinary standard figure of 300 or sometimes can reach up to 800 cu. m/hr. This is presumed to be caused by (1) relatively small size of oil tankers, (2) many kinds of oil products loaded in one ship, and (3) oil cargoes of two or three oil companies as consignees being frequently carried in one tanker, caused longer handling time thus less efficiency.

The efficiency of oil discharging, however, is still better than that of loading. Particularly the efficiency of bunkering is much worse than the aforementioned oil cargo handling due to the small size receiving facilities of the objective ships and lower capacity of pumps at storage tank yards.

For small quantity bunkering, tank trucks are being used instead of cargo pipe lines.

(3) Particulars of Oil Tankers calling at Port of Djibouti.

By analyzing the particulars of oil tankers calling at the port, none below 35,000 DWT in capacity exceed the specification of size indicated in the Japanese Technical Standards for Port Facilities.

Almost all tankers are old, i.e., 3/4 of the tankers are older than 10 years, and 20 % of them are more than 20 years old.

4.1.2 Bunkering and "Non-Commercial" Operation Ships at Berth Nos. 10, 11 and 12

The activities of bunkering for ships at Port of Djibouti for the last few years are summarized in Table 4-3.

Table 4-3 Activities of Bunkering at Port of Djibouti by Oil Companies

Name of Oil Companies	1990		1991		1992	
	Volume (MT)	Number of ships	Volume (MT)	Number of ships	Volume (MT)	Number of ships
Mobil Oil	50,627	127	26,686	102	30,267	66
Total Mory	25,103	130	22,939	123 (76)	32,592	145 (96)
Shell B.P.	5,940	58	9,742	70	12,172	106
Total	81,670	315	59,367	295	75,031	317

NOTE : 1) Source : " Statistiques Portuaires " 1991/1992 , PAID.
2) ( ) Shows the number of ships bunkering at Berth Nos. 10, 11 and 12.

Berth Nos. 10, 11 and 12 are being used not only for the handling of oil cargo but utilized for bunkering with large supply volume especially for those ships calling Port of Djibouti for bunkering purposes only.

The average berthing time of all ships for bunkering and "Non-Commercial" operation at Berth Nos. 10, 11 and 12 in 1992 was 47 hr. 20 min. per vessel.

4.1.3 Activities of Oil Companies

(1) Operation of Oil Companies

At Port of Djibouti, three (3) Oil Companies, namely Mobil Oil, Total Mory and Shell B.P. are operating. Both Mobile and Total handled about 100 thousand metric tons of oil products in 1992, whereas Shell handled about 60 thousand. Totally 336.6 thousand tons were handled of which about 10 % was for export.

The three Oil Companies are well coordinated with each other on oil cargo handling operations and making efforts to realize better efficiency and safer operation.

(2) Desires and Future Plan of Oil Companies

Through interviews made with the three (3) Oil Companies, their opinions as users on the re-construction of Berth Nos. 11 and 12 and their future working plan were obtained and enumerated below.

1) Three Oil Companies will continue their operations to maintain the activities of oil reservation.

2) Three Oil Companies have similar prospects on future demands of oil products, that the volume of bunkering may be stable and a drastic increase of domestic oil consumption may not be expected. As for the transshipment, the Ethiopian market will be hopeful.

3) The Oil Companies still have strong wishes to be allocated at least one or two oil berths for exclusive use of oil tankers.

4) Size of oil tanker and Berth water depth :

Considering the scale of oil cargo volume handled, the preferred size of oil tankers is 30,000 to 45,000 DWT, with 30,000 DWT class tanker their most desirable capacity. The water depth of the Berth is to be -12.0 m.

The Oil Companies also noted the usage of small size oil tankers of 3,000 to 5,000 DWT class which are plying between Aden, Assab and sometimes Jedda or Yanbu.

5) Oil discharging/loading equipment

According to the Oil Companies, they don't consider necessary the oil discharging/loading equipment such as oil loading arm(s).

6) All Oil Companies emphasized that there is no question on the necessity of the re-construction of the Berth Nos. 11 and 12 of which structural conditions are much below international standards and might collapse at anytime.

7) Sequence of the re-construction of Berth Nos. 11 and 12:

To avoid or minimize the stoppage and disturbance of the Oil Companies' daily operations, the re-construction works are preferable to be started after completion of Berth No. 10. Probably, Berth No. 11 should be the first and Berth No. 12 will follow.

4.2 Allocation of Oil -Berths

4.2.1 Present Situation of Oil Berths Utilization

The existing Oil Berths including Berth No. 10 are utilized under the situations as enumerated below :

(1) The dangerous cargo handling including oil cargo and LPG (Liquefied Petroleum Gas) are scattered at Berths Nos. 10, 11 and 12, and Quay No. 13 and 14, due to unsatisfactory conditions of original Oil Berth Nos. 10, 11 and 12.

(2) Among the above Berths, No. 10 is now under rehabilitation. The rehabilitation of the working platform consists of the steel sheet pile wall connecting two breasting dolphins, and the dredging of the frontal basin to -13.0 m in the 2nd phase. However, this is not included in the scope of the on-going rehabilitation.

(3) Berth Nos. 10, 11 and 12 are also utilized for bunkering with large quantity supply, and other "Non-Commercial" operations such as water supply, repair, food and spare parts supply, change of crew and so on.

4.2.2 Allocation of Oil Berths

Based on the aforementioned situation, the following basic policy on the berthing allocation is presumed for oil tankers, bunkering ships and other "Non-Commercial" operation ships at Berth Nos. 11 and 12 including Berth No. 10:

Description	Berth Nos. 11 & 12	Berth No. 10	Total
Oil cargo handling operation of Oil Tanker	80 % (below 35.000 DWT or max. draft 11.0 m)	20 % (above 35,000 DWT or max. draft 12 m)	100 %
Bunkering Service for supply of large volumes	67 %	33 %	100 %
"Non-Commercial" operation ships (large size)	67 %	33 %	100 %

4.3 Determination of Number and Size of Proposed Oil Berths

4.3.1 Required Number of Proposed Oil Berths

(1) Oil Tankers for Oil Cargo Handling

The relation between ship size (DWT) and oil cargo volume handled by individual oil tankers in 1992 are shown in Fig. 4-1.

It is assumed that in the target year 2010, the average oil cargo handling volume per vessel will be 6,050 tons, unchanged from the present condition as described in Section 4.1.1 (2).

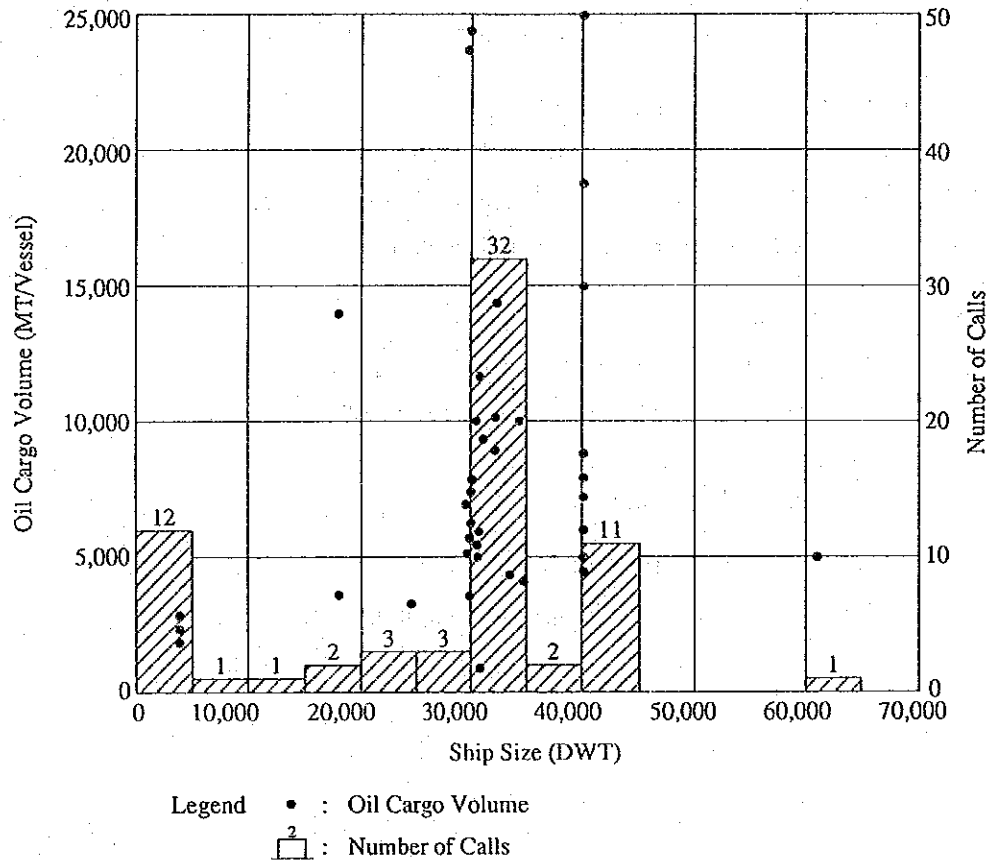


Figure 4-1 Ship Size, Oil Cargo Volume and Number of Calls

Consequently, the projected number of annual ships calls will be obtained as 123 by a quotient of the total oil cargo volume divided by the average oil cargo volume per vessel both predicted for 2010.

Applying the present average berthing time : 36 hr. 00 min./oil tanker (see Section 4.1.1 (2)), the total annual berthing time of oil tankers will be 184.5 days by multiplying annual ship calls and average berthing time.

(2) Bunkering and "Non-Commercial" Operation Ships:

Based on the present figures in 1992 (See Section 4.1.2) and the berth allocation as described in Section 4.2.2, the total annual berth occupancy days at Berths Nos. 10, 11 and 12 are predicted as follows:

Bunkering	:	209 days/annum
"Non-Commercial" Operation	:	152 days/annum
Total	:	361 days/annum

(3) Berth Occupancy rate

According to "Preliminary Design Report, Quay No 14, Berth No. 10 & Ancillary Facilities" Jan. 1986 by BCEOM, the present average total berth occupancy rate is 43.2 %.

Considering the above present berth occupancy rate and based on "queuing theory" to minimize tanker's waiting time, the berth occupancy rate of the proposed oil berth is set up at 50 %.

(4) Number of Effective Working Days:

Considering the location of the Oil Berths, which are directly facing windward against the Khamsin, the annual numbers of effective working days is presumed accordingly to be 330 days.

(5) Required Number of Oil Berths

Using the aforementioned figures, the required number of Oil Berths for the forecast oil cargo handling and bunkering activities in the year 2010 (See Chapter 3) is obtained as 3.31 by berth occupancy time from Table 4-4 divided by effective working days and berth occupancy rate.

Table 4-4 Forecasted Berth Occupancy Time in Year 2010

Category of activities		Berth Occupancy Time (days/annum)		
		Berth Nos. 11 & 12	Berth No. 10	Total
1) Oil tankers/oil cargo handling	By tankers > 35,000 DWT	-	37 days	37 days
	By tankers < 35,000 DWT	148 days	-	148 days
2) Bunkering and "Non-Commercial" operation	Bunkering	139 days	70 days	209 days
	"Non-Commercial" operation	70 days	82 days	152 days
Total		357 days	189 days	546 days

The existing three (3) oil-berths, namely Berth Nos. 10, 11 and 12 will therefore, be utilized accordingly.

As for the surplus demand portion calculated as "0.31" (=3.31-3) berth, the "Non-Commercial" ships should berth at the quays other than the above oil-berths.

4.3.2 Size of Oil Berths

The following aspects are considered to determine the size of Oil Berths:

(1) As revealed in a previous Section of this report, almost all oil tankers are calling at Port of Djibouti in semi-loaded condition except for small size tankers around 3,000 DWT.

(2) At the same time as described in Section 4.2.2 the oil tankers larger than 35,000 DWT should be allocated to Berth No. 10.

(3) In the year 2005 or 2010, those built in 1990 or 1995 will be the dominant age of oil tankers calling at Port of Djibouti.

Based on the above mentioned studies, the dimensions of proposed Oil Berth Nos. 11 and 12 are to be finalized under the following conditions:

(1)	Objective ships	:	Minimum Oil Tanker 3,000 DWT
			Maximum Oil Tanker 35,000 DWT
(2)	Maximum Draft	:	-11 m
(3)	Water depth of frontal basin	:	-12 m
(4)	Length of Berth	:	250 m

4.4 Alternative Layout Plans of Proposed Oil Berths

4.4.1 Problem of Existing Oil Berths Structures:

In order to accommodate the aforementioned objective ships the following major points should be improved:

(1) The existing structure of Berth Nos. 11 and 12 is no longer usable.

(2) The spacing of the two existing breasting dolphins of each berth is not suitable for the oil tankers.

(3) The wooden access bridges and catwalks are not strong enough nor durable;

(4) The crown height (elevation +3.50 m above MLLW as 0.) of the working platform and mooring/breasting dolphins are relatively low.

(5) Face line of the Berth Nos. 10, 11 and 12 are staggered.

4.4.2 Layout Plan of Proposed Oil-Berths

The major policies on the re-construction of the Oil-Berth Nos. 11 and 12 are tentatively summarized as follows:

(1) Oil Berths Nos. 11 and 12 will be re-constructed in a similar layout plan and scale under the conditions described above.

(2) The layout of working platforms and mooring/breasting facilities will be so arranged that all sizes of objective ships can be accommodated smoothly and safely.

(3) The size and strength of the access will be determined to meet the size of vehicles and oil pipelines to be accommodated thereon.

(4) To decide the crown height of the working platform and mooring/breasting facilities, the following points will be considered:

1) Height of existing port road level
2) Design height of on-going rehabilitation of Berth No. 10
3) Freeboard of oil tankers for oil cargo handling activities

(5) As for oil cargo handling the oil unloader will be installed on the working platform in the future stage.

(6) The face lines of proposed Oil Berth Nos. 11 and 12 will be in the same alignment with that of new Berth No. 10.

Consequently, two alternative general layout plans as shown in Figs. 4-2 and 4-3 are examined as compared in Table 4-5 and it is concluded that Alternative "1" is recommendable.

