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JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

PORT AUTONOME INTERNATIONAL DE DJIBOUTI
MINISTRY OF PORT AND MARITIME AFFAIRS
THE REPUBLIC OF DJIBOUTI

THE STUDY ON THE OIL-BERTHS RECONSTRUCTION OF PORT OF DJIBOUTI IN THE REPUBLIC OF DJIBOUTI FINAL REPORT

SUMMARY

MARCH 1994

PACIFIC CONSULTANTS INTERNATIONAL (PCI)
TOKO ENGINEERING CONSULTANTS LTD.

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

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FOREIGN EXCHANGE RATE		
1 US Dollar (US $)	=	107.85 Japanese Yen (J ¥)
	=	179.48 Djibouti Francs (FD)
1 FD	=	0.60 J ¥

(average rate from June 1 to November 30, 1993)

PREFACE

In response to a request from the Government of the Republic of Djibouti, the Government of Japan decided to conduct a study on the Oil-Berths Reconstruction of Port of Djibouti and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Djibouti a study team headed by Mr. Masaaki Goshima, of Pacific Consultants International and composed of members from this company and the company, Toko Engineering Consultants Inc., two times between August 1993 and January 1994.

The team held discussions with the officials concerned of the Government of Djibouti, and conducted field surveys at the study area. After the team returned to Japan, further studies were made and the present report was prepared.

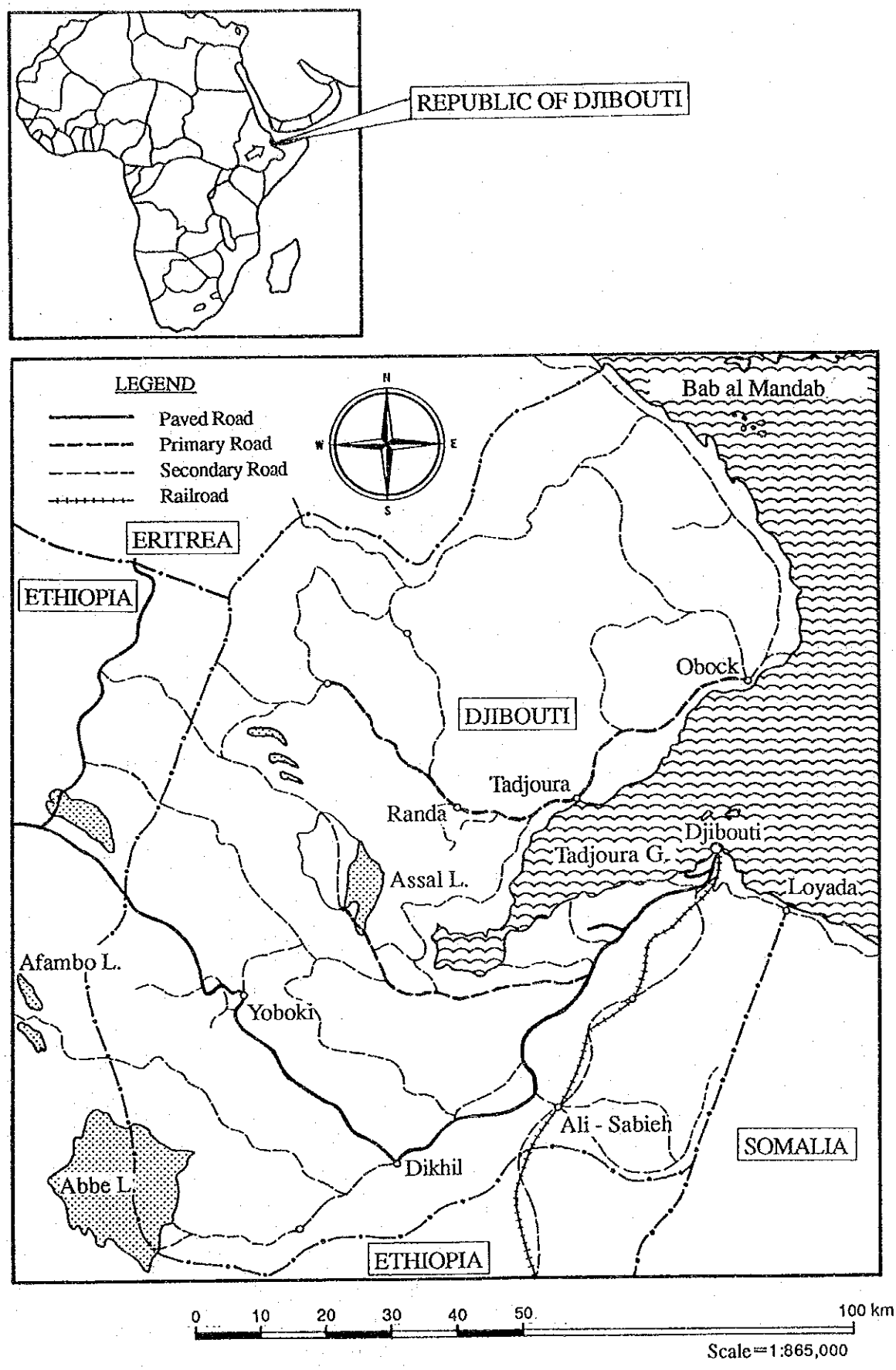
I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Djibouti for their close cooperation extended to the team.

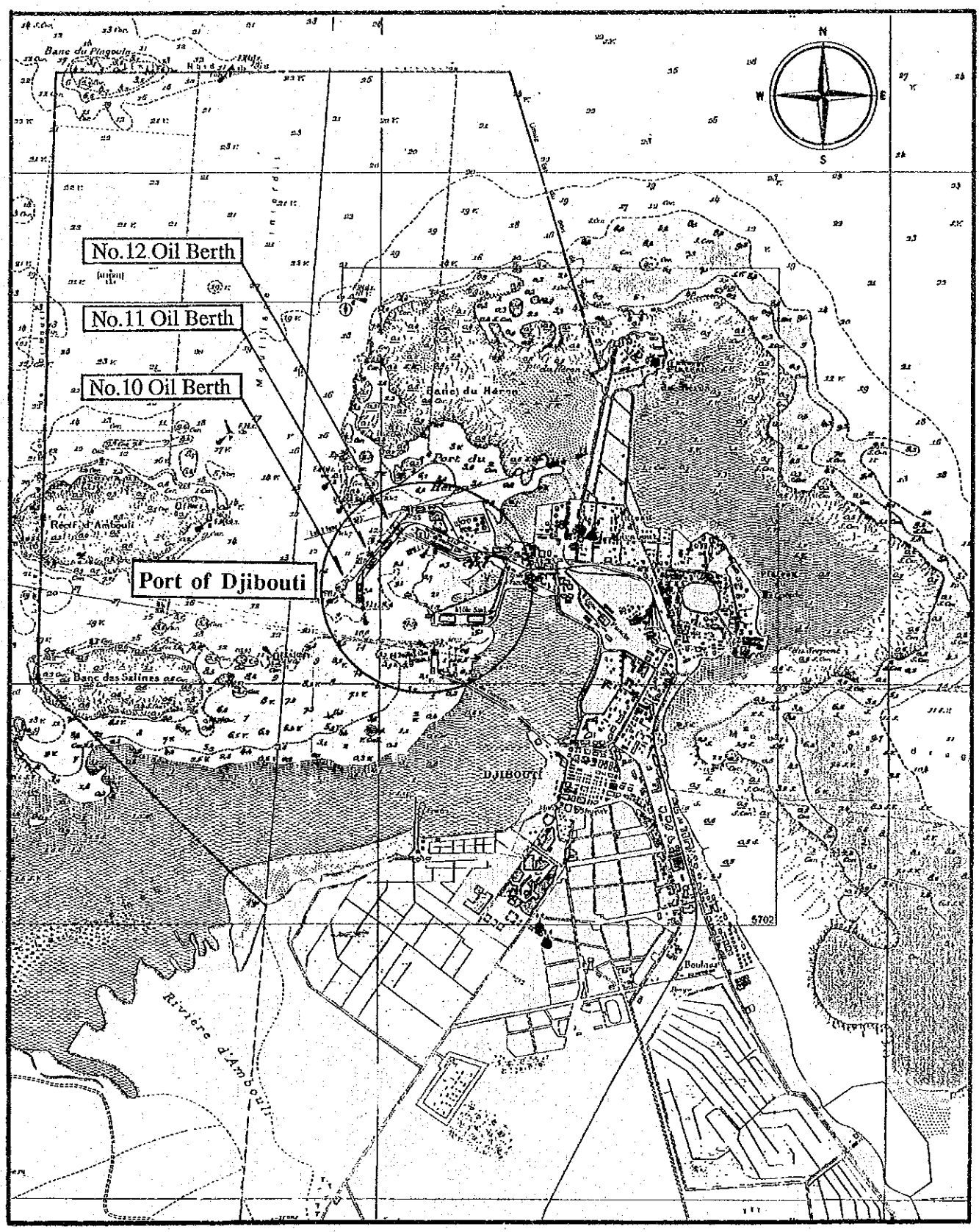
March 1994

Kensuke Yanagiya

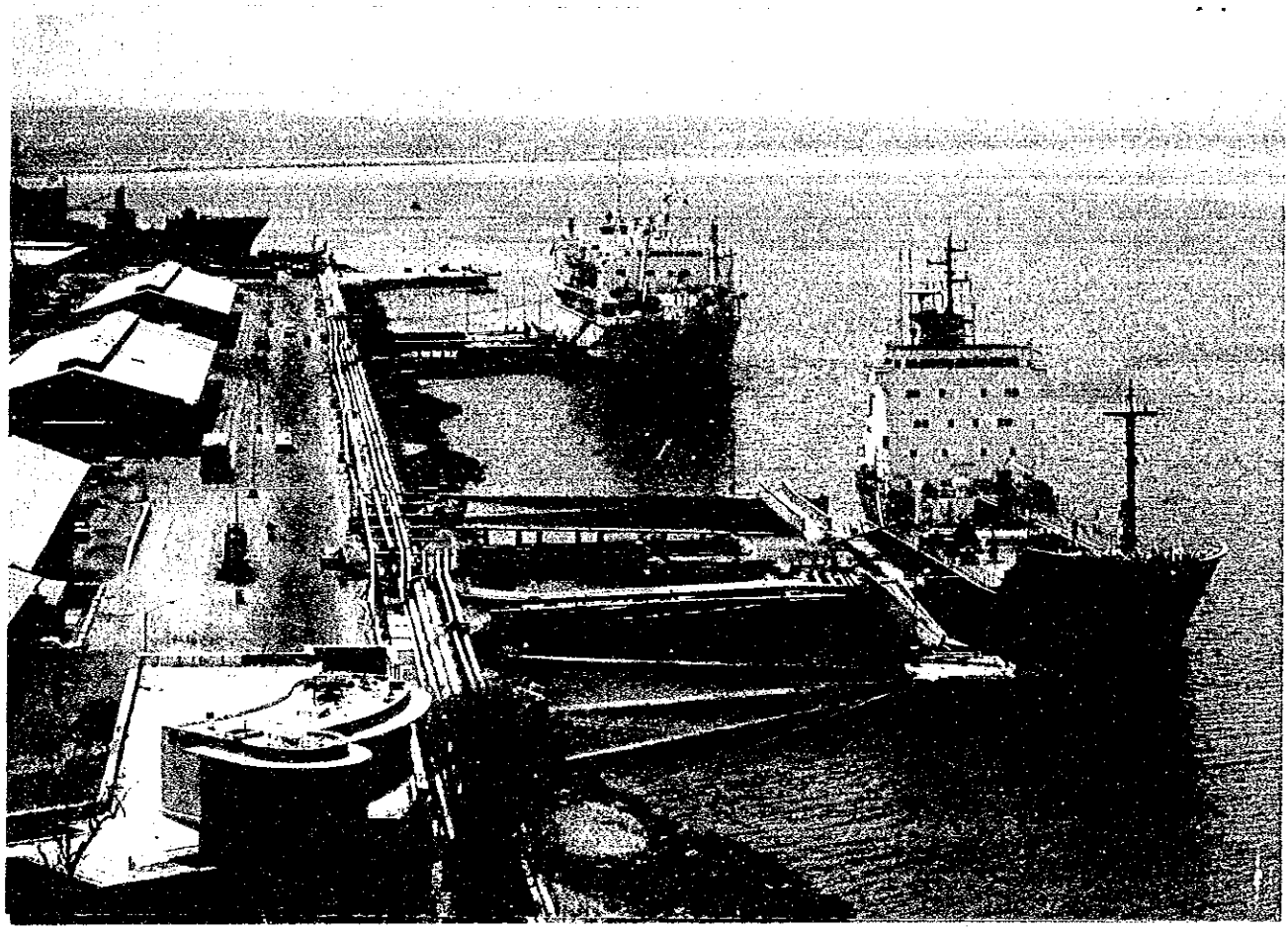
Kensuke Yanagiya
President
Japan International Cooperation Agency



LOCATION MAP (I)

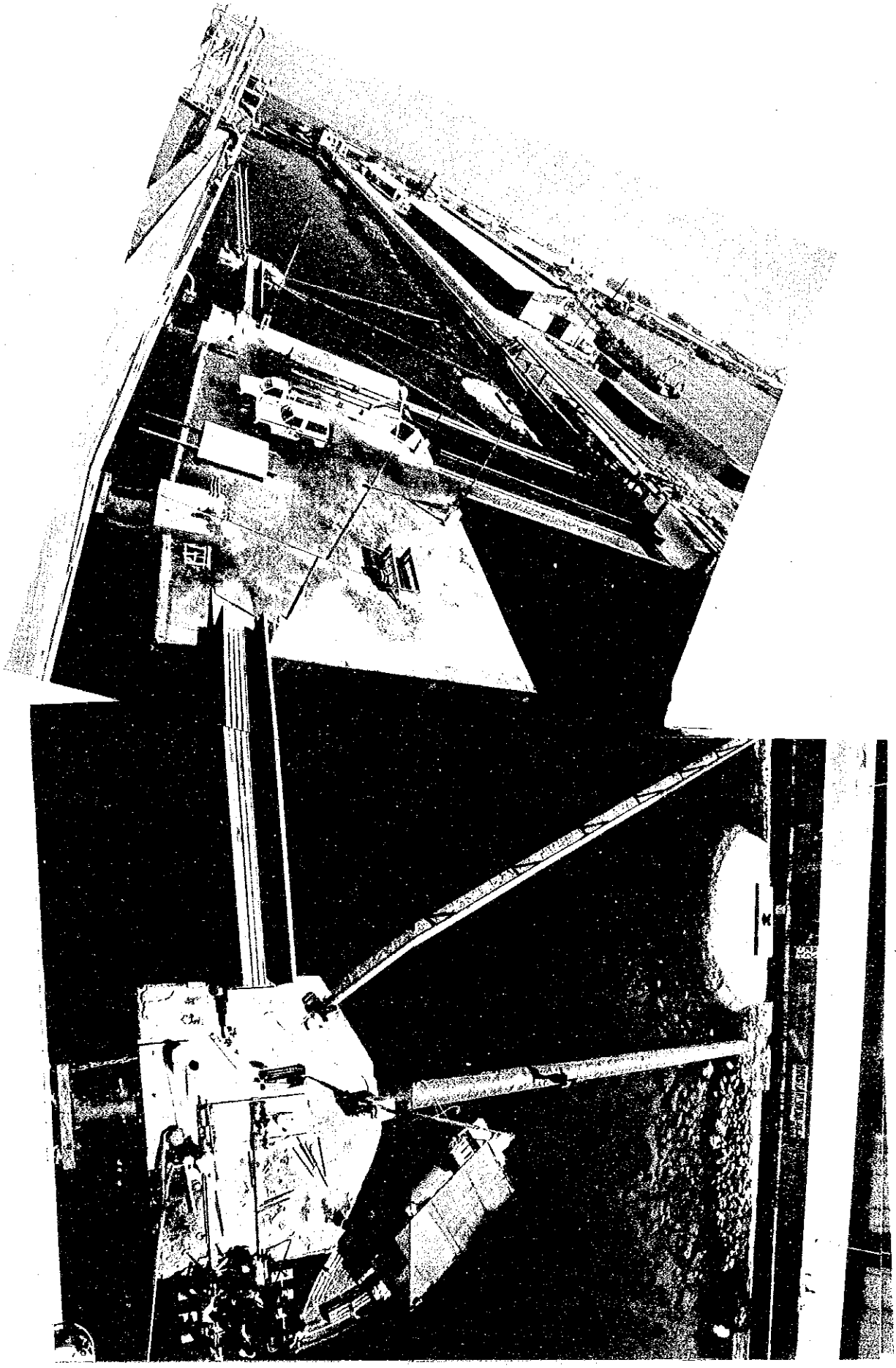


LOCATION MAP (II)



