2.6 Outline of Natural Conditions in Honduras

2.6.1 Coastal Plain of the Caribbean Sea

(1) Topography and Geology

212. The plain covers the region of composed Tertiary alluvial sediments that borders the North and Central Cordilleras, from the Motagua River to the Tinto River. It also includes some wide plains of the Quaternary sediments in La Mosquitia. Fig.2-6-1 shows a geological map of the Caribbean Sea (Refer to the Map in Appendix-D, Part I, VOLUME II).

213. Physiographically, the La Mosquitia area is part of the northern coastal plain, but geologically it differs completely from the coastal plain. The materials deposited in the coastal plains have expanded the mainland area and formed from east to west, the capes and points of Puerto Cortes, Punta Obispo, Punta Sal, Punta Castilla, Camaron Cape, Punta Patuca, Falso Cape and Gracias a Dios Cape.

214. The Northern Coast or Antillean was part of a more extensive continental surface as it was seen in the geological evolution of Honduras. Actually, the La Mosquitia coast shows the characteristics of an upheaving coast.

215. On the other hand, the western littoral coast has gone through many changes by both submergence and upheaval, and it can be classified as a mixed or compounded coast.

216. The fluvial alluvium has regulated the traces, in part, of the northern coast, expanding it and smoothing its mountainous salients towards the sea. The same alluvium has formed large deltas on the continental shelf, such as the ones from the Ulua-Chamelecon rivers, the Patuca River and the Segovia River.

217. Over a distance of about 480 km from the Motagua River to the Tinto River, the coastal plain formed by mud, sand and gravel presents a width from a few meters up to 40 km, with steep slopes because the mountainous spurs which abruptly rise with heights of 450 m to 1,500 m, suddenly descend to the coastline level. This can be observed in the mountains of Omoa, the Capiro Peak, and the Calentura Peak, both located near Trujillo.

218. Towards the east of the Tinto River, the mountains are situated farther away from the littoral, hence the plain gets more extended. The La Mosquitia plain has an area of about 20,000 km^2. It is a swampy lowland which consists of small rivers and some

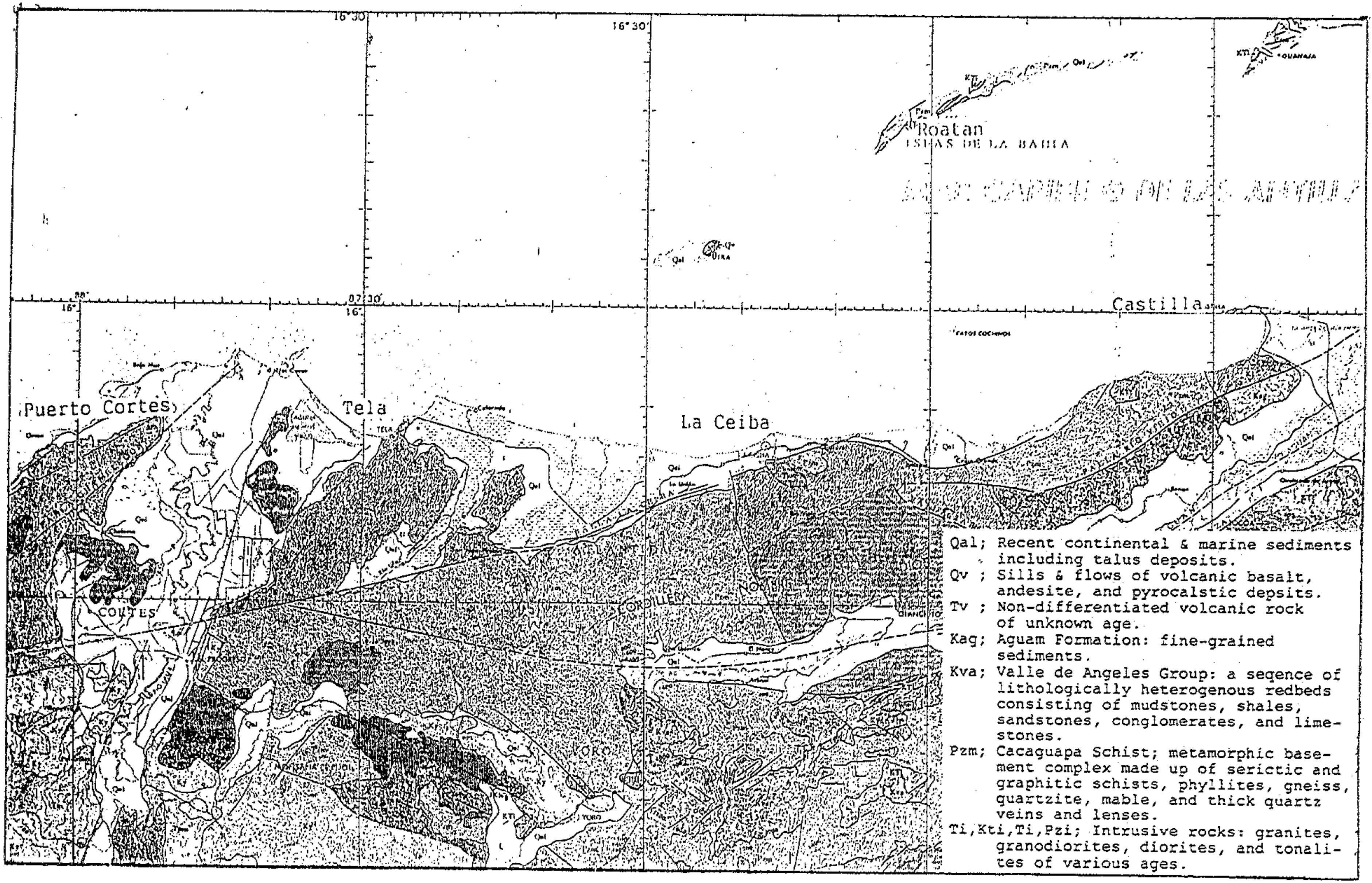


Fig. 2-6-1 Gelogic Map of Caribbean Sea

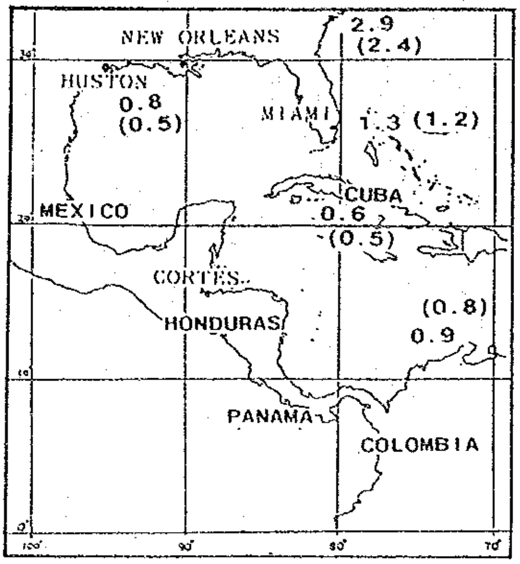
Source: Geologic Map of Honduras, 1991.
by Instituto Geografico Nacional,
SECOPT

lagoons of various dimensions.

(2) Marine Phenomenon

a) Tides

219. Fig. 2-6-2, which is reproduced from the "Sailing Directions for the North Atlantic Ocean - Third Edition, 1988", shows the tidal range in the Mexico Bay and in the Caribbean Sea, which are smaller than 2 feet (0.6 m).

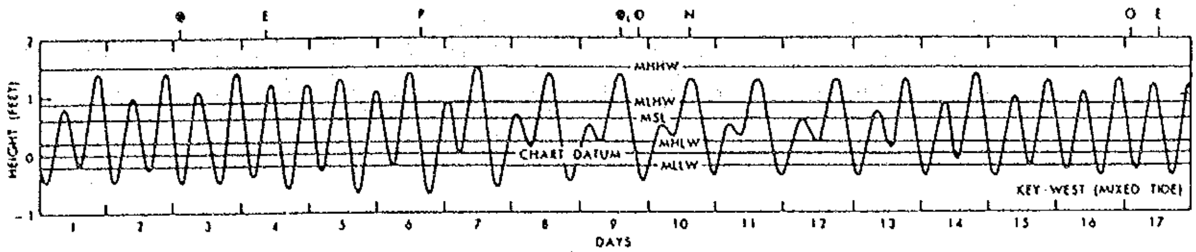


Note:
0.8 Spring Range in feet
(0.5) Mean Range in feet

Source: Soiling Directions for the North Atlantic Ocean-Third Edition, 1988

Fig. 2-6-2 Tidal Range in the Caribbean Sea

A typical tidal curve of Honduras in the Caribbean Sea is shown in Fig. 2-6-3, and two high waters and two low waters occur in a day.



Source: Sailing Directions for the North Atlantic Ocean, Third Edition, 1988

Fig. 2-6-3 Typical Tide Curve in the Caribbean Sea

Note:

M.H.H.W. (Mean Higher High Water). The height of the mean higher high water is the mean of the higher of the two daily high waters over a long period of time. When only one high water occurs in a day this is taken as the higher high water.

M.L.H.W. (Mean Lower High Water). The height of the mean lower high water is the mean of the lower of the two daily high waters over a long period of time.

M.S.L. (Mean Sea Level). Mean sea-level is the average level of the sea surface over a long period, preferably 6-8 years, or the average level which would exist in the absence of tides.

M.H.L.W. (Mean Higher Low Water). The height of the mean higher low water is the mean of the higher of the two daily low waters over a long period of time.

M.L.L.W. (Mean Lower Low Water). The height of the mean lower low water is the mean of the lower of the two daily low waters over a long period of time. When only one low water occurs in a day this is taken as the lower low water.

220. Tidal ranges of the major ports located in the coastal zone of the Caribbean Sea are as follows:

Puerto Cortes

The average tidal range is about 8 inches (0.20 m). (Details are mentioned in section 2.7.1, Chapter 2.7, Part I, VOLUME II).

Tela

The average tidal range is about 12 inches (0.30 m).

La Ceiba

The average tidal range is about 12 inches (0.30 m).

Puerto Castilla

The average tidal range is about 18 inches (0.46 m).

b) Currents

221. The current in Gracias a Dios Cape (the Honduras-Nicaragua border) generally flows in a northwesterly direction with a normal velocity of 0.5 to 1 knot (0.26 m/s to 0.51 m/s) and passes to the north of the Islas de la Bahia.

During the rainy season it has a velocity of 0.5 to 2 knots. Inside the barrier reef, south of Belize, this current flows southward to the Gulf of Honduras, where it turns eastward and follows the coast to Bahia Trujillo. The current flowing eastward is uncertain both in direction and speed.

222. A countercurrent from the north makes the surface current flow to the south of Banco Chinchorro and almost invariably flows southward around the Turneffe Islands and Glovers Reefs. This current turns eastward near Puerto Barrios, where it joins the east-going current, and follows the coast within the 100 fathom curve to Bahia Trujillo. From Bahia Trujillo, it usually flows eastward along the coast to Punta Patuca, then turns southeastward to Gracias a Dios Cape.

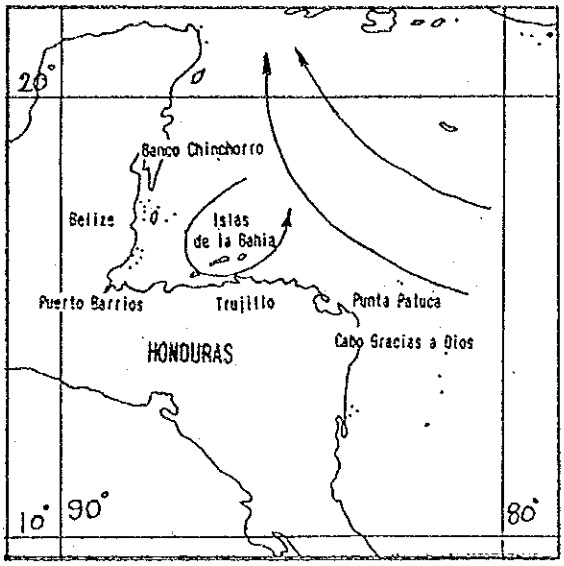
223. The Islas de la Bahia are a group of three large islands, the Isla Guanaja, Roatán and Utila, and numerous small keys and islands that extend to about 121 km west-southwest of Isla Guanaja, which lies about 37 km north of Cabo de Honduras.

224. The currents around the islands are extremely uncertain, particularly during the summer. The Equatorial Current in the north of the islands generally flows westward, but when the northers have ceased, its surface influence is felt on the islands. The countercurrent generally flows in the opposite direction, to the south of the islands. The currents in the area may be greatly altered or even reversed by winds and tides. The range of the tropic tide at Isla Roatán is greater than anywhere else in the Caribbean

Sea.

225. The current with a rising tide flows westward and northward while that with a falling tide flows southward and eastward. A circular counterclockwise eddy is observed in the north of Isla Utila.

Typical ocean currents in the Caribbean Sea are shown in Fig. 2-6-4.



Source: Atlas Pilot Chart Central American
Waters PUB, 106 DMA STOCK NO. NVPUB 106

Fig. 2-6-4 Ocean Currents in the Caribbean Sea

226. Currents of the major ports located in the coastal zone of the Caribbean Sea are as follows:

Tela

The current of Tela has been reported to flow westward before noon and eastward in the afternoon.

La Ceiba

The current in the area was reported to flow westward, at times attaining a velocity of 2 knots (1.0 m/s). During northers, the current was reported to flow southward, running directly onshore.

Puerto Castilla

There is very little current during calm periods or easterly winds. With westerly winds, the current flows eastward and counterclockwise around Bahia Trujillo at speeds varying up to 2 knots (1.0 m/s).

c) Waves

227. The height and period of deep water waves are derived, modified from "The Sailing Directions for the East Coasts of Central America and Mexico", shown in Table 2-6-1.

Table 2-6-1 Ratio of Wave Height and Period in the Caribbean Sea Throughout the Year

(Unit: %)

Height (m)	Period (sec.)						
	<5	5 - 7	8 - 9	10 - 11	12 - 13	>13	ING
0 - 0.5	22	2	1	1	0	0	11
1 - 1.5	2	14	5	2	1	*	2
2 - 2.5	3	7	4	2	1	1	1
3 - 3.5	1	2	2	1	1	*	0
4 - 5.5	1	1	1	2	0	1	0
6 - 7.5	0	0	0	1	0	0	0
8 - 9.5	0	0	0	0	0	0	0
>10.0	0	0	0	0	0	0	0

Source: "Sailing Directions for the East Coasts of Central America and Mexico" modified by the Study Team

The maximum wave height and period outside the Bay of Cortes are estimated at 6 - 7.5 m and 10 - 11 seconds, respectively.

228. Fig.2-6-5 shows the observation points of the waves and their period. Focusing on the occurrence percentage greater than 3%, a diagram of heights and periods at each point is prepared as shown in Fig.2-6-6. In the area (E), the values in July are bigger than those in January and October and almost the same as those from February to September.

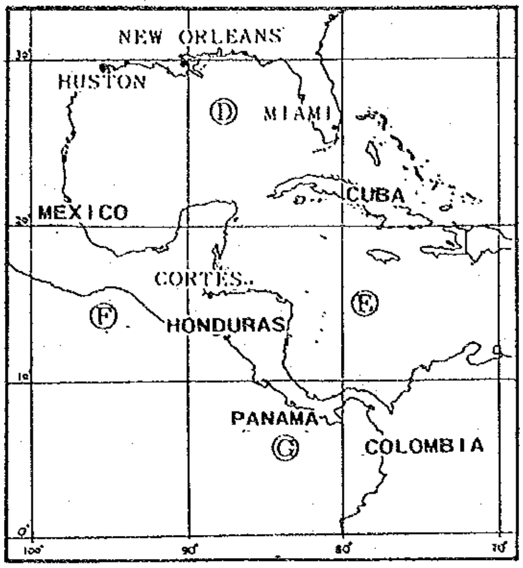
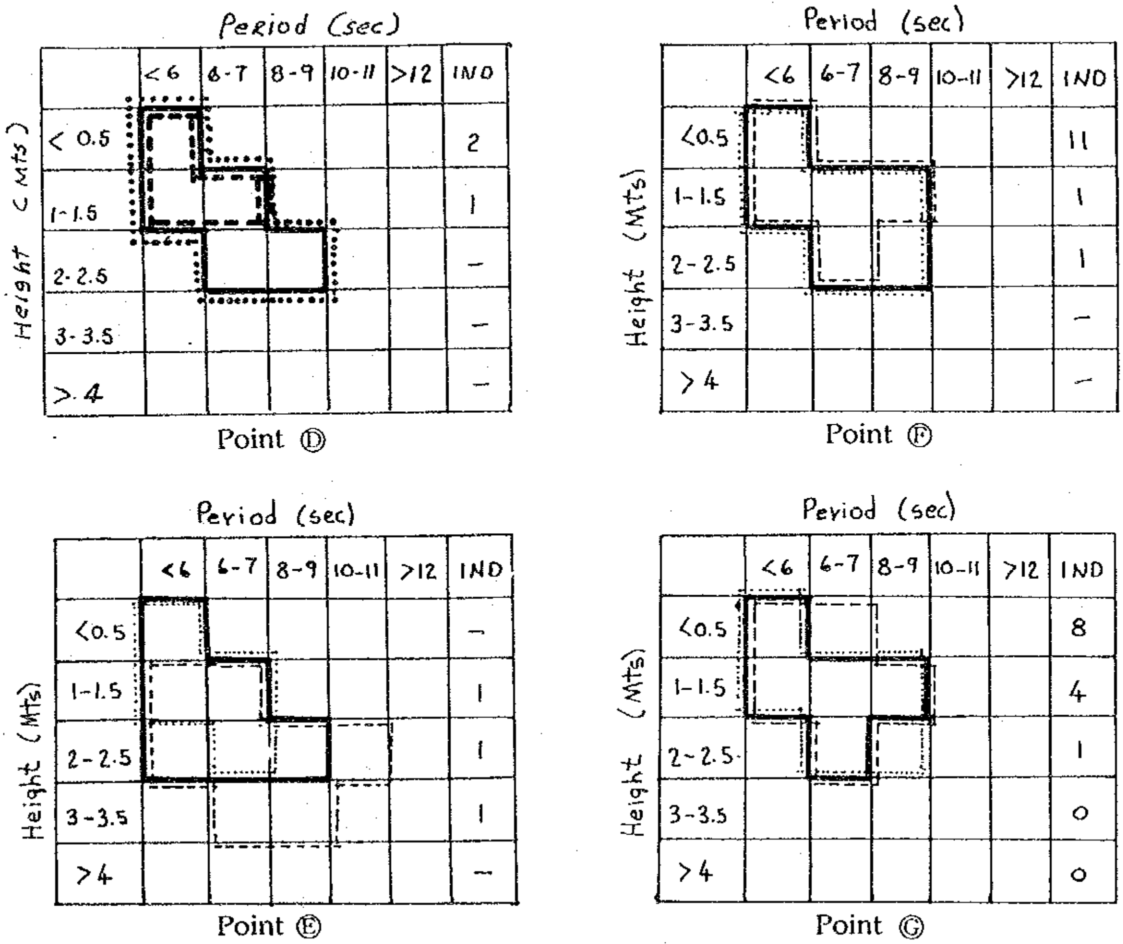


Fig. 2-6-5 Observation Points of the Wave Height and its Period



Jun. —— Jul. - - - - Oct. ....

Fig. 2-6-6 Wave Height vs Wave period Diagram (Occurrence Percentage is more than 3%)

(3) Meteorology

a) Winds

229. The winds along the coast of Honduras are easterly throughout the year with a pronounced diurnal variation. Strong winds seldom blow in the early morning except during the months of November and December. During these months there are several days with northerly winds that attain gale force. The prevailing winds on the sheltered southern side of the Islas de la Bahia are from the southeast and at times attain a maximum velocity of 45 knots (23 m/s). During these winter months, the winds may come from any direction.

The wind direction and velocity at the points A, B and C in Fig.2-6-7 are shown in Table 2-6-2.

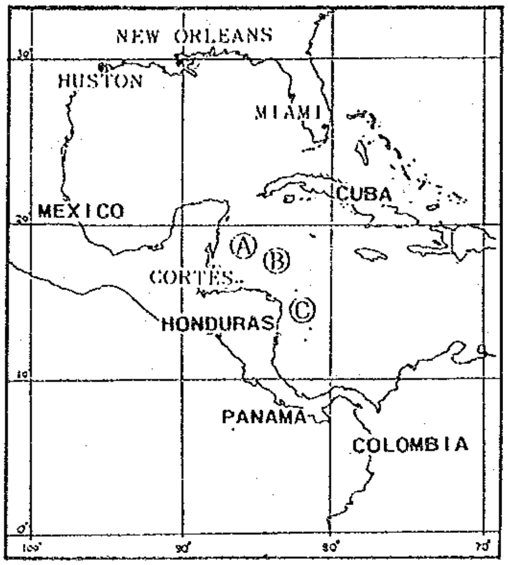


Fig. 2-6-7 Observation Points of the Wind Direction and Velocity

Table 2-6-2 Wind Direction and Velocity (m/sec)

(Point A)

Month		N	NE	E	SE	S	SW	W	NW	CALM
March	%	3	18	52	10	4	3	4	4	2
	Vel	3	4	4	4	3	2	3	4	-
June	%	2	19	63	8	2	2	2	2	0
	Vel	3	4	4	4	3	3	3	2	-
September	%	3	25	52	7	4	2	2	2	3
	Vel	2	3	4	4	3	3	3	2	-
December	%	13	33	30	8	2	4	4	5	1
	Vel	4	3	3	4	3	3	3	3	-

(Point B)

Month		N	NE	E	SE	S	SW	W	NW	CALM
March	%	5	17	44	18	4	4	4	4	0
	Vel	4	4	4	4	4	2	3	4	-
June	%	2	9	56	24	3	2	0	3	1
	Vel	4	3	4	4	3	3	-	4	-
September	%	4	15	46	19	8	2	2	2	2
	Vel	2	3	4	3	3	3	4	2	-
December	%	15	36	36	4	2	2	2	2	1
	Vel	4	4	4	3	3	3	3	4	-

(Point C)

Month		N	NE	E	SE	S	SW	W	NW	CALM
March	%	9	34	42	8	2	0	0	3	2
	Vel	4	4	4	4	3	-	-	5	-
June	%	4	17	58	12	5	4	0	0	0
	Vel	3	4	4	4	3	2	-	0	-
September	%	6	31	43	9	4	2	0	2	3
	Vel	3	3	3	3	3	3	-	3	-
December	%	20	47	26	4	0	1	0	2	0
	Vel	4	4	4	3	-	1	-	4	-

230. Winds of the major ports in the Caribbean Sea are as follows:

Puerto Cortes

The prevailing winds are easterly and northeasterly. Westerly and southeasterly winds cause moderate to heavy surf conditions in the harbor. The harbor is fairly well sheltered from northers, and storms are infrequent, with normal velocities of 3.9 - 6.9 knots (2.0 - 3.5 m/s).

Tela

The prevailing winds are easterly and northeasterly. Several strong northers are experienced during the winter months. A daily variation is also evident. Land breezes blow at night, with normal velocities of 2.8 - 6.7 knots (1.4 - 3.4 m/s).

La Ceiba

The prevailing winds and are northeasterly during the day and southeasterly at night. Normally the weather is calm with gentle breezes except during the season of the northers, when winds of gale force occur, with normal velocities of 2.9 - 5.7 knots (1.5 - 2.9 m/s).

Castilla

The prevailing winds observed at Guanaja are easterly and northeasterly. The weather is comparatively calm with normal wind velocities of 7.5 - 13.2 knots (3.9 - 6.8 m/s).

b) Temperature

231. As Honduras is located between 12° and 19° North Latitudes, the monthly temperature oscillations are very small on the coast of the Caribbean Sea. The maximum monthly temperature at main ports located on the coast of the Caribbean Sea is shown in Table 2-6-3.

Table 2-6-3 Maximum Monthly Temperature

(Unit: °C)

Month	Cortes	Tela	La Ceiba	Guanaja
Jan	30.1	32.0	31.2	33.6
Feb	30.4	33.8	31.2	33.6
Mar	35.0	39.4	41.4	35.8
Apr	32.1	39.5	33.5	35.8
May	31.2	35.8	34.0	36.4
Jun	-	35.0	34.2	37.6
Jul	33.0	36.0	35.2	36.0
Aug	32.3	34.0	33.3	36.6
Oct	31.2	33.5	32.8	36.6
Nov	-	35.2	33.4	35.4
Dec	31.4	32.2	31.3	33.6
Period	1992	1983 - 1992		

c) Precipitation

232. The precipitation pattern is of two types: rain and hail. Rain is predominant, and hail falls only sporadically during some storms. Monthly precipitation, monthly 24-hour maximum precipitation and monthly number of rainy days on the coast of the Caribbean Sea are indicated in Table 2-6-4.