4.5 Location and Back-up Facilities of Oil-Berths

Upon completion of berthing facilities, the on-land back-up facilities should have sufficient capability to meet the forecasted oil cargo volume and also satisfy the safety and environmental aspects.

The following determinations were made and there were no major difficulties found against the reconstruction of the oil-berths.

Table 4-5 Comparison of General Lay-out of Berth Nos. 11 and 12

	Alternative 1 (Fig 4-2)	Alternative 2 (Fig 4-3)
Layout Plan	1. The actual location of access bridge is adopted as it is. 2. The new faceline is set at same alignment with that of new Berth No. 10.	1. In order to provide room to maneuver for 55,000 DWT tanker at No. 10, the center of Berth Nos. 11 & 12 are to be shifted northward by 20 m and 15 m respectively. 2. same as "Alternative 1"
Advantage	1. Demolition/relocation of the existing concrete parapet wall and pipelines will be minimal. 2. The re-utilization of existing mooring points along the concrete parapet wall will be maximized, hence berthing works will be easier than "Alternative 2".	1. Appropriate bow space for Berth No. 10 will be secured (although according to the Japanese Design Standard requires 226 m length (LOA) of 55,000 DWT oil tanker, the planned one is 190 m which is even shorter than that of 35,000 DWT).
Disadvantage	1. The angle of stern line of max. size tanker (35,000 DWT) at Berth No. 4 will be larger than 45° against the face line. Careful berthing operation will be required.	1. The bow space of Berth No. 12 will be minimized by the navigation approach to Quay No. 13. 2. The location of the existing mooring points along the concrete parapet wall will be eccentric against the berthing position of ships, hence less applicable to the existing mooring points. This will increase the required number of new mooring points.
Note: For both Alternatives, the existing overhead pipelines with a head space of 3.2 m and 4.0 m for Berth Nos. 11 and 12 respectively, will require relocation prior to the construction works, to allow the access of heavy construction equipment to the seaside.		

(1) Location of Oil-Berths

The existing oil-berths are located at the extreme outer edge of the Port of Djibouti which gives the deepest water and easy accessibility thus allowing for safe maneuvering of tankers.

The hydrographic survey verified that the water depth of the frontal basin is reasonably well maintained.

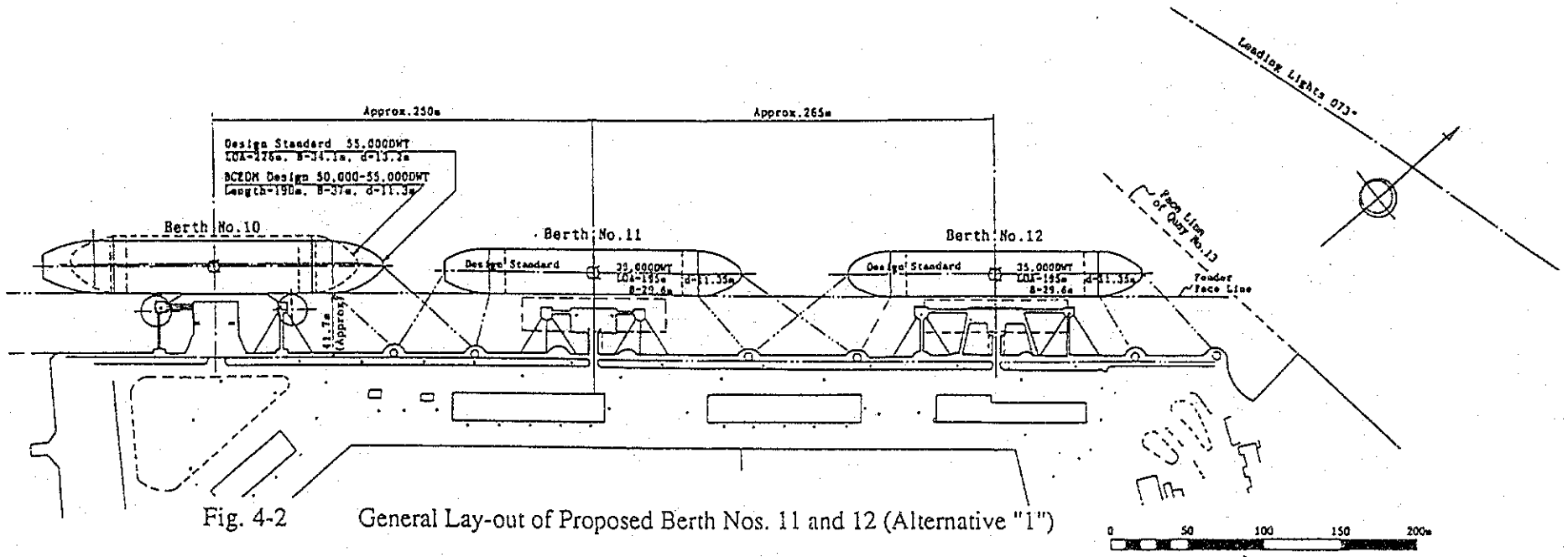


Fig. 4-2 General Lay-out of Proposed Berth Nos. 11 and 12 (Alternative "1")

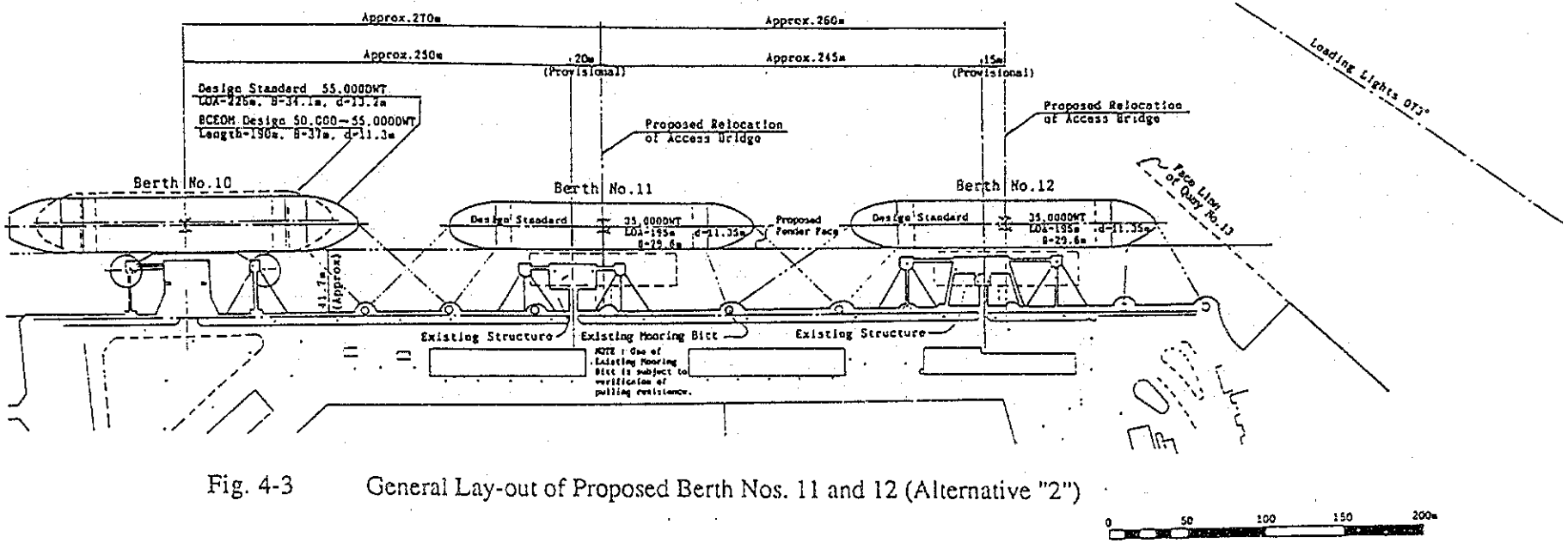


Fig. 4-3 General Lay-out of Proposed Berth Nos. 11 and 12 (Alternative "2")

Although the proposed berths are facing the outer sea where seasonal winds prevail during the Khamsin season, other alternative locations are not recommendable due to the congestion of the inner harbor and the unsafe operation. The location of tank yards which is a little remote from the existing oil-berths and connected by pipelines is not ideal from the safety view point but underground pipelines instead of the existing on-ground pipelines will minimize the hazards.

(2) Storage Tank Yards

The total capacity of the existing oil storage tanks owned by the three oil companies is approximately 200,000 cubic meters equivalent to 170,000 metric tons.

The pipelines and relevant facilities are owned, operated and maintained by the oil companies. As described in Section 2.4, some pipeline has been renewed recently.

Therefore, it can be said that the PAID and the oil companies have sufficient experience, capacity and capability for operation and maintenance since the forecast volume to be handled in the target year 2010 is 740,000 MT still very low compared with the capacity of almost two million metric tons per year in the 1960's.

(3) Inland Transportation

Among the major inland transport modes, the railways (CDE) are predominant for the transshipment of cargo to Ethiopia.

As described in Section 2.4, the CDE owns more than 100 oil tank wagons, 19 locomotives and other rolling stock which will meet future transportation demands for oil.

Chapter 5 Preliminary Design

CHAPTER 5 PRELIMINARY DESIGN

5.1 Preliminary Design Conditions

5.1.1 Design Policy

In design of facilities, their function, importance and lifetime should be taken into consideration.

As for the lifetime of the facilities, we propose thirty (30) years by examining their function, economic value, and their social and physical property.

The preliminary design for the Oil-Berth Nos. 11 and 12 will be conducted in consideration of the following points:

(1) Natural conditions at the Site shall be carefully considered so that the structures, materials and construction methods should meet the site conditions.

(2) The design of facilities will be based on Japanese standards as mentioned later unless otherwise specifically needed.

5.1.2 Design Conditions

Based on the field survey, data collected and results of site surveys, the design conditions for the facilities to be planned are established as follows:

1) Meteorological Conditions

- Winds: Maximum wind velocity = 35 m/sec. for superstructure
  = 20 m/sec. for mooring force

2) Oceanographic Conditions

- Tide: H.W.L. = + 2.90 m
  L.W.L. = + 0.20 m
  L.L.W.L. = 0.00 m = IGN - 1.77 m

- Current: 1 knot

3) Seismic Forces

The design seismic coefficient shall be determined considering regional seismic intensity, subsoil condition and importance of the facility and is evaluated as 0.12.

4) Soil Conditions

- Filling materials for Cellular Cofferdam : $\phi 35°$, $\gamma = 1.8$ t/m^3, $\gamma' = 1.0$ t/m^3
- Backfill materials : $\phi 30°$, $\gamma = 1.8$ t/m^3, $\gamma' = 1.0$ t/m^3
- Berth No. 11 area : CPT-5 is applied.
- Berth No. 12 area : CPT-8 is applied.

5) Oil-Berth Use Conditions

Table 5-1 Objective Vessels : 3,000/35,000 DWT Oil Tanker

D.W.T. (ton)	3,000	35,000
Displacement (ton)	4,259	43,940
Overall Length (m)	88	195
Molded Breadth (m)	13.8	29.6
Molded Depth (m)	6.5	15.9
Max. Draft (m)	5.6	11.0
Berthing Velocity (m/sec)	0.20	0.15

- Crown Height +3.50 m same as existing one
- Surcharge Ordinary case : $q = 1.0$ tf/m^2
  Seismic case : $q = 0.5$ tf/m^2

6) Materials for Structures

<u>STRUCTURAL STEEL</u>

- Structural Steel : SS 400 (JIS G 3101)
- Steel Pipe Pile : SKK 400 (JIS A 5525)
- Steel Bar for concrete reinforcement : SD 295 A (JIS G 3112) for deformed bar

- Sheet Pile : SY 295 (JIS A 5528)

- Allowable Stresses shall be in accordance with Japanese "Technical Standards for Port Facilities".

- Corrosion Rate of Steel : The corrosion rates of steel for design vary in level and atmosphere from 0.1 mm/year to 0.3 mm/year.

CONCRETE

- Unit Weight : Reinforced Concrete : 2.45 tf/m^3 (in air)
  : 1.45 tf/m^3 (in water)
  : Plain Concrete : 2.30 tf/m^3 (in air)
  : 1.30 tf/m^3 (in water)

- Allowable Strength of Materials

  Reinforced Concrete : 240 kgf/cm^2 (standard design strength)
  : 90 kgf/cm^2 (allowable flexural compressive strength)
  : 9 kgf/cm^2 (allowable shearing strength)
  Plain Concrete : 180 kgf/cm^2 (standard design strength)

7) Technical Standards/Codes to be applied in Design

- Japanese Industrial Standard: JIS (Japan Standards Association)

- Technical Standards for Port Facilities (Japan Port & Harbor Association)

- Standard Concrete Specifications (Japan Society of Civil Engineers)

- Technical Standards for Shore Protection Facilities (Japan Association of Coastal Engineering)

* Notes: The following French Technical Regulations are referred: CCBA68, CM66, NV65, PS69 and DTUs concerned.

5.2 Preliminary Design

5.2.1 Determination of Structural Type

In order to determine a structural type of the proposed berths, several alternatives are selected by considering the characteristics of the structural types and examining the following factors:

- Natural conditions
- Conditions of use
- Construction period
- Construction cost
- Existing structural types in the Port of Djibouti

Taking into consideration the above, the following structural types are comparatively studied as alternatives (refer to Fig. 5-1):

Solid Structural Type:

Alternative I	Steel Sheet Pile Cellular Cofferdam Type
Alternative II	Cellular Block Type

Flexible Structural Type:

Alternative III	Open-type Pier with Coupled Batter Piles

The results of comparative studies are tabulated in Table 5-2 and the steel sheet pile cellular cofferdam type is selected.

5.2.2 Preliminary Design Drawings

The preliminary design drawings of the proposed structural type are shown in Figs. 5-2 and 5-3.