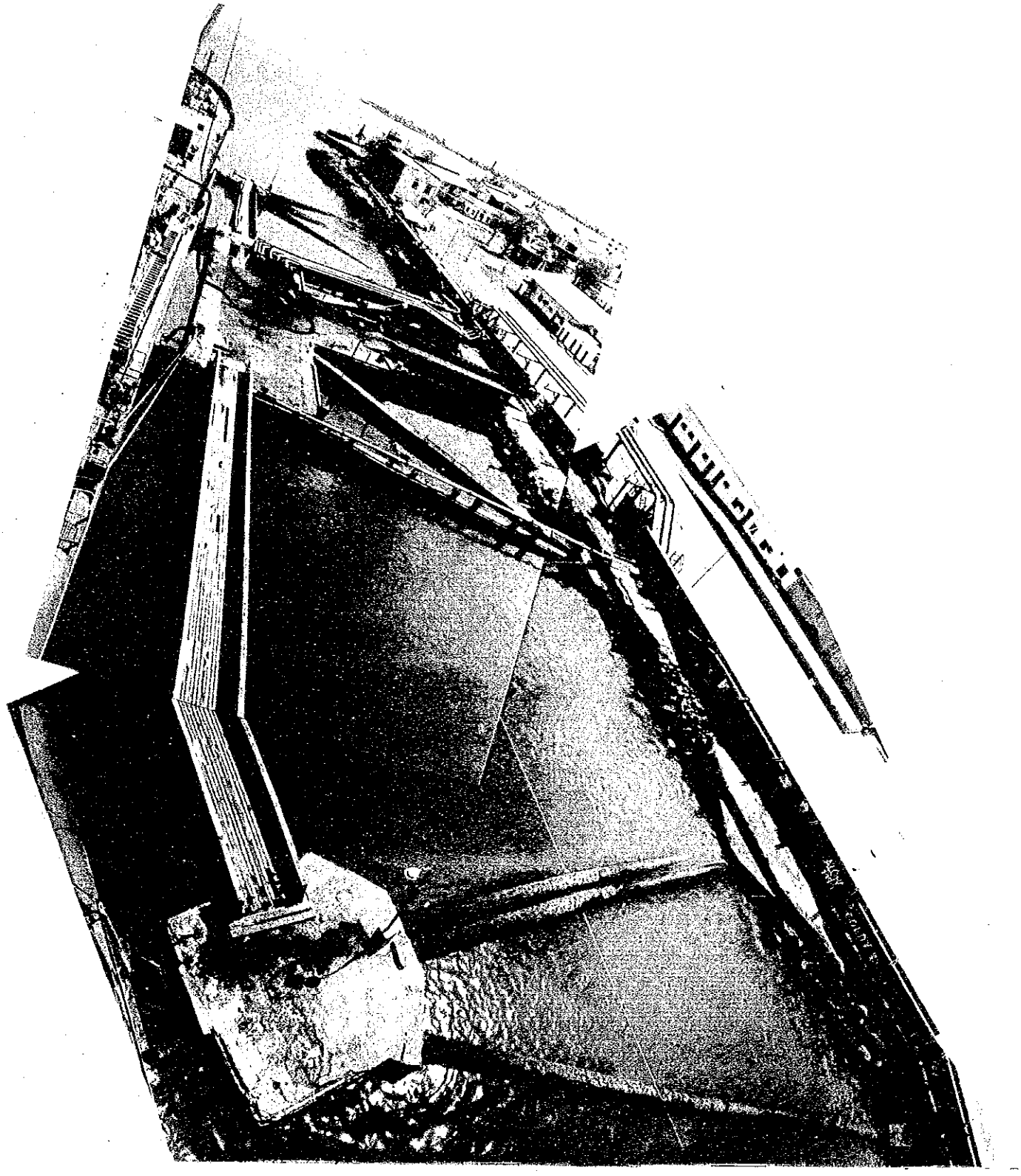
Port of Djibouti

General View of Oil-Berth Nos. 10, 11 and 12 (Sept. 26, 1993)



General View of Oil-Berth No. 11 (Oct. 6, 1993)

Photo-ii



General View of Oil-Berth No. 12 (Sept. 17, 1993)

THE STUDY ON THE OIL-BERTHS RECONSTRUCTION
OF PORT OF DJIBOUTI IN THE REPUBLIC OF DJIBOUTI

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ABBREVIATIONS

AfDB	:	African Development Bank
BD	:	Barrel per day
BM	:	Bench Mark
CDE	:	Djibouti–Ethiopian Railways
CFS	:	Container Freight Station
CPI	:	Consumer Price Index
cu. m.	:	cubic meter
D.L.	:	Datum Line
DINAS	:	Direction Nationale de la Statistique
DWT	:	Dead Weight Tonnage
EU	:	European Union
ECU	:	European Currency Unit
EDD	:	Djibouti Electric Company
ETA	:	Estimated Time of Arrival
FD	:	Djibouti Franc
FY	:	Fiscal Year
GDP	:	Gross Domestic Product
GNP	:	Gross National Product
GRT	:	Gross Registered Tonnage
GT	:	Gross Tonnage
GWh	:	Gigawatt hour = 1,000 MWh = 1,000,000 KWh
ha.	:	hectare
HP	:	Horse Power
IDA	:	International Development Association
IGN	:	Institute Geographique National
IMF	:	International Monetary Fund
ISERST	:	Institut Superieur d'Etudes et des Recherches Scientifiques et Technique
JMA	:	Japan Meteorological Agency
KFAED	:	Kuwait Fund for Arab Economic Development
KWh	:	Kilowatt hour
LBTP	:	Laboratory of Building and Public Works
L.S.	:	Lump Sum
Ma	:	Million years
MT	:	Metric ton
MWh	:	Megawatt hour = 1,000 KWh
NT	:	Net Tonnage
PAID	:	Port Autonome International de Djibouti: Port Authority of Djibouti
SFD	:	Saudi Fund for Development
SOLAS	:	International Convention for the Safety of Life at Sea
SPT	:	Standard Penetration Test
sq. m.	:	square meter
UN	:	United Nations
UNDP	:	United Nations Development Program
USAID	:	United States, Agency for International Development

Summary

SUMMARY

1 The purpose of the Study is to formulate a plan for the Reconstruction of the Oil-Berths No. 11 and No. 12 for the demand in the target year of 2010. The Study proposes the following three main points:

(1) Confirmation of the necessity for the reconstruction of the oil-berths;
(2) Formulation of a reconstruction plan of oil-berths; and
(3) Technology transfer to counterparts on the Djibouti side.

2 As a result of the field investigation and succeeding studies, it is concluded that the existing Oil-Berth Nos. 11 and 12 are no longer serviceable from a technical point of view and they should be completely reconstructed at their present location instead of their rehabilitation which will be more difficult and costly.

3 In parallel with the above structural examination on the existing berthing facilities, a demand forecast study on the oil products to be handled at the Port of Djibouti was made for the target year of 2010 and concluded as follows:

Description	Present Demand in 1992	Forecasted Demand in 2010
	(1,000 cu.m)	(1,000 cu.m)
Domestic Consumption	114.8	304.6
Bunker Supply	149.4	231.8
Transshipment	141.7	341.1
Total	406.0	877.6
(Equivalent in thousand tons)	(341.1)	(741.3)

4 The required number, size and layout of the Oil-Berths are determined to meet the above demand forecast considering the present port activities and the conditions of existing berth facilities.

The determination is made taking Oil Berth No. 10 into consideration.

A consideration is made for not only oil-tankers but also for vessels calling at Djibouti Port and berthing at Berth Nos. 10, 11 and 12 for bunkering, water supply, repair, spare parts supply, food supply, etc., hereafter referred as "the Non-Commercial" vessels.

As a result, the ships allocation and size of the berths are concluded as summarized below;

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 No. 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 layout of the berths, the center of each berth will be at the same location as the existing berth but the face line will be shifted seaward to align with new berth No. 10.

5 As a result of the succeeding preparatory design, the proposed reconstruction project of the Oil-Berths No. 11 and 12 includes the demolition of the existing berths, the construction of steel sheet pile cellular cofferdam type quaywall with a length of 90 m for each berth and access ways. For the recommended components of the Project, see Table I.

6 The required construction period will be 24 months for two berths and it is recommendable to start the reconstruction of Berth No. 11 followed by No. 12 in this order to minimize influence of construction works on the port activities.

7 Required project cost including engineering services is estimated to be 2,487 million in Japanese Yen.

8 An environmental study was made on the two stages, i.e., during the construction period and after the commencement of the oil berths operation. It is revealed that adverse environmental effects to be caused by the implementation of the project will be minimal, since the majority of the scope of the project is rehabilitation of existing berthing facilities.

To minimize oil spill to the sea, however, oil spill wall and oil sump are recommended to be provided on the individual Oil-Berths No. 11 and 12.

Promotion of environmental consciousness to all concerned is also recommended.

Effective utilization of existing pollution control devices and materials such as oil fence and oil absorbing solvent, which are kept in storage, is also recommended.

9 Based on the aforementioned proposed berthing facilities and the estimated cost concerned, project appraisal is made.

Economic benefits of the project are identified as follows:

a) Accommodation of tankers otherwise diverted to other ports, because of the difficulties of berthing at the Port of Djibouti.

b) Revenue of railway fares to transport cargo to Ethiopia that would be lost when the cargo would be diverted to Assab for transportation to Ethiopia by road.

c) Avoidance of demurrage of "Non-Commercial" vessels other than tankers.

d) Ease of operation of tankers and other "Non-Commercial" vessels by utilising three oil berths instead of one.

e) Reduced risk of pollution and accidents resulting from the congestion of the operation with one oil berth at the port.

f) Strengthening of the competitiveness of the Port of Djibouti against other ports, and good publicity effects for clients from the operation with three oil berths rather than only one.

g) Profit of local oil companies, maritime agencies and companies engaged in the port operation accrued from the operation with three oil berths.

Taking the quantifiable items a), b) and c) above into consideration, the economic internal rate of return (EIRR) and Benefit Cost Ratio at discount rate of 10 % are 13.21 % and 1.55 respectively.

The project as defined by the reconstruction of the structure of Oil Berth Nos. 11 and 12 and relevant miscellaneous facilities is deemed as feasible.

10 Finally, the Study Team recommends that the Oil-Berth Nos. 11 and 12 be newly re-constructed as early as possible to secure and encourage the economy and social activities in Djibouti and to avoid any disaster and marine pollution which may be caused by the unstable physical conditions of the existing berths.

Table I Recommended Components of the Project

Name of Facilities/Works	Dimensions, Specifications	Quantities		Remarks
		Berth No. 11	Berth No. 12	
1) Demolition of Existing Berth Structure	Demolition of existing concrete superstructures, part of foundation piles, access bridge and cat-walk.	L.S.	L.S.	
2) Quaywall	Steel sheet pile Cellular cofferdam type structure. Total length: 89.9 m Design Water depth: -12 m	1 set	1 set	
3) Accessories for Quaywall	3-1) Rubber fender 3-2) Mooring Bitt 3-3) Others	4 sets 8 sets L.S.	4 sets 8 sets L.S.	Ladders Oil pit corner protection concrete curb
4) Reinforcement of Existing Bitts	Additional armour stone for existing bitt foundations	L.S.	L.S.	
5) Access Road	Causeway type with armour rock	Ea	Ea	
6) Concrete Pavement	For apron and access road	L.S.	L.S.	Pre-cast block type
7) Lighting Facilities	Lighting poles for Quaywall and for existing mooring bitts.	L.S.	L.S.	
8) Water Supply System	Water supply pit and water supply branch pipes from main pipe line to water supply pit.	L.S.	L.S.	
9) Fire Alarm System	Fire alarm device connecting between Oil-Berth and the Harbor Masters Office.	L.S.	L.S.	
10) Ladders for Existing Mooring Bitt	For access to the existing bitts.	3 sets	2 sets	

Chapter 1 Background of the Study

CHAPTER 1 BACKGROUND OF THE STUDY

The Port of Djibouti is situated at the mouth of the Red Sea and occupies an important position as a maritime servicing base on the route to the Mediterranean Sea through the Suez Canal. For this reason, the development of the port facilities has been going on since the French colonial days. After its independence, it has been a supply center and gateway to the neighboring countries and has been served as a transshipment center.

In recent competition with Aden in Yemen and Jedda in Saudi Arabia across the Gulf, some of this uniqueness has decreased, but its function as the transshipment center for Ethiopia, Somalia and the neighboring countries has not been lost. The port has become more important in the politics and economy for the Gulf states, the middle east and east African countries.

The prosperity of the Port as an important transshipment center will contribute to the socio-economic value of Djibouti as well as to the political situation with the stable supply of oil products.

At present there are three berths used for handling bulk oil products, namely Berth Nos.10 to 12. As they were all reported to be constructed in the middle of '60s, deterioration of the facilities is evident and their structures are no longer safe, even though restrictions are imposed on the oil tankers and on the weight of vehicles upon the platforms.

Berth No.9 (Môle de Fontainebleau) is planned to be rehabilitated as a berth for the French, and Berth No.10 is currently under reconstruction with funds from Saudi Arabia and Kuwait Fund for Arab Economic Development. As for Berth Nos.11 and 12, the French firm BCEOM once diagnosed their structures in 1989. After its diagnosis there were some urgent repairs from time to time, but nothing more has been done since.

1.1 Purpose of the Study

The purpose of the Study is to formulate a plan for the Reconstruction of the Oil-Berths No.11 and No.12 for the demand of the oil-berths in the target year, i.e., 2010. The Study proposes the following three main points:

(1) Confirmation of the necessity for the reconstruction of the oil-berths at the Port;
(2) Formulation of a reconstruction plan of the oil-berths; and
(3) Technology transfer to counterparts in Djibouti.

1.2 General Description of the Republic of Djibouti

The Republic of Djibouti is situated on the Horn of Africa on the east coast, south of the Red Sea. The country overlooks the vast rolling plains of Ethiopia to the West. The land to the North has the Mountains of Goda consisting of volcanic hills and to the South are the plateaus where the nomads live.

Djibouti is geographically located at the crossroads among three continents, Europe, Asia and Africa. Before opening of the Suez Canal, the country conducted trade with the Gulf and other countries across the Red Sea and the Indian Ocean. After the Canal opened, it developed the function as a supply point for vessels passing through this area.

The Djibouti-Addis Ababa Railway, now renamed to the Djibouti-Ethiopian Railway: CDE, was constructed from 1898 to 1917. With this transportation the Port of Djibouti became established as a center of trade. The railway is important for neighboring Ethiopia as one of the limited means of transportation to the outside world.

The population of Djibouti was 519,900 after the census on March 1991, including approximately 110,000 refugees from Ethiopia and Somalia. Djibouti City, the capital, and other principal cities, such as Ali-Sabieh, Dikhil, Obock and Tadjourah, are where 75 % of the total population is concentrated. There are some 90,000 nomads living in the southern plateaus. The annual growth rate of population is estimated 6.15 % for last 8 years.

From May to September the average temperature rises to 35 °C and there are strong dry northwest or west winds, so-called "Khamsin" blowing. From October to April, the winds reverse and the average temperature is 25 °C similar to the mild summer in the Mediterranean Regions.

Economy

Djibouti's economy is dominated by the service sector accounting for 77 % of the Gross Domestic Product (GDP). 47 % of the labor force is employed in the public or quasi-public sector. GNP per capita was 89,166 FD or 502 US$ in 1988.

There is very little land available for farming and arable land comprises less than 0.3 % of the whole nation. Without irrigation water, the annual agricultural production only amounted to 1,572 tons in the 1988/89 year. Since fish is not traditionally on the

national diet, only 359 tons of fish sold in 1990. Industries are not developed, with only a few light industries.

Under these natural conditions, the country is supported by the following economic activities:

1) Djibouti-Ethiopia Railway;
2) Transshipment services for the countries on the Gulf coast;
3) Port services at the Port of Djibouti;
4) Economy of the foreign residents ; and
5) Financial and economic aid from foreign aid organizations.