Table 2-6-4 Precipitation at Ports on the Caribbean Sea

Place	Precipitation (mm/year)		24-hour Precipitation (mm/day)	Rainy Days (day/year) >1 mm/day
Puerto Cortes	Max:	1,688	154	172
	Min:	786	48	113
	Average:	998	74	142
Tela	Max:	4,163	330	203
	Min:	2,007	144	145
	Average:	2,645	219	168
La Ceiba	Max:	4,296	443	196
	Min:	2,292	183	152
	Average:	2,946	306	165
Puerto Castilla	Max:	3,898	475	223
	Min:	1,679	88	142
	Average:	2,668	197	183

Period: From 1983 to 1992

Source: Meteorological Agency, Honduras

d) Humidity

233. The coast of the Caribbean Sea has a very high humidity. The differences in humidity are related to three factors: altitude, sea currents, and trade winds. At low altitude or relief, the hot sea current of the Caribbean and trade winds increase evaporation. Maximum, minimum and average humidity at ports located on the coast of the Caribbean Sea are indicated in Table 2-6-5.

Table 2-6-5 Humidity of Ports on the Caribbean Sea

Place	Humidity (%)
Puerto Cortes	Max: 82 Mim: 74 Average: 78
Tela	Max: 88 Min: 79 Average: 84
La Ceiba	Max: 87 Min: 78 Average: 83
Puerto Castilla (observed at Guanaja)	Max: 81 Min: 76 Average: 79

Period: From 1983 to 1992
Source: Meteorological Agency, Honduras

e) Hurricanes

234. Tropical cyclones identified in Honduras are classified in Table 2-6-6.

Table 2-6-6 Tropical Cyclone Classification Criteria

Development Depression	Criteria
1. Tropical Depression	Average surface windspeed: 18m/sec.
2. Tropical Cyclones	Hot vortex, average surface widspeed: 18-33 m/sec.
3. Hurricane	Hot Vortex, average surface windspeed not less than 33 m/sec.

235. Table 2-6-7 presents monthly frequencies of recorded Atlantic basin's tropical cyclones and hurricanes in the years 1886 through 1986.

Table 2-6-7 Total and Average Number of Tropical Cyclones Occurring in Each Month

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Tropical Storms and Hurricanes	1	1	1	0	14	5	63	199	287	178	40	6	84.5
Average Over the Period	*	*	*	0.0	0.1	0.5	0.6	2.0	2.8	1.8	0.4	0.1	8.4
Hurricanes Only	0	0	1	0	3	23	33	142	182	88	21	3	496
Average Over the Period	0.0	0.0	*	0.0	*	0.2	0.3	1.4	1.8	0.9	0.2	*	4.9

Note: Asterisk(*) indicates less than 0.05 storms.

Source: Tropical Cyclones of the North Atlantic Ocean, 1871-1986
U.S. Department of Commerce - National Oceanic and Atmospheric Administration.

236. The tracks of the tropical cyclones/hurricanes which have hit the Honduras' coasts are shown in Fig.2-6-8.

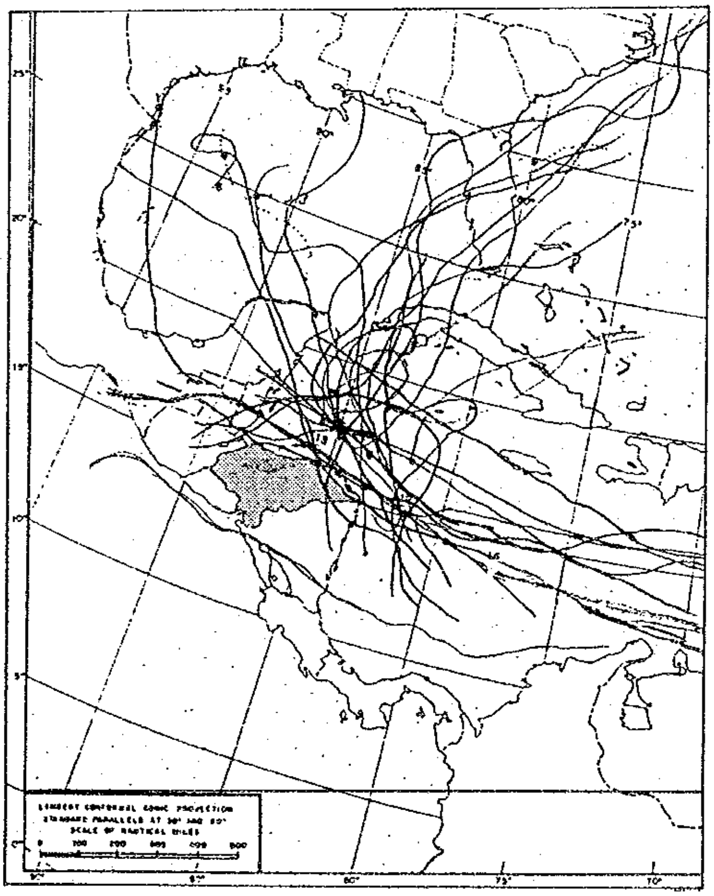


Fig. 2-6-8 Track of Tropical Cyclones/Hurricanes (1886-1986)

237. Hurricane "Fifi", one of the most devastating hurricanes, which attacked the coast of Honduras on September 18-19, 1974, caused damages of 8.0 million Lps to industry, 38.0 million Lps to the substructure, and destroyed 2,889 houses. Its track is shown in Fig.2-6-9.

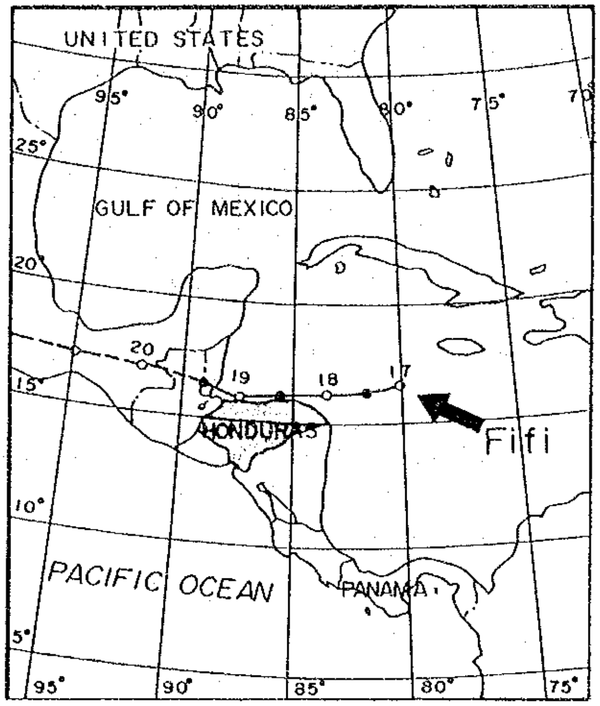


Fig. 2-6-9 Track of Hurricane FiFi (18-19 Sept. 1974)

238. Maximum wind velocities observed at the meteorological stations are indicated in Table 2-6-8.

Table 2-6-8 Maximum Wind Velocity of Hurricanes

Region	Direction	Velocity	Month	Year
Amapala	NE	58(30)	March	1968
Guanaja	NNE	75(39)	September	1974
Roatan	E	36(19)	November	1990
La Ceiba	ESE	100(51)	September	1974
Tela	SSW	45(23)	September	1969
Yoro	SE	45(23)	June	1970
La Mesa	N	65(34)	June	1988
Puerto Lempira	NNW	100(51)	September	1978
Catacamas	ENE	78(40)	April	1978
Santa Rosa de Copán	E	55(28)	July	1958
La Espernza	NNE	28(14)	February	1990
- ditto -	NNE	28(14)	November	1990
Nueva Ocotepeque	NNW	40(21)	April	1989
Tegucigalpa	NE	65(34)	May	1977
Choluteca	SW	47(24)	May	1971

Note: Unit of Velocity is in kuot(m/s)

239. Maximum 24-hour precipitation during the depressions observed at the meteorological stations is indicated in Table 2-6-9.

Table 2-6-9 Maximum 24-Hour Precipitation from 1950 to 1990

(Unit: mm)

TYPICAL CYCLONE		YEAR	LA MASA	TELA	LA CEIBA	GUANAJA	PTO. LEMPIRA	ACTED PERIOD	
Charlia	(H)	1951	40.0	12.7	-	32.0	-	Aug.	12-23
Gilda	(T)	1954	140.6	153.4	-	20.8	-	Sep.	24-27
Hilda	(H)	1955	58.68	25.2	-	43.2	-	Sep.	10-19
Janet	(H)	1955	8.9	32.6	-	81.0	-	Sep.	21-29
Abby	(H)	1960	27.9	68.6	-	98.3	52.8	Jul.	9-16
Anna	(H)	1961	102.9	90.4	-	85.6	33.5	Jul.	20-24
Hattle	(H)	1961	20.8	88.9	-	32.0	23.6	Oct.	27-31
Francelia	(H)	1669	58.2	234.4	144.8	95.0	32.0	Aug. 28	Sep. 4
Cihde	(D)	1971	0.5	32.5	0.0	98.5	9.9	Aug.	18-25
Carmen	(H)	1974	23.0	27.5	18.5	22.4	48.8	Aug. 29	Sep. 10
Fitt	(H)	1974	236.0	199.7	104.4	139.7	37.8	Sep.	14-22
Frieda	(T)	1977	0.0	7.6	20.0	36.1	36.9	Oct.	16-18
Greta	(H)	1978	27.6	80.9	106.0	152.4	201.0	Sep.	13-19
Gilbert	(H)	1988	9.8	43.4	42.2	61.8	32.2	Sep.	9

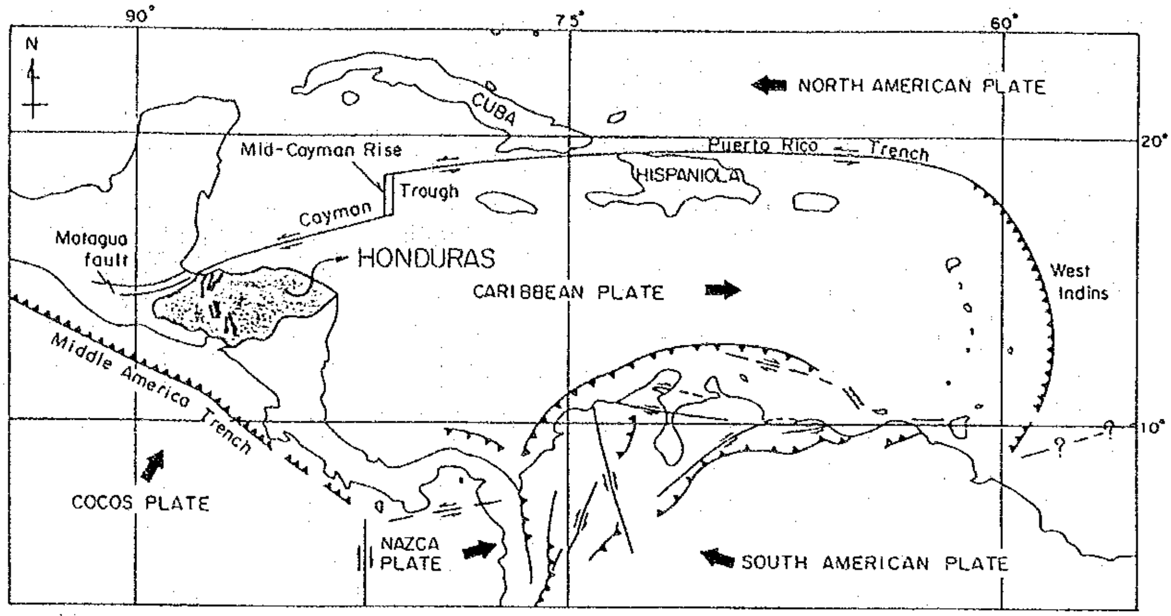
cf) (T): Tropical Cyclone
(H): Hurricane
(D): Tropical Depression

f) Earthquakes

240. The organization for earthquake observation was established in 1974 under the direction of the Department of Physics of the National Autonomous University of Honduras (UNAH), with the cooperation of the Texas University in Austin. With the operation of the station, it became possible to obtain general data on the frequency of earthquakes in the country. Observing the sequence of events, such as the Guatemala earthquake of 1976, Choloma's seismic phenomenon in 1976 and in "La Paz" in 1986 and other various events inside and outside the country has become possible.

241. The structure and boundaries of the Caribbean plate that may be caused by earthquakes in Honduras are shown in Fig. 2-6-10.

242. The seismic observation system has functioned relatively well and the signals are very acceptable. Fig. 2-6-11 shows a seismic map prepared for the month July 1992. This small seismic action of a short period seems to be associated with the ecological failure in this region.



LEGEND

Subduction zone (Teeth on overthrusting side)

Thrust fault (Teeth on upthrown side)

Normal fault (Teeth on downthrown side)

Strike-slip fault (Arrows indicate relative motion)

General direction of relative crustal plate motion

Fig. 2-6-10 Structure and Boundaries of the Caribbean Plate

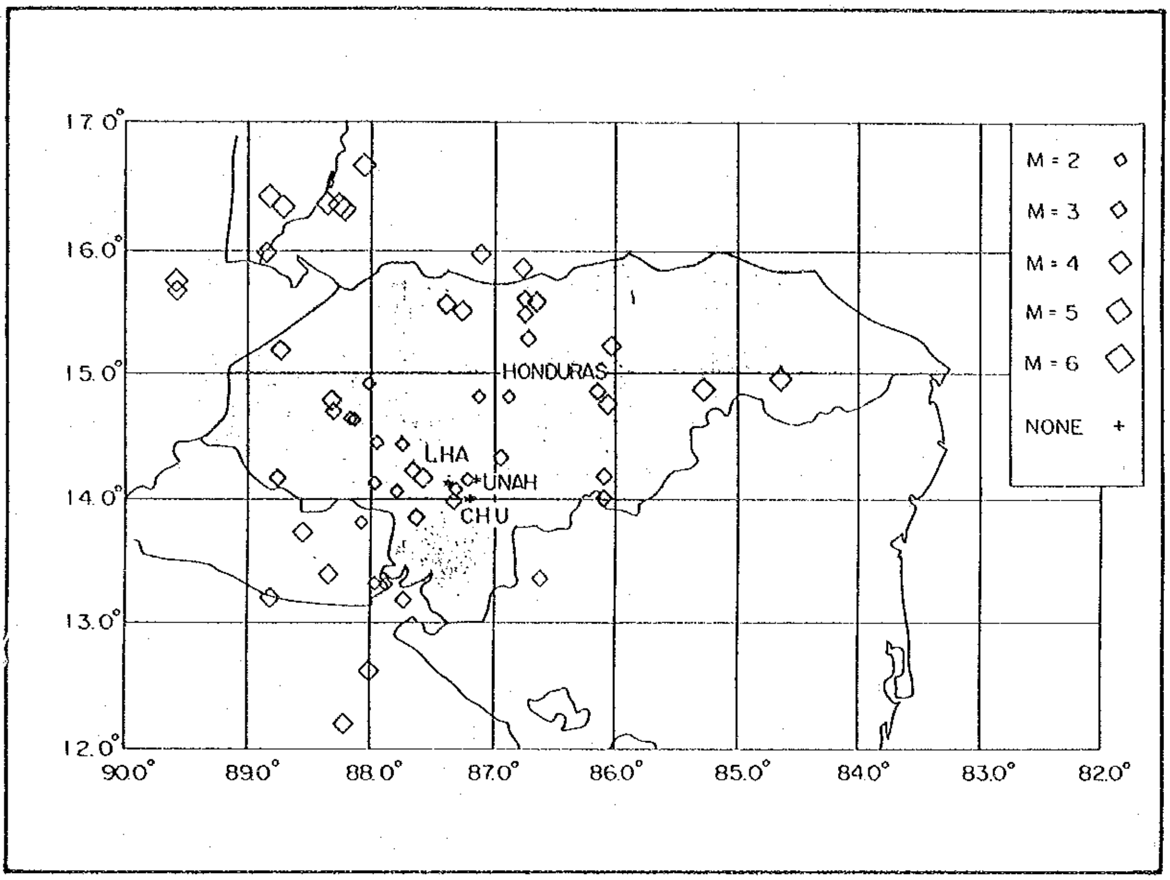


Fig. 2-6-11 Location of Port of San Lorenzo

2.6.2 Coastal Plain of the Pacific

(1) Topography and Geology

243. This coastal plain constitutes a small physiographic unity which borders the Fonseca Gulf, and consists of mud and alluvial clay from various deltas which are deposited from the north to the east extremes of the gulf. Fig.2-6-12 shows a geological map of the Pacific.

244. The region is a volcanic range extending from Guatemala to Panama in a disorderly manner. This volcanic range was active in the Quaternary period, and many of its volcanoes are still active. The mountains formed before the Quaternary period are volcanic ones. The range crosses Honduras through the Fonseca Gulf, and the islands in the gulf are a result of such volcanism.

245. The fact that Honduras does not have active volcanoes does not suggest that volcanism was not intense during the Tertiary period or at the beginning of the Quaternary.

246. Thick halophite vegetation or mangrove swamps border the littoral of the Fonseca Gulf coast. The islands are of volcanic character. The Zacate Grande is the largest island in the gulf. The Fonseca Gulf is the largest and the safest of all natural bays in the Central America Pacific Ocean.

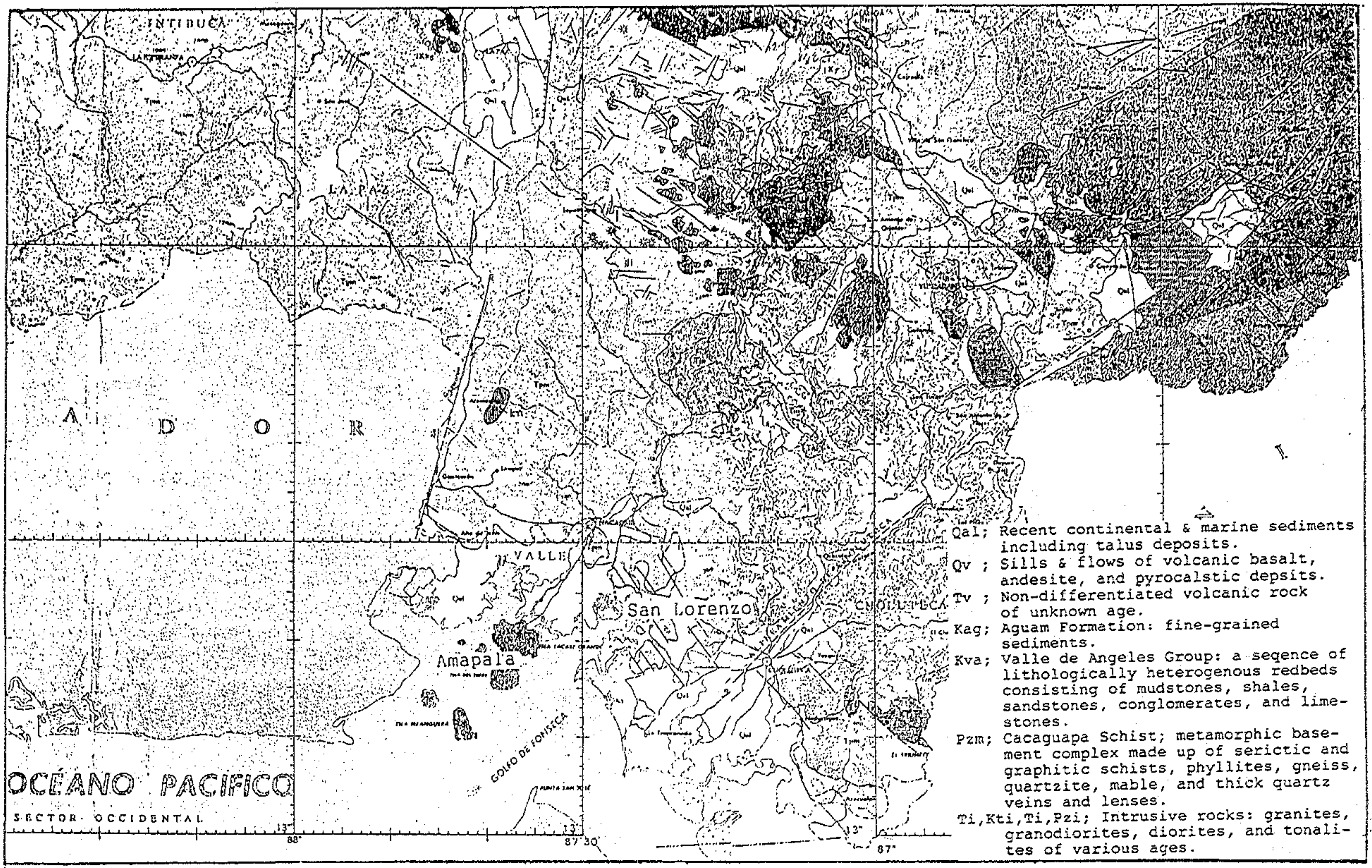
(2) Marine Phenomenon

a) Tides

247. No tidal information on the Gulf of Fonseca was available, except for the tidal predictions at La Union, El Salvador.

According to the Admiralty Tide Tables, the following values apply for La Union and Amapala:

HAT:	11.5 ft	(3.51 m)	
MHWS:	10.0 ft	(3.05 m)	
MHWN:	8.1 ft	(2.47 m)	
MSL:	5.1 ft	(1.55 m)	
MLWN:	1.9 ft	(0.58 m)	
MLWS:	-0.3 ft	(-0.09 m)	Chart Datum
LAT:	-1.7 ft	(-0.52 m)	



Source: Geologic Map of Honduras, 1991
by Instituto Geografico Nacional.

Fig. 2-6-12 Geologic Map of Pacific

Due to the absence of a tide station, the tidal range at the port of San Lorenzo is estimated based on the tide at La Union by adjusting the time (adding 45 minutes to the time indicated in the table).

b) Currents

248. At two locations, El Muerto and Raton, as shown in Fig. 2-6-13, the current was measured on the surface during the spring tide.

The velocities did not exceed 1 m/sec. It may be expected that after heavy rainfall, velocities of up to 1.5 m/sec. occur on the surface in the upper reaches of the estuary. The water in the estuary is well mixed. This is in agreement with a rough estimate of the ratios of fresh water discharge and tidal volume in the estuary.

c) Waves

249. Table 2-6-10 shows the wave record computed from information given by the U.S. Navy Hydrographic Office for the southern part of the Gulf of Fonseca.

Table 2-6-10 Wave Record in the Gulf of Fonseca

Month	Sea Conditions T = 3-12 sec			Swell T > 12 sec		
	Percent of Time	Wave Height (m)	Direction from	Percent of Time	Wave Height (m)	Direction from
Feb		insignificant		< 5	0.9 - 1.5	SW
May		insignificant		< 5 < 5 < 5	0.9 - 1.5 0.9 - 1.5 0.9 - 1.5	W SW S
Aug	5	0.9 - 1.5 0.9 - 1.5	SW S	< 5 < 5 < 5	0.9 - 1.5 0.9 - 1.5 0.9 - 1.5	W WS S
Nov		insignificant		< 5		SW

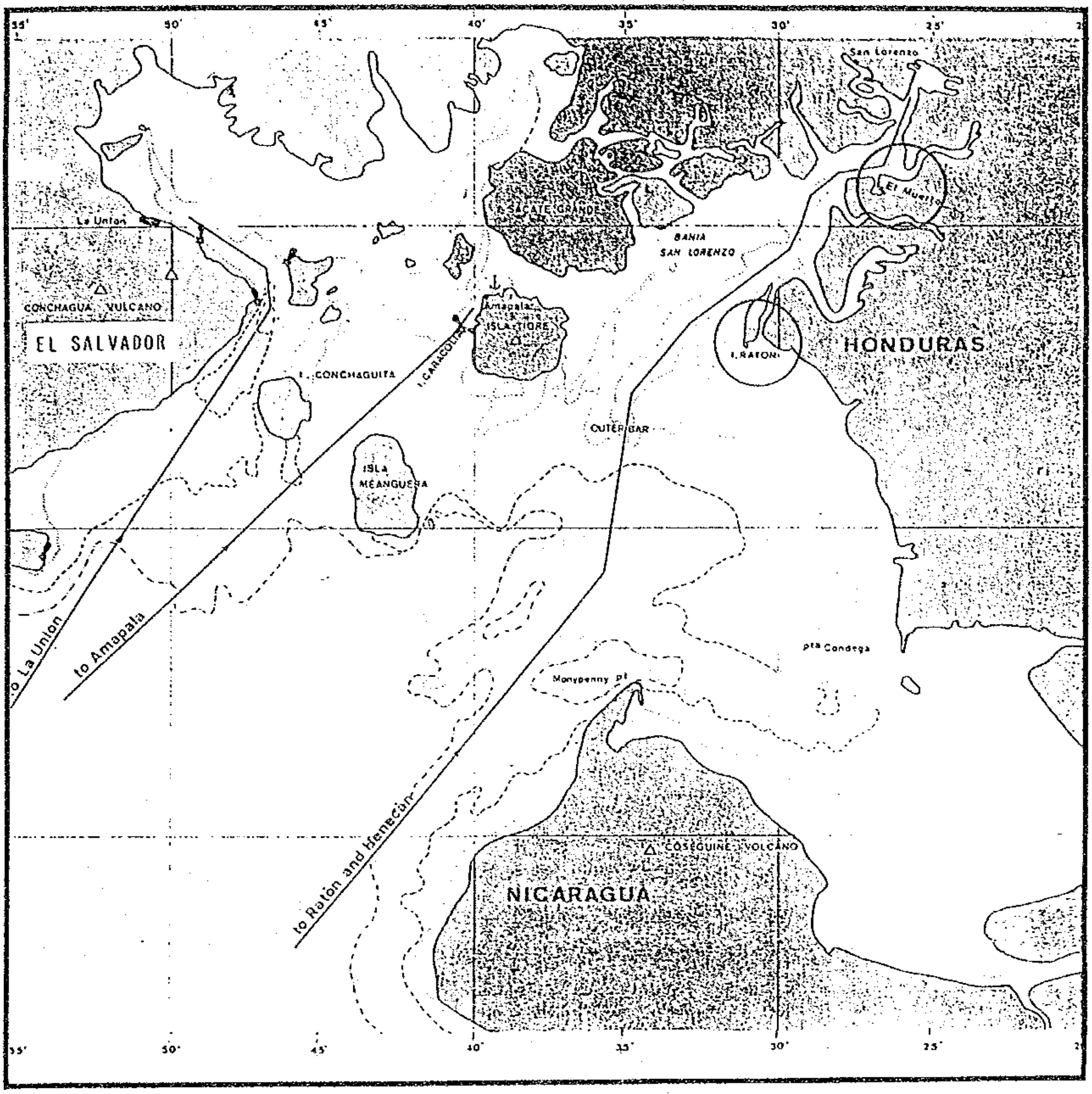


Fig. 2-6-13 Locations of Current Observation
Gulf of Fonseca

250. From the Ocean Wave Statistics, Hogben & Lumb, London, 1967, the Table 2-6-11 were collected (area 22: 10°-20°N by 90°-110°W):

Table 2-6-11 Wave Record

Direction	Period 6 - 9 sec		Period > 10 sec	
	Height 0.5 - 1.5 m	Height 2 - 4 m	Height 0.5 - 1.5 m	Height 2 - 4 m
140% - 280°	10%	3%	2%	1.5%

251. Though the shallow area in the southwest and south of Raton Island will prevent a large proportion of waves from entering the harbor area, local winds from the southwest and west can generate waves of a short period and a height of 1 - 1.5 m.