Figure 5-1 Structure Comparative Study

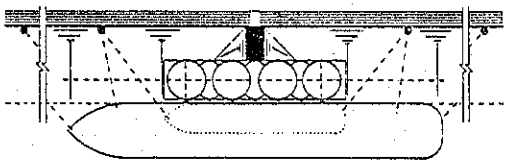
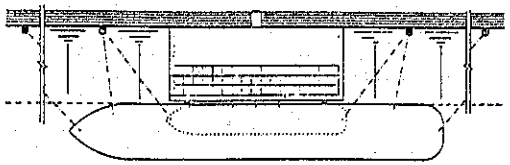
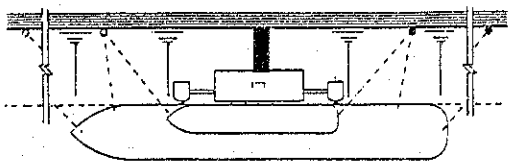
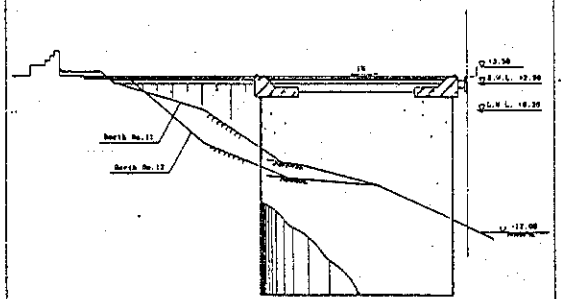
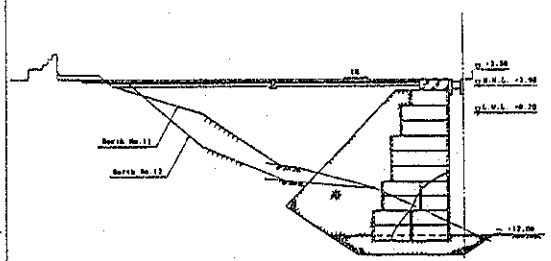
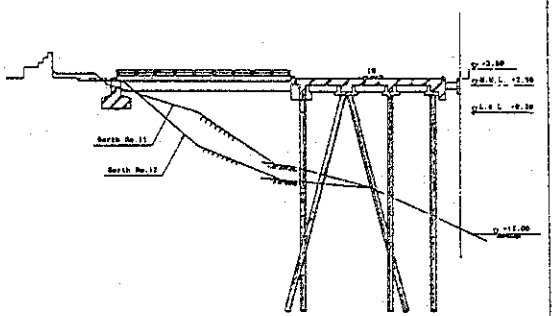
Alternative	I	II	III
Structure Type	Steel Sheet Pile Cellular Cofferdam	Cellular Concrete Block	Open-Type Pier
General Plan			
Cross Section			

Table 5-2 Structure Comparative Study

Alternative	I	II	III
Structural Type	Steel Sheet Pile Cellular Cofferdam	Cellular Concrete Block	Open-Type Pier
Advantages	- As a solid gravity type, it can be more resistant to rough wave forces and even accidental collision of ships with the structure which may happen when it is difficult to maneuver the ship during rough season. - In the Port of Djibouti, there exist many similar structural type quays. - As for the construction, heavy equipment for marine works such as a pile driving barge is not needed and it can be mostly executed on land. - The demolition of the existing structures can be minimized. - It is easy to obtain filling materials for the cellular cofferdam. - It will be easy to maintain. - It will be easy to expand the berth length.	- As a solid gravity type, it can be more resistant to rough wave forces and a collision of ship with the structure during rough season when it is difficult to maneuver the ship. - It is easy to obtain filling materials for the cellular blocks. - It will be easy to maintain. - It will be easy to expand the berth length.	- Since the critical design force for pile foundations is the berthing and mooring forces, it can be more resistant to seismic force than the other gravity type alternatives for which the critical force is seismic. - As no reflection wave will occur in front of the berth, there will be less overtopping on the berth than the other alternatives, thus, the equipment installed on the berth will be less affected by sea water. - Pile driving can be done interruptedly even during the Khamsin season. - Construction cost is moderate.
Disadvantages	- Since it is a vertical wall type, the reflection wave will overtop the berth, thus, the equipment installed on the berth will be affected by sea water. - Since steel sheet piles are standing unstably unless filled with materials inside, the sheet pile driving should be executed during calm sea conditions, thus construction method and schedule should be well controlled. In particular, the sheet pile driving can not be done during the Khamsin season.	- The same as Alternative I, the reflection wave will overtop the berth, thus, the equipment installed on the berth will be affected by sea water. - As for the construction, heavy equipment for marine works such as a crane mounted barge is needed. - The existing pile foundations should be completely removed for installation of concrete blocks on the rock mound of which the surface should be well leveled and compacted adequately. - Precast concrete blocks should be placed during calm sea conditions, thus construction method and schedule should be well controlled. In particular, the placing of concrete blocks by barge cannot be done during the Khamsin season. - It is necessary to provide a large temporary yard and a loading quay for precast concrete fabrication, stock and handling. - The transportation and installation of such precast concrete blocks by barge inside the port area will disturb port activities. - Construction cost will be very high.	- The same as the existing berths, it will be less resistant to uplift wave forces and a collision of ship with the structure during the rough season when it is difficult to maneuver the ship. - As for the construction, heavy equipment for marine works such as a pile driving barge is needed. - Costly anti-corrosive and other maintenance measures should be taken during the operation period.
Construction Cost Ratio	1.00	1.17	0.92
Evaluation	1	3	2

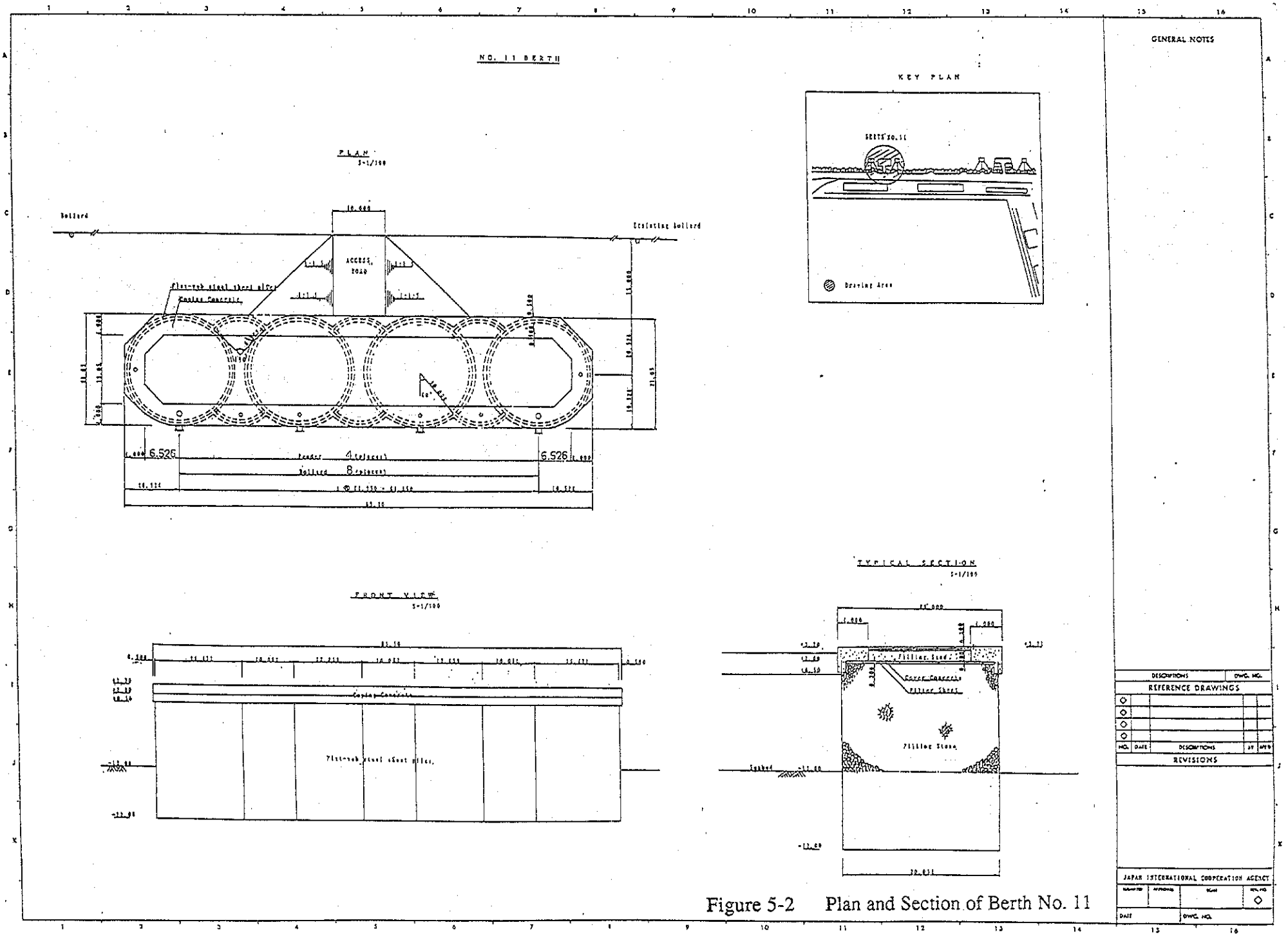
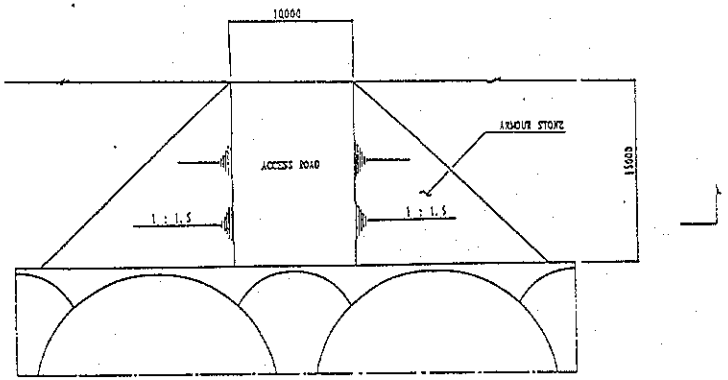
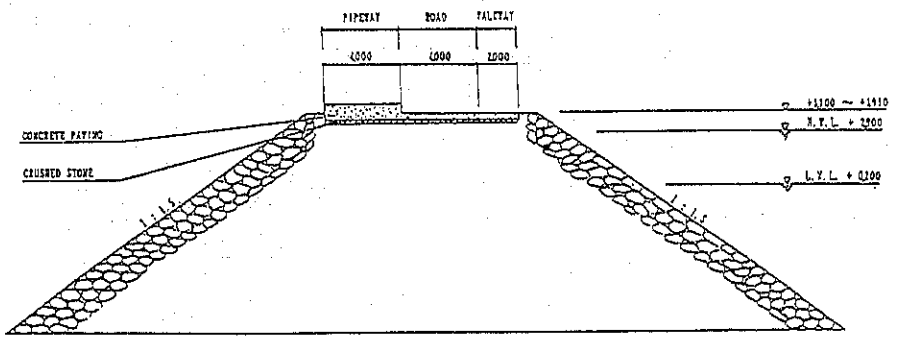


Figure 5-2 Plan and Section of Berth No. 11

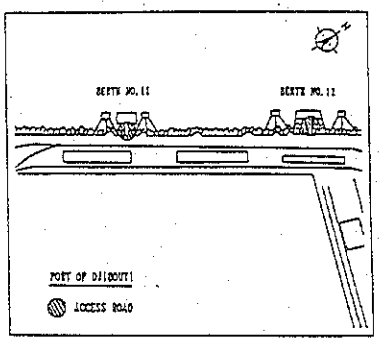


ACCESS ROAD PLAN
S = 1:200



SECTION
S = 1:125

KEY PLAN



GENERAL NOTES

DESCRIPTIONS	DWG. NO.
REFERENCE DRAWINGS	

NO.	DATE	DESCRIPTIONS	BY	APP'D
REVISIONS				

JAPAN INTERNATIONAL COOPERATION AGENCY

DESIGNED	APPROVED	SCALE	APP. NO.
			◇
DATE		DWG. NO.	

Figure 5-3 Access Road

5.3 Construction Method

5.3.1 Construction Activities in Djibouti

(1) General

In order to study the construction method, construction schedule and cost estimate, the construction activities in Djibouti have been investigated by collecting data and information. In Djibouti, there are not only local construction companies but foreign origin general contractors which perform relatively big or difficult construction projects.

(2) Local Availability of Construction Materials/Equipment

The following are locally obtainable with appropriate quality and sufficient quantity: aggregates for concrete, sand, gravel and rocks. However, the other major construction materials are to be imported from several countries.

As for the construction equipment, the following are locally available on lease: crawler cranes (20/40 t); truck cranes (5/25 t); Bulldozer (D7/D9); Graders; Back-hoes; Dump trucks; etc. However, working barges and crane mounted barges are not available in Djibouti.

5.3.2 Construction Method of Proposed Berths

(1) Site Preparation

Site preparatory works includes the cut-off of the existing parapet wall and replacement of the pipelines to underground. Then, a temporary access dike will be made of filling materials.

(2) Demolition of the Existing Structures

The existing structure will be partially demolished.

(3) Construction of Steel Sheet Pile Cellular Cofferdam

To perform the work, one 100 ton class crawler type crane is indispensable. As for the construction materials, steel sheet piles, cement, reinforcing steel bars, axially cylindrical rubber fenders and bitts are to be imported.

Table 5-3 Cost Estimate

(Unit: 1,000 Yen)

Item	Berth No. 11		Berth No. 12		Total	
	foreign portion	local portion	foreign portion	local portion	foreign portion	local portion
Direct Construction Cost	482,850	329,649	475,281	330,278	958,131	659,927
A. Preparatory Work	57,899	12,550	57,899	12,550	115,798	25,100
B. Demolition of Existing Berth	11,802	8,330	9,598	7,195	21,400	15,525
C. Quay Wall	345,211	282,132	339,670	282,132	684,881	564,264
D. Access Road	2,711	23,385	2,887	25,149	5,598	48,534
E. Other Works	65,227	3,252	65,227	3,252	130,454	6,504
(Improvements of Existing Bitts, Installation of Fire Alarms, Installation of Lighting Poles and Water Supply facilities)						
Indirect Construction Cost	205,736	198,695	169,550	94,955	375,286	293,650
TOTAL CONSTRUCTION COST	688,586	528,344	644,831	425,233	1,333,417	953,577
ENGINEERING SERVICES	86,850	27,269	65,929	20,230	152,779	47,499
TOTAL PROJECT COST	775,436	555,613	710,760	445,463	1,486,196	1,001,076

Note 1: Dredging Work, Diversions of Pipelines and Additional Pipelining are not included in this estimate.
2: Exemption from taxation and duties considered for the project related materials and machinery.
3: Exchange rates are set as 107.85 ¥/US$, 179.48 FD/US$ and 0.60 ¥/FD.