From Items 1), 2) and 3) above, the importance of the Port of Djibouti is clearly indicated.

Transport-related Infrastructure

Djibouti is the terminus for the networks to the neighboring countries (see also the "Location Map" in the front of this Report).

The total road network in Djibouti is 3,067 km, of which almost one-third, 1,130 km, is national. Of the national roads, 412 km is paved. The number of vehicles registered on December 31, 1991, was 38,442, of which 32,597 vehicles were privately owned.

See section 2.5 about the railway transportation.

1.3 General Description of the Port of Djibouti

1.3.1 General

Port activity is an important industry for Djibouti. The Port serves the vessels using the Suez Canal with fuel and water supply and performs the commercial services for trade with Ethiopia, Somalia and other neighboring countries.

The Port of Djibouti is administered by the Port Autonome International de Djibouti (PAID) which is a public corporation operated on a self-accounting basis, and is under the jurisdiction of the Ministry of Port and Maritime Affairs of the Government as a basic industry.

1.3.2 Present Port Facilities

The Port of Djibouti performs three functions as follows:

General Cargo (Traditional Port)

General cargoes are handled at 6 quays (Quay Nos. 5, 6, 7, 8, 13 and 14). The vessels that enter the Port have drafts of 8 to 11 meters and 75 % of them use the facilities of Quay Nos. 8, 13 and 14 due to the limitation of water depth.

Because of the superannuation of oil berth Nos. 10, 11 and 12, Berth No. 13 is used as a substitute oil berth. Berth No.14 was opened up in 1992 and is mainly used by bulk cargo vessels with drafts of 12 meters.

With the recent inflow of foodstuffs for aid to Ethiopia, the berths are no longer capable of handling the cargo unloaded there. There is very little space available for open storage and the paved surface is in a state of disrepair.

Oil Handling Facilities (Oil Berths)

There are three berths used for commercial oil handling. Berth Nos.11 and 12 are the subject of investigation in this Study and Berth No.10 is already under rehabilitation. Three major oil companies are in operation in Djibouti. They are Mobil, Total and Shell. Though they have a storage capacity over 200,000 tons altogether, the facilities of Berth Nos. 11 and 12 cannot be used in their full capacity.

There are three oil pipelines (10"/12" dia.) leading from the oil-berths to the storage tanks owned by the oil companies which restrict the port activities because many parts of the pipeline network are exposed on the ground.

Container Handling Facilities (South Container Terminal)

With the increase of intermediate handling of cargoes, the two quays Nos.1 and 2 in South Wharf have been utilized as a container terminal since 1985. General plan of the port is shown in Fig. 1-1 and its berthing facilities are tabulated in Table 1-1.

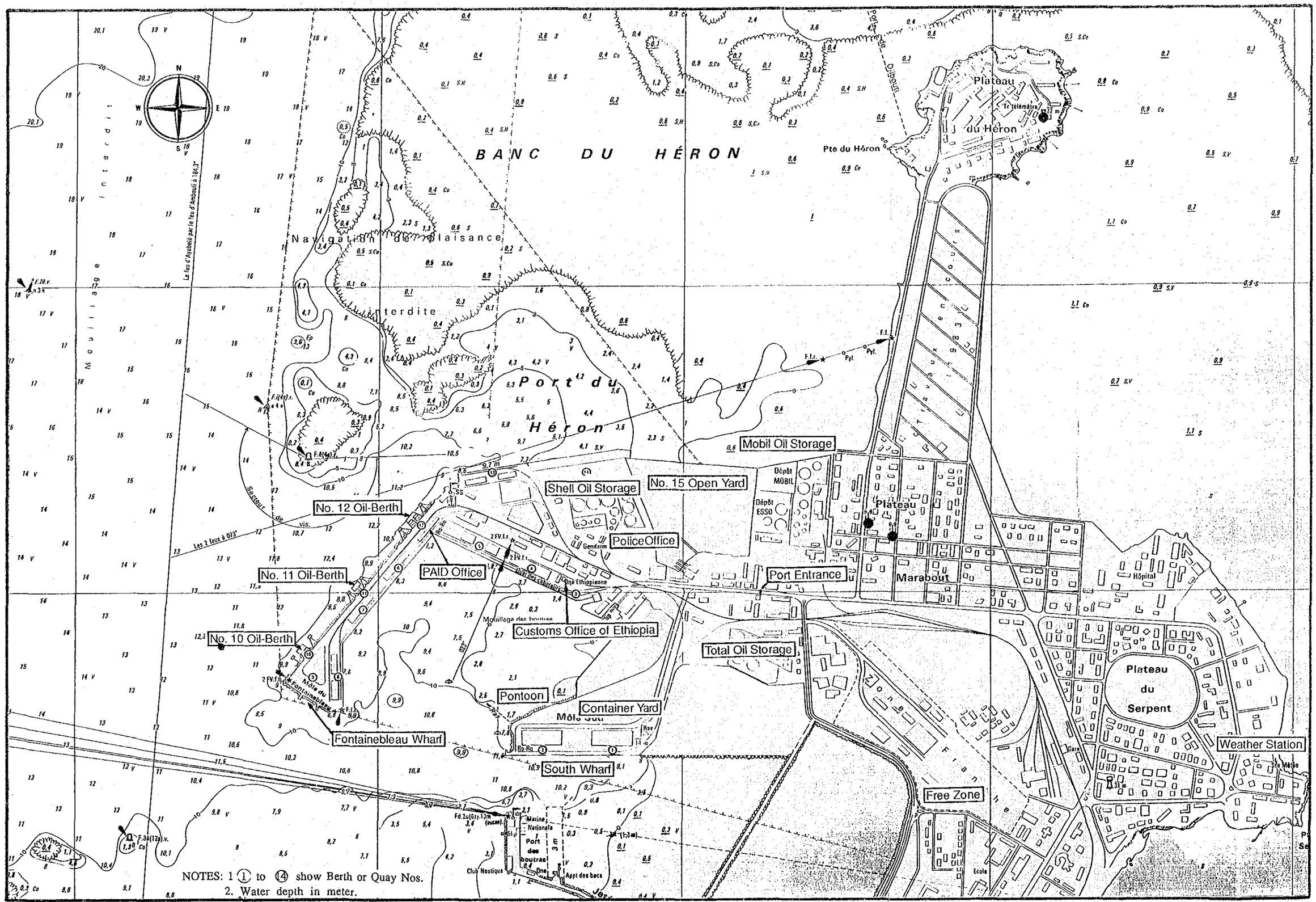


Figure 1-1 General Plan of the Port of Djibouti

Table 1-1 Berthing Facilities of the Port of Djibouti

Quay/Berth No.	Water Depth (m)	Berth Length (m)	Cargo Type
No. 1	-9.5	180	Container
No. 2	-12.0	220	Container
Ro Ro	-11.0	180 (50)	Ro Ro
No. 3	-3.5	260	Cargo (dhow ships)
No. 4	-3.5	(Nos. 3 & 4 total)	ditto
No. 5	-9.0	210	General Cargo
No. 6	-9.0	180	ditto
No. 7	-10.0	180	ditto
No. 8	-10.0	250	ditto
No. 9	-9.0	200	France
No. 10	-12.5	220	Oil (under rehabilitation)
No. 11	-12.0	180	Oil
No. 12	-12.0	250	Oil
No. 13	-10.8	210	Bulk
No. 14	-12.0	288	Bulk

As for the cargo handling equipment, two Gantry Cranes of 35 ton capacity and other handling mobiles are used. For the cargo storage, 19 Sheds/Warehouses, Open Yard and the Free Trade Zone are available.

1.3.3 Port Activities

1) Ship Calls

The vessels calling at the Port are given in Table 1-2. The table indicates that the numbers of conventional, container and Ro-Ro vessels are increasing, while the total tonnage per vessel has not changed so much. All the bulk handling vessels, oil tankers and butane gas carriers are increasing in size.

2) Cargo Traffic

As shown in Table 1- 3, the total cargo volume being handled has ranged from 1.10 to 1.30 million tons since independence. In 1991 there was a marked increase due to the political situation. Of the general cargo handled, imports are destined for neighboring countries. 80 % of the exports are in transit reflecting that transshipment is the main service provided by the Port. The amount of fuel oils handled increased during the Gulf crisis in 1990, but this has fallen off in 1991. The import of fuel oils for Ethiopia is 20 to 30 thousand tons annually and is on the rise as its economy stabilizes. Bunkering is decreasing every year indicating that the competition with other ports is becoming keener by the year.

1.4 Outline of the Related Development Plans

1.4.1 National Socio-economic Development Plan

The Laws for Socio-Economic Development (guidance law for socio-economy) were established in 1982, in which development of the country as an international maritime related city was announced as a policy.

Based on the policy, the 1984/89 National Socio-Economic Plan was established and followed by the Second Socio-Economic Guidance Law for 1990/2000 in February 1991.In May 1992, the Planning Department of the Prime Minister's Office set up the Second Socio-Economic Development Plan for the 1991/1995, where the Reform Plan for Port and Maritime Affairs for 1991/1995 is described with the following objectives:

1) Utilization of human resources
2) Promotion of private sectors for port and maritime affairs
3) Environmental protection
4) Economic improvement for port and maritime activities

1.4.2 Port Related Development Projects

In the port sector, several projects were carried out with technical and economic assistance from foreign countries such as France, Italy, Kuwait and Saudi Arabia.

The cooperation stance of these countries is characterized as follows:

France: Until March 1993, there was always a French engineer in PAID dispatched by the French Government, as part of a technical assistance program. The Master Planning of the Port was also prepared with French assistance.

Italy: Italy assists the development of the Port such as an extension project of Quay No. 14 and Open Yard No. 15 on credit basis.

Kuwait: Kuwait associated with Saudi Arabia has financed a two phased development project. First was the development of a container terminal which started operations in 1985. The Second consists of the following six packages:

1) rehabilitation of sheds and workshop;
2) procurement of cargo handling and maintenance equipment;
3) construction of workshop and CFS;
4) lighting system of the container yard and extension of Free Trade Zone;
5) Extension of container yard; and
6) rehabilitation of Berth No. 10.

Table 1-2 Ship Calls at Port of Djibouti

Type of Vessel	1984	1985	1986	1987	1988	1989	1990	1991	1992
	7,210	8,368	9,589	9,650	8,352	8,600	10,115	8,335	7,960
	267	253	263	226	244	195	270	325	333
Conventional	1,925	2,117	2,522	2,181	2,038	1,677	2,731	2,709	2,651
					16,385	17,333	17,000	15,077	13,394
					26	30	12	13	5
Multipurpose					426	520	204	196	67
	14,570	11,836	11,596	14,657	11,550	12,656	12,323	10,883	11,753
	100	128	136	108	131	122	133	171	248
Container	1,457	1,515	1,577	1,583	1,513	1,544	1,639	1,861	2,915
	8,714	8,750	8,383	10,544	10,300	9,000	11,544	14,092	13,139
	63	72	81	68	70	86	79	130	76
Ro-Ro	549	630	679	717	721	774	912	1,832	999
	16,500	14,214	14,900	21,923	16,000	23,000	22,125	30,000	0
	16	14	10	13	1	1	8	1	0
Bulk Carrier	264	199	149	285	16	23	177	30	0
	8,605	13,469	10,377	11,654	19,944	19,791	23,944	22,306	16,686
	124	81	69	78	89	86	108	98	78
Oil Tanker	1,067	1,091	716	909	1,775	1,702	2,586	2,186	1,302
	5,500	3,200	8,250	6,357	6,486	7,364	3,000	8,762	8,591
	6	5	8	14	37	11	18	42	38
Butane Carrier	33	16	66	89	240	81	54	368	326
	15,364	18,500	7,250	19,500	16,250	13,400	9,091	7,625	7,981
	11	10	8	6	4	5	11	8	10
Passenger Boat	169	185	58	117	65	67	100	61	80
					1,222	786	735	794	1,021
					45	42	34	68	68
Fishing Boat					55	33	25	54	69
	4,797	5,385	5,888	4,554	4,336	3,886	4,509	3,129	4,369
	118	104	125	287	378	175	214	224	136
Warship	566	560	736	1,307	1,639	680	965	701	594
	19,769	24,857	8,769	29,143	24,714	28,667	29,250	26,235	25,987
	13	14	13	7	7	3	8	17	11
LASH	257	348	114	204	173	86	234	446	286
	405	386	1,017	595	455	485	500	455	464
	37	44	58	121	88	103	100	44	30
Coastal Ship	15	17	59	72	40	50	50	20	14
	1,143	1,247	1,050	669	2,699	1,868	1,403	1,701	2,291
	133	97	121	133	93	91	72	67	90
Others	152	121	127	89	251	170	101	114	206
	17,531	12,842	24,127	11,391					
	49	76	63	69					
Anchorage	859	976	1,520	786					
	7,805	8,658	8,715	7,380	7,380	7,797	9,164	8,757	8,467
	937	898	955	1,130	1,213	950	1,067	1,208	1,123
Total	7,313	7,775	8,323	8,339	8,952	7,407	9,778	10,578	9,508

Note: Upper : Average GT
Middle : Number of Ship Calls
Lower : Total Gross Tonnage * 1,000 per year

Source: Annual Statistics of PAID

Table 1-3 Cargo Handling Volume at Port of Djibouti

(Unit: 1,000 metric tons)

Cargo Type	1975	1980	1985	1986	1987	1988	1989	1990	1991	1992
General Cargo	449.2	396.3	609.9	622.1	723.8	618.9	463.1	714.8	1,624.2	1,164.2
(Incoming Total)	247.5	281.8	471.5	463.2	469.8	445.6	323.5	458.4	951.7	767.7
to Djibouti	89.1	170.2	232.7	230.1	208.1	258.6	192.8	210.9	378.6	338.8
to Ethiopia	125.1	68.3	174.2	136.3	86.0	109.2	51.5	69.7	238.5	128.1
to Somalia	0.7	17.1	14.4	11.8	46.3	17.8	8.0	5.5	10.6	53.4
Transshipment	32.6	24.8	48.7	83.9	128.8	58.7	70.1	171.7	322.6	245.4
Dhow	-	1.4	1.5	1.1	0.6	1.3	1.1	0.6	1.4	2.0
(Outgoing Total)	201.7	114.5	138.4	158.9	254.0	173.3	139.6	256.4	672.5	396.5
Djibouti export	8.6	5.8	12.1	22.0	22.4	22.5	27.2	34.4	47.9	1.4
Ethiopia export	155.0	34.8	37.2	29.0	49.6	41.9	20.8	26.4	30.3	11.5
Somalia export	0.3	0.1	-	-	0.2	0.3	0.5	0.4	0.7	0.2
Transshipment	37.8	40.3	50.3	69.8	132.0	55.7	51.5	154.7	538.4	326.7
Dhow	-	33.5	38.8	38.1	49.8	52.9	39.6	40.5	55.2	56.6
Oil Products	716.9	855.6	448.9	372.4	473.0	460.1	378.1	716.0	438.4	494.9
Import	460.8	514.2	308.1	285.7	332.7	324.0	291.5	439.6	324.3	368.7
Re-export	-	20.5	39.6	1.9	9.9	7.2	21.5	194.7	54.5	51.2
Bunkering	256.1	320.9	101.2	84.8	130.4	128.9	65.1	81.7	59.6	75.0
Water Supply	170.8	130.8	84.1	86.6	115.6	151.6	72.2	85.4	90.1	82.7
TOTAL	1,336.9	1,382.7	1,142.9	1,081.1	1,312.4	1,230.6	913.4	1,516.2	2,152.7	1,517.2

Source: Annual Statistics of PAID

Following the second port development project, the third project is to be implemented based on the Master Plan formulated in early 1993. The loan agreement has been made with the KFAED and the SFD. (see Fig.1-2)

In January 1993, a new Master Plan Study for the Port of Djibouti was completed as shown in Fig 1-3.