During the wet season, heavy thunderstorms are frequent, particularly in July and August. Usually the sea in the gulf is calm, but during thunderstorms, short and violent waves are formed within minutes and pose a danger to local boats.

(3) Meteorology

a) Wind

252. The Gulf of Fonseca has a tropical climate and the only data available are those from the station at Amapala located at latitude 13°17'N and longitude 87°39'N. However, as the wind behavior at Amapala is bound to be influenced by the mountain slopes of the island, it is considered to be similar to any places in the Gulf of Fonseca itself. Wind data obtained from the weather station are shown in Table 2-6-12.

Table 2-6-12 Monthly Wind Velocity

(Unit: Knot)

Month	Maximum	Minimum	Average
Jan	8.8	5.6	7.0
Feb	9.7	5.4	6.8
Mar	8.6	5.2	6.8
Apr	7.6	4.2	6.0
May	6.5	3.5	5.2
Jun	5.6	3.4	4.3
Jul	6.7	3.7	5.2
Aug	6.3	3.4	4.7
Sep	5.6	2.9	4.4
Oct	5.2	2.8	4.1
Nov	5.6	3.0	4.5
Dec	8.2	5.1	6.8
Annual	6.5	4.6	5.5

(1983-1992)

b) Precipitation

253. Annual rainfall is about 1,700 mm. The dry season is from November to April, with a period of 130 days without any rainfall at all. From May to October, rainfall is abundant with two well defined peaks in May and September. The data for Amapala show average annual rainfall of 2,680 mm in maximum and 1,290 mm in minimum.

c) Temperature

254. The monthly maximum temperature varies very little: It is between 37.5°C and 39.7°C. The average annual temperature is 26.8°C.

d) Humidity

255. Average humidity recorded in the southern coast, Amapala and Choluteca is 66%. When the trade winds pass to the South, they are already dry, without bringing any humidity.

2.7 Natural Conditions of the Port of Cortes

2.7.1 Marine Phenomenon and Meteorology

(1) Tides

256. The tides in the Port of Cortes have been measured at the tidal station close to the west end of the Wharf No. 3 and the Bench Mark 1. The elevation of the Bench Mark 1 is 2.69 feet above the mean sea level. (Refer to Appendix-E for the locations of bench marks) From the tide records in 1992, the frequency of the tidal range in every day - the difference of high water and low water - is shown in Fig.22-7-1, and several levels are computed in the table below. The tidal levels at the Port of Cortes are computed by the U.S. Department of Commerce Coast and Geodetic Survey, based on 9-year records, 1948-1956, as follows:

Highest tide observed	1.10 ft (0.34m)
Mean high water springs	0.31 ft (0.09m)
Mean high water	0.26 ft (0.08m)
Mean sea water (Datum Level)	0.00 ft
Mean low water - 0.24 ft	(-0.07m)
Mean low water springs	- 0.29 ft (-0.08m)
Lowest tide observed	- 1.40 ft (-0.43m)

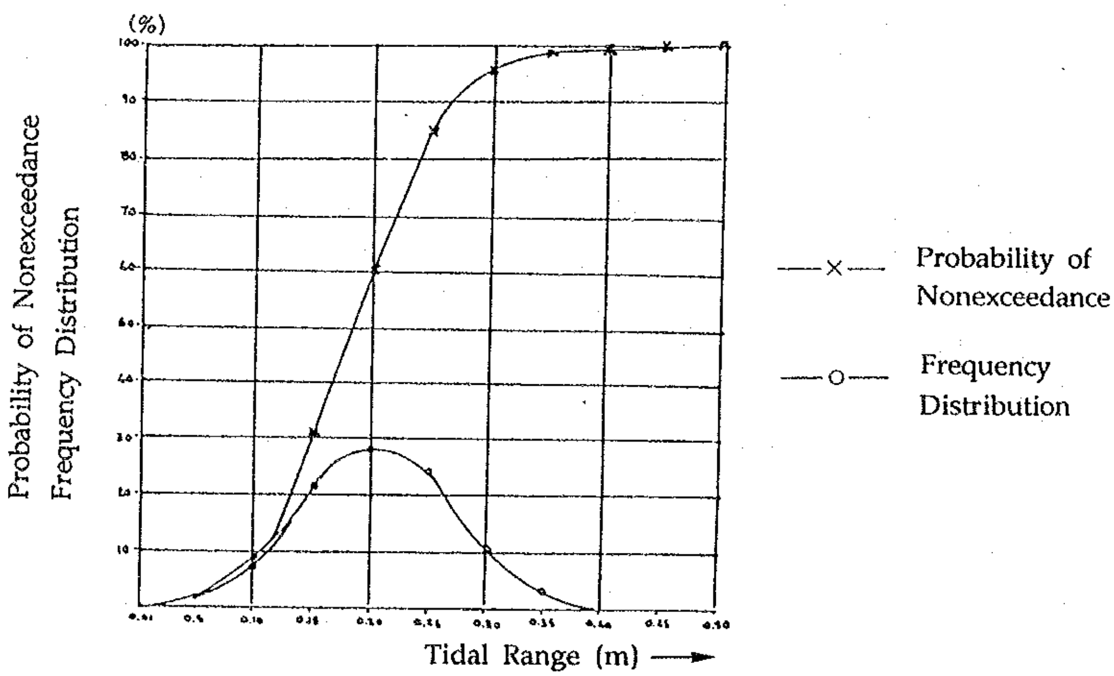


Fig. 2-7-1 Frequency of the Tidal Range

257. Several levels are applied as the datum of the Marine Chart in each region.

Pacific Coast in U.S.A.:	M.L.L.W.
Atlantic Coast in U.S.A:	M.L.W
Japan:	M.L.L.W. (Approx.)

In the Marine Chart of the Port of Cortes (HON.002 and HON.003-28163, prepared and published by the DEFENCE MAPPI HYDROGRAPHIC CENTER, Washington, in 1978 and 1984), M.L.W. is applied as the datum. On the other hand, M.S.L. is applied in the design reports and drawings for the elevations of the port facilities.

According to the Admiralty Tide Table Vol-II published by the British Navy, 1993, the tide difference between M.L.W. and M.S.L. is estimated at 0.10m.

(2) Currents

258. The currents in the harbor are shown in Table 2-7-1 and the velocity of the current is insignificant.

Table 2-7-1 Currents at the Port of Cortes

Date	Area	Time	Velocity (Knot)	Degree (°)
5 May, 1981	Wharf #5	10:10	0.7	30.0
		11:10	0.8	118.0
		12:10	0.7	135.0
		13:10	0.6	185.0
		14:10	0.6	260.0
		15:10	0.6	330.0
6 May, 1981	Buoy #3	08:35	0.3	260.0
		09:36	0.3	170.0
		10:35	0.3	165.0
		11:35	0.4	140.0
		12:35	0.4	160.0

Source: ENP's Measurement

(3) Waves

259. Under normal conditions, the wave in the harbor seems small because the harbor is sheltered against deep water waves by Punta Caballos. Focusing on sea area in front of the port facilities, the waves will be generated by the wind from the northwestern to the southern direction.

260. As the data on wind speed which were observed by ENP (see Table 2-7-4 and 2-7-5) are not connected with the wind directions, the latter are assumed to be southerly, southwesterly, westerly and northwesterly. Table 2-7-2 shows the wave heights at the Port of Cortes estimated by the S.M.B method, and the wave height seems more or less 1.5 m with a frequency of less than 0.3%.

Table 2-7-2 Estimated Wave Height at the Port of Cortes

Wind Direction	Wind Velocity (m/sec)	Wind Duration Time (hour)	Fetch (km)	Wave Height (m)	Wave Period (second)
South *0.3%	12	6	3	0.5	2.2
South west *1%	12	6	16	1.0	3.5
West *0.2%	12	6	49	1.5	4.5
North west *0.3%	12	6	82	1.6	4.7

Note: Asterisk (*) means the frequency rate of wind velocity and direction, and also refers to the Synoptic Meteorological Observations Data.

261. The northern coast of Honduras was stricken by the hurricane "FiFi" in 1974 which caused tremendous damage. The wave height was estimated to be not less than 5.1 m with a period of 6.8 seconds. This hurricane can be taken as a model for wave hindcasting assuming that it has generated the maximum wave height in stormy conditions at the Port of Cortes.

262. This wave height and period could be estimated by the following study flow:

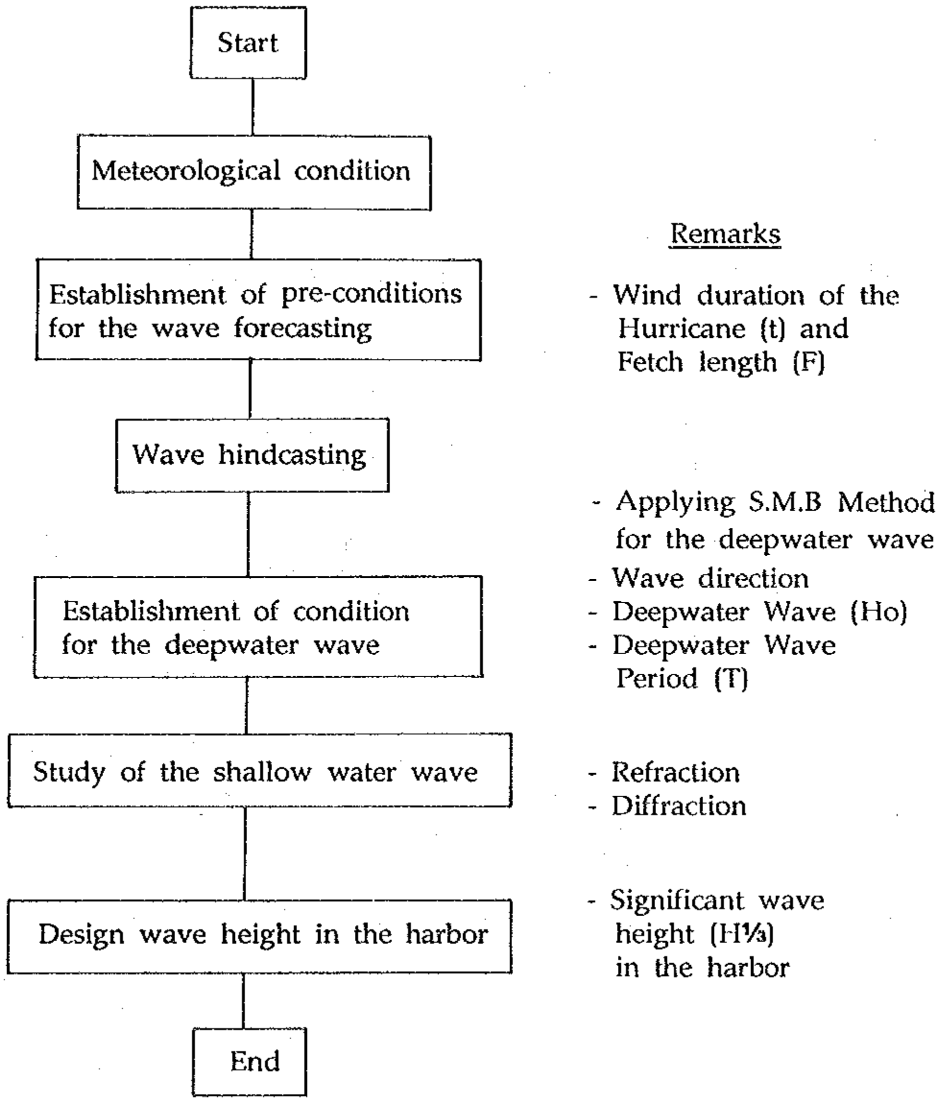
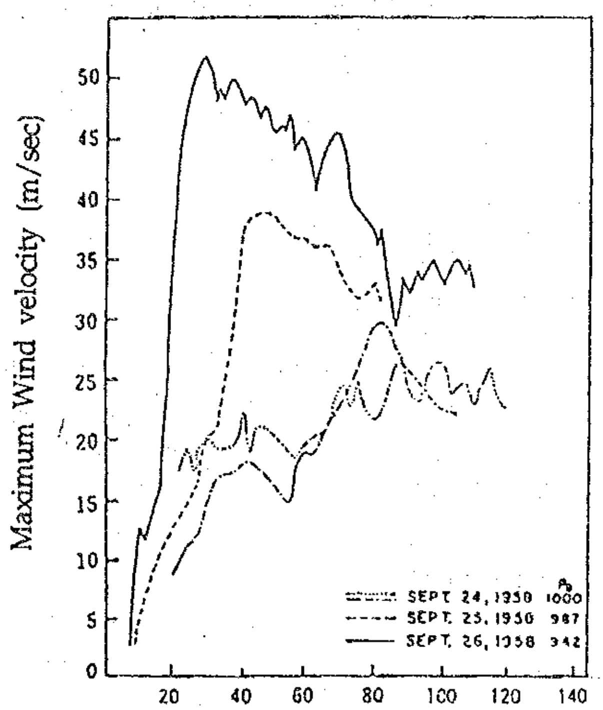


Fig. 2-7-2 Study Flow for Design Wave Height in Stormy Conditions

263. The relation between maximum wind velocity and the distance from center of hurricane's vortex for the wave hindcasting is shown in Fig. 2-7-3. The field of wind velocity which is not less than 35 m/sec can be estimated within a radius 100 km of the hurricane and the field of wind velocity which is not less than 50 m/sec can be estimated within a radius 50 km of the hurricane.



Source: "Typhoon" by Dr. Masaki Yamamisaki

Fig. 2-7-3 Relation between Maximum Wind Velocity and Distance from Center of Hurricane's Vortex

264. The fetch length of the wind can be assumed at 30 km on the basis of blowing degree (20°~25°) against an isobar as shown in the slash mark in Fig. 2-7-4 and the wind duration can be assumed to be 4 hours.

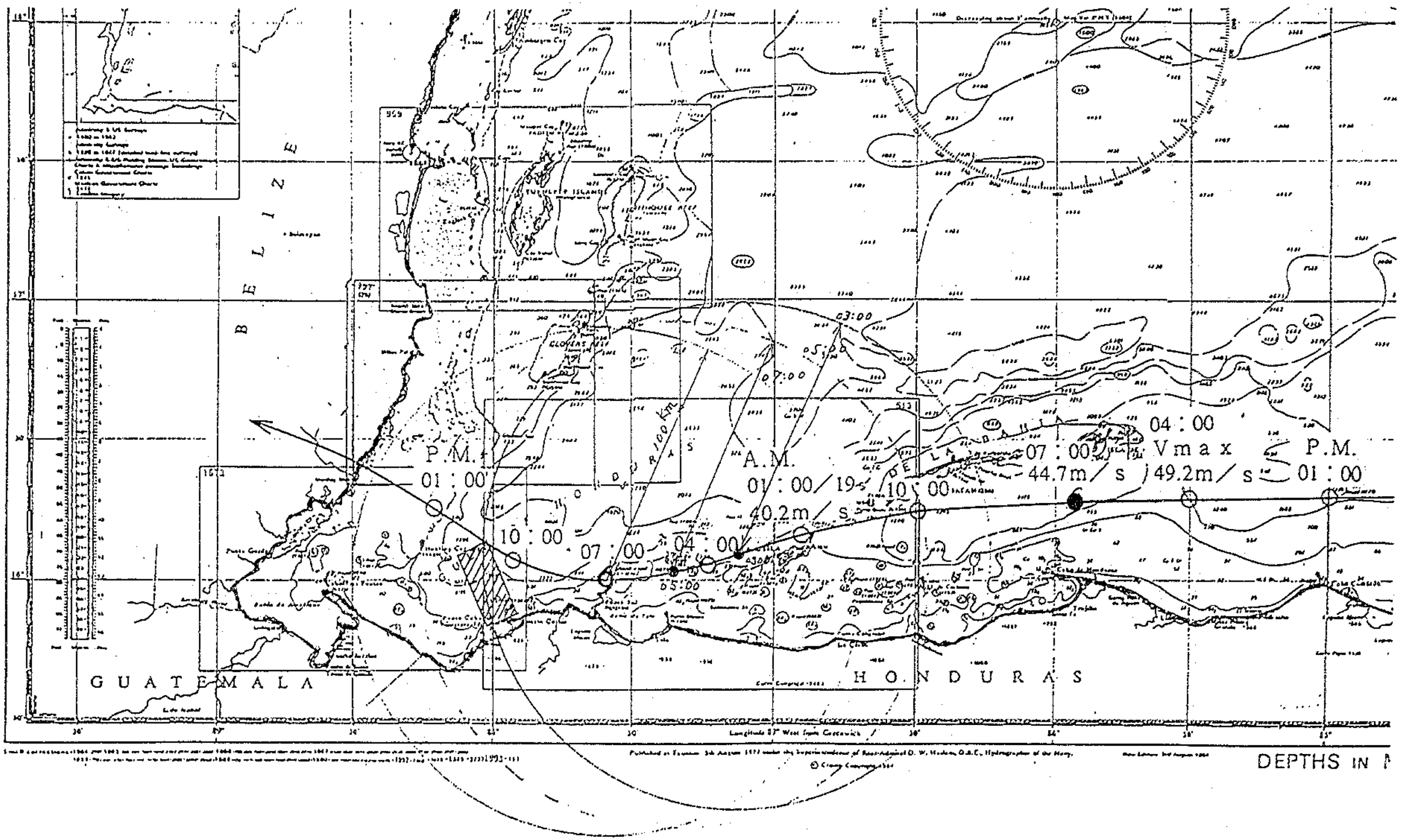


Fig. 2-7-4 Field of Maximum Wiud Velocity, Exceeded 35 m/s within Radius 100 km of Huraicane

The significant wave height and period in deep water which are caused by the wind velocity duration and fetch length in the wind field are estimated by the chart of S-M-B Method.

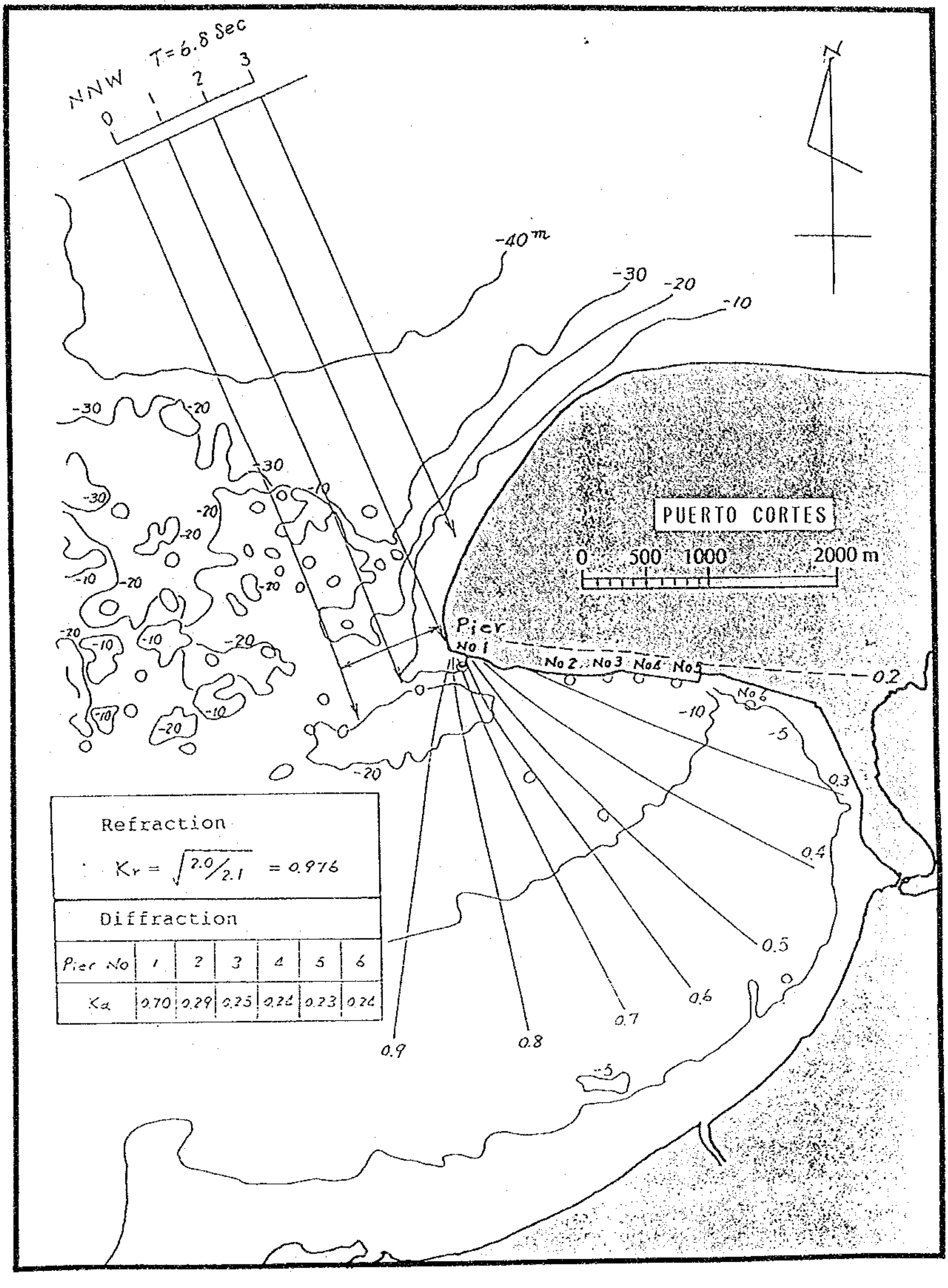
The waves entering the harbor will refract due to the change in the sea bottom between the deep sea and the water front area of Punta Caballos, and the subsequent waves will diffract in the harbor obstructed by the Punta Caballos. Fig. 2-7-5 shows wave refraction and diffraction.