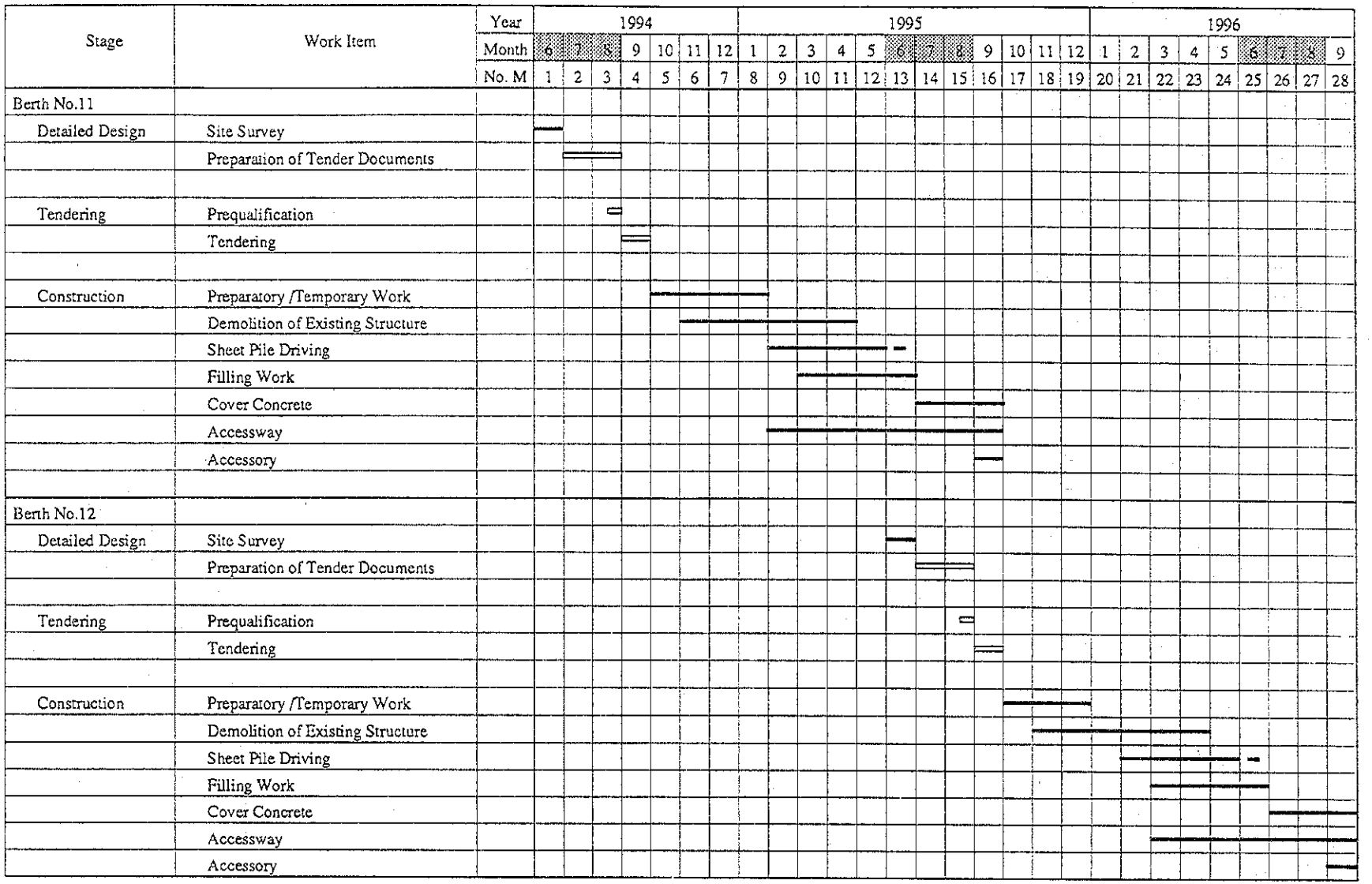
5.4 Cost Estimates

Project cost for the Oil Berths Reconstruction is summarized in Table 5-3.

5.5 Implementation Program

Implementation schedule is proposed as shown in Fig. 5-4 and it will take 28 months from the detailed design to the completion of reconstruction of Berth Nos. 11 and 12. The construction period for one berth is estimated at 12 months. In this schedule, it is emphasized that the steel sheet pile driving could not be done during the Khamsin season i.e. from June to August.

Figure 5-4 Implementation Schedule



Chapter 6 Environmental Impact Study

CHAPTER 6 ENVIRONMENTAL IMPACT STUDY

6.1 General

The proposed Oil-Berth project principally consists of re-construction works of similar berthing facilities which will give positive environmental impacts by improving the existing facilities and oil cargo handling systems but additional significant adverse effects are, therefore, not anticipated except for some small negative impacts which will be mainly caused by construction works of the project.

The project sites, including temporary construction yard, are located in the existing port area and surrounded by artificial structures hence negligibly minimal effects on the local habitants, fishery activities, aquatic creatures, ecosystem and other environmental elements.

The major considerations in this environmental impact study are therefore, on the mitigating counter measures to be made on the existing environmental conditions, particularly to minimize seawater pollution caused by oil handling activities.

6.2 Sources of Environmental Impact

Sources of environmental impact of the Oil-Berth Re-construction Project are described in two stages viz: (1) during construction works and (2) after completion.

6.2.1 During Construction Works

Sources of environmental impact which could be caused by the proposed plans can be divided into five components such as, Demolition of existing structures, Dredging/excavation, Operation of heavy equipment, Construction of structures and Transportation of construction materials.

6.2.2 After Completion

The sources of environmental impact can be divided into four components such as, existence of Oil-Berths, operation of Oil-Berths, oil tankers calling at Oil-Berths and tank yards of oil companies for reference.

6.2.3 Identification of Environmental Impact

A project impact matrix that covers the possible impacts on environmental elements during construction and after completion is shown in Table 6-1.

6.3 Forecast and Evaluation of Environmental Impact of Proposed Plan

Environmental impacts which may be caused by the proposed Oil-Berths re-construction plan are given in Table 6-1. These impacts are examined in detail as summarized in Table 6-2 and 6-3 for "during construction works" and "after completion," respectively.

6.4 Conclusion

"During the construction works", impacts which will be caused by the proposed project will not be serious for the environment and be within the manageable limits of the construction contractors.

Results of the environmental study on "after completion" shows that depending on the proposed facilities, oil handling system and proper discipline of the end users, the negative environmental impact will be moderated within the tolerable limit.

Table 6-1 Environmental Impact Matrix for the Proposed Oil-Berths Project

		Environmental Impacts								
		During Construction Works					After Completion			
	Environmental Elements	Demolition of Existing Structures	Dredge/ Excavation	Operation of Heavy Equipment	Construction of Structures	Transportation of Const. Materials	By Existence of Berths	By Operation of Berths	By Oil Tankers	By Tank Yard (For Reference)
Socio-economic Environment	Resettlement/Evacuation of local residents									
	Employment									
	Fishery									
	Traffic and public facilities					D				D
	Community stability									
	Cultural property									
	Water rights/Right of common									
	Public health									
	Waste	D			D				D	
	Hazards									
Natural Environment	Topography and geology									
	Ground water									
	Hydrological situation									
	Coastal zone		D				D			
	Flora and fauna									
	Landscaping/Aesthetics									
Environmental Pollution	Air pollution	D		D		D			D	D
	Sea water pollution		D	D						
	Soil contamination									
	Noise and vibration	D		D						
	Offensive odor									

Note : Impact levels A : Significant negative impact
B : Moderately negative impact
C : not known
D : Negligible negative impact

Table 6-2 Environmental Impact Elements and Countermeasures (during Construction Works)

Environmental impact factors	Environmental impact	Forecasted impact level 1)	Countermeasures	Remarks
1 Demolition of existing structure	1.1 Disposal of demolished material	D	Proper selection of dumping site	Demolished materials : concrete, re-bars, steel pipes
	1.2 Air pollution	D	-	Air pollution by concrete breaker(s) is negligible.
	1.3 Noise and vibration	D	-	Noise level of concrete breaker(s) at 300m distance (approx. 55 dB) is smaller than that of port operation.
2 Dredge/Excavation	2.1 Turbid water by dumped soil	D	Proper selection of dumping site	The excavated soil with few thousnd cu.m. in volume can be dumped without significant effects on the sea water quality.
	2.2 Turbid Water by Seabed excavation	D	Selection of dredger type	Since the port basin was deepened through PAID's maintenance dredging activities, only some marginal portion should be dredged. This works can be done by clam-shell dredging which will cause less turbid water.
3 Operation of Heavy equipment	3.1 Air pollution	D	-	Heavy equipment will generate $CO_2$and NOx. However, generated air pollutants are not expected to influence the ambient air quality.
	3.2 Sea water pollution	D	i) Proper supervision and control of waste oil disposal. ii) Selection of equipment iii) Provision of canvas sheet(s) for oil splash prevention	Required heavy equipment: - mobile crane - pile driver (vibratory, diesel) - concrete breaker - floating crane, or crane on barge - back hoe - clamshell - dump trucks - concrete mixer Lime which will be generated by concrete works is anticipated to be negligibly small.
	3.3 Noise and vibration	D	-	1) Noise level which will be caused by the heavy equipment is negligible as shown below: Equipment / Source of noise / At 300 m distance - Concrete breaker 113 dB 55 dB - Back hoe 118 dB 60 dB - Concrete mixer 108 dB 50 dB Considering the background noise made by port activities, above noise is within tolerable limits. 2) Vibration is negligble.
4 Construction of structures	4.1 Disposal of construction materials	D	i) Proper control of dumping materials ii) Proper control of waste/sewage from contractors camp or temporary facilities	Waste of materials: - Surplus soil - Used scaffolding material - Used concrete forms - Waste oil - Aggregate washing water
5 Transportation of construction materials	5.1 Traffic	D	-	i) Major imported materials will be directly discharged within the port area and hauled to temporoary yard. ii) Major local materials : - Aggregates for concrete - Armour rocks The transportation of those local materials will not affect ordinary traffic activities.
	5.2 Air pollution	D	-	Air pollution by material transportation is negligible.

1) See notes of Table 6-1

Table 6-3 Environmental Impact Elements and Countermeasures (after Completion)

Environmental impact factors	Environmental impact	Forecasted impact level 1)	Countermeasures	Remarks
1 By existence of berth	1.1 Disturbance of port basin by reflected wave (in case vertical wall type is adopted for berth structure)	D	-	In case vertical wall type is adopted for the structure of plateform and breasting dolphins, the calmness of port basin will be worse due to waves reflected by the vertical wall. The level of disturbance, however, will not affect significantly the environmental level, and port operations condition.
2 By operation of berth	2.1 Oil pollution of recreation beach at Plage du Heron		(See countermeasures of 2.2)	i) The beach at Plage du Heron which is located east side of Quays No. 14 and utilized for swimming, is contaminated once in a while particularly during the season of "Khamsin". ii) This situation will be improved by the countermeasures as shown in 2.2. iii) According to the Master Plan prepared by BCEOM this beach area is involved in the future plan of Export Processing Zone.
	2.2 Sea water pollution by spilt oil		i) Enactment of laws and regulations ii) Training of oil-handling workers iii) Establishment of proper oil-handling facilities - Oil spill walls on the platform. - Oil sump on the platform. - Derrick(s) or truck crane for handling of oil hoses iv) Provisions of oil handling equipment and materials - Oil pans - Oil absorption agent - Oil absorption tape - Oil vacuum pumps v) Promotion of environmental consciousness to all concerned. vi) Proper access way to the working platform, which will allow heavy vehicles to enter the oil handling work area to help workers.	i) As described in Section 7.2, Port of Djibouti has oil fence and some other oil pollution control facilities. ii) Captains of oil tanker are obligated to submit "Oil record book, Cargo ballast operation" as stipulated by "Marchant Shipping Protection of Oil Pollution Regulation 1983". iii) Most of oil tankers have segregated ballast tanks which minimize dirty ballast water. iv) While Djibouti is importing port of oil cargoes, the occasion of discharging ballast water is seldom.
3 By oil tankers	3.1 Waste by oil tankers	D	i) Strict deed of garbage collection from ships. ii) Prohibit the sewerage dumping in port area. iii) Promotion of environmental consciousness to oil tankers' personnel.	- Most oil tankers have incinerator for garbage. - Most oil tankers have sewerage tanks.
	3.2 Air pollution	D	-	- Air pollution by oil-tankers i) by emission gas of engines ii) by hydro-carbon vaporization particularly from white products such as gasoline. Those gas or vapor, are expected to be dispersed in the air through high funnel or exhaust mast.
4 By tank yard (for reference)	4.1 Traffic	D	-	- Existing land transportation will not be affected significantly by increased number of tank trucks. - Increment of rail road traffic volume by tankers of CDE (Ethiopia Djibouti Railway) will be absorbed by existing rolling-stock.
	4.2 Air pollution 4.3 Offensive odor	D	-	i) Gasoline with high volatility is handled and stored exclusively by Mobil Oil. The storage tanks for gasoline owned by Mobil Oil prevent the prolification of hydrocarbon vapor by covering free oil surface in the storage tanks with floating screen, thus minimizing air pollution.

1) See notes of Table 6-1

Chapter 7 Organization and Management

CHAPTER 7 ORGANIZATION AND MANAGEMENT

7.1 Organization and Management

7.1.1 Outline of Port Autonome International de Djibouti

Port of Djibouti is managed by the Port Autonome International de Djibouti (PAID).

The basic concept about port management of Djibouti is highly appreciated for the port function contributing to regional development and national interest.

That is, the port is considered not only as a transport industry but also as business and as being planned and managed linking the socio-economic policy of the country.