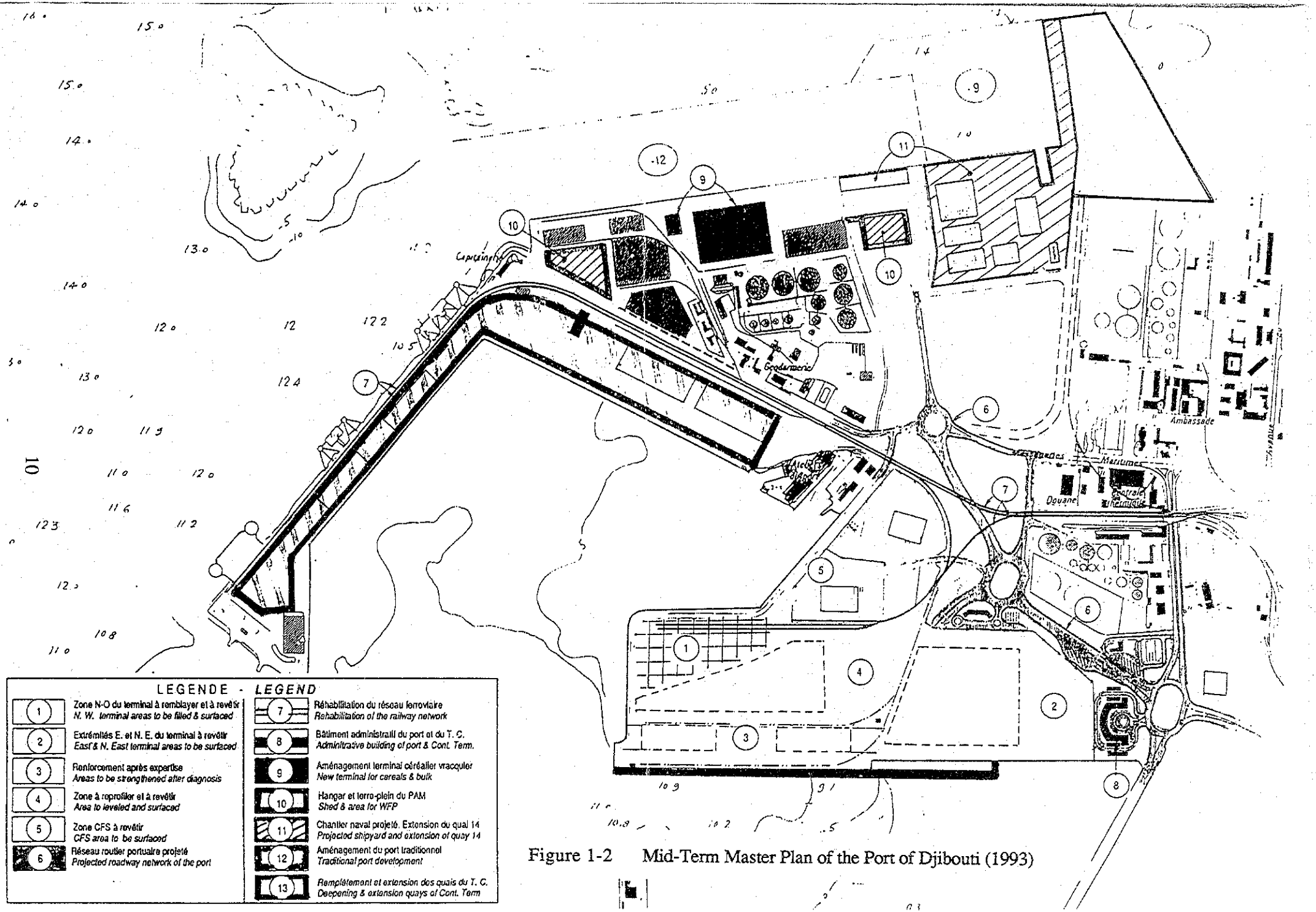


Figure 1-2 Mid-Term Master Plan of the Port of Djibouti (1993)

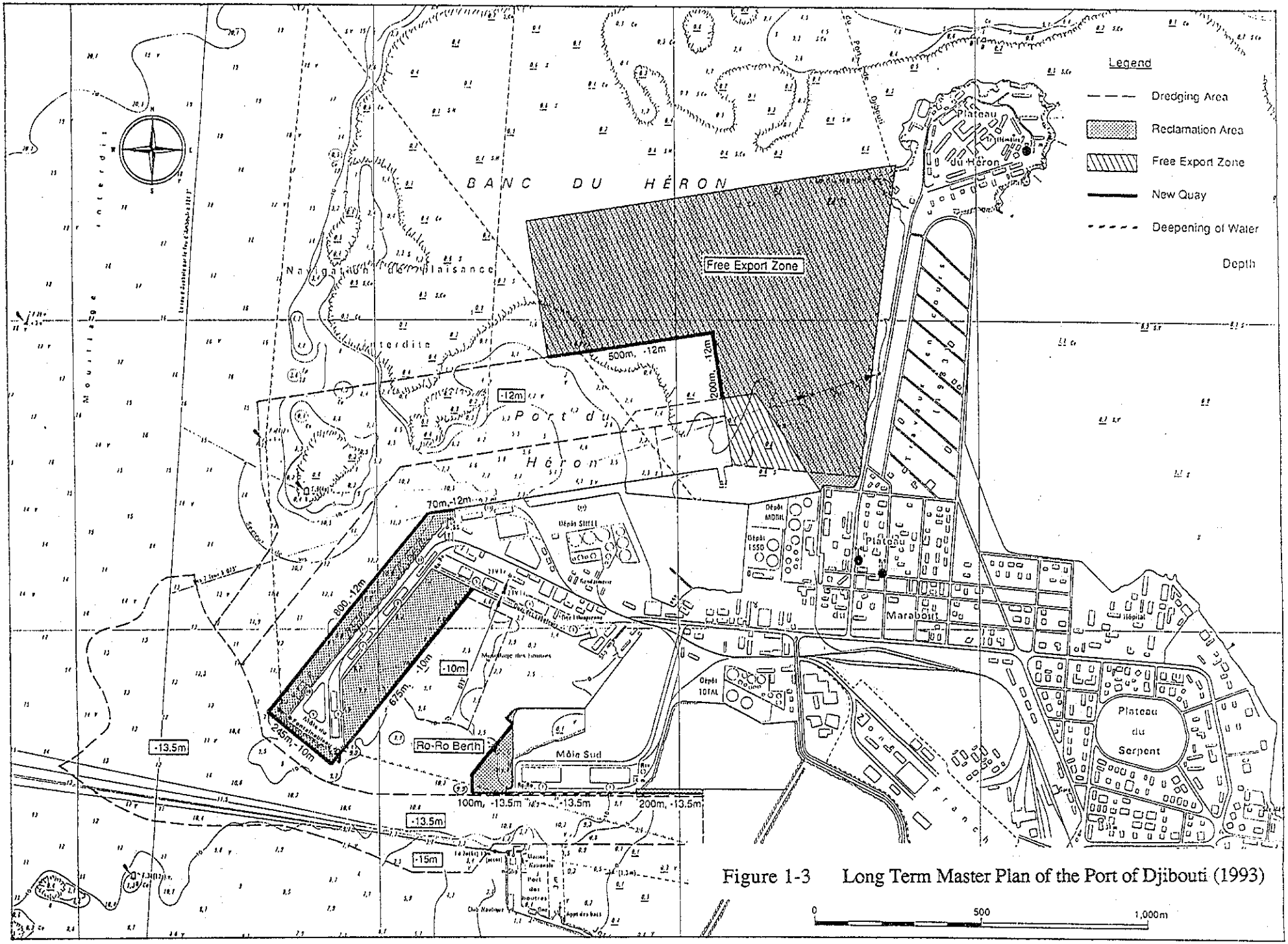


Figure 1-3 Long Term Master Plan of the Port of Djibouti (1993)

Chapter 2 Present Situation of the Oil-Berths in Port of Djibouti

CHAPTER 2 PRESENT SITUATION OF THE OIL-BERTHS IN PORT OF DJIBOUTI

2.1 General

In order to collect data and information on socio-economic and natural conditions as well as structural status of the existing facilities of Oil-Berth Nos. 11 and 12 of the Port of Djibouti, the Study Team conducted a series of site investigations in Djibouti from August 24 to October 17, 1993 and from January 15 to 25, 1994.

As for the site investigations on natural conditions, the hydrographic survey and the soil investigation were conducted as follows:

1) Hydrographic survey was conducted in front of the Oil-Berth Nos. 10, 11 and 12 covering an area of 16 ha (200 m by 800 m) from September 18 to 27, 1993.
2) Soil investigation was started on October 6, 1993 using a cone penetrometer and ten (10) points were tested completely on October 30, 1993.

Regarding the survey on the existing facilities, a series of inspections were conducted on not only the superstructures but on the sub-structures by diving experts from September 18 to 21, 1993.

2.2 Natural Conditions

2.2.1 Meteorological Conditions

A continuous climate observation has been kept by the Meteorologie Nationale, the Government of Djibouti at one inland location, Serpent, 1 km away from the Port.

General meteorological information, obtained from "RED SEA AND GULF OF ADEN PILOT, 1980 (REVISED 1987)", Meteo and ISERST are shown in Fig. 2-1 to 2-4.

In Djibouti, the average temperature is approximately 30 degrees centigrade throughout the year, and annual precipitation is approximately 150 mm. Consequently, the climate is generally warm and dry. The prevailing wind blows from the Red Sea side, but the NW wind, the so-called Khamsin, prevails in June to August when the monthly highest temperature climbs up to 40 degrees centigrade. In these months, there is no precipitation and it is unbearably hot.

The monthly maximum wind velocity is generally 10 to 15 m/sec which is not so strong except for the period of the Khamsin season. Even during the Khamsin season, it is 10 to 20 m/sec except for abnormal years.

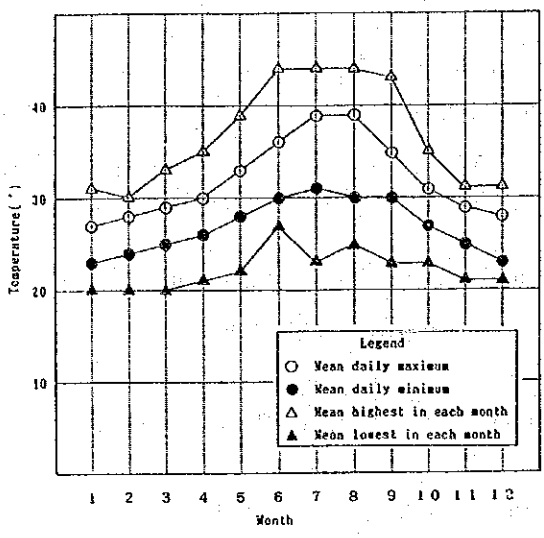


Fig. 2-1 Temperature in Djibouti (1941 ~ 1970)

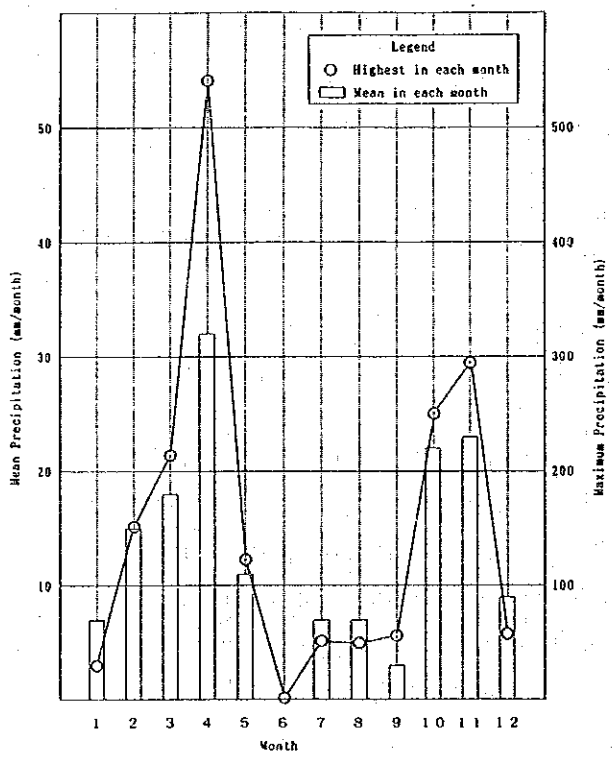


Fig. 2-2 Precipitation in Djibouti (1961 ~ 1980)

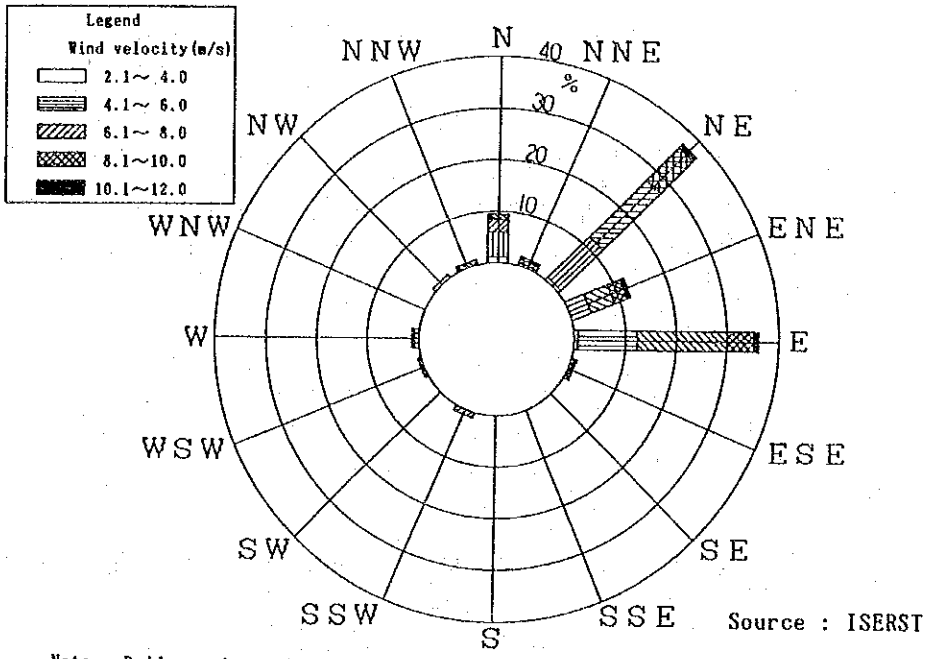


Fig. 2-3 Windrose in Djibouti (1984)

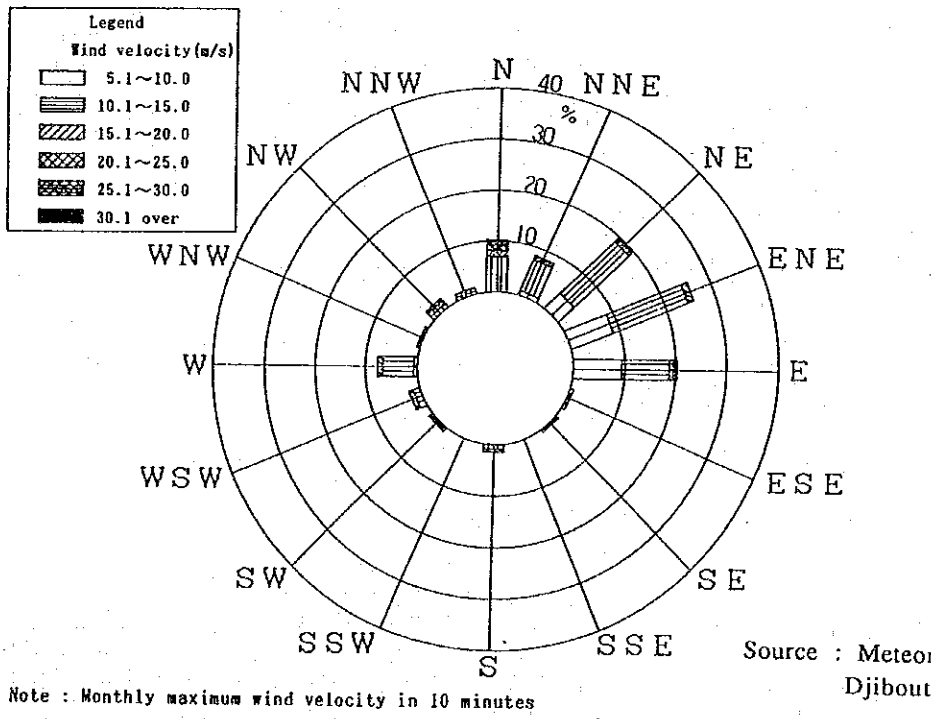


Fig. 2-4 Windrose in Djibouti (1971 ~ 1990)

2.2.2 Oceanographic Conditions

(1) Waves

Wave observation data is not available from PAID. Consequently, the Study Team has conducted the wave hindcasting, based on the wind information observed in Djibouti. In the process of wave hindcasting, the estimated values were computed using the of SMB Method. The results of wave hindcasting are shown in Table 2-1.