265. Design waves in the harbor are indicated in Table 2-7-3.

Table 2-7-3 Wave Height ($H_{1/3}$) after Wave Diffraction

$H_{1/3}$ = (Wave Height at Port entrance) x K_d = 4.4 x K_d						
Number of Wharfs	1	2	3	4	5	6
K_d	0.70	0.29	0.25	0.24	0.23	0.24
$H_{1/3}$	3.1	1.3	1.1	1.1	1.0	1.1

Note: K_d : Diffraction Coefficient
$H_{1/3}$: Significant wave height (m)



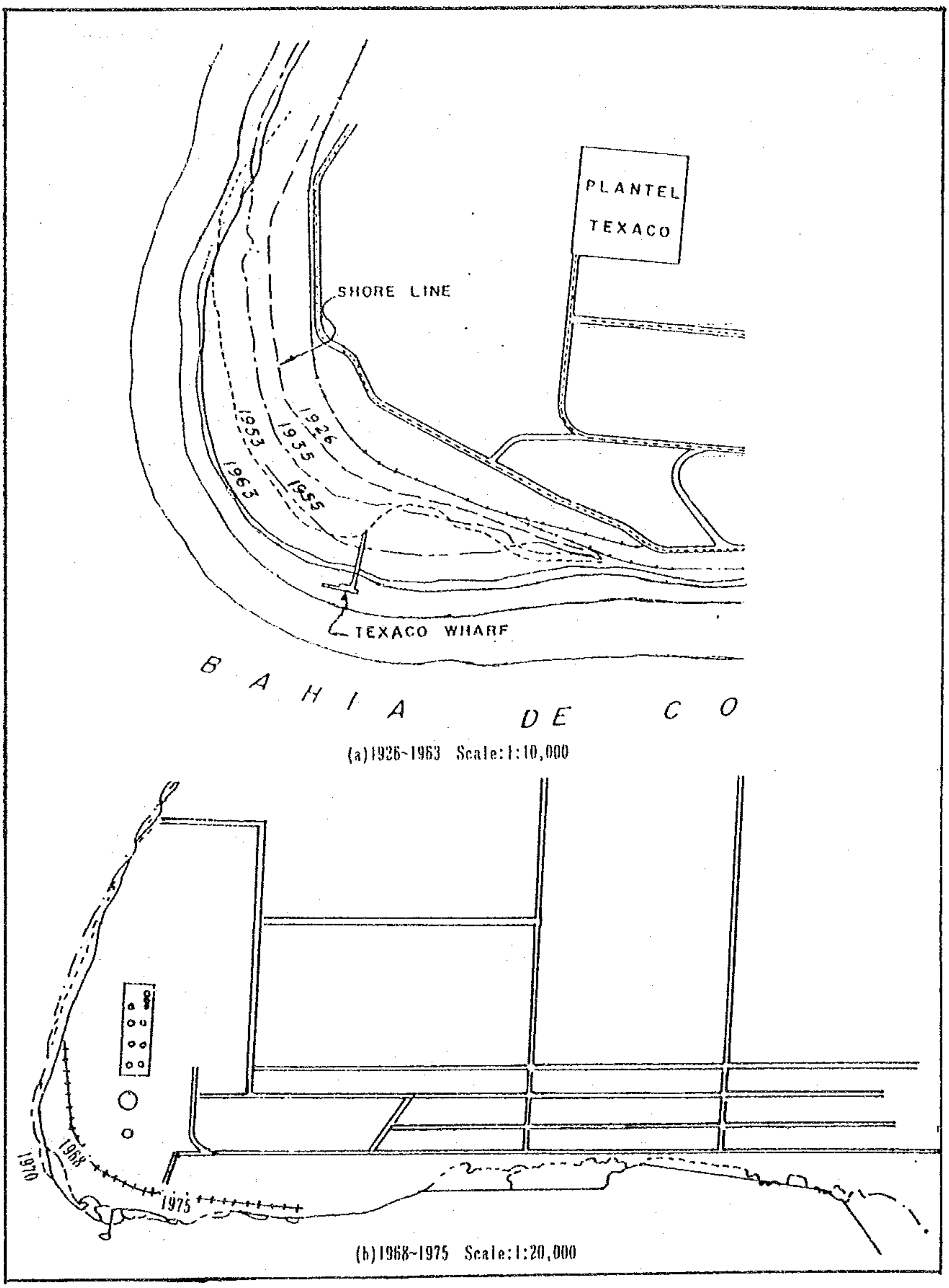
Pier No	1	2	3	4	5	6
Kd	0.70	0.29	0.25	0.24	0.23	0.24

Fig. 2-7-5 Wave Refraction and Diffraction

(4) Littoral Drift

266. The coastline surrounding the Bay of Cortes is a natural beach, except for the constructed section of the port and the operating area for the harbor between the Wharf No. 2 and Berth No. 5. The water front area of the Port of Cortes is calm without bad effects by marine phenomena such as waves and littoral drift, due to the topographic conditions of the peninsula.

267. Only Punta Caballos, located at the head of the peninsula, is affected by sand sedimentation. The change of the shoreline was studied by the Municipality of Port of Cortes from 1926 to 1963, and from 1968 to 1975, and the evolution is shown in Fig.2-7-6.



(a)1926~1963 Scale:1:10,000

(b)1968~1975 Scale:1:20,000

Fig. 2-7-6 Change Shorelines of the Punta Caballos

268. The maintenance dredging has been carried out periodically around the Wharf No. 1 (Texaco Pier for Refinery). Fig.2-7-7 shows the total volume of the dredged material since 1981, and the yearly volume to be dredged is estimated approximately 150,000 - 200,000 m^3. Outside the port area, a section of the coastline is affected by erosion at Los Amates in Omoa and ENP is considering some measures for coastal protection.

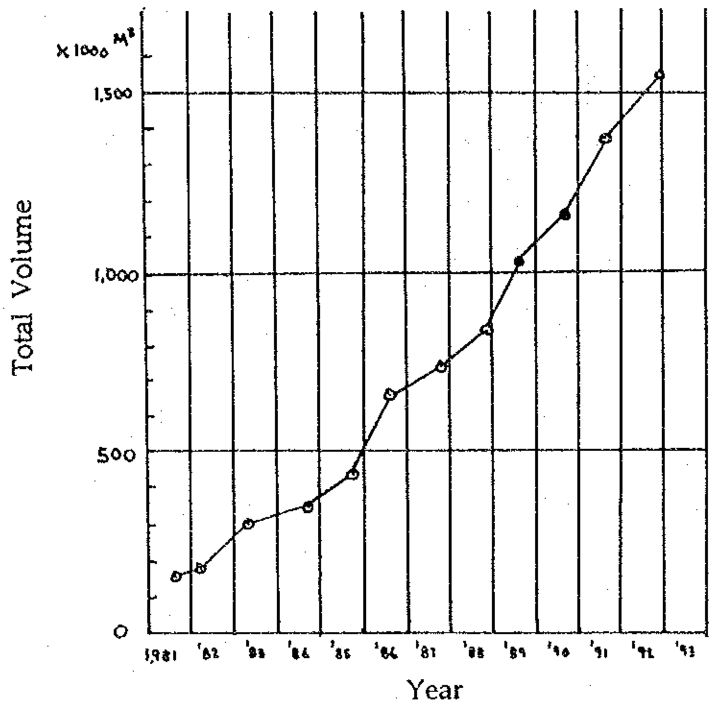


Fig. 2-7-7 Total Volume of Dredged Material

269. Considering the environmental effect of the port development, it seems that there are no problems like littoral drift, erosion or sand sedimentation, due to the sufficient depth and space from the topographic viewpoint and/or calm marine conditions in front of the expected pier of the port.

(5) Winds

270. The wind speed is recorded by an anemometer at the meteorological station of ENP Cortes, but there have been no data on the wind direction since January 1992. Table 2-7-4 shows only wind speeds observed in 1992.

Table 2-7-4 Wind Velocity at the Port of Cortes

(Unit: m/sec)

Month	Average Wind Velocity	Maximum Wind Velocity
January	0.0	0.0
February	0.0	0.0
March	1.2	11.3
April	3.0	5.2
May	2.7	9.8
June	-	-
July	3.0	7.6
August	2.6	9.7
September	2.8	4.8
October	2.8	5.4
November	-	-
December	2.2	8.5

Table 2-7-5 shows the wind speed (m/sec) at the Cortes Station.

Table 2-7-5 Wind Speed (m/sec) at Cortes Station, 1992

Month	<3	3.0-5.0	5.0-7.0	7.0-10.0	10.0-15.0	15.0-20.0
Jan	31	-	-	-	-	-
Feb	29	-	-	-	-	-
Mar	26	4	-	-	1	-
Apr	13	15	2	-	-	-
May	20	10	-	1	-	-
Jun	16	12	-	2	-	-
Jul	16	13	-	2	-	-
Aug	21	8	-	1	-	-
Sep	19	11	-	-	-	-
Oct	18	11	2	-	-	-
Nov	*	*	*	*	*	*
Dec	23	7	-	1	-	-
Total	232	91	4	7	1	-
Ratio	69.3%	27.1%	1.2%	2.1%	0.3%	0

*: No Data

(6) Temperature

271. Table 2-7-6 shows monthly high (low) temperature and monthly highest (lowest) temperature at the meteorological station of ENP Cortes in 1992.

Table 2-7-6 Monthly High (Low) Temperature and Monthly Highest (Lowest) Temperature

(Unit: °C)

Month	Monthly High (Low) Temperature	Monthly Highest (Lowest) Temperature
January	28.6(21.1)	30.1(19.5)
February	28.6(21.3)	30.4(20.0)
March	29.5(22.8)	35.0(20.5)
April	30.7(23.7)	32.1(21.0)
May	29.7(23.0)	31.2(19.5)
June	-	-
July	31.1(23.7)	33.0(21.0)
August	31.2(23.4)	32.3(22.0)
September	30.9(23.9)	31.4(22.5)
October	30.1(23.4)	31.2(21.5)
November	-	-
December	28.9(21.7)	31.4(19.5)

(7) Precipitation

272. Table 2-7-7 shows monthly precipitation and maximum 24-hour precipitation at the meteorological station of ENP Cortes in 1992.

Table 2-7-7 Monthly Precipitation and Maximum 24-Hour Precipitation

(Unit: mm)

Month	Monthly Precipitation (Rainy Days)	Max.24-Hour Precipitation
January	153.3 (15)	47.5
February	218.3 (9)	67.9
March	121.1 (7)	83.7
April	204.6 (11)	77.9
May	135.0 (16)	42.7
June	-	-
July	196.8 (13)	69.1
August	159.8 (16)	40.9
September	217.7 (19)	61.0
October	535.5 (22)	87.4
November	-	-
December	279.9 (19)	41.4
Total	2,323.0 (147)	-

(8) Earthquake

273. The seismic intensity of a earthquake is calculated according to the following formula:

$$V = Z \times I \times C/Rw$$

where, V = Seismic coefficient
Z = Factor for subsoil conditions
C = Coefficient of importance
I,Rw = Coefficient

The Cortes area is included in the seismic zone 3 of the UBC (Uniform Building Code), and the value of Z is fixed at 0.3. To calculate the seismic intensity of an earthquake using the formula V=ZxIxC/Rw, let Z=0.3, I=1.25, C=2.75, and Rw=9. Substituting these values in the formula, the result is V=0.115, as shown below:

$$V=(0.3)(1.25)(2.75)/(9)=0.115$$

2.7.2 Topography

274. The Port of Cortes is located on the north side of a 11 km wide bay between two capes: Punta Caballos to the north and Punta de Omoa to the southwest, and it is surrounded by the Puerto Cortes Peninsula.

275. From Punta Caballos to the mouth of the Alvarado Lagoon, including the city of Puerto Cortes, the topography is even, and the land is swampy. A coastal plain, almost 500 m to 1,000 m wide, has developed south of the mouth of the lagoon, alongside the bay. Also, many river mouths are located in this plain, with the Tulian River (or El Indio) being one of the largest.

276. The sea bottom is gently dipping 1.0 degree to -5 m in depth from south to north alongside the bay. From -5 m to -15 m the sea bottom topography is flat, dipping 0.15 degrees. Therefore, the water depth in front of the port reaches -10 m.

277. The possible expansion area of the Study Area was partly covered by the bathymetric survey which was carried out by the ENP in 1992, with area "A" located in front of the existing reclaimed area, and area "B" in front of the Free Zone, as shown in Fig. 2-7-8 "Location Map of Bathymetric Survey". The Study Team also carried out a bathymetric survey in March 1993 with the purpose of ascertaining the existing data on the area "A", and in the area "B", the Study Team performed the survey even beyond the area where the ENP team did it before, as shown in Fig.2-7-8.

278. The survey was done by using a boat (supplied by ENP) carrying the Echo-Sounder, Type PDR 101, frequency 200 kHz, made by Senbon Denki Co., Ltd., Japan, and moving from offshore towards the coast in a straight line. The line spacing was generally 100 m except for area "A". Along each line the water depth was recorded. The position of the moving boat was followed by a topographer who used a set of transceiver to communicate with the boat's pilot.

279. The results are presented in Fig. 2-7-9 indicating the existing data, the real position of the boat with the corresponding water depth.

2.7.3 Geology

280. The surface layer is covered with coastal deposits consisting of silt and sand generated by sea currents mainly in the east to west direction, which have carried sediments from the Chamelecon River and the Ulua River.

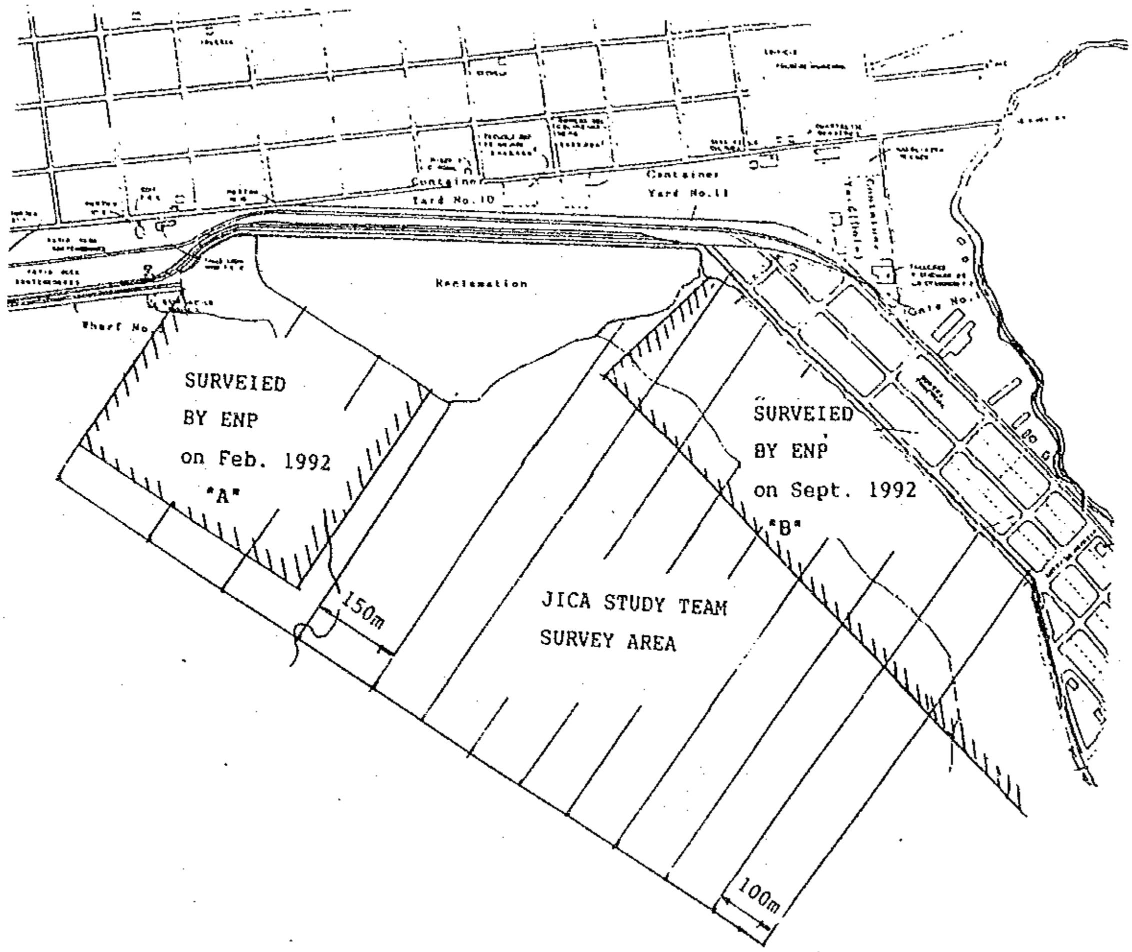


Fig. 2-7-8 Location Map of Bathymetric Survey

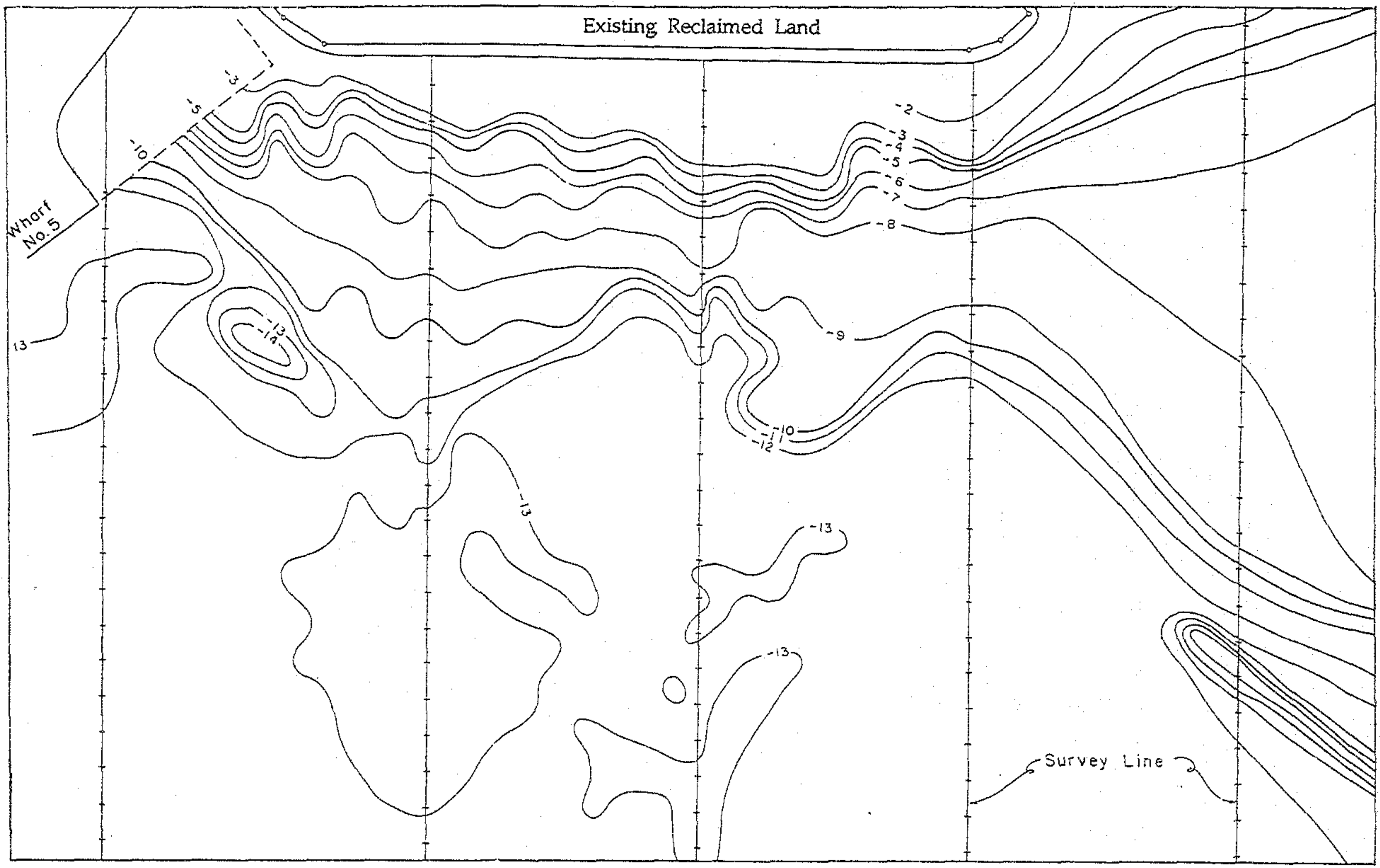


Fig. 2-7-9 Bathmetrie Survey Map (Scale: 1:3,000)

281. The recent lower deposits consist of fine sand with silt and silty clay, and they reach both the silt and the clay deposited in the Pleistocene.

282. The Study Area is located to the southeast of the Wharf No. 5. Nearby the study area, some geological investigations were carried out before, and their positions are indicated in Fig.2-7-10.

283. The geological investigation performed by the Study Team consisted of three core borings of the sea bottom, carried out in the period from February 26 to March 25, 1993. The purpose was to examine the foundation conditions of the port facilities to be designed for the development of the Port of Cortes.

284. The boring works were done by the contractor SWISSBORING using a boring machine of the rotary type for operation out of or under the water. The borings were done from a floating platform. In each boring and at every two meters of depth, a SPT (Standard Penetration Test) was performed, taking a disturbed soil sample at a time. In soft soil (clay or/and silt), samples of undisturbed soil were taken by using a thin wall sampler of the Shelby Tube type, inserted into the ground by hydraulic pressure.

285. Three boreholes (B-1, B-2 and B-3) totalling of 132.35 m were drilled and the depth of each boring was as follows:

Period	Sea depth (MSL)	Bottom of boring	Boring length (MSL)	
B-1 Mar. 1-11	-1.00	-57.50	56.50	
B-2 Mar.20-22	-9.50	-29.95	20.45	
B-3 Mar.11-18	-1.00	-56.40	55.40	(Unit: m)

286. A total of 53 SPT were performed. For laboratory testing, 53 disturbed samples were obtained from the SPT sampler and 8 undisturbed samples were obtained from thin wall (Shelby Tube) samplers.

287. The soil samples obtained from the borings were sent to the laboratory for testing. All tests were performed according to the American Society for Testing and Materials (ASTM). The soil classification is carried out in accordance with the United Soil Classification System.

288. The SPT results are presented in tabular form as well as graphed in the drill logs. The disturbed samples were obtained in every case from the SPT samples after each test was performed. The following laboratory tests were performed on the disturbed samples:

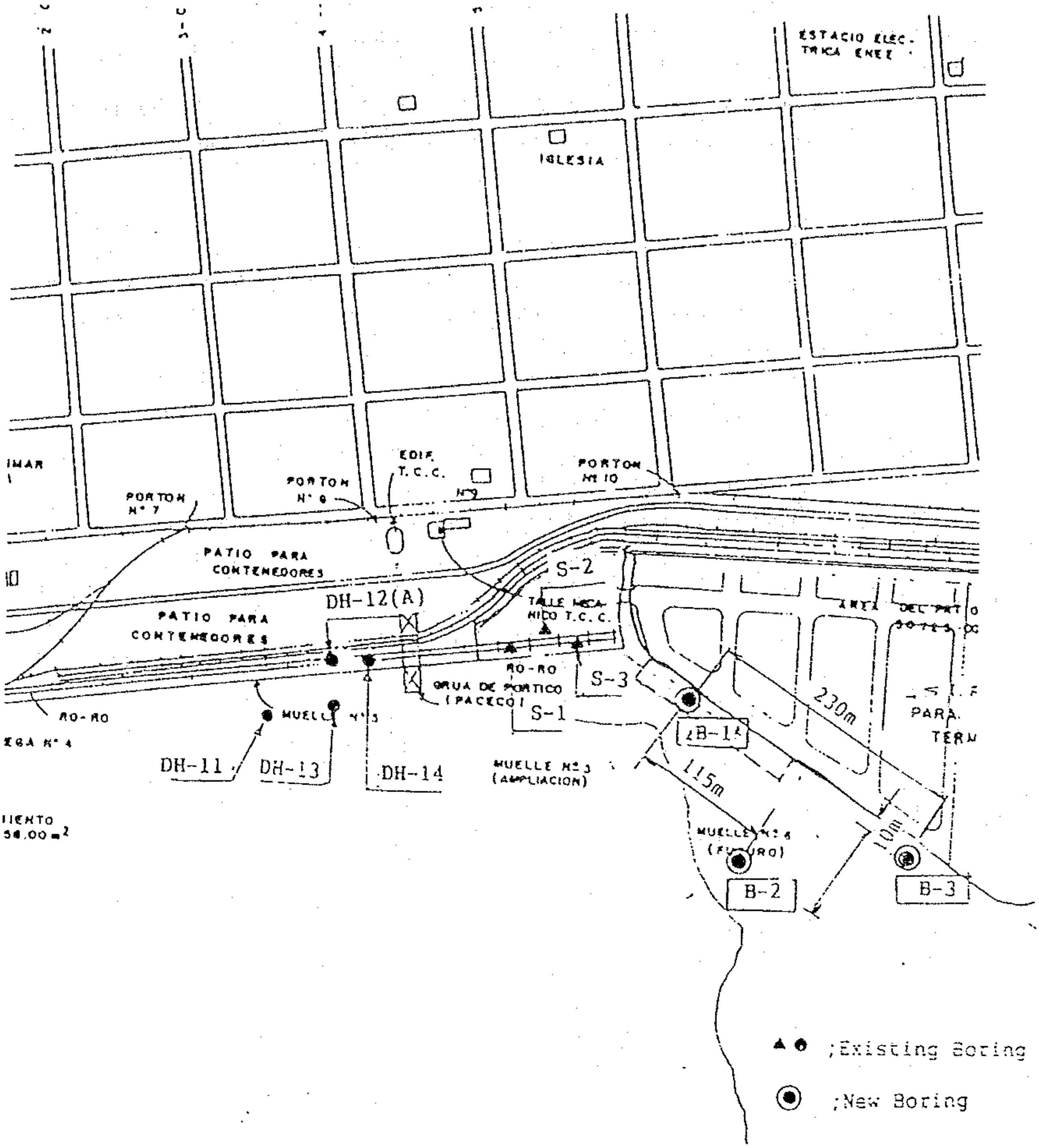


Fig. 2-7-10 Location Map of Boring

- Grain Size Analysis Test and Classification
- Liquid Limit and Plasticity Index Tests
- Specific Gravity Test
- Dry Density and Wet Density Tests
- Natural Moisture Content Test

For samples composed of loose sand or loose silty sand, the dry and wet density tests could not be performed.