7.1.2 Organization of PAID

The highest decision making authority of PAID is the Board of Council, but the development plans of the Port of Djibouti and other related matters are determined by the Cabinet Conferences and Presidential Decrees.

The Port is managed by the Port Director under the jurisdiction of the Board of Council. Chairman of the Board is the Minister of Port and Maritime Affairs and Members consist of the representatives from national assembly, related governments, private sectors and Labor Unions.

The Board makes the final decisions on all matters concerning port management, facilities and operation, except for the work and facility plans. Major job authorities of the Board are to:

1. Decide scope of works to be executed within the proposed plan.
2. Decide the maximum charge and the using conditions of facilities which are managed by the Board.
3. Permit on the lease contract of the port premises for the period from 1 year to 30 years.
4. Establish companies or organizations performing the activities relative to the port and maritime affairs.

The organization chart of the PAID is shown in Fig. 7-1.

PAID is the organization executing the decisions made by the Board. The Port Director is appointed by government ordinance and executes all matters relating to the Board authorities.

The Port Director appoints the Managers for the major Divisions of the PAID with the approval of the Chairman of the Board, whereas the Port Director appoints all personnel of the Port, and manages all public services relating to the port management. Besides this, he represents the Port on judicial and civil affairs.

In addition, he decides the amounts of the surplus of necessary funds and reserve funds, and also executes personnel affairs based on labor agreements, procurement contracts and other pre-determined matters.

7.1.3 Present Situation of Management and Operation

(1) Control of Vessels Entry and Departure

The Harbour Master Office of PAID controls all the navigations of vessels in the Port and near shore. One 2,200 Hp tugboat and two other tugboats with maximum power of 1,800 Hp are in operation. The tugboat with 2,200 Hp is equipped with fire fighting devices.

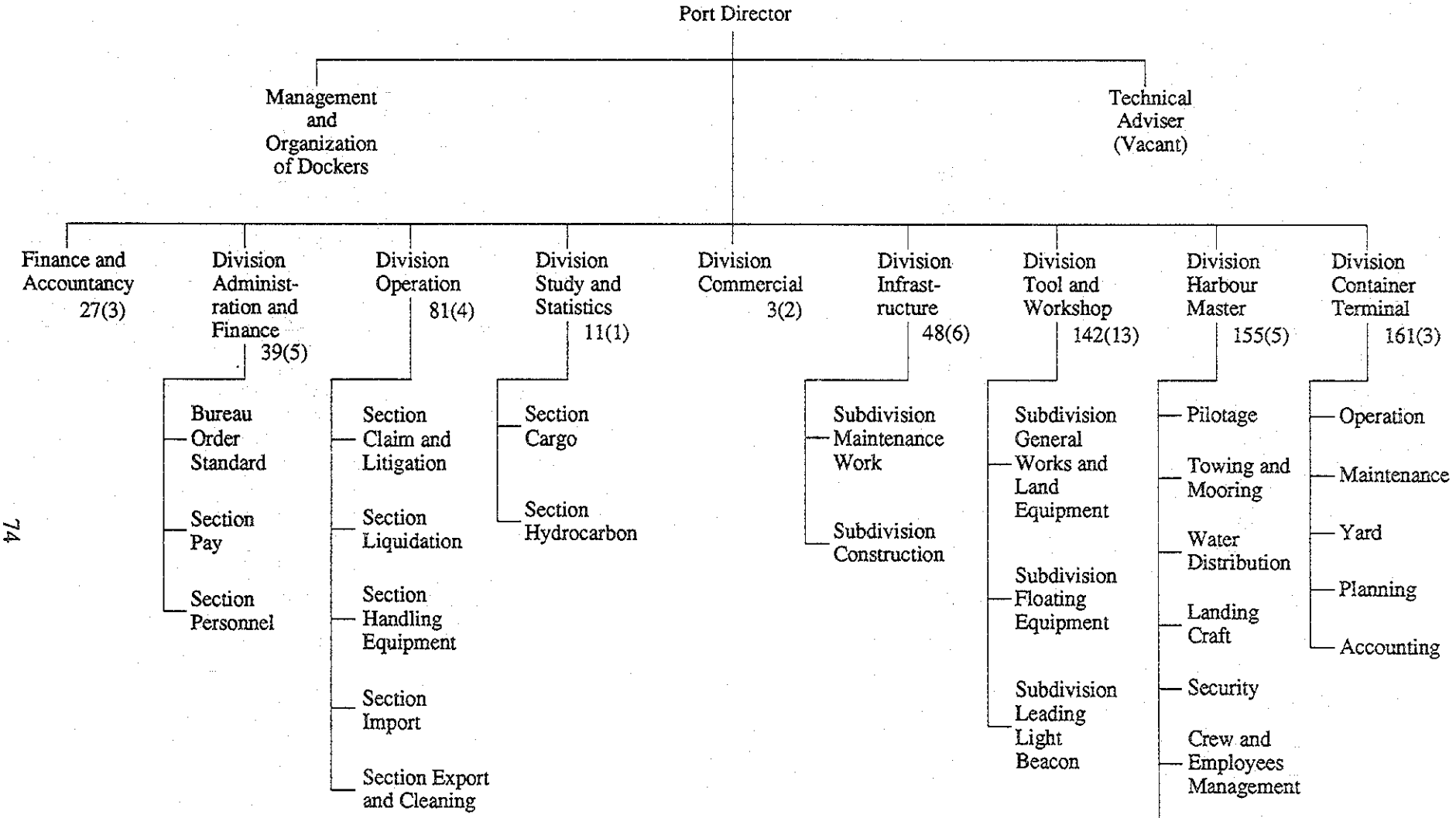
Compulsory pilotage are required for all ships in the Port, except for small ones.

The assignment of ships is adjusted and controlled by the Harbour Master Office. The pilot station communicates with ships by means of the port VHF system.

(2) Mooring Facilities

1) Cargo Handling Works at Oil Berths

The oil unloaded at Berth Nos. 11 and 12 is transferred to the oil storage tanks of 200,000 m^3 capacity owned by three oil companies. The pipelines laid ashore consist of common pipeline group shared by the three oil companies and other branch pipelines connected to individual oil tank yards. The common pipelines are comparatively new, and the maintenance costs are equally shared between the three oil companies.



1: Members in parentheses indicates PAID staff.
2: Two of the staff members in Operation division are cooperating person.
3: A few trainees are appointed to infrastructure, tool and workshop and container terminal division.
4: Total 672 members excluding trainees.

Figure 7-1 Organization Chart and Number of Members of Port Autonome International de Djibouti

Port entry and departure, as well as berthing and unberthing of oil tankers, are directed by the pilots, tugboats, line boats, and line men of the Harbor Master's Office. The port entry and departure can be arranged at any time of the day.

For unloading of oil, each oil company assigns five men to the oil-berth and three men to the onshore oil base for connection and disconnection of tanker pipelines and onshore system by rubber pipings.

At the Port of Djibouti there are six maritime agencies.

2) Cargo Handling at Container Terminal

Since 1985, the South Wharf which comprises Berth Nos. 1 and 2, has been functioning as the container terminal. All the containers brought into the Port are stocked once in the container yards and transferred to cargo owners, and then loaded to ships.

Stocking plans for exporting cargoes are made by PAID one day before the receipt of containers, based on the booking lists submitted to PAID by the maritime agencies. For the transfer of import cargoes, PAID makes plans one day before the transfer of cargoes which are prepared by the planners exclusively assigned to this work.

(3) Berth Assignments

In the Port, berth assignment is managed on a first-come-first-served basis. Any ship arriving considerably behind the entry schedule is required to wait until a berth is vacated. Ship owners can make a prior request to PAID for assigning of a berth close to the stock yards.

For the application of a port entry permit, ship owners shall submit the entry schedule to the Port Master of the Maritime Affairs Division at least 7 days prior to the entry. The Maritime Division provides the entry schedule for the coming month. In any case, the port users shall report to PAID on their confirmed time for arrival and submit necessary documents 24 hours prior to their arrival. Ship owners are required to pay beforehand the tariffs and cargo handling charges to PAID.

Berth No. 12 has been used preferentially for oil transfer. Berth No. 11 has been used as a supplemental berth to Berth No. 12.

(4) Development Plan

The development plan for Djibouti was established in May 1992 by the Planning Department of the President and is shown in "Socioeconomic Development Guideline (1991 - 1995)". The Guideline stipulates the targets, including, improvement of PAID's managing capability, and promotion of port-related private sector business, in addition to the mid-term development program for the year 2002 plans, the improvement of the Port Office building.

7.1.4 Present Operation and Management Problems

(1) Organization

In order to further promote the use of the Port and to secure a superior position to such competing ports as Aden, Jedda, and Suez, it is mandatory that the Port provides easier access and more attractive settings for the users both in the port facilities and operation and management system. However, PAID has no such section having these functions at present.

(2) Control of Incoming and Outgoing Vessels

During the monsoon season of the Khamsin from June to September, there are some problems to secure the safe navigation of large vessels, in such case that two or more ships are maneuvering at the same time. Also, the present tight schedules for pilotage and tugboat operation tends to cause some delay for entry and departure of vessels.

(3) Dredging

As there has been no littoral drift in Djibouti Port, it is not necessary to periodically dredge the channel bottom; however, there is a shoal in front of Berth No. 13, and dredging of the ship's channel is required to maintain safe navigation.

(4) Demolition of Pipeline

The demolition works of unused pipeline are to be completed at the earliest possible time so that the works will not hinder the cargo handling works.

(5) Transfer of Cargo

For the cargo transfer, interchanging of various documents is required among the Maritime Agency, Oil Company and the tanker. As well as the customs clearance, this is a part of the reason for a delay of the beginning of handling work.

(6) Insufficient System for General Cargo Handling Plans

Plans for the general cargo handling are not made by PAID, but are prepared manually by the shipping agencies. This makes it difficult to establish immediately a consistent general cargo handling plan.

(7) Oil Handling

Quantities of oil discharged from tankers to the onshore oil base depends on the pump capacity of the tanker. Also, the three different types of oil cannot be discharged simultaneously. The discharging time can hardly be shortened.

Presently, the oil discharge rubber hoses are connected and disconnected by manual operation.

(8) 24-Hour Operation System

The berthing and the associated operations during nighttime may possibly endanger the safe navigation of ships. Also, for the safety of workers, all the port workers are required to wear helmets and safety shoes regardless of whether they are working at night or day.

(9) Communication System

The communication system currently used between PAID and users do not appear to be satisfactory due to the shortage of the available telephone circuits. The effective distance of UHF for the communication between PAID and vessels seems to be in a rather narrow range in the light of international standards.

(10) Computerization

The PAID's computer system is now adopted in the container terminals for the cargo operation and control systems, but for the operation and navigation control work for the berths, the computer system has not been introduced yet.

7.1.5 Improvement Measures for the Present Operation and Management

Although some deficiencies are found in the control and management system, PAID seems to have been functioning relatively well. However, the following measures are considered to be necessary for further improvement.

(1) Recording System

It is considered that a periodical recording system be established to grasp the actual conditions of the damage or repairs to port infrastructure.

(2) Assignment of Engineers

In order to implement the above measures, an experienced port and harbour engineer should be assigned to the presently vacant post of the Technical Adviser.

(3) Establishment of New Sections for Port Sales

It is recommended that there should be staff members in PAID, who are mainly responsible for promotion of port business, grasping the needs from users, i.e., Oil Companies, Maritime Agencies and Crew and Captain of Tankers, and offering them useful information. In this respect, reinforcement of the Commercial Division by rearranging the business staff members will be effective.

(4) Maintenance of Tugboats Capability

In order to meet the requirements for the pilotage of larger size vessels and for securing the safety of navigation outside the port area, tugboats should be well maintained. In particular, stock of necessary spare parts, daily inspection and maintenance for equipped facilities should be compulsorily done by the Harbor Master's Office and the Workshop Division.

(5) Develop Cargo Handling Plan

To secure efficient and safe cargo handling, PAID is to establish a unitary cargo handling plan.

(6) Simplify Documentation Procedures

Procedures for documentation to apply for incoming and outgoing vessels and cargo handling need to be simplified.

(7) Improve Communication System

The number of telephones and telephone circuits should be increased so as to improve the present deficiencies in communication system and to establish an efficient control and management system.

7.1.6 Financial Status of PAID

PAID is to bear all operational, administrative expenses required for which the following funds are to be appropriated as financial resources:

(1) Port dues.

(2) Handling charges of import, export and transit of cargoes.

(3) Port charges to cover expenses to be incurred for the maintenance of anchorage, channels and water area.

(4) Revenue from the port charges as compensation for the services rendered by PAID to ensure safety of the crew, passengers and cargoes, to maintain cleanliness of the area within the port limits or the area under direct supervision, and to maintain public security.

(5) Usage fees of the public facilities either owned/controlled or leased by PAID.

(6) Allocated charges from a self-governing body, the Chamber of Commerce & Industry, other public institutions, or private sectors to cover part of PAID's expenditures.

In addition, employment of the funds is to include all expenses to be incurred for the establishment, reconstruction, renovation or expansion of the structures and facilities as well as disbursement of loans, for which the following resources are to be appropriated:

(1) Depreciation gains.

(2) Transfer from reserve accounts.

(3) Gains by transfer of movables and immovables.

(4) Allocated charges from the self-governing body, the Chamber of Commerce & Industry, other public organizations, or private sectors to cover part of PAID's expenditure, as required.

(5) Government funds either as capital contribution or annual dues.

PAID is financed by the above resources, and details on financing are shown in Table 7-3 PAID's Budget (1989 to 1993) and Table 7-1 Balance Sheet (1989 to 1992).