Table 2-1 Hindcast Wave Height

Directions of Wave	Recurrence Period (year)			
	30		50	
	Significant Wave Height $H_{1/3}$ (m)	Significant Wave Period $T_{1/3}$ (s)	Significant Wave Height $H_{1/3}$ (m)	Significant Wave Period $T_{1/3}$ (s)
NNE	1.5	4.2	1.6	4.3
N	1.6	4.2	1.6	4.2
NNW	1.6	4.1	1.7	4.2
NW	1.8	4.7	1.9	4.9
WNW				
W	1.8	4.7	1.9	4.8

(2) Tide

The tide was observed at thirty minute intervals at Berth No. 12 while a hydrographic survey was conducted by the Study Team.

Table 2-2 shows levels to be applied in the planning of the present project, which were determined after comparing the data by the Study Team with other available tidal data.

Table 2-2 Tide Level

Height above datum of soundings					
		Mean High Water		Mean Law Water	
H.W.L.	L.W.L.	Higher	Lower	Lower	Higher
+2.9 m	+0.2 m	+2.4 m	+2.2 m	+1.0 m	+1.8 m

H.W.L.; Mean Springs High Water Level
L.W.L.; Mean Springs Low Water Level

(3) Current

No long-term reliable data is available as to the tide currents in the area. The only information was that obtained from the Harbor Master's Office who stated that the maximum current velocity might be around 1 knot. This is in accordance with a description found in the Report by BCEOM in 1986.
In order to obtain the actual tide current patterns in the study area, a current survey was conducted on 2nd October, 1993, just two days after a full moon at the sea in front of Berth No. 10, using a floater. The velocity was observed in a range from 0.1 to 0.2 knots. The direction was west or southwest for ebb tide and southwest or south by southwest for flood tide..

2.2.3 Topography and Hydrography

The topographic survey was conducted with a transit and a level. A total of 33 reference points were set with paint marking and pins at 25 m intervals on the existing concrete parapet wall along Berth Nos. 10, 11 and 12.

The bench mark B.M.3B of IGN was used as survey reference point.

The hydrographic survey was conducted by using an echo sounder equipped on the survey boat and, being guided by transits and marker buoys, at an interval of 25 m within an area of 800 m by 200 m.

The Hydrographic Survey Map is shown in Fig. 2-5.

2.2.4 Geological and Soil Conditions

(1) Geological and Geophysical Characteristics of Djibouti

Geological history of Djibouti is shown in Fig. 2-6.

(2) Seismic Requirements of Djibouti

Djibouti is located on the boundary of plate tectonics linking the African and Arabian Peninsulas at the triple junction of three rifts, namely two ocean ridges in the Red Sea and the Gulf of Aden and the continental east African valley, i.e., Ethiopian rift.

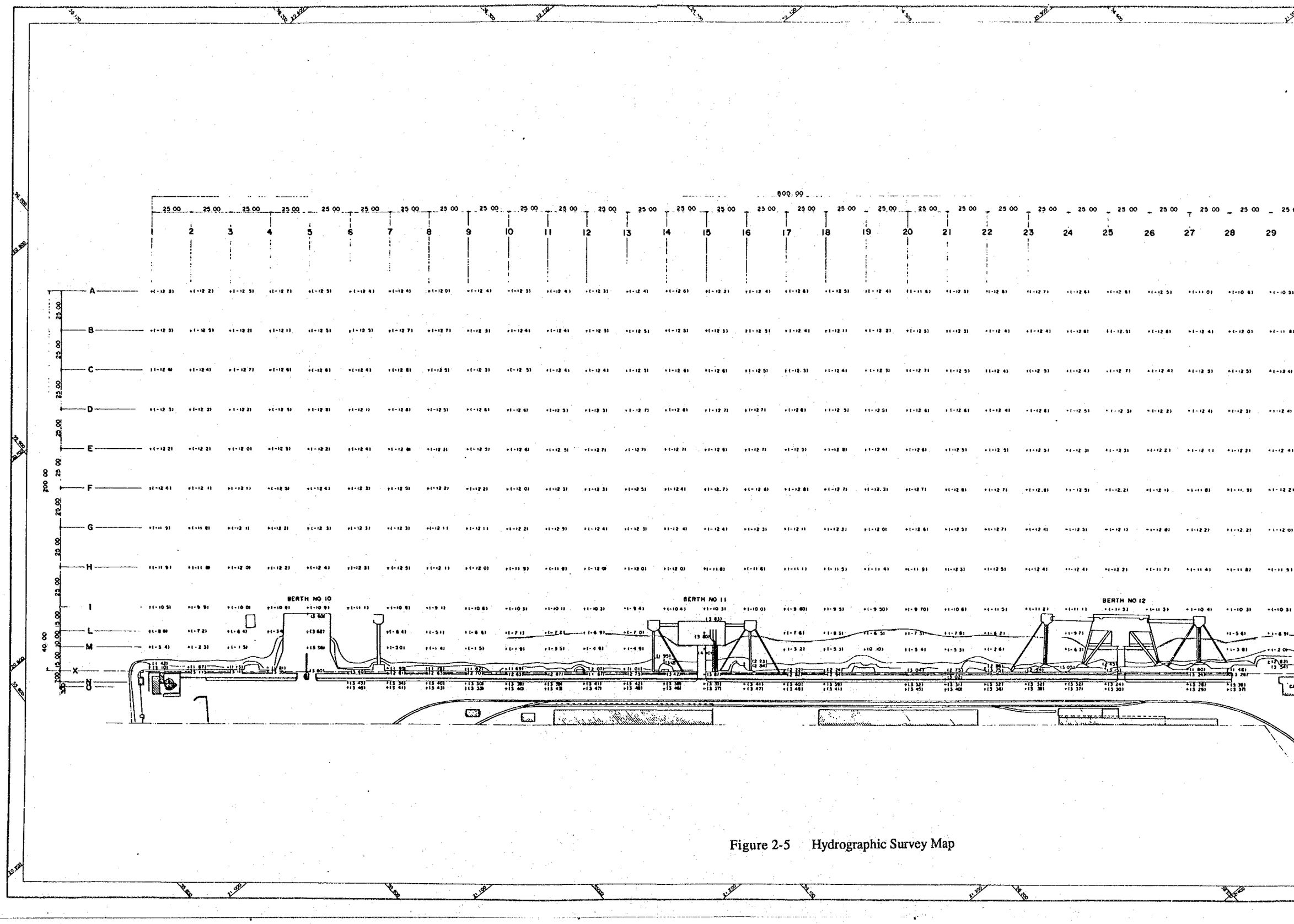


Figure 2-5 Hydrographic Survey Map

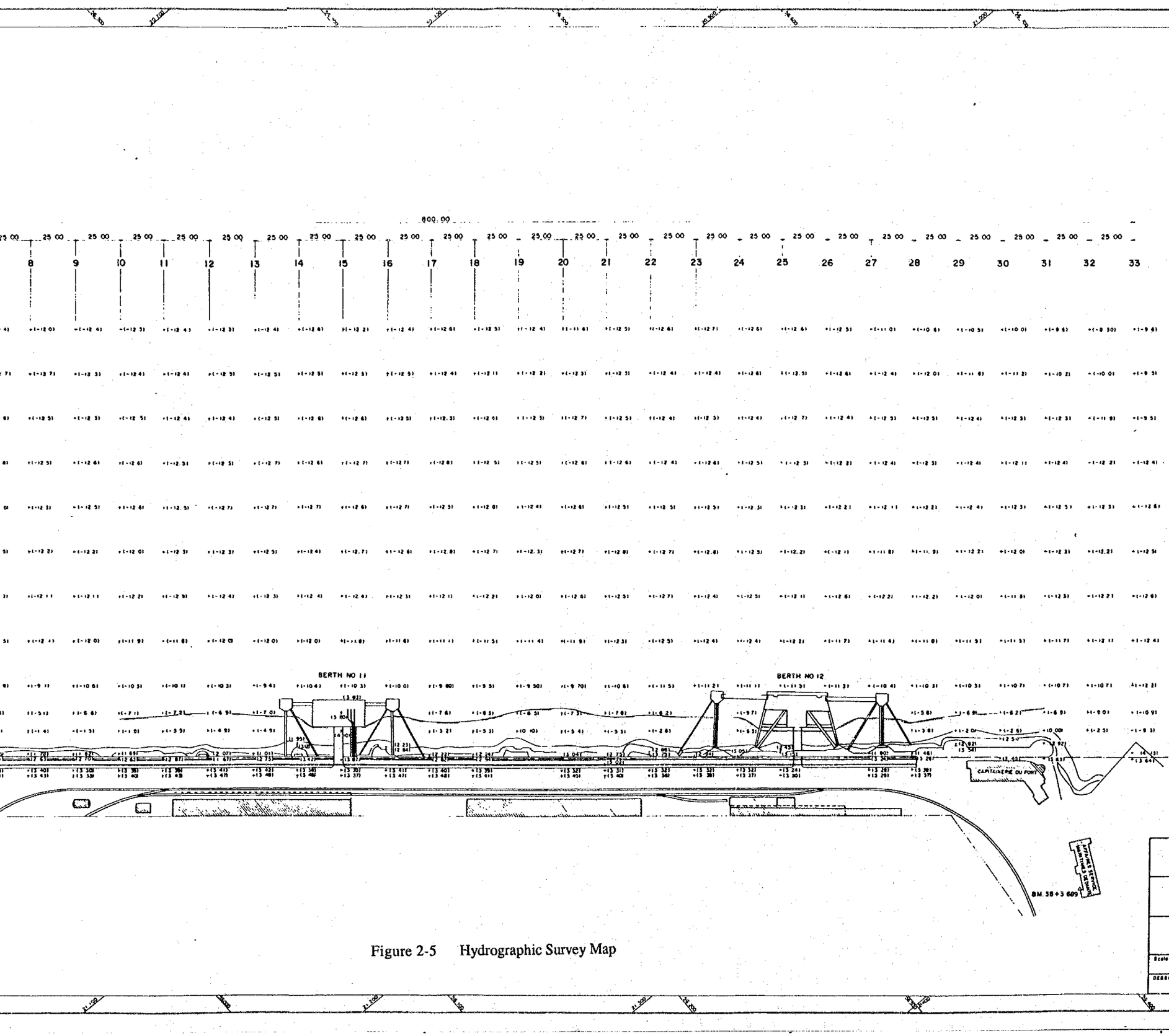
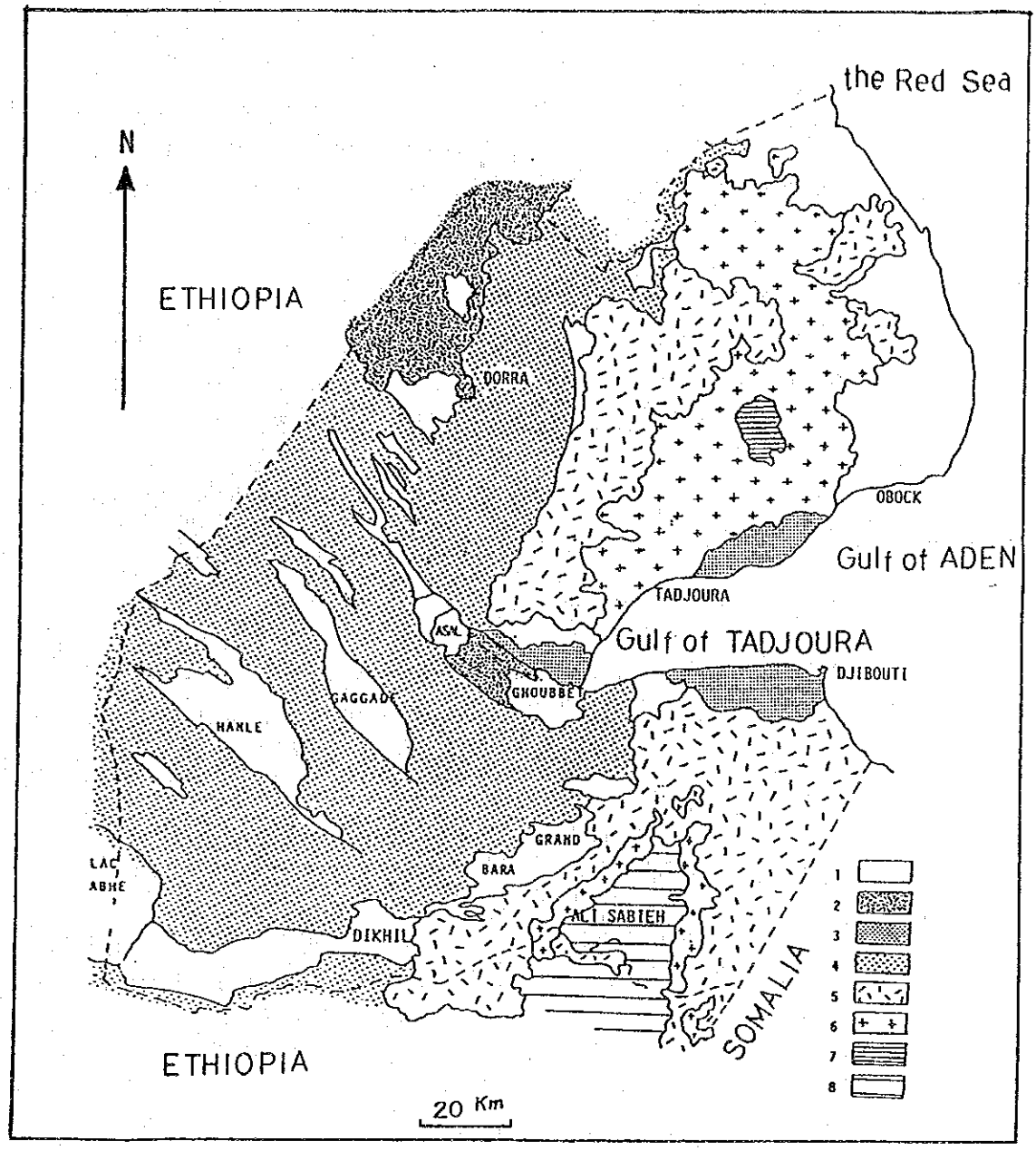


Figure 2-5 Hydrographic Survey Map



1. Formation of Recent Deposits
2. Axial Series (- 1 Ma)
3. Initial Basalt Series
4. Stratoid Series
5. Dalha Basalt
6. Mablas Rhyolite
7. Ancient Basalt (+ 25 Ma)
8. Mesozoic Formation

Figure 2-6 Simplified Geological Map of Djibouti

Most earthquakes occur along these boundaries, and Djibouti encountered several earthquakes in the past. Disastrous earthquakes in Djibouti are of the epicentral type engendering along the axis of the Gulf of Tadjoura at a shallow depth of 3 to 10 km. By analyzing the past 32 earthquake records from 1899 to 1992, almost all earthquakes were observed with a magnitude of less than six (6) degrees. However, due to short distances between the Djibouti City and epicenters, relatively high intensities were recorded.

The earthquake which severely damaged Djibouti city was the one that occurred in April 1973 with a magnitude of 5.5. This earthquake caused some damage to the Port of Djibouti such as cracks in pavement, ruptures on embankments and damage to the port office building.

"Tsunami", seismic swell, has never been observed in Djibouti due to the shallow and small water surface area of the Gulf of Tadjoura.

(3) Previous Soil Investigations

In the port area, there have been several soil investigations conducted since the French colonial era. Considering these previous investigations, cone penetration tests conducted by the Study Team were planned and the results are described in the following paragraph.

(4) Results of Cone Penetration Test Conducted by the Study Team

Ten dynamic cone penetration tests were carried out at locations along Oil-Berth Nos.11 & 12 as indicated in Fig.2-7 in order to determine the structural type of the berths. The tests were performed by the LBTP (Laboratoire du Bâtiment et des Travaux Publics) under the supervision of the Study Team.