289. The following laboratory tests were performed on the undisturbed samples obtained from the Shelby Tube samplers:

- Grain Size Analysis Test and Classification
- Liquid Limit, Plastic Limit and Plasticity Index Test
- Specific Gravity Test
- Dry Density and Wet Density Tests
- Natural Moisture Content Test
- Unconfined Compressive Strength Test
- Consolidation Test

290. The Borehole B-1 was started on March 1, 1993 and finished on March 11, 1993 to a final depth of 56.50 m. 23 SPT were performed and 23 disturbed samples were obtained for laboratory testing. Seven attempts were made to obtain undisturbed samples with thin wall Shelby Tubes, but only four samples were obtain. Ten wooden core boxes were filled with the recovered samples.

291. At the beginning of this borehole, serious problems were encountered with the unconsolidated sands which caved in the hole every time the drill string was raised. To avoid this problem, a 11.5 cm casing pipe was lowered to the bottom of the hole after each core run to a final depth of 32.45 m. At this depth, a significant stratigraphic change occurred from sand to clay. Due to physical characteristics of the clay, the caving problem stopped at this depth and the borehole was reduced in diameter. Casing of the borehole continued with 9.0 cm drill rods to a final depth of 50.55 m.

292. At a depth of 1.02 m, a 15 cm thick rock layer was found. It required the use of a diamond bit and a conventional double tube corebarrel to be drill through. This rock probably rolled to that location from the existing fill material found on the shore next to the drilling area.

293. A total of 9.5 work shifts (a shift worked 11 hours) were required to finish this borehole with an average of 5.95 m of drilling per work shift.

294. The Borehole B-2 was started on March 20, 1993 and finished on March 22, 1993 to a final depth of 20.45 m. Nine SPT were performed and 9 disturbed samples were obtained. No undisturbed samples were obtained by Shelby Tubes, since no clay was found. Four wooden core boxes were filled with the recovered samples.

295. A casing pipe (11.5 cm) was lowered to a depth of 18.00 m to avoid the caving of sands and to keep the bottom of the borehole clean prior to each SPT. A total of 3 work shifts were required to finish this borehole, with an average of 6.80 m of drilling per work shift.

296. The Borehole B-3 was started on March 11, 1993 and finished on March 18, 1993 to a final depth of 56.00 m. Twenty one SPT were performed and 21 disturbed samples were obtained. Four undisturbed samples were also obtained from Shelby Tubes for laboratory testing. Nine wooden core boxes were filled with the recovered soil samples.

297. The borehole had to be cased with a 11.5 cm casing pipe to a depth of 28.00 m due to the caving of sands. At a depth of 29.55 m, a 0.95 m thick white coral layer was found. Due to its hardness, this coral had to be drilled with a diamond bit and a conventional double tube corebarrel. After this depth, the borehole diameter was reduced and 8.9 cm drill rods were used as casing to a final depth of 52.00 m. A total of 7.5 work shifts were required to finish this borehole, with an average of 7.47 m of drilling per work shift.

298. Fig.2-7-11, 2-7-12, and 2-7-13 show the soil properties of each borehole.

299. Fig.2-7-14 shows the comparison of the N-values for the three holes, and the continuity of the stratum can be seen in Fig.2-7-15 (a) and (b).

300. The upper "recent deposit" layer consists of loose fine sand or silty clay till -11 m depth. This soil probably rolled to that location from the existing fill material found on the study shore area.

301. Underlying this stratum are fine sand deposits, well or badly graded. Their origin could be marine, beaches or the littoral, sometimes they might have a little silt or clay. This stratum has variable thickness, it is encountered at a depth of 33 m below the sea surface level in B-1, 25 m in B-3, and 36 m in the former borehole DH-13. The internal friction angle of this deposit was roughly estimated to be over 40°. The estimation was based on the results of STP, where over 40 blows were required for a 30 cm penetration.

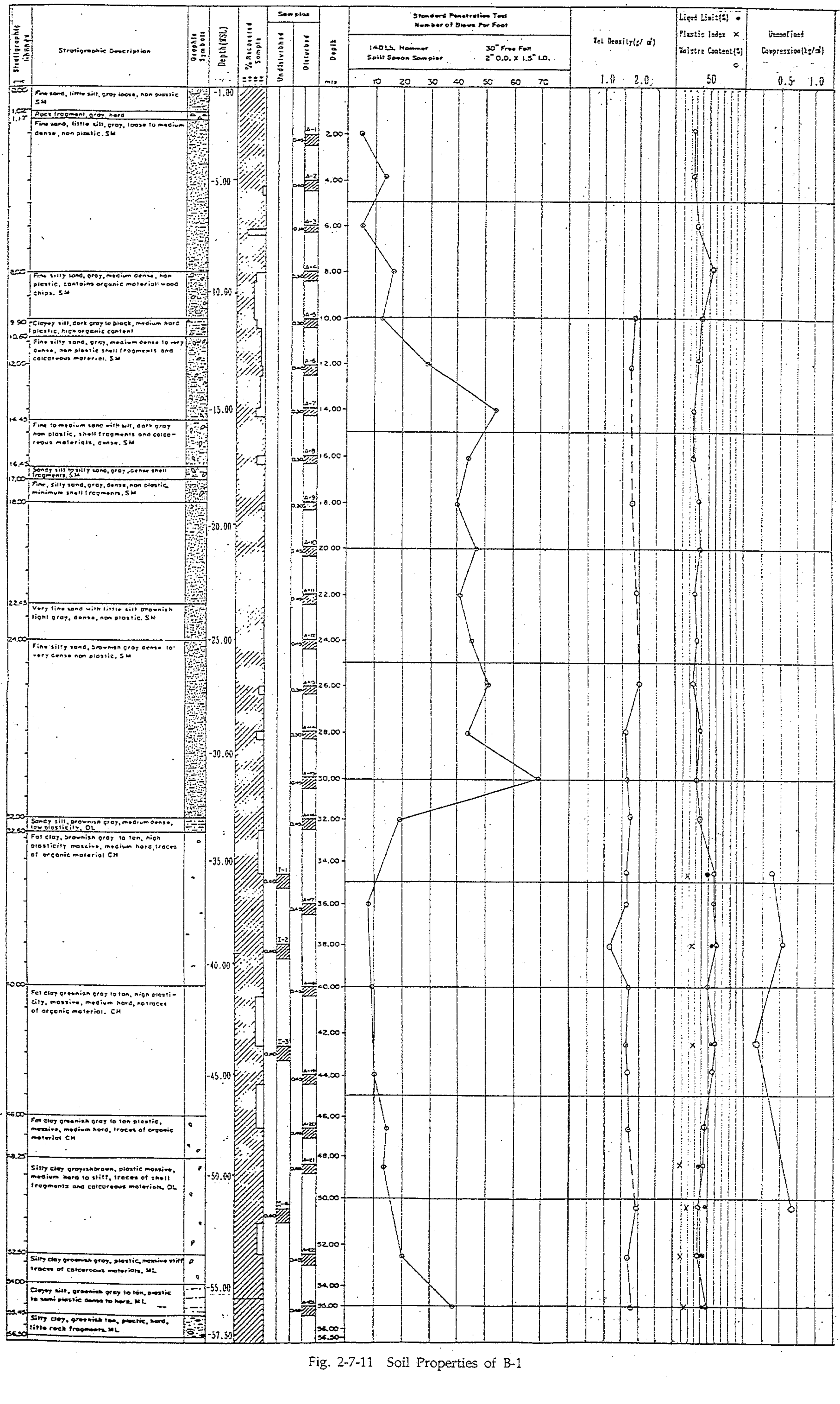


Fig. 2-7-11 Soil Properties of B-1

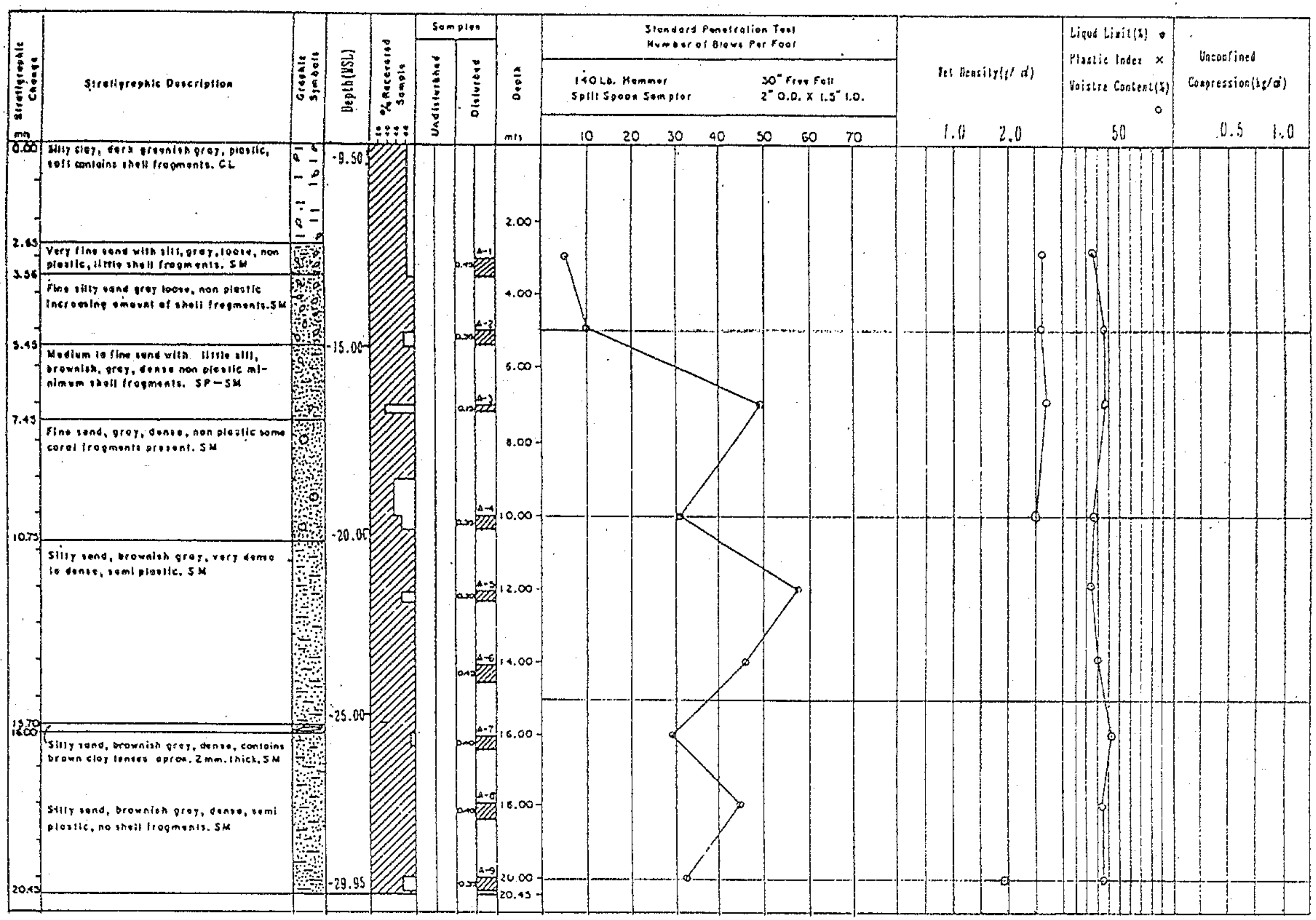


Fig. 2-7-12 Soil Properties of B-2

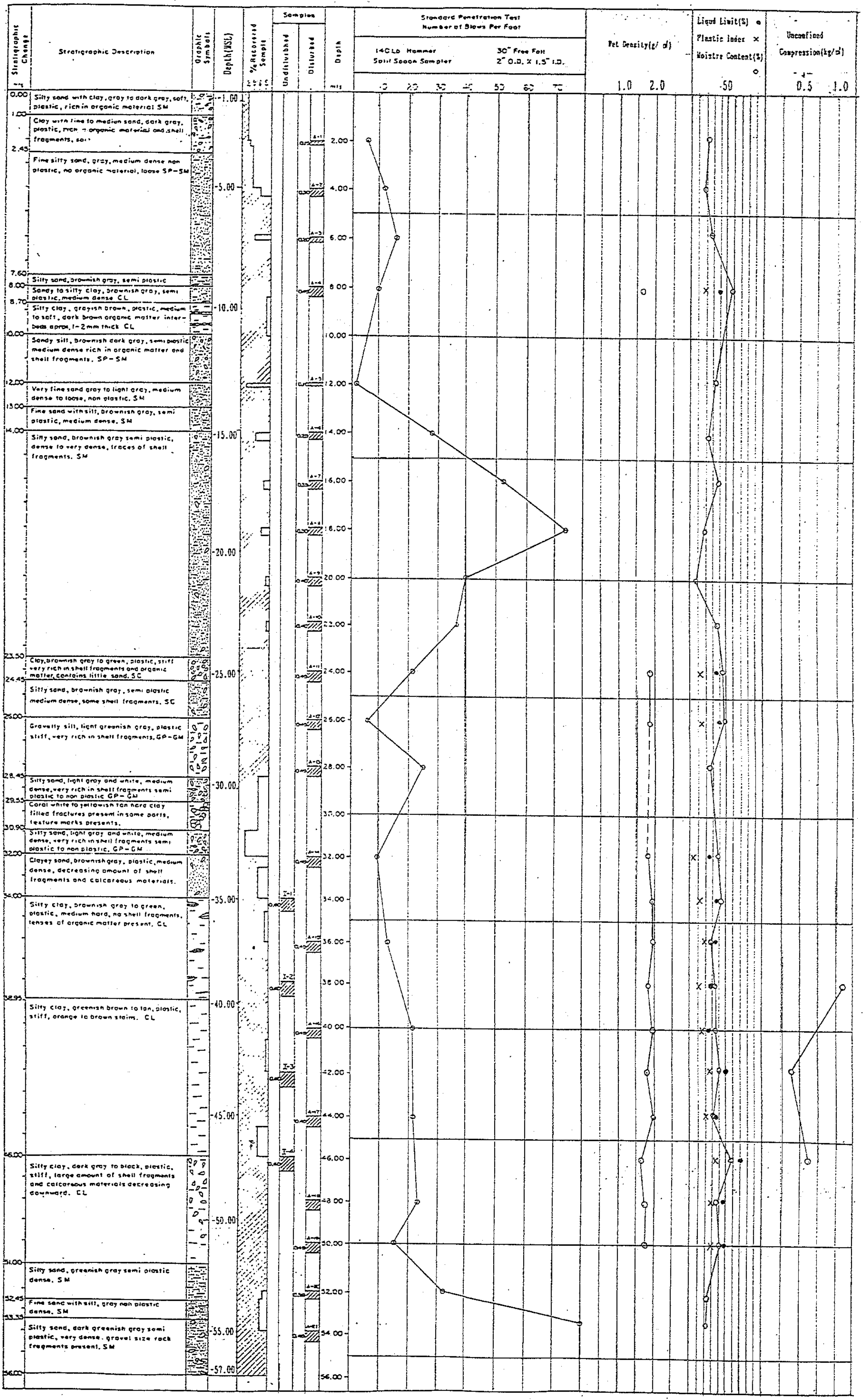


Fig. 2-7-13 Soil Properties of B-3

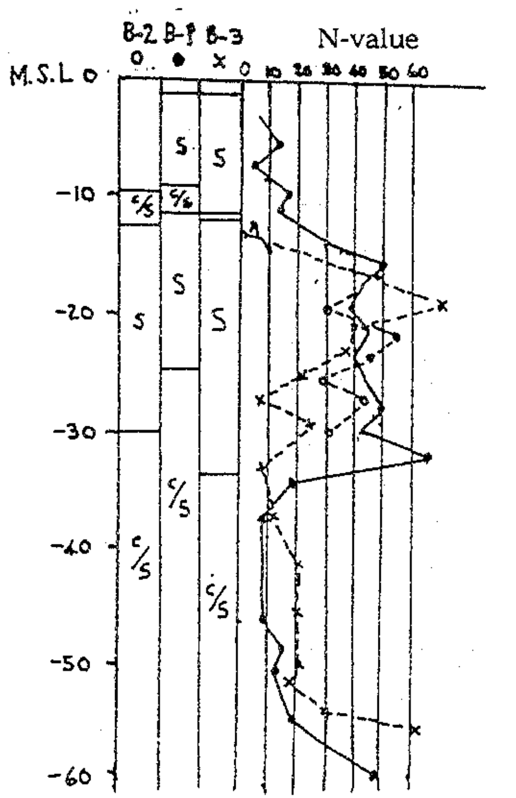
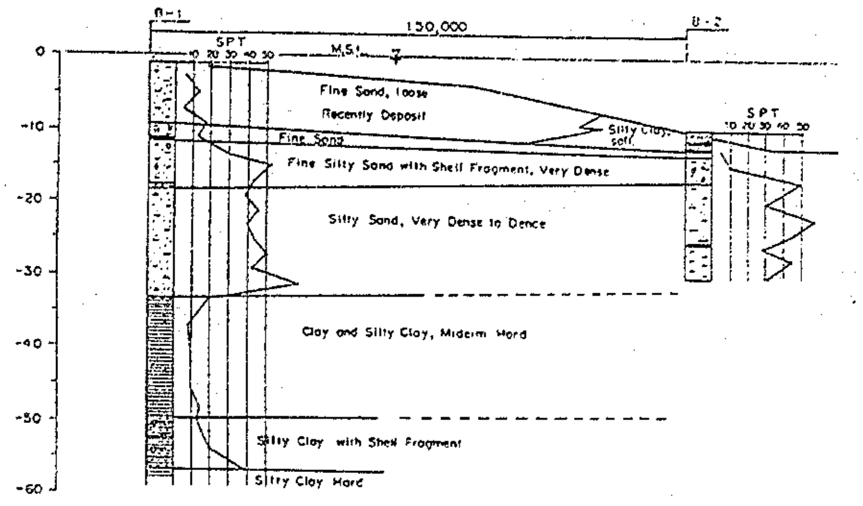
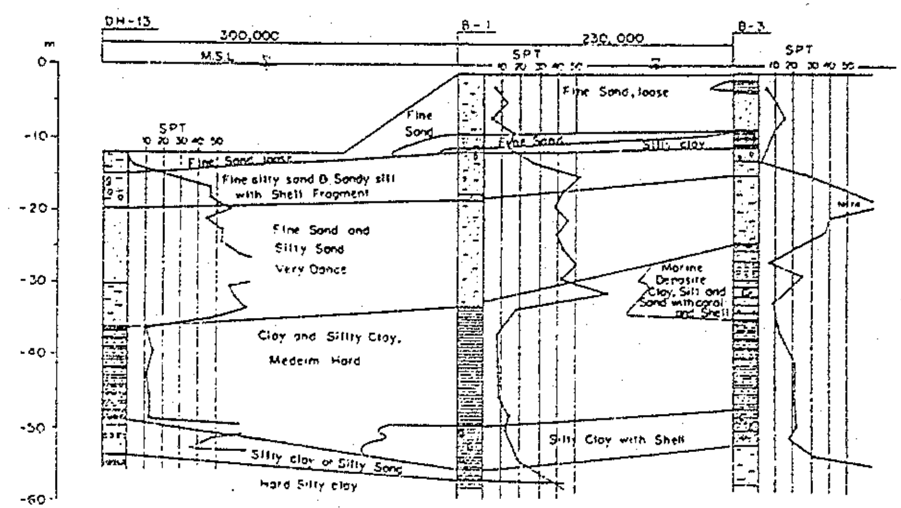


Fig. 2-7-14 Comparison of the N-values



(a) B-1 and B-2



(b) DH-13, B-1, and B-3

Fig. 2-7-15 Geological Cross Section

302. Underlying the sand stratum, there is a layer of gray, silty clay or clay of deltaic origin, with medium to high plasticity, and soft to medium consistency. The unconfined compression tests indicated compression strength values between 0.35 kg/cm². This layer lies 50 m under the sea surface level. This layer is still unconsolidated, because the consolidation yield stress is low (0.26 kg/cm² - 1.0 kg/cm²), the soil is still compressible.

303. The last stratum is composed of stiff silty clay and very dense silty sand with gravel size rock fragments. It is well consolidated and can provide a sufficiently reliable foundation bed to support the heavy structures. The thickness of this stratum was not defined in the boring.

304. The weak layer covering the sea bottom is not suitable as a foundation bed for heavy structures. Due to this condition, deep foundation work or piles should be used. A foundation depth around 25 m from the sea surface level should be considered.

305. Existing port facilities consist of pile foundation, therefore, for the new facilities foundation, concrete piles were chosen. The axial ultimate bearing capacity of a single pile is obtained by loading tests or a statical bearing capacity formula. In the design, the bearing capacity shall be calculated in accordance with a statical formula, and the formula for sandy soil is shown below:

$$R_u = CNA_p + \frac{\overline{N}A_s}{5}$$

R_U: Ultimate bearing capacity of the pile (TF).
C: Coefficient (C=40 by Meyerhof, and C=30 by "Technical Standards for Port and Harbor Facilities in Japan")
A_P: Tip area of the pile (m^2)
A_S: Total circumferential surface area of the pile (m^2)
N: N value of the subsoil at the tip of the pile
$\overline{N}$: Mean N value for the total embedded length of the pile

In this case, N shall be calculated in accordance with the following formula:

$$N = \frac{N_1 + \overline{N_2}}{2}$$

where N_1: N value at the tip of the pile
$\overline{N}$: Mean N value in the range from the tip of the pile to 4B above
B: Diameter or width of the pile (m)

306. The maximum pulling resistance of a single pile shall be estimated by the following statical formula:

$$Rut = \frac{\bar{N}As}{5}$$

where

Rut: Maximum pulling resistance of the pile (t)

$\bar{N}$: Same as above

As: Same as above

307. The axial ultimate bearing capacity and maximum pulling resistance of a single pile were calculated by the above formulas, and the results are as follows:

(Pile Size: 0.45 m square pile)

Depth of Tip below M.L.W (m)	Ru (t)		Rut (t)
	Meyerhof	Japanese Standard	
-25.0m	544	463	220
-30.0m	557	476	233
-35.0m	564	483	240

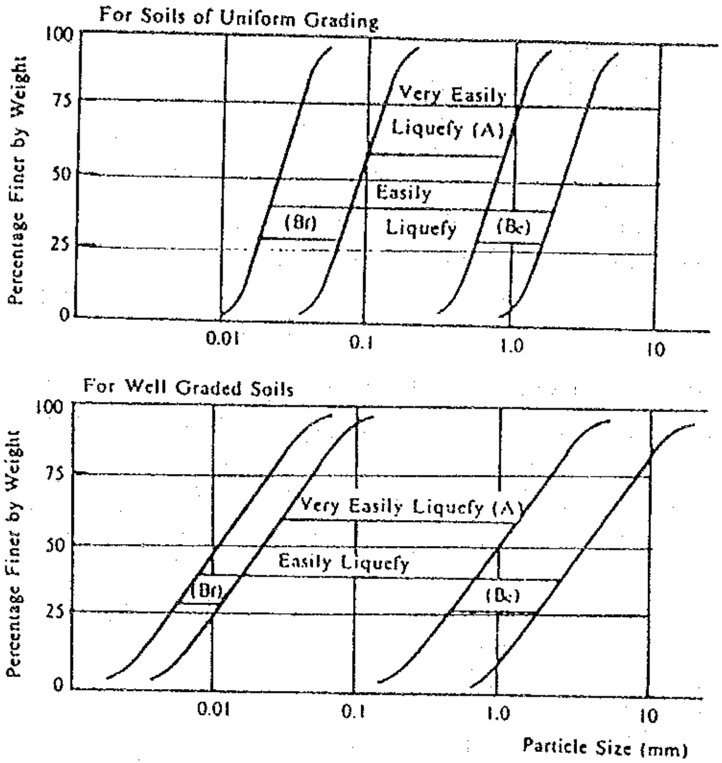
308. Saturated sandy deposits tend to liquify during earthquakes, causing damage to structures. Liquefaction should be taken into consideration in this project. Liquefaction potential was assessed by the following procedure.

A) Classify the soil under consideration by comparing the grain size accumulation curve with the range shown in Fig. 2-7-16 (a). Plotting the grain size of the Boreholes B-1, B-2 and B-3 on this figure, the range result is as shown in Fig. 2-7-16 (b).

B) Judging the liquefaction by soil depth and its N-value shown in Fig. 2-7-17 (a), the N-value of Boreholes B-1, B-2 and B-3 are compared with it as shown in Fig. 2-7-17 (b).

309. During earthquakes, the upper layer (above -11.0 m) is likely to occur liquefaction due to the poor grading and loose sand. On the other hand, the lower sand layer is

no fear of liquefaction. Therefore, the foundation of the structures should be based on the lower sand layer.



Source: Technical Standards for Port and Harbour Facilities in Japan.