Table 7-1 PAID Budget (1989 ~ 1992: Actual, 1993: Provisional))

(Operating Income & Expenses) (Unit: FD million)

Income						Expenses					
Item	FY '89 Actual	FY '90 Actual	FY '91 Actual	FY '92 Actual	FY '93 Provisional	Item	FY '89 Actual	FY '90 Actual	FY '91 Actual	FY '92 Actual	FY '93 Provisional
Port Charges	741.1	825.8	1,058.3	1,168.8	1,026.2	Materials, parts, etc. purchases	165.9	221.2	299.3	352.6	402.8
Various service fees	912.5	1,028.5	1,948.8	1,794.7	1,731.5	Personnel expenditure	888.6	968.9	1,202.4	1,343.8	1,268.1
						Dues	1.6	1.3	0	3.6	3.5
Facility lease, etc.	128.5	128.1	126.6	129.0	131.5	Maintenance fee	239.8	270.3	270.9	422.9	508.3
Ferry income	16.8	15.4	26.6	3.4	15.0	Transportation fee, travel expenses	21.1	12.6	16.2	32.3	24.4
Other income	18.4	15.3	14.5	19.5	5.8	Management fee	74.7	79.6	87.5	107.9	103.6
Funds employment	117.3	100.9	84.2	52.4	80.0	Interests & commission	53.7	65.6	121.0	141.2	130.0
						Appropriation for depreciation reserve	326.3	364.4	768.1	720.8	360.0
						Other expenditures					20.0
						Provisional return	162.7	130.1	493.6	42.7	169.3
Total	1,934.6	2,114.0	3,259.2	3,167.8	2,990.0	Total	1,934.6	2,114.0	3,259.2	3,167.8	2,990.0

(Capital Income & Expenses) (Unit: FD million)

Income						Expenses					
Item	FY '89 Actual	FY '90 Actual	FY '91 Actual	FY '92 Actual	FY '93 Provisional	Item	FY '89 Actual	FY '90 Actual	FY '91 Actual	FY '92 Actual	FY '93 Provisional
Borrowings	2.3	37.5	641.4	1,954.0	1,589.0	Property acquisition	818.6	139.4	931.1	2,458.8	1,972.9
Reserve for depreciation	998.7	369.9	756.7	337.0	360.0	Repayment	238.8	239.8	239.4	345.9	321.0
Provisional return	178.0	138.9	602.1	214.4	169.3	Loan and advance payment		100.0			
Savings of revolving funds				299.3	175.6	operation funds	121.6	67.0	829.7		
Total	1,179.0	546.3	2,000.2	2,804.7	2,293.9	Total	1,179.0	546.3	2,000.2	2,804.7	2,293.9

Note: Based on the fiscal year 1993 budgets.

According to the financial statements for fiscal years 1989 through 1993, PAID paid taxes based on the revenue earned, thereby contributing to the national administration. The relevant profits are shown in Table 7-2:

Table 7-2 Profits of PAID 1989 - 1991

(Unit: FD million)

Fiscal Year	Profits
1989	142
1990	110
1991	482
1992	40

The investment for expansion of the port facilities or renovation of deteriorated facilities and repayment of loans were costly, except in 1990 when the Gulf War broke out, resulting in PAID's financial difficulty.

Acquisition of property appropriated as the expenditure for the capital gains & expenses was due to construction of a container terminal, its expansion, and expansion and/or renovation of other port facilities and equipment. Relation between property acquisition and repayment is shown in the following table:

Table 7-3 Properties Acquired and Repayments

(Unit: FD million)

Fiscal Year	Property Acquired	Repayment	Remarks
1989	818.6	238.8	Actual
1990	139.4	239.9	Actual
1991	931.1	239.4	Actual
1992	2,458.8	345.9	Budget
1993	1,972.9	321.0	Budget

The large scale facility investment is expected to end in 1993, but it is anticipated that depreciation costs associated with facility investments will increase, affecting the PAID management.

A proposal to increase the port charges by 80 % to improve PAID's financial conditions has been brought before a cabinet meeting, followed by the approval of the PAID's Board of Council. The revenue anticipated by the increased port charges is FD 164,849,519 according to the fiscal year 1991 financial statements.

7.1.7 Overview of PAID's Financial Conditions

As can be seen from Table 7-1 Capital Income & Expenses, the borrowings tend to increase after 1991. Until 1990 the repayments were larger than the borrowings. In 1991, however, the repayment stood at FD 239.4 million while the borrowing was FD 641.4 million.

As the borrowings and fixed assets increased, so too were the depreciation reserves. From the view point of raising funds, this condition involves no financial problem since the repayment of DF 239.4 million in 1991 was within the amount of depreciation reserves.

The actual profit in the 1992 settlement account was DF 42.7 million, which accounts for only 20 percent of the originally estimated profit in the budget of DF 214.4 million. This can be explained by the fact that the actual appropriation for depreciation reserves made in 1992 was DF 720.8 million, which was more than double the originally estimated amount of DF 337 million.

A total of FD 169.3 million was appropriated in the 1993 budget as the profits, while FD 360 million was earmarked for the appropriation of depreciation reserves.

7.2 Anti-Disaster and Safety Management

7.2.1 Present Port Activities

Present disaster management and control system were observed through inspections and interviews with Harbor Master's Office, a captain of an oil tanker discharging cargo oil at Berth No. 12, ships agents and oil companies.

(1) Port Approaches

(a) Communications to the Port

Before the arrival at Port of Djibouti, the following information will be transmitted to the Port by telex or V.H.F.:

- 4 days before arrival, send estimate time of arrival (E.T.A.)
- 3 hours and 1 hour before arrival, notice of E.T.A. to the Port

(b) Approaches to Anchorage

Once the ship arrives at the Port of Djibouti, the ship enters into the anchorage through approaches in accordance with the navigation procedures.

It is very easy to approach the anchorage zone. The anchorage for berth waiting is located between "BANC DU PINGOUIN" and "RECIF DE HOUMBOULI"

(c) Approach Channel to Berth Nos. 11 and 12

i) Channel: Length = 3,000 m, Width = 750 m, Depth = 15 to 25 m

Allowable under-keel clearance: 10 % of draft

Proceeding to the Berth is very easy, because of the wide approach channel and established, well maintained navigational aids.

ii) Turning Basin: sufficiently wide.

(d) Pilotage

The Port has seven (7) pilots available 24 hours a day throughout the year. Pilotage is compulsory for all ships with a net tonnage in excess of 300 tons.

(2) Berthing

(a) Actual Practice for Berthing

i) All vessels should be assisted by a tug boat, a pilot boat and a mooring line boat. The list of tug boats available at Port of Djibouti is shown in Table 7-4.

ii) For ship lengths over 170 m, two (2) tug boats must be employed.

iii) Ships line is used for tow-line.

iv) Number of crew and working hours of pilotage is tabulated below:

Work Item	Number of Crew	Working Hours
Tug Boat	6 to 7 each per team	3 teams/2 shifts (08:00 to 18:00 and18:00 to 08:00)
Pilot Boat	3 to 4 "	
Mooring Line Boat	2 to 3 "	
Shore Line Handler	18 in total	

Table 7-4 Service Crafts in Port of Djibouti

Name	Capacity/Size	Built	Fire Fighting Equipment	Owned By
1. Tug Boat				
Abdu Baker Pacha	1500 HP	1965	none	HMO
Arthur Rimbaud	1800 HP	1975	none	ditto
Bab-El Mandeb	2200 HP	1988	water/foam	ditto
2. Pilot Boat				
Etoile	L=12 m	1989	none	ditto
Ras Syan	L=8 m	1965	none	ditto
3. Mooring Line Boat				
Dorale	L=8 m	1989	none	ditto
Asseyla	L=8 m	1965	none	ditto
Ali-Adde	L=8 m	1965	none	ditto
4. Oil Collection Boat				
Vega	L=10 m	1989	none	ditto
5. Rescue Boat				
Bourhan Ali Warki	3300 HP, 253 GRT	1989	foam	DAM
6. Coast Guard Ship				
Ali Oudom	L=18.5 m, 51 GRT	1989	none	CGO

Note: HMO: Harbor Master's Office
DAM: Director of Maritime Affairs
CGO: Coast Guard Office

Source: Harbor Master's Office of PAID

(b) Mooring

i) In ordinary starboard berthing, the mooring head is undertaken at Berth Nos. 11 and 12.

ii) Use ship's mooring line, the number of lines is: Fore and Aft lines (2); Breast lines (4); Spring lines (4); Total (12) lines.

(3) Entry Procedure and Documentation

The flow of Ship's Documents, is shown in Fig. 7-2.

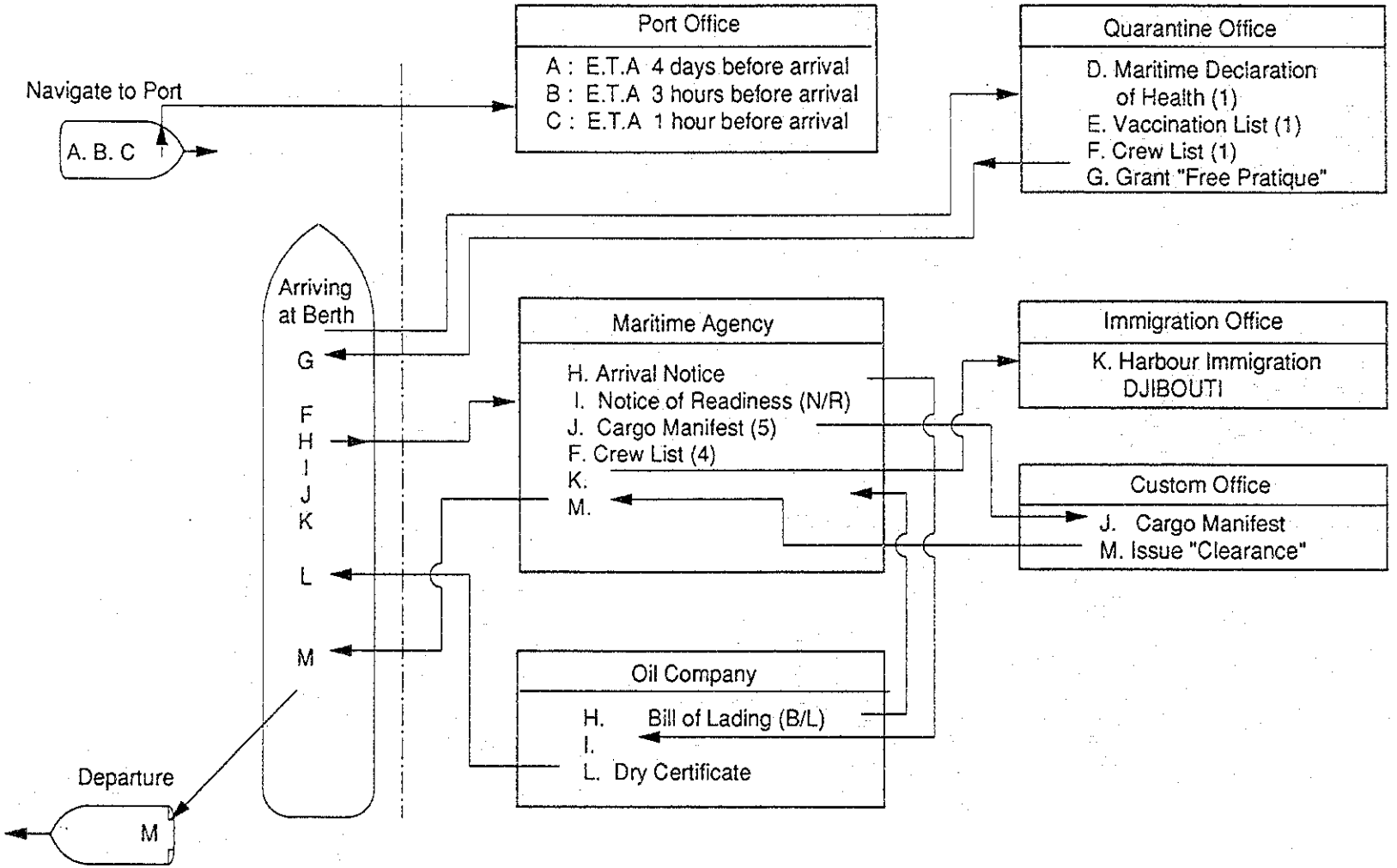


Figure 7-2 Flow Chart of Ship's Documents

(4) Cargo Oil Handling Works

Oil cargo is handled by the three oil companies, namely Shell, Total and Mobil, in the procedure described below:

(a) Preparation

i) The oil company arranges a wharf watchman to be on alert with a CO_2 bottle 30 minutes before ship's arrival.

ii) After mooring at the berth, five (5) oil company workers come on board and commence hose connection work with ship's officer. Upon completion of hose connection work, confirm with a transceiver the condition of pipeline and shore tank yard where three (3) other workers of the oil company are deployed.

(b) Commencement of Oil Discharging

After the completion of hose connection work, inform ship's officer and open the valves, start oil pumping.

Then, three (3) wharf watchmen are deployed, one each from PAID, the Fire Department and the oil company.

(c) Completion of Oil Discharging

Upon completion of oil pumping, tank inspection is conducted with a ship's officer and a surveyor, and a "Dry Certificate" to the Captain is issued. Hose is disconnected from the ship's manifold, and oil discharging work is completed.

(5) Ship's Departure

The maritime agency goes on board and gives a "Clearance" to the Captain. The pilot goes on board, stands by a tug boat and a line man, confirms ship's condition of departure, and starts the operation of ship departure. If the ship has a bow thruster, the number of tug boats may be reduced.

(6) Organization of Harbor Master's Office (PAID)

Under the Harbor Master, there are an assistant harbor master, seven (7) pilots and other staff.

7.2.2 Present Condition of Anti-Disaster and Safety Management

(1) Emergency Operation System (refer to Fig. 7-3)

Depending on the scale of disaster, PAID requests the assistance of emergency system from outside of the Port.

(2) Present Conditions of Anti-Disaster and Safety Equipment and Materials

(a) There are no site patrol system, fire detectors, or alarm system. Communication among office and personnel concerned are made by using V.H.F, transceivers and telephones.