A brief description of the tests are as follows:

1)	Location	: as shown in Fig. 2-7
2)	Test Machine	: Automatic Ram Sounding Machine
3)	Test Period	: October 3 to 30, 1993
4)	Test Number	: 10 locations
5)	Penetration Depth	: approx. 20 m from the seabed

Based on the test results combined with the review of the previous studies, it is analyzed that:

Oil-Berth No. 11 Area

The soil profile can be drawn up as shown in Figs. 2-8 and 9. These figures show that the soil strata are mostly flat. Although no soil samples were taken at this time, the geological formation of the area is classified into the four typical layers as follows:

- Alternation of Sand & Clay
- Sandy & Gravelly Madrepore
- Clay
- Sandy Clay & Clayish Sand

Oil-Berth No. 12 Area

In the same manner, the soil profile can be drawn up as shown in Figs.2-10 to 11. The geological formation of the area is described as follows:

- Alternation of Sand & Clay
- Madrepore
- Madrepore (soft & clayish)
- Madrepore (mostly soft)

2.3 Present Condition of the Oil-Berth Facilities

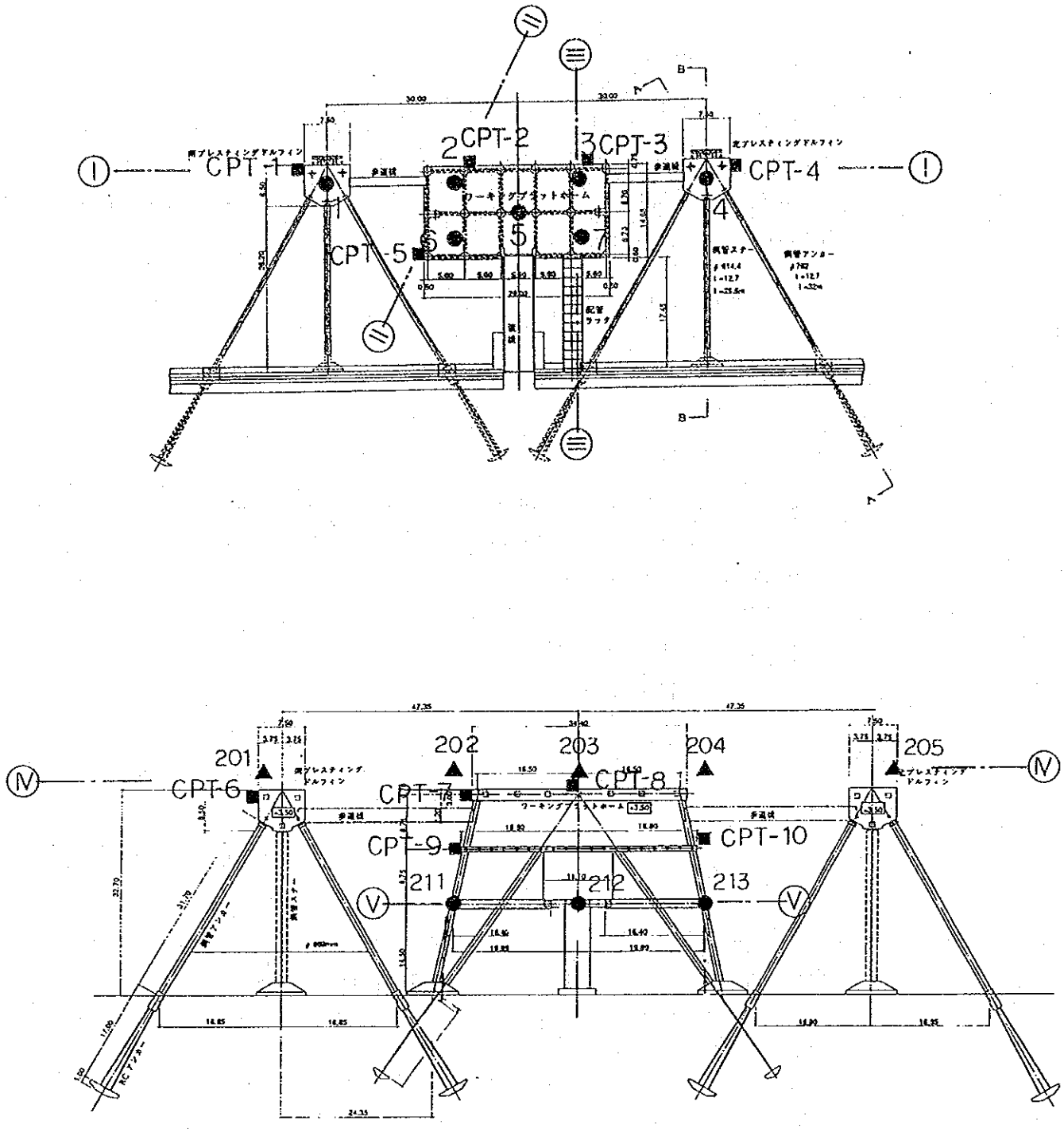
2.3.1 Structure of Berths

(1) General

Berth Nos. 11 and 12 were constructed approximately 30 years ago. The structure of the platforms and dolphins are of a pile foundation, each dolphin being supported by a steel stay and two anchors at one end fixed to the onshore to resist mooring forces and berthing impact of ships. Since these platforms and dolphins have been severely damaged by the recurrent earthquakes and bumping accidents with ships, they have severely deteriorated. In view of this situation, it is quite likely that grave accidents can not be avoided, if no immediate appropriate action is taken to improve the structures.

(2) Purpose of Investigation

The purpose of the investigation is to inspect the extent of deterioration of the existing platforms and dolphins at Berth Nos. 11 and 12, and to ascertain whether the present system can be economically and reliably used by rehabilitating the obsolete facilities or to be completely replaced by a new system.



] Figure 2-7 Location Map of Cone Penetration Test

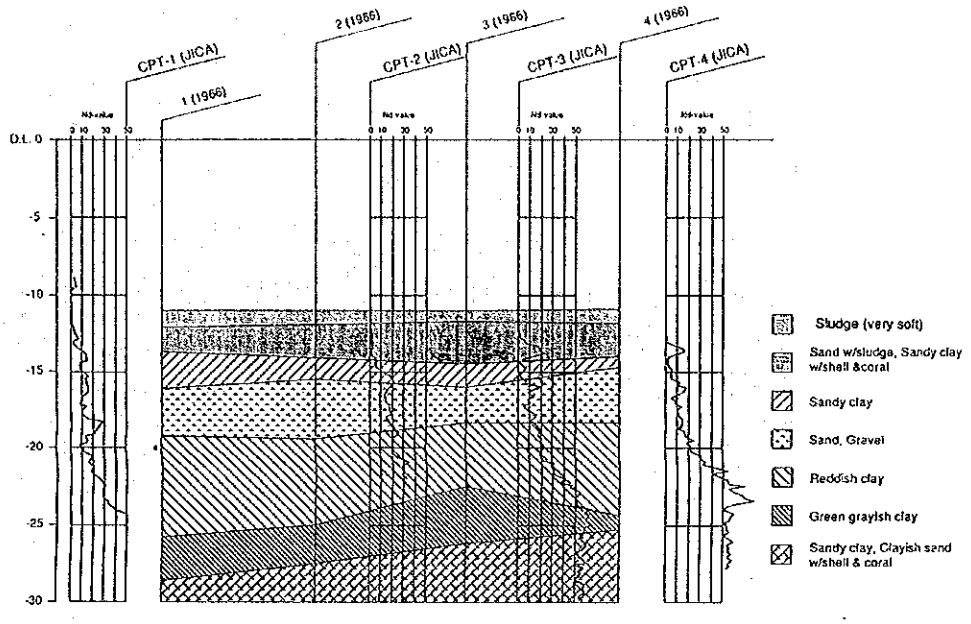


Figure 2-8 Soil Profile at Berth No. 11 (I - I)

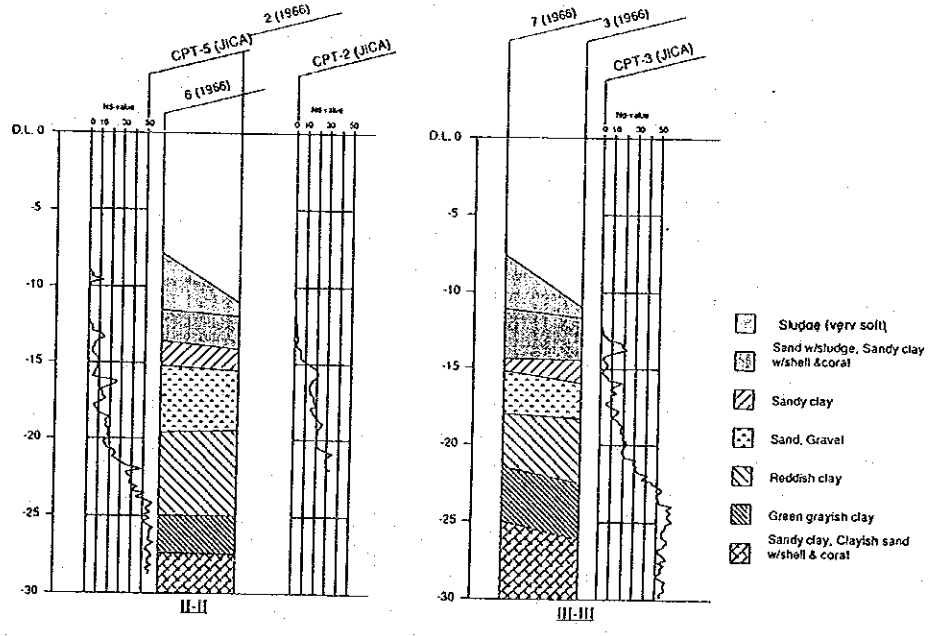


Figure 2-9 Soil Profile at Berth No. 11 (II - II & III - III)

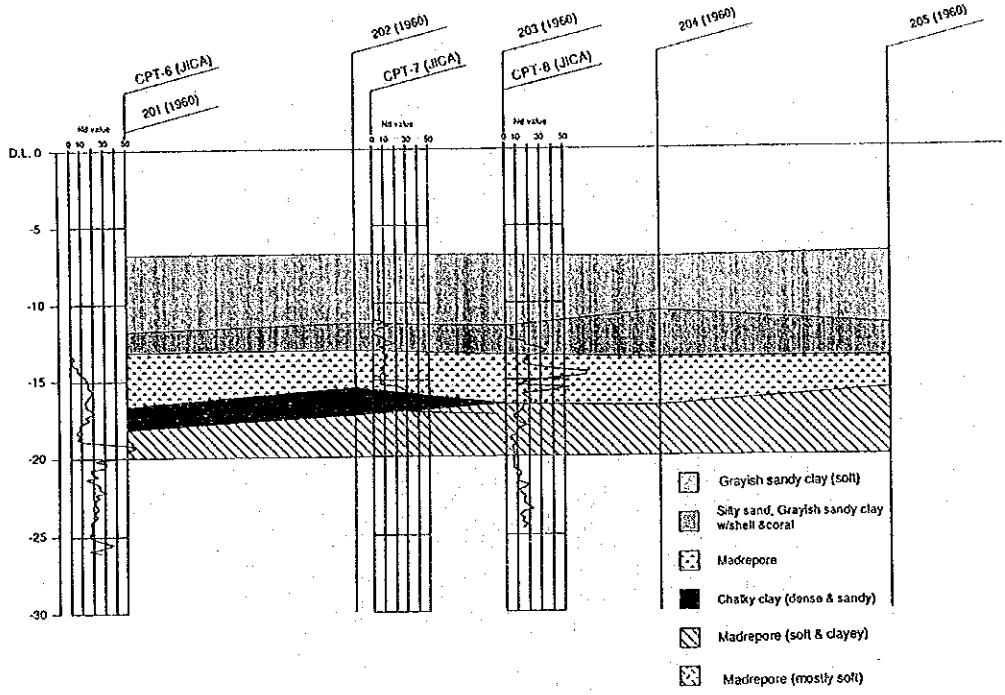


Figure 2-10 Soil Profile at Berth No. 12 (IV - IV)

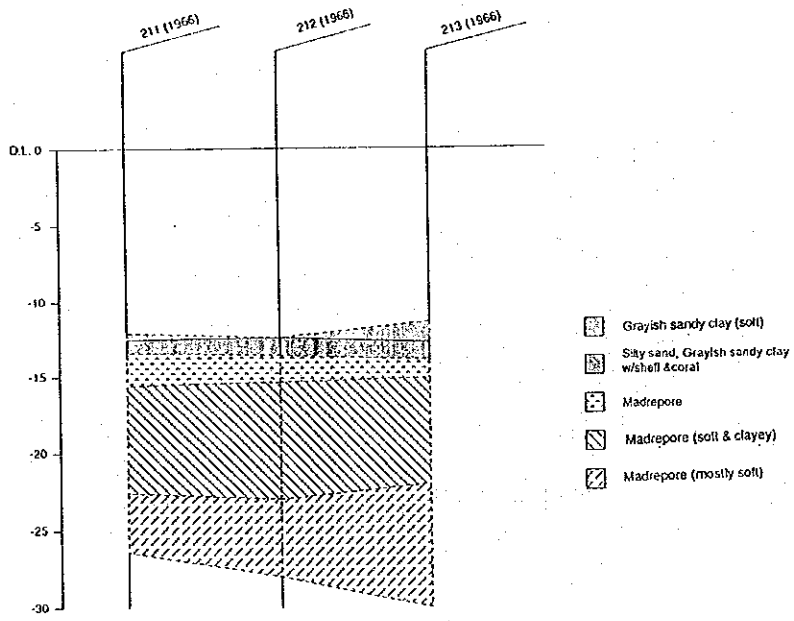


Figure 2-11 Soil Profile at Berth No. 12 (V - V)

(3) Scope and Methods of Investigation

1) Scope of Work

The scope and the locations of the investigation are shown in Table 2-3.

Table 2-3 Scope and Location of Field Investigation

Item	Location for Inspection
Corrosion of steel structures	Steel pipes for dolphin stays and anchors.
Damage of reinforced concrete structures	Superstructures of dolphins, slabs and beams of platforms.
Measurement of concrete strengths	Superstructures of dolphins, slabs and of platforms.
Damage of fenders	Fenders for dolphins and platforms.
Visual inspection of structures	Superstructures of dolphins and platforms, piles and steel anchors, stays, armored stones.

2) Methods of Investigation

a) Corrosion of Steel Structures

Rust and paint of steel pipe anchors and stays are first removed with hammers and wire brushes to expose the steel substrate. Then, the thicknesses of the steel structures are measured at the selected points by means of an ultrasonic thickness gauge.

b) Deterioration of Concrete Members

The extent of the corrosion of reinforcing steel bars, and cracks, separations and peeling of the concrete structures have been visually inspected. The degree of deterioration of each concrete structure is generally evaluated.

c) Concrete Compressive Strengths

Compressive strengths of the concrete structures are measured with a Schmidt Rebound Hammer. For the measurements, positions on the concrete structures, having neither separations nor peeling, are selected. The surface of each selected position is thoroughly cleaned, and the compressive strength is measured at a total of 20 points. Then, the average compressive strength at each position is obtained.

d) Fenders

The present conditions of the Kleber Company's axially cylindrical fenders, front pads, shock absorbers, anchor bolts, and chains have

been checked by visual inspection. The result of the inspection is then examined to determine whether these can be further used or require improvements.

e) Visual Inspection of Structures

The present conditions of the steel anchors, stays, dolphins, and platform piles are visually inspected. The submerged portions of the structures are inspected by diving experts.

(4) Results of Investigations

1) Corrosion of Steel Members

The results of the investigation are shown in Table 2-4.

Table 2-4 Corrosion of Steel Members

Berth	Location	Original thickness t1 (mm)	Measured thickness t2 (mm)	Corroded thickness t1-t2 (mm)	Age (year)	Speed of corrosion (mm/yr)
No. 11	South dolphin stay	12.7	7.23	5.47	30	0.182
	South dolphin anchor (inside)	12.7	7.77	4.93	30	0.164
	North dolphin anchor (inside)	12.7	8.95	3.75	30	0.125
	North dolphin stay	12.7	8.89	3.81	30	0.127
	North dolphin anchor (outside)	12.7	9.19	3.51	30	0.117
No. 12	South dolphin anchor (outside)	12.7	11.21	1.49	9	0.165
	South dolphin stay	12.7	11.40	1.30	9	0.144
	North dolphin anchor (inside)	12.7	11.30	1.67	9	0.185
	North dolphin stay	12.7	11.50	1.20	9	0.133
	North dolphin anchor (outside)	12.7	11.60	1.10	9	0.122

2) Reinforced Concrete Structures

The results of the investigation on the reinforced concrete structures reveals significant corrosion of reinforcing steel bars. The corrosion has further progressed and the sections of the steel bars noticeably reduced. At Berth No. 11, the corroded steel bars hung down at many locations.