Fig. 2-7-16(a) Ranges of Grain Size Accumulation Curves for Liquefiable Soils

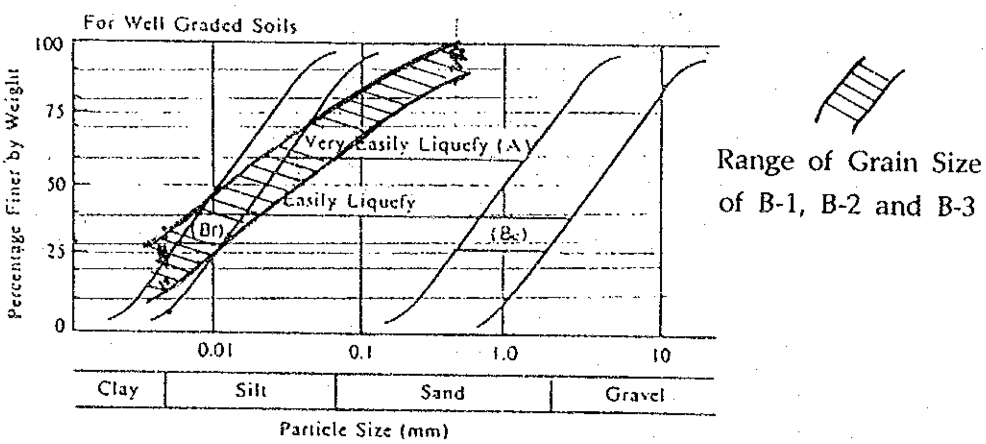
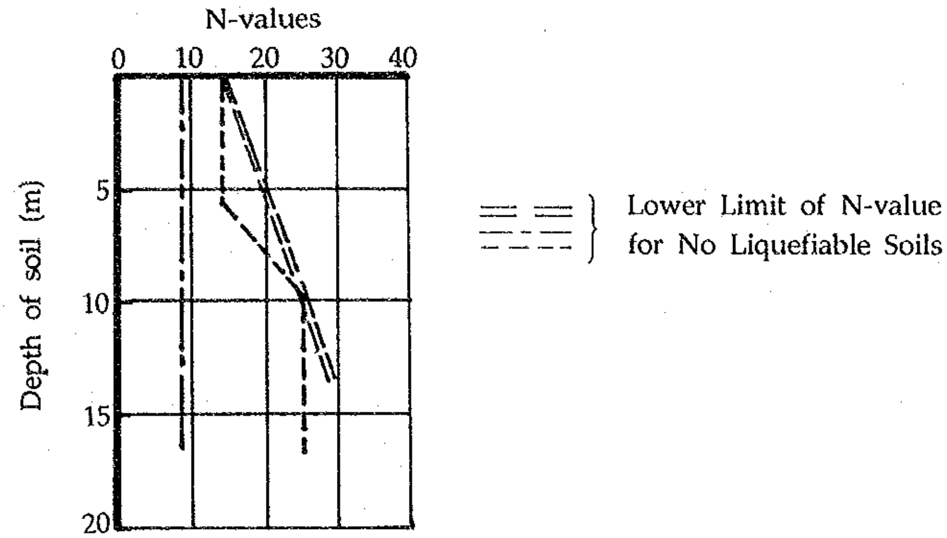


Fig. 2-7-16(b) Comparison of Grain Size



Source: Pocket Book of Civil Engineering
by Association of Japanese Civil engineering

Fig. 2-7-17(a) Limit of No Liquefaction

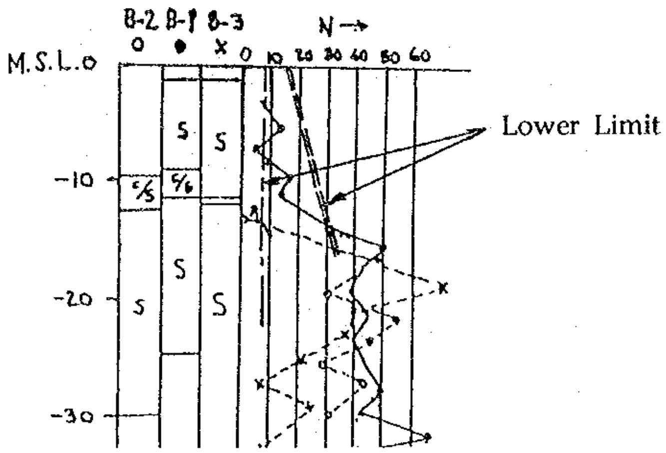


Fig. 2-7-17(b) Comparison of N-value

2.8 Present Environmental Situation

2.8.1 Legal and Institutional Matters

310. The environmental issue in Honduras is still at its inceptive stage. The government of Honduras, however, has initiated various actions to tackle the issue. One of the most important actions is the creation of the National Commission for the Environment (CONAMA) which counsels and promotes actions for formulation and application of national policy so as to control adequately the national resources and to promote and manage environmental quality of the country. Another important action is the submission of the " General Law for the Environment" to the National Congress. The law is still under discussion at the Congress.

311. Other important institutional changes which may affect port sector are; promulgations of the Planning Law in 1986 and promulgation of the Law of Municipalities in October 1990.

312. "Honduras Environmental Agenda 1992" published by CONAMA describes environmental issues in various fields including coastal region and proposes policy guidelines. The Agenda also specifically states recommendations for regional strategy of each coastal region.

313. There are 51 wild life reserves of ten (10) various types in Honduras. Among these reserves, detailed data is not available to the Study Team, however, there is no such area which could suffer severely by port activities as well as port construction work.

2.8.2 Present Situation of Port Environment

314. Environment comprises a very wide range of factors. Water quality is one of the most familiar items to port activity.

315. The port environment in and around ports in Honduras are observed as pretty good. There is no serious contamination in water and air quality, and there are no big noise and vibration problems. The fear arises from a much simpler matter. There is a possibility of coastal transformation because of the construction of a breakwater for the new port at La Ceiba. The possibility of a flood along the river arises, where many rocks have been taken away for the use as construction materials for the new port. The construction of ports of Castilla and San Lorenzo were undoubtedly made sacrificing a certain area of mangrove trees. Environmental problems should be treated in a scope of balance with the benefit of development. All Honduran ports are located near beautiful scenery. Port people should be well aware of its value and be very careful for their

activities.

316. When talking about environment more precisely, the discussion must be based on wide range of scientific facts. However, that is not the case for Honduran ports because there are no serious environmental problems observed. Three sets of independent water quality test results are utilized to analyze the water quality in and around the port of Cortes.

a. Test 1: The monitoring of water quality which has been conducted by ENP after the suggestion by Japanese Government Scope of Work Mission.

b. Test 2: The water quality (Coliformes) test conducted by Municipality of the Port of Cortes.

c. Test 3: The water quality test conducted by the Study Team on March 15th, 1993.

317. ENP has been conducting a monthly water quality test at five (5) locations mainly along the wharves. The test device is "Pack Test" Kyoritsu Chemical check Laboratory cooperation, which Japanese September Mission for the negotiation of this study left behind. The device gives only limited accuracy of measured water quality items, say temperature, COD (Chemical Oxygen Demand), NH4 (Anmonium), NO2 (Dioxide nitrogen) and PH. Following tables are the examples of these measurements. Japanese standard values for COD and PH are also given below.

Table 2-8-1 Results of Water Quality Test 1 (Sep. 2, '92)

Points	Temperature	COD	NH4	NO2	PH
No.1	30	0	0.5	0.02	9.0
No.2	30	0	0.5	0.02	9.0
No.3	30	0	0.5	0.02	5.0
No.4	30	0	0.5	0.02	9.0
No.5	30	0	0.5	0.02	8.5

Table 2-8-2 Results of Water Quality Test 1 (Jan. 19, '93)

Points	Temperature	COD	NH4	NO2	PH
No.1	30	0	0.4	0.02	9.5
No.2	30	0	0.5	0.02	9.3
No.3	30	0	0.4	0.02	5.0
No.4	30	0	0.5	0.02	9.0
No.5	30	0	0.5	0.02	9.0

Remarks: Measuring Point Location

No.1	Texaco pier
No.2	Wharf No.2
No.3	Wharf No.4
No.4	Wharf No.5
No.5	Coca Cola Beach

Table 2-8-3 Japanese Standards for Water Quality (sea area)

Utilization	COD(mg/l)	DO(mg/l)	PH
Category 1	2 or less	7.5 or more	7.8-8.3
2	3 or less	5 or more	7.8-8.3
3	8 or less	2 or more	7.0-8.3

Remarks: Category 1 is the level of water quality in which water bathing is possible, Category 2 is for industrial use and Category 3 is the level of water level which may induce unpleasantness to general public.

318. From the result, the water quality is pretty good although the PH value indicates the possibility of somewhat abnormal circumstances when comparing with the Japanese standard value. Of course, the natural conditions very much differ from Japan and PH measuring device might reflect the difference, however, the study results should be carefully evaluated.

319. Other study results are obtained from the Municipality. They are planning a sanitary system project. The study results extracted below are conducted as a background study in the said project. Fig.2-8-1 shows the water sampling points in and around the Bay of Cortes and Table 2-8-4 lists the test results.

Table 2-8-4 Results of Coliform Test

Point	Location	Date	Time	Coliforms (number/100ml)
1	Coca Cola	Aug. 8 '89	16:30	8
	ditto	15	10:10	450
	ditto	Sep.26	17:20	3000
2	Coca Cola	Aug. 8 '89	16:40	114
	ditto	15	10:13	72
	ditto	Sep.26	17:30	2000
3	Coca Cola	Aug. 8 '89	16:50	124
	ditto	15	10:18	300
	ditto	Sep.26	17:35	7000
4	Rio Mar	Aug. 8 '89	17:00	164
	ditto	15	10:30	4500
5	Cienaguita	Sep.26 '89	17:50	3000
6	El Faro	Aug.15 '89	17:00	200
	ditto	Sep.26 '89	18:00	400
7	El Faro	Aug.15 '89	16:50	1500
	ditto	Sep.26 '89	16:45	1000
8	Travesia	Aug.15 '89	16:20	300
	ditto	Sep.26 '89	16:30	120

320. The Table shows that the maximum number of coliform (7000) is acquired on September 26 at point 1 (Coca Cola Beach, in front of the public bathroom) The measurements on September 26 tends to give a higher number, while the measurements on August 8th give a lower number.

321. Along the north coast of Cortes Peninsula, the numbers of coliforms are small and the numbers increase inside the Bay. At Rio Mar, the number of coliforms tends to show the maximum.

2.8.3 Result of water quality measurement in port of Cortes

322. Water samples were bottled onboard on March 15, 1993 and took away to Tegucigalpa where Laboratorio de Analisis Industrial made necessary analyses. Among the water quality items, only water temperature and transparency is measured on site. The weather was cloudy.

323. Fig.2-8-2 shows the locations where water was bottled. The water sampling locations

are carefully chosen so as to clarify the effects of port activity on the water quality in the Bay water. Points D and E represents the background of the Bay water. Points B and C are to catch the effects of port activities and Point A is to evaluate the inflow from the Alvarado Lagoon. At Points C and E, sample waters were taken at two layers, that is at the surface and at the middle layer (half of the depth).

324. Table 2-8-5 lists the results of water quality tests. From the table, it is noted that the salinities at the points A, B and C are low compared with the results of other points. This is because the fresh water is coming into the Bay there by lowering the salinity. It should be borne in mind that it had been raining heavily for more than a week before the date of water sampling and this brought in lots of fresh water. The test results of DO, COD as well as transparency indicate that an extraordinary phenomenon happened at the time of the measurement. Therefore, the test results should be treated as an example of the worst water quality in this region.

Table 2-8-5 Results of Water Sampling Tests

Location	Water Temp.	Trans -parency	Salinity	PH (mg/l)	DO (mg/l)	COD (mg/l)
1	26	1.7m	25	7.8	6.82	189
2	28	3.9m	28	7.7	5.86	377
3	28	3.6m	28	7.7	5.80	755
3'	32	3.6m	32	7.9	6.88	377
4	32	4.6m	32	7.9	6.76	
5	32	4.9m	32	7.8	6.37	
5'	32	4.9m	32	7.9	6.25	

Remarks: ' means water sample was taken from the middle layer.

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PART II

References

Figuars and Tables in Volume I

Table 1-1-1 Export Statistics at Port ('82 - '92)

Unit: Thousand MT

Export	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Meat	16,815	14,857	10,407	8,495	10,695	9,492	9,985	9,277	11,191	12,730	17,238
Plantains	996	587	1,438	16,637	14,988	11,471	8,522	5,007	2,530	1,259	13,370
Bananas	897,875	691,062	824,476	802,863	755,497	936,559	863,732	839,716	824,622	740,739	792,502
Pure of bananas	9,910	7,987	12,532	129,534	108,467	59,514	58,825	43,835	12,564	16,131	12,682
Coffee	57,900	75,132	68,896	72,903	79,614	86,915	76,401	88,254	104,444	87,574	118,756
Sugar	87,083	100,179	101,245	105,049	94,042	84,887	54,438	20,763	29,191	19,983	12,820
Tobacco	3,707	3,897	3,041	2,739	1,995	1,137	1,349	1,379	2,108	2,539	4,009
Timber	228,173	188,232	154,567	156,056	170,705	173,641	140,744	128,047	94,807	104,999	112,558
Cement	10,769		2	15,827	44,760	61,022	109,920	210,563	105,748	36,492	29,167
Bagged cement											
Corn or maize				10,207							
Bulk minerals	66,803	101,957	126,777	139,166	71,791	38,032	79,519	88,040	66,530	82,396	87,325
Fuel and derivates		18,973	31,733	38,355	18,747	15,911	42,371	35,190	25,116	6,899	
Molasses	61,164	57,432	45,664	40,751	38,941	28,216	16,154	16,575	18,863	12,307	31,257
African Palm-oil			1,511	17,876	25,015	27,878	10,982	1,664			10,515
Nuts & African palms				1,015							
Pineapples	31,082	29,796	31,655	27,011	26,949	38,306	25,678	31,384	38,675	49,444	48,547
Coconuts	2,302	2,075	1,933	1,608	1853	1,333	774	1,665	1,102	1,391	1,921
Grapefruit	10,959	11,218	12,496	11,408	16,543	14,245	12,691	17,403	13,777	12,722	16,986
Melons								106	516	47,256	58,028
Cotton	5,927	2,467	4,829	4,977	4,644	1,178		757	350		
Cotton seeds				9,500				61			
Ornamental plants											260
Other products	169,292	165,336	177,906	199,018	195,566	258,777	272,038	301,274	308,695	300,613	358,629
Another countries' materials	27,761	31,867	32,976	22,983	25,990	22,957	9,484	13,504	18,693	22,014	27,208
Total Export	1,688,518	1,503,054	1,644,084	1,833,978	1,706,802	1,871,471	1,793,607	1,854,464	1,679,522	1,557,488	1,753,778
Total Imort + Export	2,807,246	2,819,377	3,105,171	3,165,895	3,073,338	3,460,560	3,545,088	3,684,404	3,472,822	3,589,190	3,706,986

Source : ENP

Table 1-1-2 Import Statistics at Port ('82 - '92)

Unit: Thousand MT

Import	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Wheat	84,441	81,079	106,277	112,670	108,319	118,289	103,217	122,307	93,941	160,647	106,542
Other foodstuffs	46,804	80,155	53,880	46,247	79,622	110,745	143,861	121,288	136,504	219,682	108,041
Drinks & Tobacco	2,360	979	889	405	512	795	798	2,178	1,356	863	1,882
Chemicals	38,448	53,293	49,653	46,198	53,917	53,183	44,537	58,321	56,361	47,329	55,430
Fats of animal & vegetal extraction	6,874	6,922	6,546	8,749	11,639	7,540	10,548	4,409	2,423	8,815	9,238
Fertilizers	49,903	70,803	109,735	61,290	109,443	106,840	120,345	114,241	131,502	135,829	109,071
Petroleum and derivates	518,257	602,717	685,780	600,047	569,517	652,934	762,399	826,489	766,380	804,879	807,410
Iron & Steel	30,620	42,508	54,741	63,508	32,934	43,581	74,650	58,590	81,262	59,097	94,472
Machinery & Transportation equipment	11,627	14,657	19,214	23,420	19,800	21,538	27,401	25,347	17,720	23,115	30,505
Paper and carton in rolls	91,393	86,592	81,637	98,042	90,299	78,634	76,386	69,506	65,250	51,885	18,669
Others	169,168	179,652	188,532	179,165	185,918	250,683	236,350	258,800	246,584	273,638	291,710
Transit traffic											
Domestic transit	31,167	59,501	65,963	72,872	85,934	120,857	127,769	154,974	158,446	197,468	262,365
Foreign transit	37,666	37,465	38,240	19,304	18,682	23,470	23,220	13,490	35,571	48,455	57,873
Total Import	1,118,728	1,316,323	1,461,087	1,331,917	1,366,536	1,589,089	1,751,481	1,829,940	1,793,300	2,031,702	1,953,208

Source : ENP

Table 1-1-3 Agriculture and Forestry Production

Unit : Thousand

	Corn	Sorghum	Rice	Beans	Coffee	Bananas	Plantains	Sugar Cane	Cotton	African Palms	Tobacco	Pine Apple	Melon	Timber
Unit	ton	ton	ton	ton	ton	ton	ton	ton	ton	ton	ton	ton	ton	cu.m
1970	352.54	46.00	15.15	47.90	33.70	956.28	82.87	1,374.54	5.72	32.80	3.95	5.31	0.56	N.D
1971	359.16	47.72	29.35	54.61	36.02	1,188.70	87.54	1,407.11	6.44	43.27	3.86	6.09	0.58	N.D
1972	361.93	50.67	36.42	49.76	36.38	1,070.31	94.35	1,484.81	12.16	47.90	3.04	6.98	0.60	N.D
1973	350.45	49.35	31.57	41.87	48.04	1,044.05	102.24	1,157.32	14.88	51.85	3.58	12.96	0.65	N.D
1974	358.43	52.21	30.57	51.76	45.45	862.07	95.62	1,571.23	14.56	50.80	4.63	14.88	0.67	N.D
1975	343.06	48.72	33.97	47.54	50.98	582.10	83.01	1,557.12	8.75	51.08	5.17	17.05	0.69	N.D
1976	377.94	52.44	35.02	43.00	50.08	813.12	94.98	1,645.12	19.82	49.49	5.85	17.22	0.72	N.D
1977	343.65	49.35	29.17	43.09	48.31	940.13	93.71	1,993.35	31.71	56.75	6.76	17.39	0.75	610.40
1978	369.68	50.71	37.42	44.45	63.78	950.02	91.76	2,101.53	21.14	61.87	6.31	31.36	0.96	615.80
1979	362.11	39.01	41.14	43.91	66.68	1,123.07	96.53	2,555.45	24.72	60.92	6.80	30.23	3.22	567.00
1980	333.58	52.12	45.13	44.95	69.76	1,096.67	110.50	2,865.30	21.18	85.69	7.12	141.50	4.10	545.00
1981	418.54	42.05	45.00	54.21	80.42	1,002.68	112.22	2,879.82	18.60	107.73	7.30	160.80	4.90	543.00
1982	404.07	42.41	49.76	54.39	77.02	1,050.67	115.99	3,052.50	8.16	159.26	6.17	195.34	5.00	475.00
1983	388.15	44.45	63.69	44.82	85.77	875.09	118.16	3,150.16	12.84	200.08	5.58	171.20	5.30	453.00
1984	430.06	49.03	58.65	49.81	64.23	990.57	122.83	3,047.97	17.92	259.69	4.81	182.30	5.80	412.00
1985	426.61	38.65	52.21	50.58	83.65	1,089.28	133.86	2,988.95	14.56	311.67	5.44	198.00	6.20	421.20
1986	405.65	32.07	61.87	50.53	70.65	1,018.24	146.97	2,988.68	8.94	325.32	4.63	207.70	17.00	389.20
1987	399.08	36.29	56.97	45.00	93.65	1,150.42	157.63	2,659.00	8.03	293.52	4.54	210.20	33.00	449.30
1988	431.92	46.22	47.45	23.18	91.67	1,106.74	154.00	2,503.92	8.48	339.11	3.72	212.70	31.10	419.60
1989	498.05	54.93	65.77	59.24	93.39	1,076.76	154.04	2,719.06	4.35	330.58	4.72	215.20	48.60	397.70
1990	561.60	69.49	64.32	61.96	112.83	1,031.17	162.25	2,891.84	4.54	339.38	5.13	N.D	N.D	328.10
1991	557.61	83.83	86.41	78.97	94.08	959.00	168.42	2,910.39	1.36	342.56	4.99	N.D	N.D	302.60
1992	569.90	86.27	72.58	80.88	128.53	959.14	174.23	3,016.21	1.27	383.07	5.03	N.D	N.D	N.D

Source : Secretaria de Recursos Naturales

Table 1-1-4 Cultivated Area of Agriculture and Forestry

	Corn	Millet	Rice	Beans	Coffee	Bananas	Plantain	Sugar Cane	Cotton	African Palms	Tobacco	Pine Apple	Melon	Timber
Unit	ha	ha	ha	ha	ha	ha	ha	ha	ha	ha	ha	ha	ha	ha
1970	318,145	59,121	8,318	71,860	93,538	22,232	6,839	25,209	3,266	4,451	4,579	N.D	N.D	N.D
1971	325,090	60,384	14,050	80,100	96,277	21,391	7,711	25,270	3,652	4,726	3,435	N.D	N.D	N.D
1972	332,054	60,336	14,855	73,935	99,096	21,692	7,862	25,512	7,269	5,176	3,522	N.D	N.D	N.D
1973	322,127	59,842	14,820	67,242	101,997	22,786	8,288	24,308	9,323	5,436	4,154	N.D	N.D	N.D
1974	321,505	62,370	14,627	73,761	109,082	19,000	7,766	27,095	8,243	5,963	5,350	N.D	N.D	N.D
1975	315,793	60,434	14,818	70,731	111,178	19,326	6,406	27,338	4,619	7,671	6,007	N.D	N.D	N.D
1976	338,991	62,955	14,785	66,234	112,886	18,493	7,517	28,037	10,287	7,711	6,792	N.D	N.D	N.D
1977	304,784	60,445	13,808	66,724	114,838	19,585	5,634	31,058	17,779	13,255	7,857	N.D	N.D	N.D
1978	314,582	60,347	14,976	66,640	116,823	20,570	5,900	32,675	11,998	15,299	7,895	N.D	N.D	N.D
1979	326,765	60,829	18,197	66,189	118,843	20,983	9,056	37,036	11,168	18,558	8,681	N.D	N.D	N.D
1980	292,313	61,501	19,681	68,317	120,897	20,764	7,333	40,027	8,578	17,787	8,464	N.D	N.D	N.D
1981	340,654	49,560	21,212	76,452	122,086	20,088	7,307	44,162	8,031	20,235	8,418	N.D	N.D	N.D
1982	340,934	48,014	22,909	70,986	122,989	20,697	7,441	45,072	4,393	20,386	7,463	N.D	N.D	N.D
1983	335,712	51,183	25,256	63,728	124,194	19,148	7,447	44,414	4,528	20,523	7,626	N.D	N.D	N.D
1984	359,780	56,123	21,884	70,579	122,487	20,415	7,580	44,495	7,641	20,541	7,244	N.D	N.D	N.D
1985	331,981	45,480	18,774	78,653	124,291	20,787	8,070	44,829	7,268	22,327	7,040	N.D	N.D	N.D
1986	318,262	48,664	20,742	84,357	122,864	19,825	8,927	41,862	4,139	23,112	6,331	N.D	N.D	N.D
1987	341,594	55,052	20,569	84,634	124,723	20,652	9,655	41,791	4,008	20,301	6,259	N.D	N.D	N.D
1988	319,032	49,010	16,963	97,292	126,436	21,064	10,417	38,469	4,397	22,618	6,257	N.D	N.D	N.D
1989	351,098	62,193	23,058	83,909	141,237	21,084	10,574	40,707	2,044	23,788	7,324	N.D	N.D	N.D
1990	358,320	62,271	23,468	85,848	143,698	21,120	11,012	40,783	1,743	24,569	7,207	N.D	N.D	N.D
1991	360,457	62,432	21,000	154,700	146,817	17,500	11,278	41,776	1,689	26,760	7,372	N.D	N.D	N.D
1992	362,606	62,595	19,600	157,500	150,002	17,500	11,550	42,793	1,633	29,147	7,542	N.D	N.D	N.D

Source : Secretaria de Recursos Naturales

Table 1-1-5 Marine Production

Unit : MT

	1988	1989	1990	1991	1992	
Shrimp	2,906	1,683	3,608	5,306	5,906	
Lobster	1,152	747	852	1,276	1,761	
Fish	748	623	1,491	1,382	N.A	
Conch	130	412	216	775	N.A	
Others	125	371	64	57	N.A	
	5,061	3,835	6,231	8,795	N.A	

Source : Secretaria de Recursos Naturales, Banco Central

Table 1-1-6(a) Export of Marine Products

Unit : MT

	1988	1989	1990	1991	1992	
Shrimp	4,145	3,431	1,840	4,107	N.A	
Lobster	1,936	1,891	406	1,024	N.A	
Fish	131	3	281	299	N.A	
Conch	210	N.A	N.A	N.A	N.A	
Others	16	838	410	731	N.A	
	6,437	6,164	2,938	6,161	N.A	