(b) Fire Fighting Equipment

i) at Oil-Berth Nos. 11 and 12, one each portable CO_2 bottle provided.

ii) at Security Section (PAID Fire Dept.)

a. Fire Pump Trucks : two each with capacity of water 2 kl, Foam 1 kl

b. Foam Liquid Tank : 1 kl x 2 tanks, 20 l x 25 cans

c. Portable CO_2 Bottle : 20 units

(c) Equipment for Oil Spill

i) No equipment provided for oil spill at Berth Nos. 11 and 12

ii) At Security Section (PAID Fire Dept.)

a. Oil Powder : 250 l x 20 bags (IMAX made in Holland)

b. Oil Catcher : 60 m

c. Oil Collector : "VEGA" (L: 10 m x B: 4 m, built in Japan 1989)

iii) Rescue Boat "BOURHAN ALI WARKI" built in Japan 1989, belongs to Direction of Maritime Affairs. Equipped with 800 m oil fence and some oil solvent. The vessel is mainly despatched upon request of the IMO (International Maritime Organization). [Gulf Coast Three (3) Country-Conference]

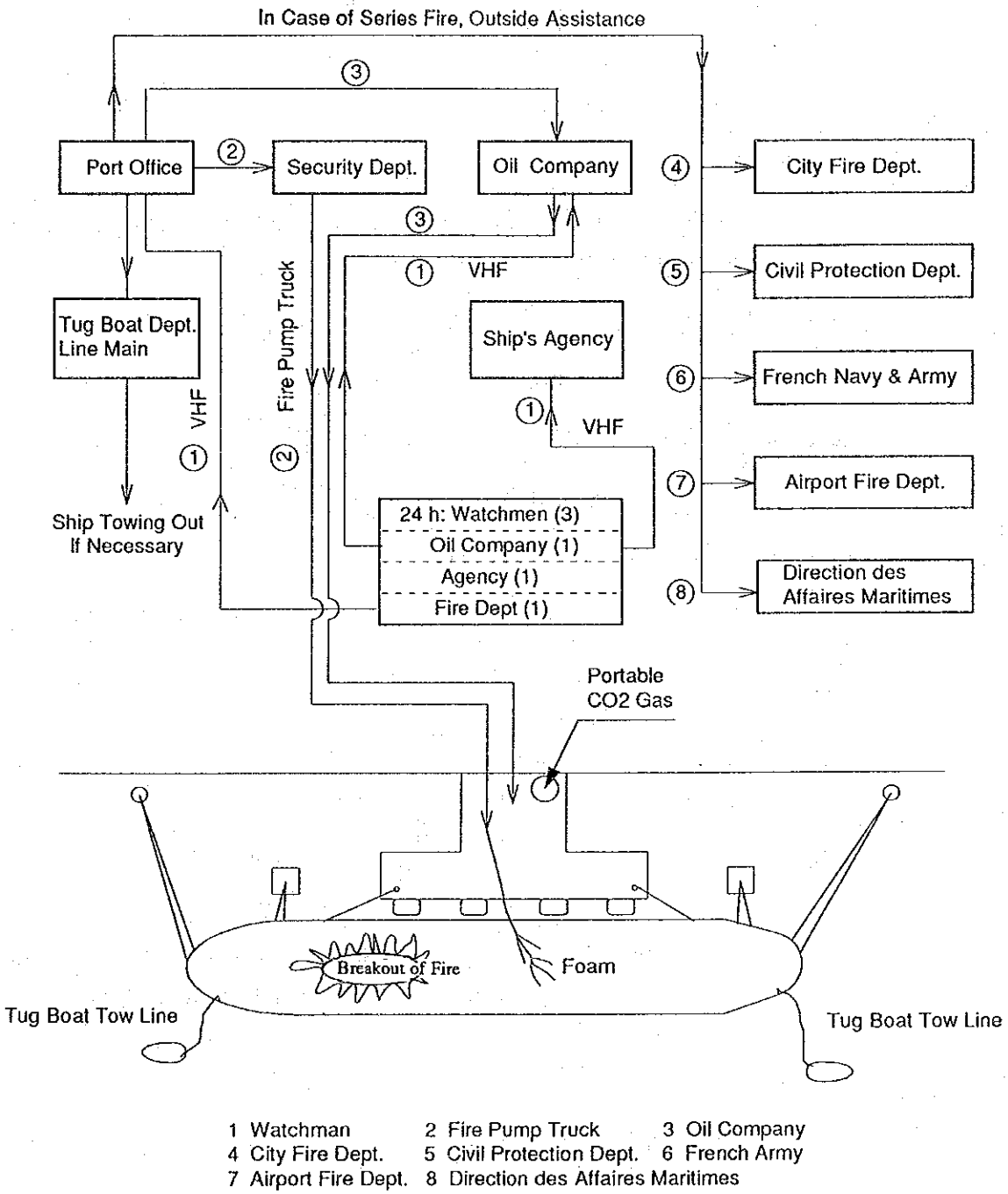


Figure 7-3 Emergency Operation System

(d) Fire Fighting and Anti-Oil Pollution Equipment and Materials

The information below has been given by MOBIL Oil Djibouti.

1) Oil Companies Coordination

1-1) MOBIL

- Movable Nozzles, Hoses, Foam Generators and Emulsion Drums

1-2) SHELL

- Movable Form Nozzles, Form Nozzle, Hoses, Emulsion Drums & Buckets, Drum Carrier and Emulsion Breakers.

1-3) TOTAL

- Movable Form Nozzles, Hoses and Emulsion Drums

1-4) Pool MOBIL & TOTAL at Airport d'Ambouli

- Hoses, Movable Form Nozzle & Emulsion Drums

1-5) Fire Department at Airport d'Ambouli

- Water/Emulsion Trucks with Nozzles & Tanks and Emulsion Drums

1-6) SHELL at Airport d'Ambouli

- Form Nozzle, Emulsion Drums and Hoses

2) Equipment and Materials for Anti-Oil Pollution

2-1) Program of Gulf of Aden Protection for Oil Pollution

- Oil Fence, Oil Skimmers with Pump, Hoses and Tanks, "Slickbar" Submergible Pump with Hose, Emulsion Breakers, Personnel Protective Clothing, Breathing Apparatus, Motor Generator and Walkie-talkies.

2-2) SHELL Storage

- Bags of Camsorb Powder, Emulsion Breaker Drums and Buckets.

2-3) MOBIL Storage

- Bags of Absorbing Powder.

2-4) TOTAL Storage

- Emulsion Breaker Drums & Buckets and Absorbing Materials.

7.2.3 Others

(1) Access to/from the ship and the shore is by ship's gangway only.

(2) Proper personal safety gear such as hard hats and life jackets are not provided except for some oil company's workers.

(3) The Government of Djibouti ratified SOLAS.

7.2.4 Recommendations on the Anti-disaster and Safety Management

In order to up-grade the present condition of anti-disaster and safety management system, the following improvement measures are recommended from the viewpoint of the international level of safety.

(1) Safety Precaution and Emergency Procedure

a) Terminal Emergency Plan

A terminal emergency plan which covers all aspects of the action to be taken in the event of an emergency should be developed by the terminal.

b) Terminal Regulations

A bulletin board showing a notice of harbour regulation extract should be put up at the entrance of Oil-Berth Nos. 11 and 12.

In addition, portable notices stating "Loaded Flammable Cargo" should be displayed at the ship's both side.

(2) Safety Check List

The Ship/Shore Safety Check List is for the safety of both ships and terminals and of all personnel and should be completed jointly by the responsible officer onboard and the terminal representative. The check list should be referred to the "International Safety Guide for Oil Tankers & Terminals (ISGOTT)".

(3) Fire Training and Drill

All personnel working at the terminals and oil berths should receive instructions in fire prevention and fire fighting techniques. Periodic Drills should be performed about twice a month.

(4) Fire Alarm

Fire alarm systems are needed on the working platform at the Oil Berths to notify directly to the Harbor Master's Office (hereinafter called the Office).

(5) Electric Currents Between Ships and Shore

To prevent an ignition spark, an insulating flange should be inserted within the length of the flexible hose strings to the shore pipeline system. In addition, flexible hose strings should include in each string a single length of non-conducting hose.

(6) Fire Extinguisher

About 5 CO_2 bottles for each berth, which are smaller than the existing wheel type and can be carried on the shoulder, should be included as equipment against minor electrical fires. CO_2 bottles should be weighed and the contents should be checked periodically.

(7) Approaching Ship's Position

Maintenance of the radar is necessary to ensure the port efficiency and vessel's safety.

(8) Wharf Ladder

A permanent wharf ladder with safety net or the extension of the working platform of the berth is necessary to maintain a safe passage between the ship and the shore.

(9) Mooring Equipment

Conventional pier equipment such as mooring bitts will be useful for Berth Nos. 11 and 12.

A berthing vessel takes a total 12 mooring lines at present, however vessels of over 20,000 DWT are better to take 16 mooring lines namely three (3) head lines, three (3) stern lines, three (3) forward breast lines, three (3) aft breast lines, two (2) forward spring lines, and two (2) aft spring lines to ensure safety.

(10) Electric Crane

An electric crane, which has a working load 1 M/T, a height of about 15 meters and an out-reach of about 10 meters, is needed around the center position on each berth.

(11) Oil Fence

The regulation which prescribes the preparation of an oil fence to encircle the tanker during the cargo handling operation should be established.

(12) Oil Treatment Equipment

Oil treatment equipment, e.g. oil catcher, oil powder etc., which are placed in store at present, should be regularly placed on the working platform at Berth Nos. 11 and 12 to take emergency action for oil spills.

(13) Lighting Equipment

Explosion proof lighting equipment, which ensure enough luminous intensity for safe cargo handling operations at night time, should be installed at the oil berths including the mooring bitts.

(14) Others

a) Emergency Tow Away Cable

Tow away cable of adequate strength and condition should be made fast to bollards on the tanker, forward and aft, and their eyes run out and maintained at, or about, the waterline.

The arrangement varies with the place or ports, therefore, the master onboard should be advised of the local requirements.

b) Drainage

Upon completion of the oil handling operation, the residual oil in the connection hose should be drained into fixed drain tanks or portable drip pans. It is desirable to provide an oil pit on each working platform at Berth Nos. 11 and 12.

Chapter 8 Project Appraisal

CHAPTER 8 PROJECT APPRAISAL

8.1 General

The purpose of this chapter is to appraise whether development effects of the Reconstruction Project of Oil Berth Nos. 11 and 12 in the Port of Djibouti (hereinafter referred as the "Project") could be satisfactorily expected from a viewpoint of the national economy of the Republic of Djibouti, and whether the administration and operation of the reconstructed berths could be performed appropriately or not from an analysis of the expected relevant costs and benefit of the Project.

In the economic analysis, the national development effect of the implementation of the Project was evaluated using a cost benefit analysis. Factors regarding the development effect of the Project which cannot be quantified are also described herewith.

The financial aspect of the Project was described by comparing the revenues with the expenditures of the PAID relevant to the Project in the year 2010 with the analysis of the port charges, tariffs on cargoes and maintenance, administration, and operation expenses relevant to the implementation of the Project.

8.2 Cost and Benefit Aspects for the Project

8.2.1 Economic Analysis

The appraisal of the Project was made by utilizing the Economic Internal Rate of Return (EIRR) derived from analyses of the case in which the Project would not be implemented. The economic benefit of the Project is defined here as the difference between the case with the Project (hereinafter called "Project Solution" case) and the case without the project (hereinafter called "Reference Solution" case).

The life of the Project is assumed to be set at 30 years starting from 1995. The Project Solution case is assumed to be the case in which Oil Berth Nos. 11 and 12 would be reconstructed in 1995 and 1996 respectively, and the Reference Solution case is the one in which Berth Nos. 11 and 12 would not be reconstructed and would not be put in use after 1995 owing to the deterioration now in progress.

a) Accommodation of diverted tankers

In the Reference Solution, since oil tankers can only be accommodated at Berth No. 10, "Non-Commercial" operations and bunker supply will be gradually driven away from Berth No. 10 as the number of tankers calling at the berth increases.

In the Project Solution, those tankers diverted to other ports can be berthed at the Port of Djibouti utilizing the three oil berths.

The benefits of the Project Solution include revenue to PAID from port charges of 12 FD/GT and 41 FD/MT, and tariffs on petroleum products of 365 FD/MT for inport and 179 FD/MT for export, in addition to profits from supplies of water (about 3 FD/MT). The benefits of recovered revenues from the tankers for the operation of the reconstructed Berth Nos. 11 and 12 are expected to be 17,539 thousand FD in 2010 and will exceed 100,000 thousand in 2020.

b) Recovery of railway transportation by CDF from Djibouti to Ethiopia

The railway revenues relating to the diverted transshipped oil cargoes to Assab, or the other ports for road transportation to oil consuming centers in the neighboring countries will also be lost due to the congestion of the oil berths in Djibouti port.

The revenues from railway transportation fees which will be lost owing to diversion of the transit oil cargoes in the Reference Solution are estimated from 60,108 thousand FD in 2008 to 1,740,325 thousand FD in 2024.

c) Demurrages of "Non-Commercial" vessels

Some "Non-Commercial" operations vessels and large volume bunker supply are handled at Berth Nos. 10, 11, and 12 at present. In the Reference Solution, these vessels will be gradually pushed away to the other berths, and after 2008, they will be completely diverted away from Berth No. 10. These demerits are expressed as demurrages for two days per vessel taking the congestions at the other berths into consideration. In the Project Solution, the benefits of the reduction of queuing time for vessels of "Non-Commercial" operation and of bunkering supply at Berth Nos. 11 and 12 will be from 207,603 thousand FD in 1996 to 474,680 thousand FD after 2007.

Aggregating the above a),b), and c), the result of the calculation of the EIRR is shown as a base case in Table 8-1.

On the basis of a 12 % opportunity cost of capital in the developing countries such as Djibouti, and discount rates established by international financial organizations, such as US AID, International Bank for Reconstruction and Development (IBRD), and Asian Development Bank (ADB), the EIRR of 13.21 % is considered to be feasible.

A sensitivity analysis is also made to ensure the feasibility of the Project in case various factors related to the Project vary as follows:

Case A: The costs increase by 10 %
Case B: The benefits decrease by 10 %
Case C: Case A and Case B combined

The results of the sensitivity analysis are shown in Table 8-1.

Table 8-1 Sensitivity Analysis of EIRR

Case	EIRR (%)	NPV (10 %)	B/C Ratio
Base case	13.21	1,575,962,000 FD	1.55
Case A	12.16		
Case B	12.26		
Case C	11.26		

Also, as noted previously, factors in connection with the implementation of the project which cannot be quantified are described as follows:

d) Smooth operations of tankers and other "Non-Commercial" vessels other than tankers by utilising three berths.