3) Compressive Strengths of Concrete

The compressive strengths of concrete members have been measured with a Schmidt Rebound Hammer. The measured strengths are adjusted according to the tapping angle of the Hammer and age of concrete material to obtain the actual strengths, as shown in Table 2-5.
From the results, it is confirmed that the existing concrete is no longer sound to some extent as compared with the normal concrete compressive strength of 240 kg/cm^2.

Table 2-5 Concrete Compressive Strengths

Berth	Measured Location		Compressive Strengths (kg/cm^2)
No. 11	South dolphin	(upper side)	238
	North dolphin	(upper side)	229
	Platform slab		172
No. 12	South dolphin	(upper side)	231
	North dolphin	(upper side)	186
	Platform slab		209
	Platform beam	(outside)	224
	Platform beam	(inside)	226

4) Fenders

The field inspection has revealed that the fender bodies themselves could be further used, however, where the frontal pads have been deformed, the pads are quite likely to be further deformed by the berthing forces directly placed on them.
On account of these observations, immediate rehabilitation of the frontal pads, by repairing the deformed flat pads, appears to be necessary. The detached chains should also be urgently repaired, since the fender bodies themselves may possibly become detached, if the detached chains are left. It will not allow equal contact of the frontal pads with berthing ships.

5) Visual Inspection of Structures

The results of the visual inspection of the structures are summarized in Table 2-6 and 2-7, and the locations of deformed portions are shown in Fig. 2-12 and 2-14.

2.3.2 Ancillary Facilities

The ancillary facilities attached to Berth Nos. 11 and 12 are enumerated in Table 2-8.

2.3.3 Present Condition of Revetments

The revetment behind the berths is of a concrete retaining wall type. Comparing the surveyed elevations of the existing crest with the original elevation of the crest, it was confirmed that the crest has settled about 0.1 to 0.3 m from the original level.
The present conditions of the armor stones have been inspected by two divers over a length of 500 m, from the mid-point between Berth Nos. 10 and 11 to the Harbor Master's Office. The inspection has revealed that the armor stones generally maintain their designed shape, and no appreciable collapse or break is found.

Table 2-6 Visual Inspection of Structres

Berth	Location	(*) Ref. No.	Existing Condition
No. 11	South dolphin	①	Steel anchor (outside) disconnected.
		②	Anchor bolts corroded.
		③	A hole exists near the center of steel anchor.
		④	a space exists between anchor concrete foundation and steel pile.
	North dolphin	⑤	Anchor bolts corroded.
		⑥	A space exists between anchor concrete foundation and steel pile.
		⑦	Reinforcing steel bars of foundation at land side exposed.
	Platform	⑧	Pipe racks are lost.
		⑨	Concrete head of pile is lost.
		⑩	Supporting pile deformed.

Note: (*) Refers to the location numbers shown in Fig. 2-12.

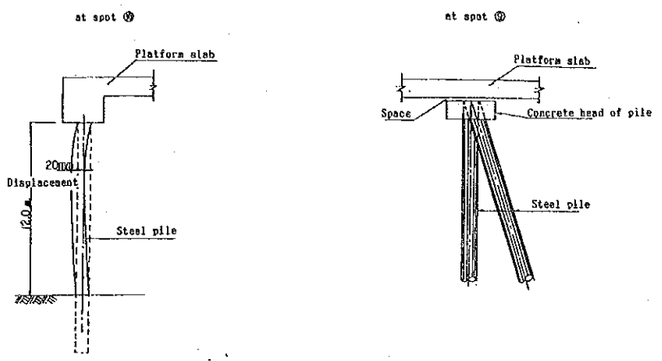


Figure 2-13 Detail of Deformed Spots at Berth No. 11

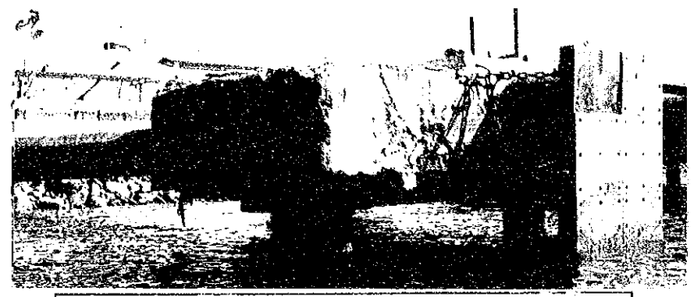


Photo - Ⓓ Berth No.11 North dolphin (19/9/' 93)
Deteriorated superstructure concrete and exposed steel bars.

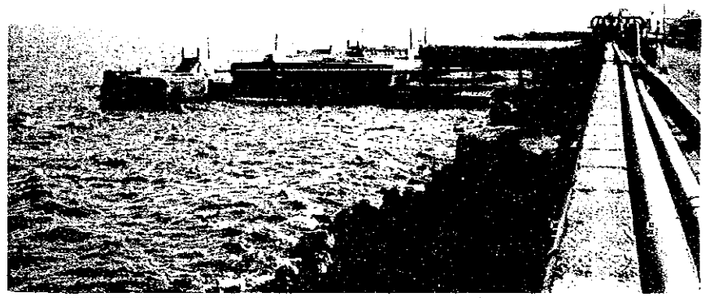


Photo - Ⓐ Berth No.11 south dolphin (9/9/' 93)
Steel anchor disconnected.

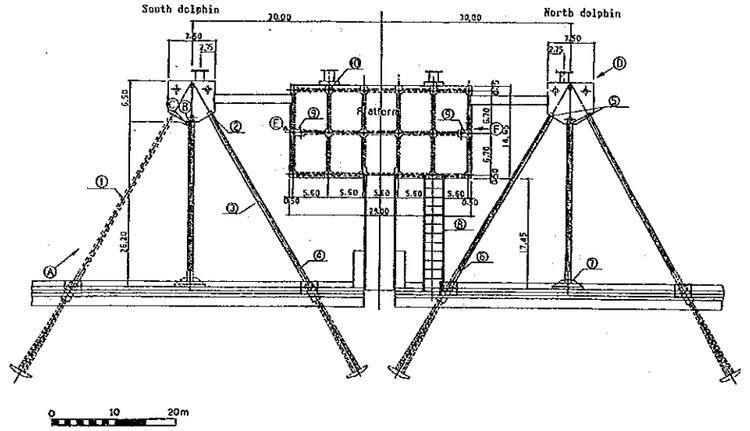


Figure 2-12 Visual Inspection Spots at Berth No. 11

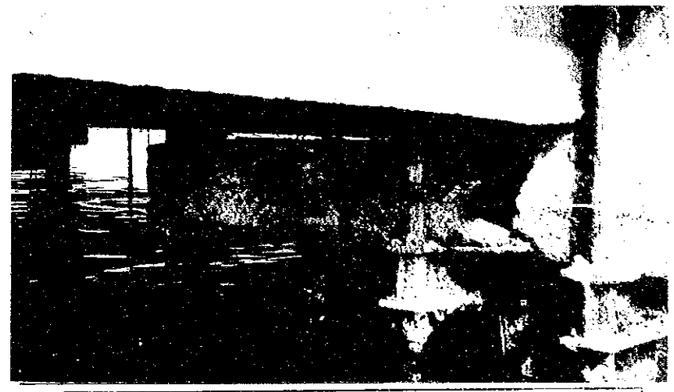


Photo - Ⓔ Berth No.11 Platform (22/9/' 93)
Batter pile disconnected.

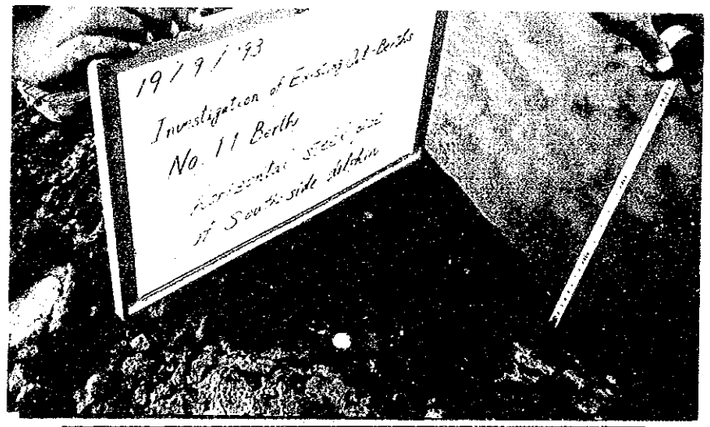


Photo - Ⓑ Berth No.11 south dolphin (19/9/' 93)
Measurement of rust thickness of corroded steel stay.

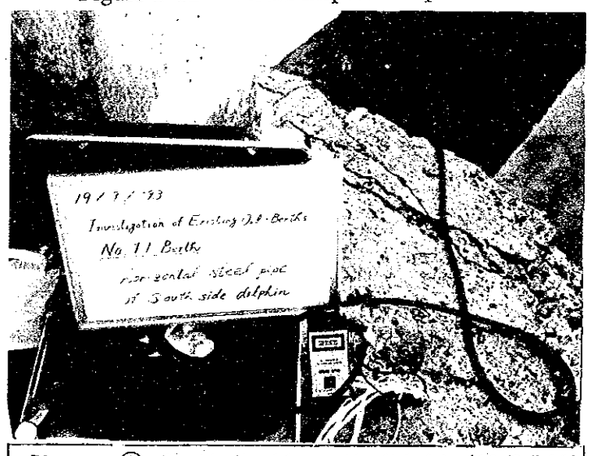


Photo - Ⓒ Berth No.11 south dolphin (19/9/' 93)
Measurement of corroded steel stay.

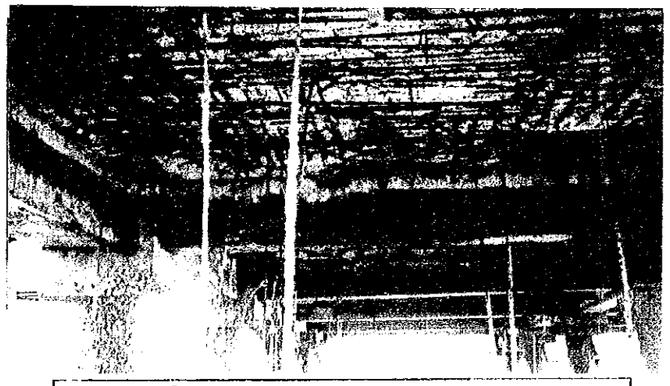


Photo - Ⓕ Berth No.11 (19/9/' 93)
Exposed bottom steel bars.

Table 2-7 Visual Inspection of Structres

Berth	Location	(*) Ref.No.	Existing Condition
No.12	South dolphin	①	Anchor bolts corroded.
		②	Steel anchor (inside) disconnected.
	North dolphin	③	Anchor bolts lost.
		④	Supporting pile damaged.
	Platform	⑤	Supporting pile damaged.
		⑥	Supporting pile lost.
		⑦	Catwalk damaged.

Note: (*) Refers to the location numbers shown in Fig. 2-14.

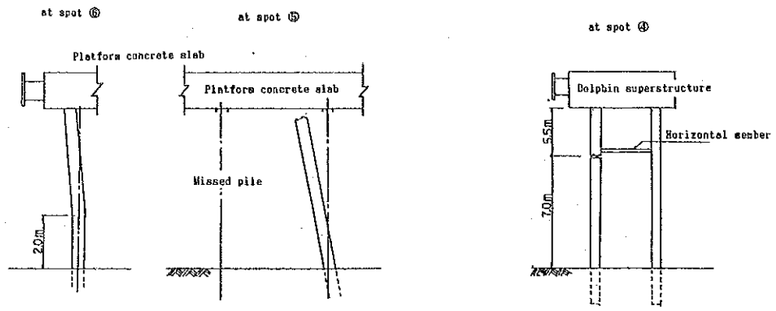


Figure 2-15 Detail of Deformed Spots at Berth No. 12

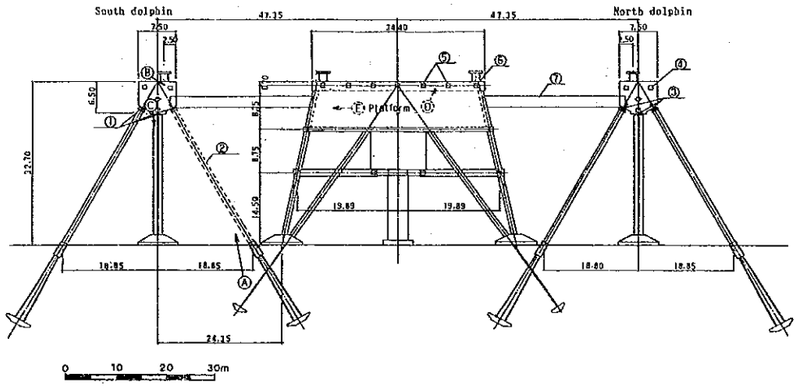


Figure 2-14 Visual Inspection Spots at Berth No. 12

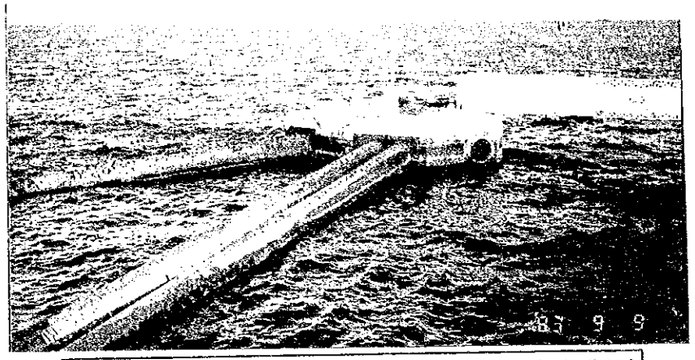


Photo - Ⓐ Berth No.12 south dolphin (9/9/' 93)
Steel anchor disconnected.

Photo - Ⓑ Berth No.12 south dolphin(18/9/' 93)
Deteriorated superstructure concrete and exposed steel bars.

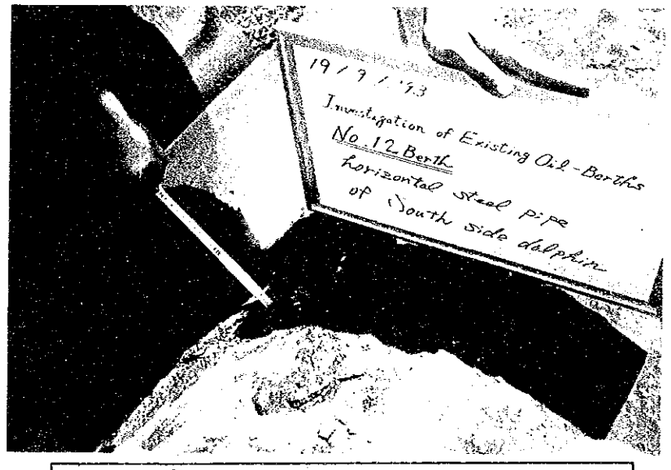


Photo - Ⓒ Berth No.12 south dolphin(19/9/' 93)
Measurement of rust thickness of corroded steel stay.

Photo - Ⓓ Berth No.12 Platform (19/9/' 93)
Missed 2 piles of frontal row.

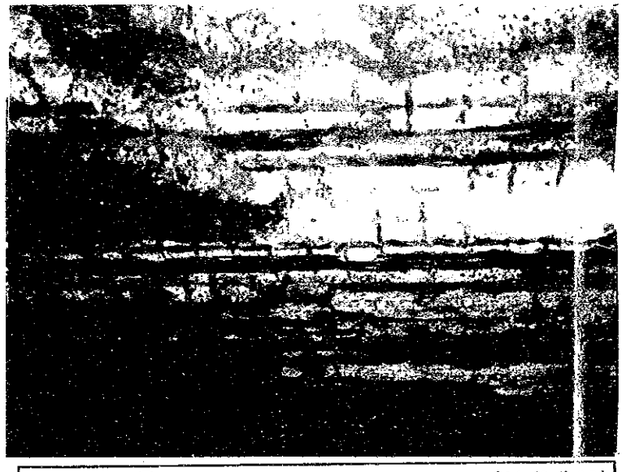


Photo - Ⓔ Berth No.12 Platform (19/9/' 93)
Exposed bottom steel bars.