Source : Secretaria de Recursos Naturales

Table 1-1-6(b) Export of Shrimp at Port of Cortes

Unit : MT

	1988	1989	1990	1991	1992	
Shrimp		2,841	2,829	5,482	6,823	

Source : ENP

Table 1-1-7 Mining and Industrial Products

Unit : Thousand

	Fiver Cement sheet	Sugar	Flour	Textile	Cigaret	Matchies	Cement	Soft Drink	Beer	Rum	Mixed Rum	Re-Bar Iron Ties	Process Milk	Vegetabl Oil	Vegetabl Lard	Mining Metal Content
Unit	sq.m	ton	ton	sq.m	20Pieces	50Pieces	ton	Dozens	Dozens	Liters	Liters	Kg	Liters	Kg	Kg	MT
1978		112.9	51.8	20,329	108,508	57,604	274.3	477,788	105,568	1,613	5,861	N.A	N.A	N.A	N.A	N.A
1979	2,099	145.9	53.5	16,844	115,576	46,120	288.4	522,588	124,584	1,708	6,203	N.A	N.A	N.A	N.A	N.A
1980	2,030	184.9	58.4	13,848	107,128	58,855	307.2	478,762	122,232	1,821	5,817	N.A	N.A	N.A	N.A	N.A
1981	1,680	189.0	56.0	11,478	107,988	62,096	310.9	522,635	116,148	1,955	5,875	N.A	N.A	N.A	N.A	N.A
1982	1,538	208.1	54.7	8,389	107,072	60,470	277.4	444,674	110,546	1,871	5,478	N.A	N.A	N.A	N.A	N.A
1983	1,878	210.4	61.6	11,955	101,221	64,081	485.4	489,606	131,160	1,705	4,882	N.A	N.A	N.A	N.A	N.A
1984	2,090	217.8	63.0	13,538	106,936	60,016	534.2	516,093	142,398	1,546	4,483	8,647	42,872	2,992	30,238	N.A
1985	2,470	212.6	66.9	11,598	115,594	65,166	347.5	533,452	132,204	1,555	4,272	16,371	46,377	2,095	29,495	N.A
1986	2,294	221.9	73.7	9,863	106,718	68,243	360.0	510,353	144,803	1,693	4,484	11,846	49,935	2,620	33,859	N.A
1987	3,204	186.9	74.4	15,149	104,565	62,141	451.2	586,704	153,377	1,684	4,129	16,599	53,477	6,883	35,067	N.A
1988	3,676	169.1	81.1	16,817	115,961	65,337	560.1	681,693	173,451	1,892	4,435	21,608	58,602	8,394	36,207	N.A
1989	4,302	187.3	81.7	16,676	127,990	72,823	648.8	693,634	187,934	2,046	4,427	19,737	58,237	10,132	36,158	40.24
1990	4,589	182.1	81.6	13,958	134,489	69,576	697.7	675,572	203,659	2,077	4,627	23,544	59,113	11,304	44,807	34.79
1991	4,717	174.8	N.A	15,996	126,487	61,484	693.0	887,160	188,982	2,287	5,308	20,077	50,653	9,542	43,007	48.37
1992	4,773	N.A	N.A	16,327	N.A	N.A	760.1	904,885	229,816	N.A	N.A	24,645	59,355	N.A	N.A	45.48

Source : Banco Central, Secretaria de Recursos Naturales

Table 1-1-8 Consumption of Petroleum

Unit : KL

	1985	1986	1987	1988	1989
Gasoline Super	70.4	77.1	91.4	100.8	116.4
Gasoline Regular	61.1	63.4	66.9	69.4	70.4
Kerosene	45.9	47.1	47.4	50.7	54.7
Diesel Oil	324.5	299.8	340.3	374.4	411.7
Fuel Oil	80.7	64.6	91.6	118.2	151.4
L.P.G	23.0	23.3	24.6	28.6	25.7
Gasoline/Aircraft	5.9	5.9	6.5	4.5	3.5
AV-JET-A-1	52.5	55.6	62.8	68.6	67.4
Asphalt 85/100	6.9	7.9	7.2	7.6	6.5
Asphalt RC-250	3.1	0.5	—	0.8	0.7
Asphalt MC-70	—	—	—	1.4	1.6
TOTAL	673.8	645.1	738.7	825.1	910.1

Source : Comision Administradora del Petroleo
Ministerio de Economia y Comercio

Table 1-1-9 Electric Consumption

Unit: million kwh

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Generation														
Electricty	720	819	899	979	1,037	1,125	1,184	1,384	1,460	1,783	1,939	2,031	2,281	2,318
Consumption	585	691	767	841	856	924	979	1,199	1,217	1,468	1,566	1,580	1,801	1,768
Residensial	150	178	211	240	264	282	291	330	340	372	405	436	502	539
Commercial	93	107	117	123	132	137	151	177	193	230	243	267	291	316
Industrial	87	109	135	164	152	162	170	168	146	151	155	187	192	179
Big company	207	236	243	238	248	277	292	282	264	265	314	336	352	371
Public light	17	18	19	21	19	25	28	27	27	28	30	31	32	26
Governmental	22	27	32	36	31	38	41	80	88	99	111	101	123	138
Foreign country	8	15	9	18	9	2	5	134	158	322	307	221	308	N.D
Consumption ENEE	1	1	1	1	1	1	1	1	1	1	1	1	1	
Loss of transmittion	136	128	131	138	182	203	205	185	242	316	373	448	494	549

Source : ENEE

Table 1-1-10 Capacity of Generation Plants

Unit : Kw

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
SantaFe	10,000	10,000	10,000	5,000	5,000	5,000	5,000	0	0	0	0
La Puerta S.P.S	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000
Puerto Cortes	30,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000
Miraflores	13,580	13,580	13,580	13,580	13,580	13,580	13,580	0	0	0	0
La Ceiba	26,600	26,600	26,600	26,600	26,600	26,600	26,600	26,600	26,600	26,600	26,600
San Lorenzo	4,160	4,160	4,160	4,160	4,160	4,160	4,160	0	0	0	0
Sub Total	99,340	129,340	129,340	124,340	124,340	124,340	124,340	101,600	101,600	101,600	101,600
Canaveral	28,500	28,500	28,500	28,500	28,500	28,500	28,500	28,500	28,500	28,500	28,500
Rio Lindo	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000
El Nispero	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500
El Cajon	0	0	292,000	292,000	292,000	292,000	292,000	292,000	292,000	292,000	292,000
Sub Total	131,000	131,000	423,000	423,000	423,000	423,000	423,000	423,000	423,000	423,000	423,000
Insulate System	12,802	13,352	13,482	13,615	13,615	13,945	15,565	15,565	2,290	1,920	1,820
Total	243,142	273,692	565,822	560,955	560,955	561,285	562,905	540,165	526,890	526,520	526,420

Source : ENEE

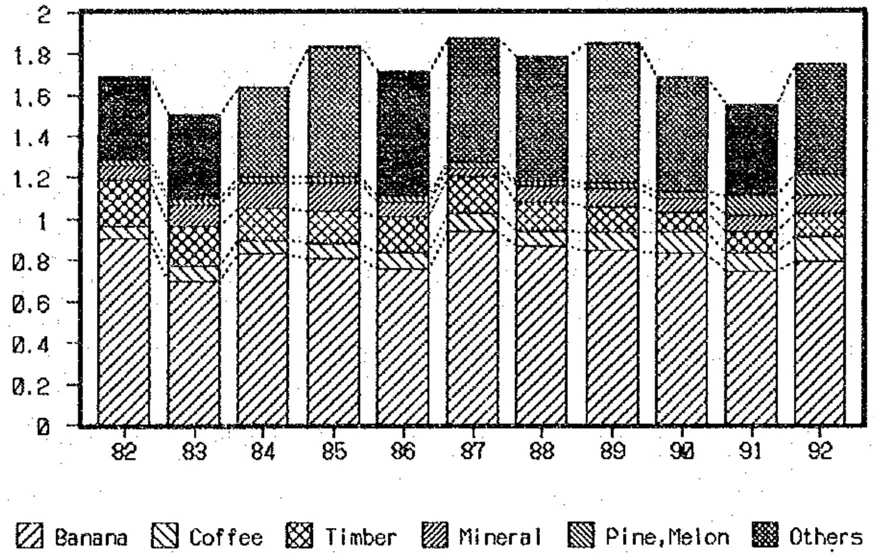

Fig. 1-1-1 Volume of Export Commodities
(Unit: Million MT)

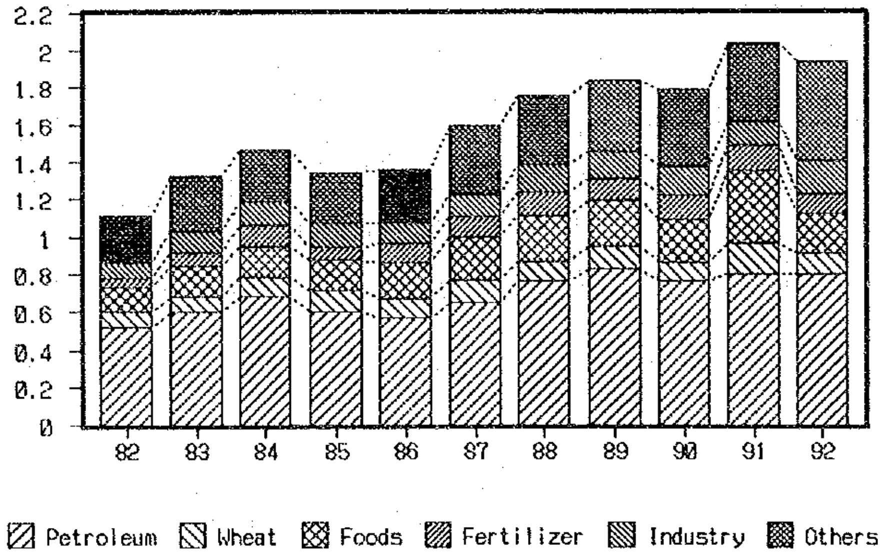

Fig. 1-1-2 Volume of Import Commodities
(Unit: Million MT)

Table 1-1-11 Cosumption of Petroleum for Generation

Unit : KL

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
SantaFe	962	1,249	313	0	0	0	0	0	0	0
La Puerta S.P	6,385	4,210	1,422	87	6	0	0	0	0	0
Puerto Cortes I	14,431	11,678	2,557	0	0	0	0	0	0	8,080
Puerto Cortes II	0	4,526	4,367	40	23	29	35	35	612	17,329
Miraflores	7,738	5,228	4,043	8	0	0	0	0	0	0
La Ceiba	81,087	7,532	2,875	97	119	271	72	35	202	7,299
Insulate Systems	9,364	9,490	10,006	8,172	9,487	10,565	9,515	2,774	1,373	1,517
Total	119,967	43,912	25,583	8,404	9,635	10,865	9,622	2,844	2,188	34,224

Source : ENEE

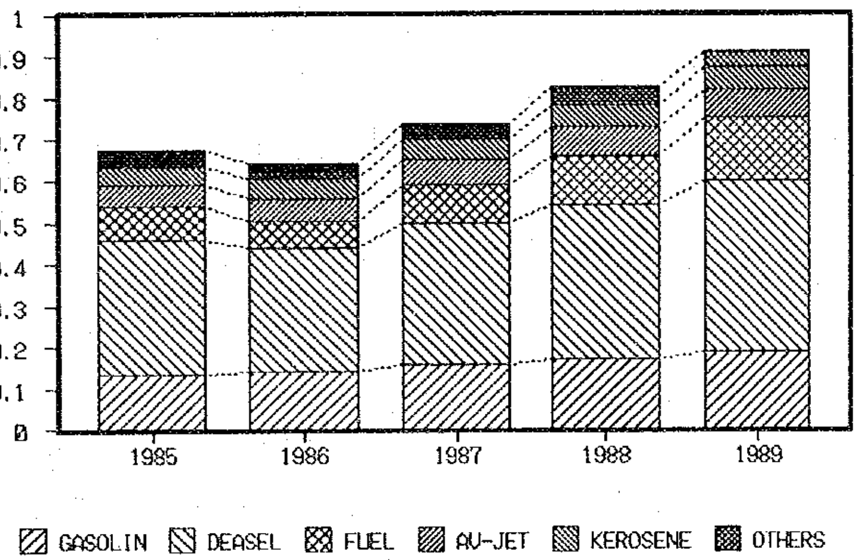

Fig. 1-1-3 Consumption of Petroleum
(Unit: Million KL)

Table 1-1-12 Vehicle Statistics

	1986	1987	1988	1989	1990	1991
For lease	13,394	11,997	12,190	13,187	14,664	17,037
Tourist car	2,257	1,891	1,999	2,706	3,331	4,071
Van	537	522	593	710	891	1,048
Pickup and Panel	1,100	636	511	424	390	422
Truck	6,085	5,910	5,181	4,891	4,184	4,632
Bus	3,410	3,032	3,287	3,228	3,507	3,954
Others	5	6	619	1,228	2,361	2,910
Particuler	70,990	82,692	91,023	101,411	112,417	129,170
Tourist car	23,937	26,900	29,846	32,833	35,267	39,634
Van	5,959	6,254	6,499	6,591	6,882	7,896
Pickup and Panel	33,326	41,353	45,724	51,896	54,419	62,953
Truck	5,853	6,342	6,528	7,054	7,667	8,894
Bus	1,648	1,794	2,054	2,160	2,449	3,056
Others	267	49	372	877	5,733	6,737
Other use	8,204	6,220	6,170	6,426	5,739	7,224
Mission internationa	1,620	1,606	1,772	1,144	315	900
Diplomat	420	343	169	187	17	150
Consul	58	52	11	10	26	100
Nationales	6,100	4,212	4,205	5,077	5,328	5,784
Officiales	6	7	7	8	53	65
National congress	-	-	-	-	-	225
Trailer	1,810	2,026	1,994	2,539	2,899	3,426
Total	94,398	102,935	111,377	123,563	135,719	156,857
Indices (1986=100)		109.04%	117.99%	130.90%	143.77%	166.17%
Growth rate for previouse year		9.04%	8.20%	10.94%	9.84%	15.57%
Population(Thousand)	4,174.7	4,313.4	4,456.8	4,604.8	4,757.8	4,915.9
Density／Automobile	44.22	41.90	40.02	37.27	35.06	31.34

Source : Banco Central

Table 1-1-13 Per capita Consumption of Food Products for Residential Area in 1987

Unit : Net Grams

Food Products	Metropolitan	Urban	Rural	National
Milk Products				
Cream	20.0	14.9	4.7	10.0
Fresh Cheese	15.9	21.2	13.6	15.4
Fluid Milk	138.7	82.5	37.1	68.9
Powder Milk	4.5	5.6	1.6	2.9
Meat				
Poultry	26.9	15.3	8.6	14.3
Pork	10.1	4.8	5.8	6.8
Beef	41.9	45.9	13.5	25.4
Fish and Sea Products	4.0	6.8	5.5	5.8
Eggs	32.5	28.2	22.6	25.9
Beans				
Red	42.3	51.3	68.4	59.5
Cereals				
Rice	51.0	50.5	36.3	51.7
Wheat Flour	13.6	16.8	7.9	10.5
Dry Grain Corn	2.5	0.9	5.5	4.0
Corn Tortilla	188.5	223.8	461.3	359.2
Sugars				
White Suger	39.4	46.9	35.9	38.6
Oils				
Vegetable Oil and Grease	36.0	35.8	22.0	27.9
Vegetable				
Coleslow	25.5	19.9	9.4	14.8
Tomata and Green Chile	32.3	25.6	14.9	20.8
Onion	11.7	8.3	7.5	7.5
Cucumber, Ayote	15.9	17.9	5.7	11.1
Potatoes and Roots	25.1	26.4	15.8	19.8
Fruits				
Citrics	56.4	17.5	7.8	21.6
Watermelon, Melon and Papaw	27.7	9.6	7.9	13.2
Plantains and Banana	77.1	79.8	49.0	61.0
Other Fruits	14.2	16.2	8.2	10.4
Other Products				
Coffee	7.0	7.3	10.1	8.9
Soft Drinks	97.4	66.1	18.6	45.3
Other Products				
Processed	103.4	69.6	37.0	58.5

Source : Basic feeding program, Planification, coordination and budget secretary (SECPLAN)

Table 1-1-14 Export Statistics ('82 - '92)

Unit:Thousand MT

Exports	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Meat	16,815	14,857	10,407	8,495	10,695	9,492	9,985	9,277	11,191	12,730	17,238
Shrinps										5,482	6,823
Plantains	996	587	1,438	16,637	14,988	11,471	8,522	5,007	2,530	1,259	13,370
Bananas	897,875	691,062	824,476	802,863	755,497	936,559	863,732	839,716	824,622	740,739	792,502
Pure of bananas	9,910	7,987	12,532	129,534	108,467	59,514	58,825	43,835	12,564	16,131	12,682
Coffee	57,900	75,132	68,896	72,903	79,614	86,915	76,401	88,254	104,444	87,574	118,756
Sugar	87,083	100,179	101,245	105,049	94,042	84,887	54,438	20,763	29,191	19,983	12,820
Tobacco	3,707	3,897	3,041	2,739	1,995	1,137	1,349	1,379	2,108	2,539	4,009
Timber	228,173	188,232	154,567	156,056	170,705	173,641	140,744	128,047	94,807	104,999	112,558
Furniture										109	243
Cement	10,769		2	15,827	44,760	61,022	109,920	210,563	105,748	36,492	29,167
Bulk minerals	66,803	101,957	126,777	139,166	71,791	38,032	79,519	88,040	66,530	82,396	87,825
Fuel and products		18,973	31,733	38,355	18,747	15,911	42,371	35,190	25,116	6,899	
Molasses	61,164	57,432	45,664	40,751	38,941	28,216	16,154	16,575	18,863	12,307	31,258
African Palm-oil			1,511	17,876	25,015	27,878	10,982	1,664			10,515
Pineapples	31,082	29,796	31,655	27,011	26,949	38,306	25,678	31,384	38,675	49,444	48,547
Grapefruit	10,959	11,218	12,496	11,408	16,543	14,245	12,691	17,403	13,777	12,728	16,930
Coconuts	2,302	2,075	1,933	1,608	1853	1,333	774	1,665	1,102	1,385	1,921
Mangos										71	271
Melons								106	516	47,256	58,028
Water melon										1,926	3,993
Lemon & Lime										1,189	608
Cotton	5,927	2,467	4,829	4,977	4,644	1,178		757	350	78	
Cotton seeds				9,500				61			
Vagrtable										11,030	14,357
Ornamental plants										2,740	3,368
Balsam liquid										57	66
Limestorn										2,486	1,806
Cacao										1,518	1,518
Corn or maize				10,207							
Textile										14,807	26,620
Resin										3,340	3,771
Nutts,African-palm				1,015							
Weight of Containers										218,652	252,513
Other products	169,292	165,336	177,906	199,018	195,566	258,777	272,038	301,274	308,695	37,128	42,484
Another countries' materials	27,761	31,867	32,976	22,983	25,990	22,957	9,484	13,504	18,693	22,014	27,208
Total Export	1,688,518	1,503,054	1,644,084	1,833,978	1,706,802	1,871,471	1,793,607	1,854,464	1,679,522	1,557,488	1,753,775

Table 1-2-1 Population Forecast of Honduras

Unit : Thousand

Year	Population				Rate of increase		
	Total Population	Population Density	Urban Population	Rural Population	Total Population	Urban Population	Rural Population
1974	2,820.3	25.2	884.4	1,935.9			
1975	2,914.0	26.0	930.6	1,983.4	3.322%	5.224%	2.454%
1976	3,010.8	26.9	978.8	2,032.0	3.322%	5.179%	2.450%
1977	3,110.8	27.8	1,029.3	2,081.5	3.321%	5.159%	2.436%
1978	3,214.2	28.7	1,082.0	2,132.2	3.324%	5.120%	2.436%
1979	3,321.0	29.6	1,137.0	2,184.0	3.323%	5.083%	2.429%
1980	3,431.3	30.6	1,194.6	2,236.7	3.321%	5.066%	2.413%
1981	3,545.3	31.6	1,254.7	2,290.6	3.322%	5.031%	2.410%
1982	3,663.1	32.7	1,317.4	2,345.7	3.323%	4.997%	2.405%
1983	3,784.8	33.8	1,383.0	2,401.8	3.322%	4.980%	2.392%
1984	3,910.6	34.9	1,451.5	2,459.1	3.324%	4.953%	2.386%
1985	4,040.5	36.0	1,523.0	2,517.5	3.322%	4.926%	2.375%
1986	4,174.7	37.2	1,597.6	2,577.1	3.321%	4.898%	2.367%
1987	4,313.4	38.5	1,675.5	2,637.9	3.322%	4.876%	2.359%
1988	4,456.8	39.8	1,756.9	2,699.9	3.325%	4.858%	2.350%
1989	4,604.8	41.1	1,841.7	2,763.1	3.321%	4.827%	2.341%
1990	4,757.8	42.4	1,930.3	2,827.5	3.323%	4.811%	2.331%
1991	4,915.9	43.9	2,022.8	2,893.1	3.323%	4.792%	2.320%
1992	5,079.2	45.3	2,119.2	2,960.0	3.322%	4.766%	2.312%
1993	5,248.0	46.8	2,219.8	3,028.2	3.323%	4.747%	2.304%
1994	5,422.3	48.4	2,324.8	3,097.5	3.321%	4.730%	2.288%
1995	5,602.5	50.0	2,434.3	3,168.2	3.323%	4.710%	2.282%
1996	5,788.6	51.6	2,548.5	3,240.1	3.322%	4.691%	2.269%
1997	5,980.9	53.4	2,667.5	3,313.4	3.322%	4.669%	2.262%
1998	6,179.7	55.1	2,791.9	3,387.8	3.324%	4.664%	2.245%
1999	6,385.0	57.0	2,921.4	3,463.6	3.322%	4.638%	2.237%
2000	6,597.1	58.9	3,056.4	3,540.7	3.322%	4.621%	2.226%
2001	6,762.0	60.3	3,162.7	3,599.3	2.500%	3.478%	1.656%
2002	6,931.1	61.8	3,272.4	3,658.7	2.500%	3.469%	1.649%
2003	7,104.4	63.4	3,385.6	3,718.7	2.500%	3.460%	1.642%
2004	7,282.0	65.0	3,502.5	3,779.5	2.500%	3.451%	1.634%
2005	7,464.0	66.6	3,623.0	3,841.0	2.500%	3.442%	1.627%
2006	7,650.6	68.3	3,747.4	3,903.2	2.500%	3.433%	1.620%
2007	7,841.9	70.0	3,875.7	3,966.2	2.500%	3.424%	1.613%
2008	8,037.9	71.7	4,008.0	4,029.9	2.500%	3.415%	1.606%
2009	8,238.9	73.5	4,144.5	4,094.4	2.500%	3.406%	1.599%
2010	8,444.8	75.3	4,285.3	4,159.5	2.500%	3.397%	1.592%

Source : Banco Central, Estimated by The Study Team

Table 1-2-2 Forecast of Population for States and Cities

Unit:Thousand

	1988			1988	1992	2000	2010
	SECPLAN	SECPLAN&Calculation		Banco Central	Banco Central	Banco Central	The Study Tea
		URBAN	RURAL				
Total Population	4,443.7			4,456.8	5,079.2	6,597.1	8,444.8
Atlantida	238.7	112.8	126.0	239.0	274.4	361.7	469.4
Colon	149.7	38.7	111.0	150.0	168.7	213.2	265.7
Comayagua	239.9	86.6	153.2	240.2	272.9	352.1	447.8
Copan	219.5	46.8	172.6	219.9	246.2	308.4	380.8
Cortes	662.8	433.7	229.1	663.0	774.5	1,055.0	1,410.7
Choluteca	295.5	72.7	222.8	296.1	332.6	419.3	521.3
El Paraiso	254.3	52.3	202.0	254.8	285.1	356.6	439.6
Francisco Morazan	828.3	604.0	224.3	828.3	974.4	1,344.6	1,818.2
Gracias a Dios	35.0	0.0	35.0	35.1	38.5	46.0	54.0
Intibuca	124.7	15.5	109.2	125.0	138.7	170.5	206.5
Islas de La Bahia	22.1	3.9	18.2	22.1	24.7	30.7	37.5
La Paz	105.9	18.5	87.4	106.2	118.4	147.2	180.2
Lempira	177.1	6.0	171.1	177.5	195.3	235.4	278.9
Ocotepeque	74.3	9.9	64.3	74.5	82.7	101.9	123.6
Olancho	283.9	58.5	225.4	284.4	318.3	398.1	490.7
Santa Barbara	278.9	61.1	217.8	279.4	313.1	392.6	485.4
Valle	120.0	30.5	89.5	120.2	135.1	170.7	212.5
Yoro	333.5	107.3	226.2	334.1	378.0	484.0	611.0
Urban Population	1,751.7	1,758.7		1,757.0	2,119.2	3,056.4	4,285.3
Rural Population	2,692.0		2,685.0	2,699.8	2,960.0	3,540.7	4,159.5
Urban Main Cities							
Destrito Central		577.6		579.3	703.4	1,014.5	1,567.5
San Pedro Sula		287.5		288.4	347.9	501.7	780.4
La Ceiba		68.8		69.0	83.2	120.0	186.7
Choluteca		54.5		54.7	66.0	95.2	148.0
El Progreso		60.1		60.3	72.7	104.9	163.2
Puerto Cortes		31.5		31.6	38.1	55.0	85.5
Comayagua		37.2		37.3	45.0	64.9	100.9
Tela				23.2	24.3	35.0	54.4
Siguatepeque				27.6	33.9	48.9	76.1
Santa Rosa de Copan				19.7	22.1	31.9	49.6
Danli				29.1	37.9	54.7	85.1
Juticalpa				19.7	23.5	33.9	52.8
Olanchito				14.0	16.6	23.9	37.2