It is possible for Djibouti Port to handle vessels flexibly and safely.

e) Reduction of possible risks for pollution and accidents resulting from the congestion of vessels in the Reference Solution

In the Reference Solution, even tankers cannot be accommodated at Djibouti oil berth and "Non-Commercial" vessels would have demurrages equivalent to two days due to the congestion. Under such circumstances, probability of risks for oil spills and accidents will be higher.

f) Competitiveness and effects of good publicity

Modern facilities and comfortable operations for tankers and other vessels at Djibouti Port will strengthen its competitiveness against other ports, such as Jedda and Aden, and will provide shipping operators and cargo shippers with credibility and confidence for calling.

g) Benefits to local companies

Other than the above benefits, local companies will certainly benefit from the project for more speedy and safe operations with three oil berths.

From the foregoing analyses, it is concluded that the Project is feasible from the viewpoint of Djiboutian economy and will be worth implementing.

8.2.2 Financial Aspects

Financial aspects of the Project are described to ensure for PAID to operate and manage Oil Berths Nos. 11 and 12 to be reconstructed properly and effectively. Here, revenues and expenses regarding handling of oil products at the Port of Djibouti in 2010 are analyzed and compared with those in 1992.

The revenues from tanker operations mainly consist of port charges for tankers and tariffs on oil products imported to and in transit at the Port of Djibouti. As noted before, port charges for tankers averaged 246,086FD per tanker with 20,979 gross tons carrying 6,050 tons of oil cargoes. This is equivalent to 41FD per ton of oil.

Revenues from tariffs on oil products in 2010 are calculated using the present tariff rates as follows:

	Imported	Transshipment	(FD/ton)
Gasoline	750	360	
Kero/Jet	750	360	
Gas Oil	170	120	
Fuel Oil	170	120	

The combined average tariff on oil products becomes 293FD/ton in 2010, compared with 331FD/ton in 1992.

On the other hand, the expenses of PAID in connection with the oil handling at the Port of Djibouti in 2010 are estimated by an analysis of the actual results of those expenses in 1989 through 1992.

in 1,000FD

Expense	1989	1990	1991	1992
Total expense (A)	1,771,841	1,983,892	2,765,531	3,125,076
Excl. special expenses (B)	871,852	960,241	1,125,730	1,380,328
(B)/(A)	49.2 %	48.4 %	40.7 %	44.2 %

With respect to personnel expenses, if the staff specified to container terminal and other departments is excluded, the number of staff engaged in operations including tanker operations is about 45 % of the total staff from an analysis of the job description.

On this assumption, and from the share of tankers in the total number of vessels, expenses for tanker operations in 1989 through 1992 were calculated.

Expenses of PAID relevant to tanker operations at the Port of Djibouti are estimated 279 thousand FD/MT in 1992 and 370 thousand FD/MT in 2010 on the assumption of growth rates of the expenses.

From BCEOM's forecast of total cargoes handled at the Port of Djibouti in 2000 and 2010, most of the items of expenses are assumed to increase in accordance with the growth of the total cargoes handled at the Port.

The number of staff of PAID is assumed to increase personnel expenses. Since transportation expenses are closely related with the personnel expenses, these expenses also are assumed to be increased.

As shown in Table 8-2 tanker related expenses and the revenue will result the deficit in 2010, whereas the profit in 1992. This decline results not only in a decrease of the revenue but in an increase of expenses.

To cope with the situation and keep the present profit level in 2010, efforts in increasing revenues and decreasing expenses of PAID have to be done. The rate of increase of expenses to PAID from 1989 to 1992 was over 20 % due to the rapid expansion of container business. The rate of increase of the expenses of PAID, however, are estimated as modest in accordance with the growth rate of cargoes forecast by BCEOM, except personnel related expenses. To keep the present profit level in 2010 only by raising the rates for port charges and tariffs, PAID will have to increase these rates by 1.2 % p.a., or 3.6 % per every three years, or 7.5 % per every

6 years. If these increases in rates will have a bad influence on the competitiveness of the Port of Djibouti, PAID will have to make every effort in the restraint of the increase of their expenses, especially those of personnel related expenses.

Table 8-2 Forecast of Revenues and Expenses Related to Tankers in 2010

FD per ton of oil

Item	1992	2010
Revenues:		
Port charges	41FD	41FD
Tariffs	333	293
Water Supply	3	3
Total (A)	377	337
Expenses: (B)	279	370
(A) - (B)	98	-33

Moreover, water supply to calling vessels has been in the deficit in proportion to the purchased volume of water owing mainly to the leakage and use of water without permission by dhow ships. This should be improved as soon as possible to make profits from the water supply.

Also, most of the tankers calling at the Port of Djibouti do not have bunker oil supply except in case of emergency due mainly to high oil prices there. This could be improved by making use of price information systems more effectively to compete with the other neighboring bunkering ports, such as Jedda and Aden.

Chapter 9 Conclusions and Recommendations

CHAPTER 9 CONCLUSIONS AND RECOMMENDATIONS

The Oil Berth Nos. 10, 11 and 12 of the Port of Djibouti, are the only existing oil receiving facility in Djibouti, handling many kinds of refined oil products for domestic consumption, bunkering and transshipment.

This transaction of oil cargo handling plays a significant role in Djibouti's economic and social aspects, such as fuel supply for electric power generation and transportation including vehicles, railways and aviation, and the revenue through port and inland transportation activities supports the financial situation of the Djibouti Government.

The transshipment of oil products mainly to Ethiopia, which no longer has a shore-line due to the independence of Eritrea, and some to Somalia, both countries that have quite close relations with Djibouti, has also a significant role in the stabilization of the economic conditions of this region.

The Oil Berths are also serving for bunkering to large size ships and for "Non-Commercial" ship activities such as water supply, spare parts supply, ship repairs, and so on, which makes the port congestion moderate.

Taking into consideration the above mentioned important roles of the Oil Berths and the present situation of port activities revealed through the Study, hereunder are the conclusions and recommendations.

9.1 Conclusions

(1) Existing Berth Structure

The existing structures of Oil Berth Nos. 11 and 12, including all working platforms and breasting dolphins, may collapse any time now by a slight butting or pulling force from berthing ships due to the deteriorated structural integrity and strength, and severe deterioration of the structure. The wooden catwalks and access bridges are also inadequate.

This possible sudden collapse of the berth structure(s) may cause injury to on-shore workers, serious damage to the ship alongside the berth, and also cause marine pollution.

Although Berth No. 10 is now under construction and scheduled to be completed by the middle of 1994, it is not sufficient for the future demand nor for present port activities. Immediate renewal measures are therefore imperative for Berth Nos. 11 and 12.

(2) Demand Forecast

Based on the socio-economic situation of Djibouti and the present oil cargo handling volume, the demand of oil products for the target year 2010 is forecasted as follows:

(in thousand cu.m)

Description	1992					2010				
	Gasoline	Kero/Jet	Gas Oil	Fuel Oil	Total	Gasoline	Kero/Jet	Gas Oil	Fuel Oil	Total
Domestic Consumption	17.6	15.3	31.9	50.0	114.8	31.9	40.9	85.1	146.8	304.6
Bunker Supply	0.4	82.2	49.1	17.7	149.4	0.7	117.5	83.6	30.1	231.8
Transshipment	3.1	33.3	86.5	18.8	141.7	7.5	80.2	208.2	45.3	341.1
Grand Total	21.1	130.8	167.5	86.5	406.0	40.1	238.6	376.9	222.2	877.6
(Equivalent to thousand tons)					(341.1)					(741.3)

(3) Reconstruction Plan of the Oil Berths

The required number and size of the Oil Berths for the forecasted oil cargo volume in 2010 are determined taking the following present conditions into consideration, i.e.

- Average size of Oil Tankers: 20,979 GT ('90/'92 Average)
- Average oil cargo handling volume per call: 6,050 ton ('91/'92 Average)
- Average berthing time of oil tanker per call: 36 h, 23 m ('90/'92 Average)
- Average berthing time of "Non-Commercial" vessels: 47 h, 20 m ('92 Average)
- Berth occupancy rate: 50 %
- Annual effective working days: 330 days

Based on the above figures, the number of required berths obtained is 3.31 berths including Berth No. 10, hence the renewal of Berth Nos. 11 and 12 are necessary. The size of the berths are also determined as follows.

Berth No. 10 : For Oil Tankers of 35,000 DWT or above or equivalent "Non-Commercial" vessels with a maximum draft less than 12.0 m.

Berth Nos. 11 and 12 : For Oil Tankers of 3,000 to 35,000 DWT or equivalent "Non-Commercial" vessels with maximum draft less than 11.0 m.

As for the structure of the Berths, a steel sheet pile cellular cofferdam type is recommended as a result of comparative study.

The project cost including engineering services is estimated to be 2,487 million in Japanese Yen, consisting of 1,486 million of local currency portion and 1,001 million of foreign currency portion. Required total duration is 24 months for the construction of Berth Nos. 11 and 12.

(4) Environmental Aspects

1) Although the source of the present oil spills and pollution could not be identified, spilt oil was frequently observed at not only the oil berths but also at many places in the harbour basins. The effort for promotion of environmental consciousness to all concerned is not sufficient to solve the problem of pollution.

2) Although the Port of Djibouti has pollution control devices such as oil fence and oil absorbing chemicals, they are kept in store and not immediately available for use in emergency operation activities at the Oil Berths.

3) The environmental study shows that "during the construction works" impacts which will be caused by the proposed project will not be serious and be within the manageable limit by the constructors efforts. As to "after completion of the project", the negative environmental impacts are also forcasted to be moderated within the tolerable limit depending on the proposed berth facilities, oil handling system and proper discipline of the end users of the facilities.

(5) Oil Berth Operation and Management

1) Some records of the Oil Berths activities, such as the records of oil cargo handling time, bunkering time with handling volume, assigned berth numbers, and so on, are now being kept by the individual oil companies with relevant share of oil cargoes, thus total activities as a port is difficult to monitor.

To manage the entire activity of the Oil Berths in connection with the oil storage yards activities, a more comprehensive involvement of PAID for the oil cargo handling activities is necessary.

2) Due to the resignation of foreign personnel, who was assigned as a technical advisor of PAID until March 1993, and no definite schedule of replacement, the training of the local technical staff of PAID is imperative instead.

3) Control and record system of port maintenance is not adequate.

(6) Anti-disaster and Safety Management

1) Emergency alarm devices are not provided on the working platform of individual Oil Berths, which is indispensable to prevent disasters.

2) The size of the existing platforms is too small to accommodate the wharf ladders of various sizes of vessels.

(7) Project Appraisal

The following economic benefits are determined in the Study;

1) Accommodation of Oil Tankers as a result of the renewal of Oil Berth Nos. 11 and 12.

2) Revenues of railways to transport cargoes to Ethiopia.

3) Accommodation of "Non-Commercial" vessels by which port congestion will be moderated.

4) Ease of operation of oil tankers by utilizing new berths.

5) Reduction of the risks for pollution and accidents.

6) Good publicity effects for the client together with increased competitiveness against other ports.

7) Profit increase to local oil companies, maritime agencies, and other organizations engaged in port operations.

Among the above benefits 1), 2) and 3) are quantified, and the Economic Internal Rate of Return (EIRR) is estimated to be 13.21 %. On the basis of a 12 %

opportunity cost of capital, the Project, as defined by the reconstruction of the structure of Oil Berth Nos. 11 and 12 and relevant miscellaneous facilities, is considered feasible.

(8) Others

1) Due to a lack of proper lighting facilities and access way for those mooring bitts along the existing concrete parapet wall, mooring of vessels will be difficult.
Also the strength of some of those mooring bitt foundations are inadequate against maximum mooring force.

2) For construction purposes, the overhead pipelines at the entrance of the Berths should be replaced with underground pipes.

(9) Effects of the Project

By the implementation of these renewal measures of Oil Berth Nos. 11 and 12, the following effects can be expected:

Direct Effects

i) The potential disaster and marine pollution, which could be caused by collapse of the existing structures, will be prevented.

ii) The proposed reconstructed Berth Nos. 11 and 12, together with Berth No. 10 can handle the forecasted oil cargo demand for the year 2010.
The adverse effects on other general and container cargo berths will, therefore, be minimized.

iii) The efficiency of the berthing, mooring and cargo handling activities will be improved by the stable structure, fender system and mooring facilities.

Indirect Effects

i) The potential disaster and marine pollution, which could be caused by copllapse of the existing structures, will be prevented.

ii) The stabilized supply of oil products in line with the activities of railway transportation to Ethiopia by CDE, will help to improve the living conditions of the masses in this region.

9.2 Recommendations

(1) Structures for Berth Nos. 11 and 12

All existing structures including Working Platforms and Breasting Dolphins with horizontal support members, access bridges and catwalks should be demolished.

Steel sheet pile cell type structures are recommended for re-construction in lieu of other types.

Coping and pavement of the cell structure and accessway, accessories of the pier such as rubber fenders, mooring bitts, rockmound type accessway should also be re-constructed.

For other miscellaneous facilities the following items are also recommended.

1) Provision of lighting poles and ladders for mooring bitts along the parapet wall for night work and easy access of line men.
2) Reinforcement of some existing mooring bitts to cope with the mooring force.
3) Relocation of overhead pipe lines to underground pipes.

(2) Environmental Control

1) Oil spill wall should be provided on the working platform.
2) Oil pit and sump should be provided within the oil spill wall.
3) Enactment of environmental law and/or regulations for territorial sea pollution.
4) The promotion of environmental consciousness by means of training and advertising for all concerned, at both shore and ship sides, should be undertaken.
5) The existing pollution control devices should be used or placed near to the Berths for more effective use.

(3) Oil Berth Operation and Management

1) Proper oil berth operation recording system for oil berth activities management and control, should be established by PAID.
2) Training of technical staff is strongly recommended.

In the absence of a foreign technical advisor, a long term technical training system and relevant schedule, including periodic dispatch system of student(s) studying abroad and arrangement of required budget, should be considered.

3) Proper control and recording system of maintenance activities should be provided.

(4) Anti-disaster and Safety Management

Fire alarm devices should be provided at the working platform.

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