Table 2-8 Ancillary Facilities of Berth Nos. 11 and 12

Berth	Location	Item	Standard	No.
No. 11	North dolphin	Fender	Cell type (kleber) 1,500 H	1
		Bitt	80 ton type	1
		Water supply pipe	Ø8.5"	1
		Water supply tap	47 x 34 x 13	1
	South dolphin	Fender	Cell type (kleber)	1
		Bitt	80 ton type	1
		Lighting pole	200 W	1
		Water supply pipe	Ø8.5"	1
		Water supply tap	47 x 34 x 13	1
	Platform	Fender	Cell type (kleber) 1,500 H	2
		Bitt		2
		Lighting pole	200 W	4
		Oil pipe	Ø8.5", flange size 15"	1
		Oil pipe	Ø12.5", flange size 15"	1
No. 12	North dolphin	Fender	Cell type (kleber) 1,500 H	1
		Bitt		1
		Lighting pole	200 W	1
	South dolphin	Fender	Cell type (kleber) 1,500 H	1
		Bitt	80 ton type	1
		Lighting pole	200 W	1
	Platform	Fender	Cell type (kleber) 1,500 H	2
		Bitt		2
		Lighting pole	200 W	3
		Water supply pipe	Ø9"	1
		Water supply pipe	Ø10"	1
		Water supply tap	47 x 34 x 13	1
		Oil pipe	Ø12"	4
		Oil pipe	Ø10"	1
		Oil pipe	Ø9"	1
		Recovering pipe of residual oil	Ø2"	1
		Oil pan	1.3 m x 2.6 m	3

2.3.4 Evaluation of Existing Oil-Berth Facilities

The results of the field investigation and the evaluation made on the existing facilities of Berth Nos. 11 and 12 have led to the conclusion that to construct the new berths is more advantageous than to continue using the existing facilities by rehabilitating them.

a) According to the original design for the berths, the fenders were made of wood material, but were replaced in 1986 by the present larger ones to cope with the increased berthing forces by larger vessels. However, no consideration has so far been given to reinforcing of the dolphin and platform structures resulting in damage to the pile bodies and heads

b) The dolphins of Berth No. 11 and dolphins and platform of Berth No. 12 are no longer capable by themselves of bearing the horizontal berthing and earthquake forces. All of these forces are resisted by the horizontal anchors or stays connecting these superstructures to the revetment. The structure using these horizontal connecting members is severely damaged and deteriorated with some missing and disconnected members. No further serviceability is expected.

c) Only the platform at Berth No. 11 is of the self-standing type by its own batter piles. However, the upper parts of both of the two pairs of batter piles have been damaged due to the berthing forces of large vessels far exceeding the originally designed bearing forces of the piles. They can no longer sustain the horizontal forces, and could easily collapse even by a slight force due to the movement of vessels or earthquake.

d) If no measures are taken to improve the existing conditions of the berths, the degradation of concrete and reinforcing steel bars will continue, and may cause further reduction of their strength. Since the dolphins and platforms are in an unstable condition, a severe accident will occur without rehabilitation.

e) If the existing berths are to be continuously used after rehabilitation, there will be many structural problems as mentioned above, and as such, rehabilitation of the existing facilities appears to not be appropriate. Rehabilitation of the facilities would be more expensive and the economic life of the rehabilitated facilities could be shorter than that of the renewed facilities.

f) From an overall consideration of the results of field investigations and analyses, it is concluded that the construction of new berths is more appropriate than to continuously use the existing berths by rehabilitation.

2.4 Oil Distribution/Storage Facilities

2.4.1 Oil Distribution Pipelines

The oil storage tanks of three international oil companies, namely Shell, Mobil and Total, are connected to the berths of the Port through the oil distribution pipelines.

The pipelines between Berth No. 12 and the entrance of the Oil Berths are jointly used by the three oil companies.

A coordinating company has been selected every year among the three companies, and Mobil is the coordinating company for 1993. The maintenance costs of the common pipelines are shared among the three companies.

2.4.2 Oil Storage Facilities

Each terminal of the three companies has several oil storage tanks, and the total oil storage capacity of the three companies is approximately 200,000 m^3.

Shell has a total of 13 storage tanks, however, at present 2 tanks have been out of use, with the total available oil storage capacity of 60,890 m^3.

Totally 13 tanks are provided in Mobil's storage complex, out of which 12 tanks are used for oil storage. The total oil storage capacity of these tanks is 81,896 m^3.

Total has 15 tanks in its complex, of which 12 tanks are used for oil storage. The total storage capacity of the oil tanks is 56,724 m^3.

The oil from tankers is distributed to each of the oil terminals by means of pumps equipped on board. Oil bunkering from the oil terminals to ships is provided with pumps in the oil terminals. For bunkering of less than 10 kl of oil, the oil companies use a tank lorry to supply the oil.

2.5 Railways

(1) General

The construction of the Djibouti-Ethiopian Railways (C.D.E.) was started in 1896 and completed in 1917, presently serving a total of 782 km, of which a

portion of about 100 km belongs to Djibouti. 35 stations exist between Djibouti and Addis Abeba.

This railway system starts from the Port of Djibouti and ends at Addis Ababa. The spurs to the oil terminals are owned by the oil companies.

The C.D.E. has a firm function as the relay base traffic network for neighboring countries. According to the five-year plan, the total import traffic volume is expected to increase up to 246,000 tons by 1995/1996, a little less than 150 percent of the volume in 1990. The amount of export also increases up to 198,000 tons, a little less than 160 percent compared with the 1990 volume.

(2) Organization

The headquarters of CDE is located in Addis Ababa. CDE is administered by an administrative committee. This administrative committee is composed of twelve (12) members, assigned for a four year term.

As a whole, CDE employs 2,570 workers of which 382 are working in Djibouti.

(3) Transportation Capacity of C.D.E.

C.D.E. has a total of 107 railway tank wagons with a capacity of 30 kl or 24 kl. In addition, 541 freight wagons, excluding the 107 tank wagons, and 55 passenger cars belong to C.D.E. C.D.E. operates six passenger trains, and five or six freight trains a week.

(4) Railway Fares

Passenger fares and freight charges of C.D.E. are as follows:

Table 2-9 Railway Passenger Fares

Class	Fares (DF)	Section
First	4,000	Djibouti - Dire Dawa
Second	3,000	Djibouti - Dire Dawa
Third	2,000	Djibouti - Dire Dawa

Source: C.D.E.

Table 2-10 Railway Freight Charges

Products	Rate (DF/ton)	Section
White oil	8,345	Djibouti - Dire Dawa
White oil	13,247	Djibouti - Addis Ababa
Heavy oil	6,720	Djibouti - Dire Dawa
Heavy oil	13,247	Djibouti - Addis Ababa

Source: C.D.E.

(5) Reconstruction Funds to C.D.E.

The European Union has contributed a fund of 450 million French Francs to C.D.E., and a further 35 million ECUs was already committed to finance C.D.E. In addition, Italy, France and Japan have provided financial assistance to C.D.E. for procurement of spare parts for the telecommunication system.

Chapter 3 Demand Forecast

CHAPTER 3 DEMAND FORECAST

The purpose of this Chapter is to estimate domestic demand, transshipment, and bunker supply of petroleum products in Djibouti in the year of 2010, in order to allocate oil berths in Djibouti port to tanker vessels loading and unloading these petroleum products.

3.1 Socio-Economic Background

3.1.1 Economic Indicators

According to the Government statistics, the population of Djibouti was 519,900 in the middle of 1991 including the population of refugees which was said to be around 100,000. GDP per capita was considerably higher than those of the neighboring countries, such as Ethiopia (118 US dollars) and Somalia (156 US dollars).

Consumer prices were relatively stable and the exchange rate of Djibouti francs to US dollars has been fixed at 177.72 FD since 1974.

3.1.2 Finance

According to the budgetary balance of the Government from 1981 to 1991, budgetary balance had been in surplus until 1987, but had been in most years at break-even level since 1988.

The amount of official development assistance from bilateral and multilateral sources amounted to 116.9 million US dollars in 1991, and France contributed most in bilateral assistance in the amount of 48.9 million US dollars.

3.1.3 Foreign Trade

The volume of cargoes handled at the Djibouti port was around one million metric tons during 1984 and 1988. The Gulf war and international aid commodities to Ethiopia suffering famine and political conflicts helped boost the activities of Djibouti Port in addition to the completion of the container yard.

Petroleum trade has decreased from 1,104 thousand tons in 1983 to 467 thousand tons in 1991 due to improvements in the services and facilities at the competing neighboring ports. For reference, the major ports around the Red Sea area with their characteristics are listed in Table 3-1.

Table 3-1 Bunkering at Major Ports around the Red Sea

Name of Port	Nation	Price of Bunker Oil [1]	Bunkering Information [2]
Aden	Yemen	D/O $260 F/O $110 to 120 (180CST)	F/W: Available F/O: 3500, 2500, 1000, 600, 200 SEC OK
Berbera	Somalia	N/A (Not available)	F/W: Alongside OK (15T/H) F/O: N/A
Bosaso	Somalia	- No information	- No information
Assab	Eritrea	N/A	F/W: OK, F/O: All grade available (Required advance notice)
Massawa	Eritrea	N/A	F/W: Alongside only D/O: Supply by tank truck F/O: Alongside only
Port Sudan	Sudan	N/A	F/O: 1000 SEC only (Required advance notice available)
Hodeidah	Yemen	N/A	F/W: Available Only small quantity of D/O available
Mogadicio	Somalia	N/A	F/W: Alongside F/O: May available, inquire agent
Jidda	Saudi Arabia	D/O $240 F/O $ 81(180CST) Barge delivery	F/W: Available F/O: All type bunker available

Notes 1. Source 1) Japanese Shipping Company
2) "Guide to port entry, 1993"

2. D/O : Diesel oil (Gas oil)
F/O : Fuel oil
F/W : Fuel/Water

3. CST : Centi Stokes (Classification of oil)
SEC : Red Wood (Classification of oil)
3500 SEC Å‡380CST, 2500 SEC Å‡280 CST, 1500 SEC Å‡180 CST.
Larger figure shows higher viscosity and lower quality.
Ocean going vessels, domestic ferry, fishing boats are using 380 CST, 180 CST and D/O respectively.

3.1.4 Domestic Energy Consumption

Djibouti is required to import all its energy needs since it produces no energy resources. In the final energy consumption, only petroleum products and electricity are used, but all electricity has been produced through expensive diesel generators fueled by gas oil and fuel oil which account for almost half of the total domestic petroleum consumption.

As indicated in Table 3-2, Djibouti's total energy consumption was 98,524 million Kcal and 189 thousand Kcal per capita in 1991 compared with 287 thousand Kcal in 1981. The decrease was considered due to the rapid increase of population resulting from refugees flowing in from the neighboring countries.

Table 3-2 Oil Consumption and Electricity Generation

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Petroleum Products(Kl)												
Gasoline	14,250	14,345	13,932	13,560	13,034	13,122	13,112	13,740	12,529	12,320	12,303	11,949
Kerosene	8,390	9,465	9,893	10,777	11,888	12,257	12,651	13,154	13,651	13,965	14,625	15,229
Gas Oil	24,539	21,102	28,496	26,466	29,328	32,907	36,194	36,651	31,476	32,352	37,523	31,871
Fuel Oil	27,825	32,981	38,505	38,408	37,990	39,522	41,120	44,885	41,015	50,466	48,877	50,025
Total	75,004	77,893	90,826	89,211	92,240	97,808	103,077	108,430	98,671	109,103	113,328	109,074
Imported Oil(Kl)	76,578	79,884	92,825	91,002	93,954	99,771	104,989	110,087	100,260	110,756	115,055	
Total Energy Consumption (million kcal)	105,267	106,511	104,792	102,810	100,410	101,639	102,197	106,912	98,644	97,659	98,524	96,124
Per Capita (1000 Kcal/head)	287	286	274	254	234	223	211	214	193		189	
Energy Intensity (Kcal/FD)			3.75	3.33	2.99	2.89	2.72	2.66				
Electricity generated(MWh)	119,505	126,563	142,188	140,863	158,827	164,020	173,408	185,949	180,106	193,139	197,583	206,044
Per Capita (KWh/head)	327	340	371	348	369	360	359	372	353		380	

Source: DINAS

3.2 Trends in Ocean Traffic

In 1991, the total number of vessels calling at Djibouti Port was 1,208 including 95 Oil Tankers and total net tonnage reached 5,824 thousands.

3.3 Trends in Oil Traffic

Drafts of the tankers calling at Djibouti Port in 1991 were less than 11 meters. The gross tonnage was mostly between 16,000 and 19,000 with a few exceptions.

In 1990, the average anchoring time of tankers in Djibouti port was 41 hours and 15 minutes, of which the average berthing time was 39 hours and 15 minutes. In 1992, they were shortened to 39 hours 26 minutes and 30 hours 23 minutes respectively.

3.4 Trends in Oil Demand

In Djibouti, petroleum demand is divided into 3 categories; they are domestic demand, bunker supply, and transshipment. The evolution of the demand for each sector is shown in Table 3-3.

3.4.1 Domestic Consumption

There are three international major oil companies operating in Djibouti. They are Mobil, Shell and Total. They all have their own oil terminals at the port of Djibouti and are handling all petroleum products. Mobil has the largest share with almost 50 percent, and the other two companies have around 25 percent each.

Domestic consumption for petroleum in Djibouti, consists of six main products, namely premium gasoline, regular gasoline, kerosene, jet fuel, gas oil, and heavy fuel oil. Gasoline is used for motor vehicles exclusively and sold at about 20 service stations under the brand names of Mobil, Shell, and Total. Only Mobil is importing gasoline and the other two oil companies purchase gasoline from Mobil.

Kerosene is used for cooking in the residential sector, and jet fuel for aviation. Use of gas oil varies from motor vehicles, electricity generation, railways, agriculture to industry. The transportation sector consumes most of it.

Fuel oil is solely used for electricity generation in the domestic market. Electric de Djibouti (EDD) makes a bid for the purchase of fuel oil every three years, and Shell is the supplier at present. EDD notifies the volume requirements for fuel oil to an oil company who must have a stock-holding equal to 3 months' supply, the cost of which is borne by EDD.

Table 3-3 Evaluation of Oil Demand

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Domestic Consumption												
Premium Gasoline	9,007	9,271	9,218	9,025	8,654	8,634	8,761	9,224	8,370	8,358	8,606	8,237
Regular Gasoline	5,243	5,074	4,714	4,535	4,380	4,488	4,351	4,516	4,159	3,962	3,697	9,293
Kerosene/Jet Fuel	8,390	9,465	9,893	10,777	11,888	12,257	12,651	13,154	13,651	13,965	14,625	15,229
Gas Oil	24,539	21,102	28,496	26,466	29,328	32,907	36,194	36,651	31,476	32,352	37,523	31,871
Fuel Oil	27,825	32,981	38,505	38,408	37,990	39,522	41,120	44,885	41,015	50,466	48,877	50,025
Total	75,004	77,893	90,826	89,211	92,240	97,808	103,077	108,430	98,603	109,103	113,328	114,825
Bunker Supply												
Aviation Gasoline	202	986	398		155	157	173	184	101	141	175	412
Kerosene/Jet Fuel	71,792	78,548	78,710	78,269	77,254	72,792	70,083	82,468	92,905	117,020	113,813	82,238
Gas Oil	31,608	46,185	40,383	42,713	49,356	48,352	49,003	69,775	53,071	70,784	45,557	49,108
Fuel Oil	230,693	211,904	109,768	77,100	67,846	46,028	71,380	59,338	26,447	37,445	24,286	17,665
Total	334,295	337,623	229,259	198,082	194,611	167,329	190,639	211,765	172,524	225,390	183,831	149,428
Transshipment												
Premium Gasoline												
Regular Gasoline												3,126
Kerosene/Jet Fuel												33,315
Gas Oil												86,498
Fuel Oil												18,802
Total									119,815	286,628	189,875	141,741
Grand Total									390,942	621,121	487,034	405,989

Source: PAID, EPH