Source : Banco Central, SECPLAN, The Study Team

Table 1-2-3 Labor Force by Economic Sectors of Honduras

Unit : Thousand

Year	Total Population	Labor Force	Propotion Labor Force	Agricul-tural	Mining	Industrial	Electric & Gas	Const-ruction	Commer-cial	Transpor-tation	Bank, Insurance	Service
1974	2,820.3	808.7	28.68%	487.5	3.7	89.7	2.5	25.9	62.8	22.0	8.7	105.9
1975	2,914.0	831.2	28.52%	494.2	4.0	93.6	2.6	27.4	66.2	24.5	9.3	109.3
1976	3,010.8	854.4	28.38%	501.0	4.0	98.7	2.8	28.1	69.7	25.8	9.7	114.6
1977	3,110.8	878.5	28.24%	507.5	4.2	104.2	2.8	29.5	73.4	26.2	10.4	120.3
1978	3,214.2	903.4	28.11%	514.0	4.3	109.5	2.9	33.1	77.3	28.9	10.6	122.9
1979	3,321.0	929.0	27.97%	520.6	4.5	115.1	2.9	37.2	81.3	31.7	10.7	124.9
1980	3,431.3	956.1	27.86%	528.4	4.6	120.5	3.1	39.0	85.9	33.9	11.0	129.6
1981	3,545.3	984.2	27.76%	536.3	4.8	126.2	3.3	41.0	90.6	36.3	11.4	134.3
1982	3,663.1	1,013.4	27.67%	544.3	4.9	132.2	3.6	43.1	95.5	38.9	11.8	139.2
1983	3,784.8	1,043.8	27.58%	552.4	5.0	138.4	3.8	45.3	100.8	41.7	12.2	144.2
1984	3,910.6	1,074.1	27.47%	568.5	5.2	142.4	3.9	46.6	103.7	42.9	12.5	148.4
1985	4,040.5	1,105.2	27.35%	584.8	5.3	146.6	4.0	47.9	106.9	44.1	12.9	152.7
1986	4,174.7	1,140.7	27.32%	605.9	4.4	150.9	4.1	49.3	110.0	45.4	13.4	157.2
1987	4,313.4	1,181.0	27.38%	622.2	3.4	156.1	4.6	51.8	114.3	46.7	13.7	168.1
1988	4,456.8	1,218.2	27.33%	640.5	4.1	160.6	4.9	54.8	117.5	48.1	14.0	173.6
1989	4,604.8	1,406.1	30.54%	673.2	4.1	165.5	8.7	76.8	140.6	39.6	24.3	273.3
1990	4,757.8	1,463.3	30.76%	687.9	4.1	172.4	9.5	82.5	148.3	41.2	26.1	291.3
1991	4,915.9	1,523.3	30.99%	702.8	4.1	179.6	10.3	88.7	156.5	42.8	27.9	310.5
1992	5,079.2	1,586.4	31.23%	718.1	4.1	187.1	11.2	95.4	165.1	44.6	29.9	330.9
1993	5,248.0	1,652.8	31.49%	733.8	4.2	194.9	12.2	102.5	174.2	46.3	32.0	352.8
1994	5,422.3	1,722.7	31.77%	749.7	4.2	203.0	13.2	110.2	183.8	48.2	34.3	376.0
1995	5,602.5	1,796.2	32.06%	766.0	4.2	211.5	14.4	118.5	194.0	50.1	36.8	400.8
1996	5,788.6	1,873.5	32.37%	782.7	4.2	220.3	15.6	127.4	204.7	52.1	39.4	427.2
1997	5,980.9	1,955.0	32.69%	799.7	4.2	229.5	17.0	137.0	216.0	54.2	42.2	455.4
1998	6,179.7	2,040.9	33.03%	817.1	4.2	239.0	18.5	147.2	227.9	56.3	45.2	485.4
1999	6,385.0	2,131.3	33.38%	834.9	4.2	249.0	20.1	158.3	240.4	58.6	48.4	517.4
2000	6,597.1	2,226.6	33.75%	853.1	4.2	259.4	21.9	170.2	253.7	60.9	51.8	551.5
2001	6,762.0	2,327.2	34.42%	871.6	4.2	270.2	23.8	182.9	267.7	63.4	55.5	587.9
2002	6,931.1	2,433.2	35.11%	890.6	4.2	281.4	25.9	196.7	282.5	65.9	59.5	626.6
2003	7,104.4	2,545.1	35.82%	910.0	4.2	293.2	28.1	211.4	298.0	68.5	63.7	667.9
2004	7,282.0	2,663.2	36.57%	929.8	4.2	305.4	30.6	227.3	314.5	71.2	68.2	712.0
2005	7,464.0	2,787.8	37.35%	950.0	4.3	318.1	33.3	244.3	331.8	74.1	73.1	758.9
2006	7,650.6	2,919.5	38.16%	970.6	4.3	331.4	36.2	262.7	350.1	77.0	78.3	808.9
2007	7,841.9	3,058.6	39.00%	991.8	4.3	345.2	39.3	282.4	369.4	80.1	83.9	862.3
2008	8,037.9	3,205.6	39.88%	1,013.3	4.3	359.6	42.8	303.6	389.8	83.3	89.9	919.1
2009	8,238.9	3,360.9	40.79%	1,035.4	4.3	374.5	46.5	326.4	411.3	86.6	96.3	979.7
2010	8,444.8	3,525.2	41.74%	1,057.9	4.3	390.2	50.6	350.9	434.0	90.1	103.1	1,044.3
Rate Past10 year	2.500%	4.288%		2.175%	0.199%	4.168%	8.745%	7.504%	5.515%	3.990%	7.119%	6.592%

SOUCE: BANCO CENTRAL, STUDY TEAM

Table 1-2-4 GDP by Economic Sector (Current Price)

Unit : Million Lempiras

	Agriculture, Forest, Hunt, and Fishing	Mine and Quarry Explotation	Industry Manufacture	Electricity Gas and Water	Construction	Commerce, Restaurant Hotel	Transport, Ware House Communicatio	Financial Establish Insurance	Service for Communal, Social	Private Housing	Public and Defence Admi.	Total G.D.P	PER CAPITA G.D.P lempiras
1978	933	73	520	42	199	507	229	200	315	188	227	3,433	1,068
1979	1,025	105	606	52	213	605	280	247	370	222	282	4,007	1,207
1980	1,087	96	687	64	270	730	313	297	453	250	346	4,593	1,339
1981	1,129	93	727	73	263	845	359	321	537	278	417	5,042	1,422
1982	1,132	109	768	81	320	821	365	320	560	315	440	5,231	1,428
1983	1,171	117	834	89	364	809	373	358	591	378	453	5,537	1,463
1984	1,236	131	915	104	384	812	388	398	635	445	488	5,936	1,518
1985	1,407	139	935	113	356	854	408	443	695	504	584	6,438	1,593
1986	1,400	114	972	229	286	915	462	475	787	558	608	6,806	1,630
1987	1,539	83	1,070	236	302	961	509	517	880	612	652	7,361	1,707
1988	1,742	126	1,244	241	365	1,027	567	597	963	662	664	8,198	1,839
1989	1,951	158	1,389	276	464	1,089	648	712	1,075	721	773	9,256	2,010
1990	2,503	194	1,823	353	574	1,289	703	826	1,290	790	814	11,159	2,345
1991	3,176	246	2,250	497	823	1,567	914	1,109	1,434	909	1,050	13,975	2,843
1992	3,436	310	2,628	580	1,123	1,735	1,004	1,286	1,543	1,018	1,167	15,830	3,117

Source : Banco Central

Table 1-2-5 GDP by Economic Sector
(Constant Price 78)

Unit : Millon Lempiras

	Agriculture Forest, Hunt and Fishing	Mine and Quarry Explotation	Industry Manufacture	Electricity Gas and Water	Const-ruction	Commerce, Restaurant Hotel	Transport, Ware House Communicati	Bank Establish Insurance	Service for Communal, Social	Private Housing	Public and Defense Social Admi.	G.D.P	Indices for 1978	Rate for Previous Year	Indices for 1992	Per Capita GDP Lempiras
1978	933	73	520	42	199	507	229	200	315	188	227	3,433	100.00%			1,068
1979	965	77	554	47	178	556	242	215	318	193	252	3,597	104.78%	4.78%		1,083
1980	985	66	529	52	202	560	249	209	336	209	262	3,659	106.58%	1.72%		1,066
1981	1,007	60	526	56	176	586	276	220	341	220	289	3,757	109.44%	2.68%		1,060
1982	1,052	72	502	60	208	518	297	207	320	232	278	3,746	109.12%	-0.29%		1,023
1983	983	78	534	64	228	480	305	211	319	244	266	3,712	108.13%	-0.91%		981
1984	1,056	87	575	67	240	462	317	230	313	236	273	3,856	112.32%	3.88%		986
1985	1,080	89	582	77	221	463	329	235	326	254	316	3,972	115.70%	3.01%		983
1986	1,072	83	606	82	177	507	334	247	360	258	314	4,040	117.68%	1.71%		968
1987	1,161	51	646	96	184	517	348	264	384	272	329	4,252	123.86%	5.25%		986
1988	1,155	69	678	108	211	531	372	299	406	288	331	4,448	129.57%	4.61%		998
1989	1,271	78	704	113	242	507	396	325	410	300	341	4,687	136.53%	5.37%		1,018
1990	1,285	71	709	128	218	503	411	335	406	313	291	4,670	136.03%	-0.36%		982
1991	1,366	78	719	129	230	514	423	353	373	323	285	4,793	139.62%	2.63%		975
1992	1,406	94	747	138	299	525	439	378	369	334	292	5,021	146.27%	4.76%	100.00%	989
1993	1,438	94	773	148	307	531	454	395	376	349	295	5,160	150.30%	2.76%	102.76%	983
1994	1,472	94	800	159	316	536	470	414	384	366	298	5,308	154.63%	2.88%	105.72%	979
1995	1,506	95	828	171	325	542	487	434	392	384	302	5,465	159.18%	2.94%	108.83%	975
1996	1,541	95	857	184	335	548	504	456	401	403	306	5,629	163.97%	3.01%	112.11%	972
1997	1,576	95	888	198	346	554	522	479	410	424	310	5,802	169.02%	3.08%	115.56%	970
1998	1,613	96	920	213	358	561	541	503	420	447	315	5,985	174.33%	3.15%	119.19%	968
1999	1,650	96	953	230	370	568	560	530	431	471	320	6,177	179.93%	3.21%	123.02%	967
2000	1,688	96	987	248	383	575	580	558	442	497	325	6,380	185.84%	3.28%	127.06%	967
2001	1,727	96	1,023	268	398	583	601	588	454	524	331	6,594	192.07%	3.35%	131.32%	975
2002	1,766	97	1,061	289	413	591	623	621	467	554	336	6,820	198.65%	3.42%	135.81%	984
2003	1,807	97	1,100	312	430	600	646	656	481	587	343	7,058	205.59%	3.49%	140.56%	993
2004	1,848	97	1,141	338	448	609	669	693	496	621	349	7,310	212.92%	3.57%	145.57%	1,004
2005	1,890	98	1,183	365	467	619	694	733	511	658	356	7,576	220.67%	3.64%	150.87%	1,015
2006	1,934	98	1,227	395	488	629	720	776	528	698	364	7,857	228.86%	3.71%	156.47%	1,027
2007	1,978	98	1,273	428	510	640	746	822	546	741	372	8,154	237.52%	3.78%	162.39%	1,040
2008	2,023	99	1,321	463	534	652	774	871	564	788	381	8,469	246.68%	3.86%	168.65%	1,054
2009	2,069	99	1,371	502	559	664	803	923	585	837	390	8,802	256.38%	3.93%	175.29%	1,068
2010	2,116	99	1,423	544	587	676	833	980	606	891	400	9,154	266.65%	4.01%	182.31%	1,084

Source : Banco Central, The Study Team estimation

Table 1-3-1 Estimation of GDP

Unit : Million Lempiras

		Actual & Estimated Population	Actual GDP	Scenario 1		Scenario 2	
				GDP	PER CAPITA GDP Lempiras	GDP	PER CAPITA GDP Lempiras
74	1974	2,820.3	2,589	2,589	918	2,589	918
75	1975	2,914.0	2,650	2,650	909	2,650	909
76	1976	3,010.8	2,901	2,901	964	2,901	964
77	1977	3,110.8	3,147	3,147	1,012	3,147	1,012
78	1978	3,214.2	3,433	3,433	1,068	3,433	1,068
79	1979	3,321.0	3,597	3,597	1,083	3,597	1,083
80	1980	3,431.3	3,659	3,659	1,066	3,659	1,066
81	1981	3,545.3	3,757	3,757	1,060	3,757	1,060
82	1982	3,663.1	3,746	3,746	1,023	3,746	1,023
83	1983	3,784.8	3,712	3,712	981	3,712	981
84	1984	3,910.6	3,856	3,856	986	3,856	986
85	1985	4,040.5	3,972	3,972	983	3,972	983
86	1986	4,174.7	4,040	4,040	968	4,040	968
87	1987	4,313.4	4,252	4,252	986	4,252	986
88	1988	4,456.8	4,448	4,448	998	4,448	998
89	1989	4,604.8	4,687	4,687	1,018	4,687	1,018
90	1990	4,757.8	4,670	4,670	982	4,670	982
91	1991	4,915.9	4,793	4,793	975	4,793	975
92	1992	5,079.2	5,021	5,021	989	5,021	989
93	1993	5,248.0		5,160	983	5,310	1,012
94	1994	5,422.3		5,308	979	5,615	1,035
95	1995	5,602.5		5,465	975	5,937	1,060
96	1996	5,788.6		5,629	972	6,278	1,085
97	1997	5,980.9		5,802	970	6,639	1,110
98	1998	6,179.7		5,985	968	7,020	1,136
99	1999	6,385.0		6,177	967	7,423	1,163
0	2000	6,597.1		6,380	967	7,850	1,190
1	2001	6,762.0		6,594	975	8,234	1,218
2	2002	6,931.1		6,820	984	8,638	1,246
3	2003	7,104.4		7,058	993	9,061	1,275
4	2004	7,282.0		7,310	1,004	9,506	1,305
5	2005	7,464.0		7,576	1,015	9,972	1,336
6	2006	7,650.6		7,857	1,027	10,460	1,367
7	2007	7,841.9		8,154	1,040	10,973	1,399
8	2008	8,037.9		8,469	1,054	11,511	1,432
9	2009	8,238.9		8,802	1,068	12,075	1,466
10	2010	8,444.8		9,154	1,084	12,667	1,500

Source : Banco Central, IDB, Estimated by The Study Team

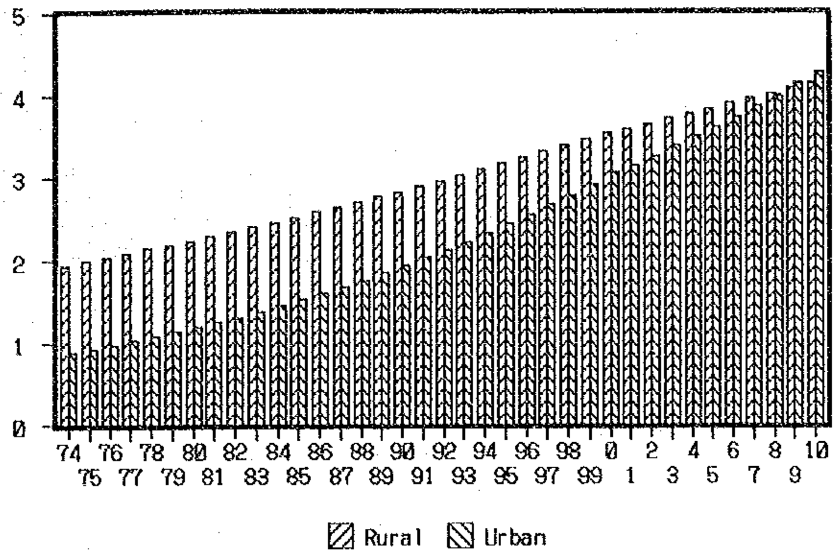

Fig. 1-3-1 Population Forecast
(Unit: Million)

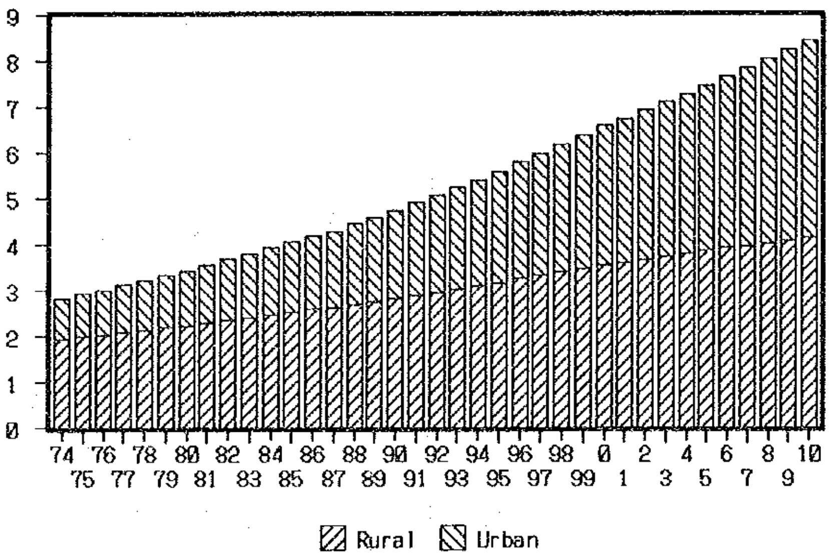

Fig. 1-3-2 Population Forecast
(Unit: Million)

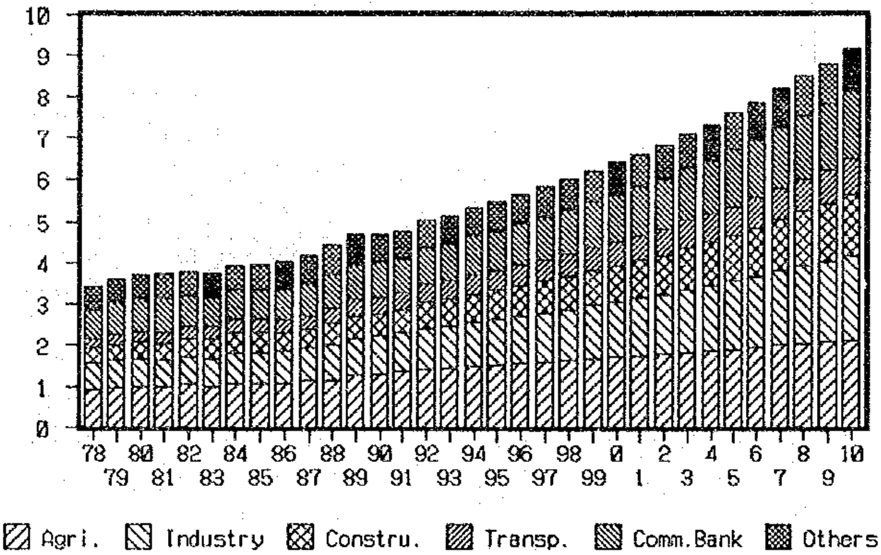

Fig. 1-3-3 GDP(Constant price 78)
(Unit: Million Lempiras)

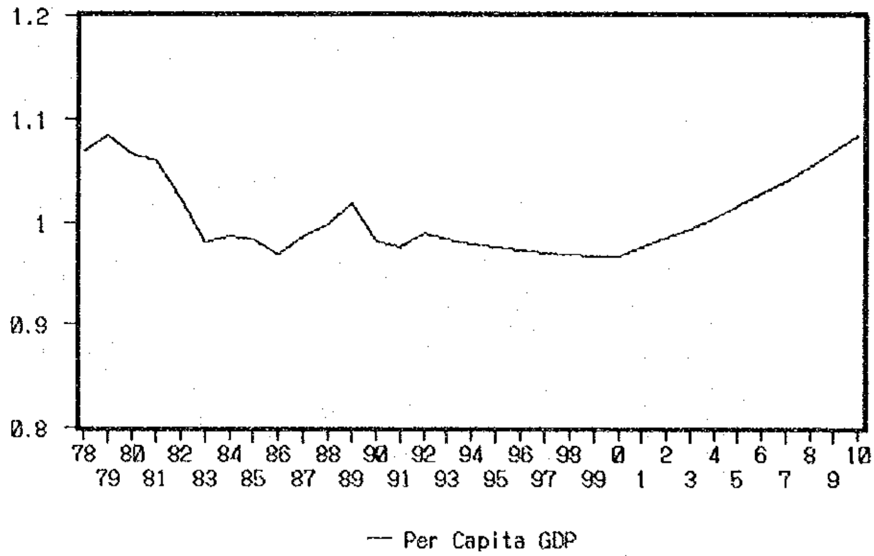

Fig. 1-3-4 Per Capita GDP by Scenario 1 (constant 78)
(Unit: Thousand Lempiras)

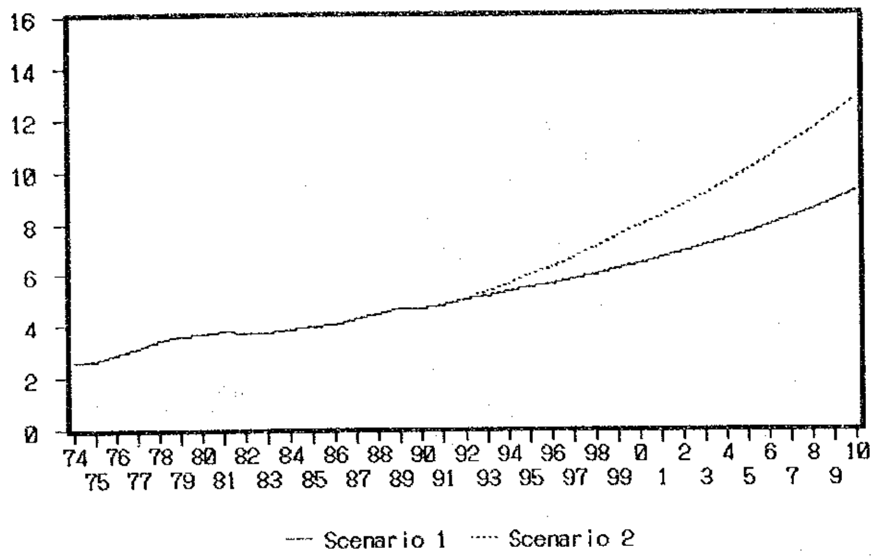

Fig. 1-3-5 Total GDP
(Unit: Million Lempiras)

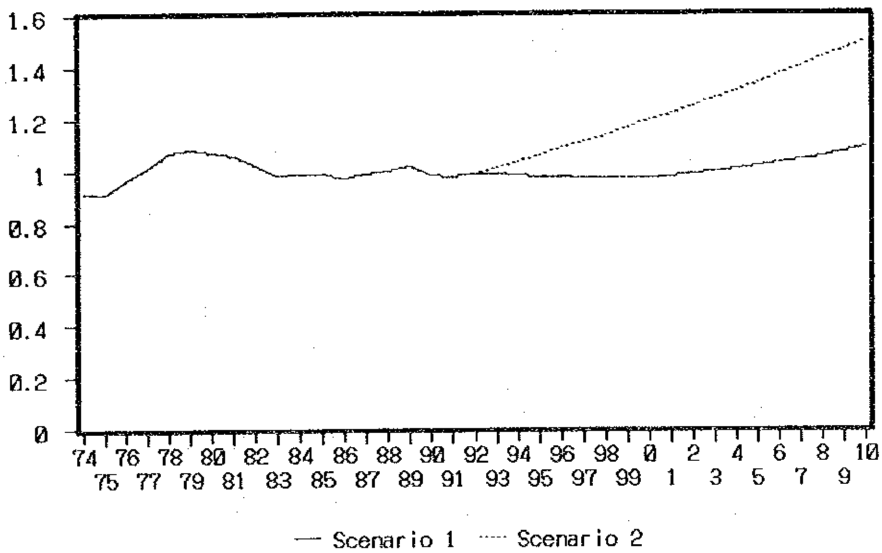

Fig. 1-3-6 Per Capita GDP
(Unit: Thousand Lempiras)