CHAPTER 1

OUTLINE OF SOUTHERN TAGALOG (REGION IV)

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1.1 Geography

Region IV, exclusive of Metro Manila, is as a rule called Southern Tagalog, which is composed of the southeast portion of the island of Luzon, Mindoro Island, Palawan Island, and other small islands located nearby.

Administratively, Southern Tagalog is divided into eleven (11) provinces; Batangas, Cavite, Laguna, Quezon, Rizal, Aurora, Marinduque, Occidental Mindoro, Oriental Mindoro, Palawan and Romblon. The region's land area is approximately 46,924 sq. km. or 15.6% of the country's total area (300,000 sq. km.) and ranks first in territorial size. Figure 1.1.1 shows the regional divisions of the Philippines and the administrative divisions within Region IV.

1.2 Demographic Profile

Southern Tagalog has a population of 6,119,000 as of 1980, accounting for 12.7% of the country's total population, and is the most populous area among the 13 regions.

The average annual growth rate of the population of Southern Tagalog is 3.2% from 1975 to 1980, higher than the national average. This could be attributed to the region's proximity to Metro Manila (Appendix 1.2.1).

As of the third quarter of 1982, 2,370,000 people are employed in Region IV (94.6% of the labor force), of which 44.6% are engaged in agriculture, fishing, and forestry, somewhat less than the national average of 51.9% (Appendix 1.2.2).

There are about 1.08 million households in Region IV as of 1981 and the average per household income is around 4,012 pesos per year (Appendix 1.2.3).

1.3 Geology

Region IV streaches from the Southwest Luzon Upland in the northeast to the Balabac Islands southwest of Palawan Island in the southwest. The regionis mostly ridges, upthrusted and/or uplifted belts of ophiloite and volcano plutonic complexes. The interventing low areas are sedimentary basins and through following uplift of foldings. The region longitudinally runs along active crustal underthrusting or subduction along its bordering trenches.

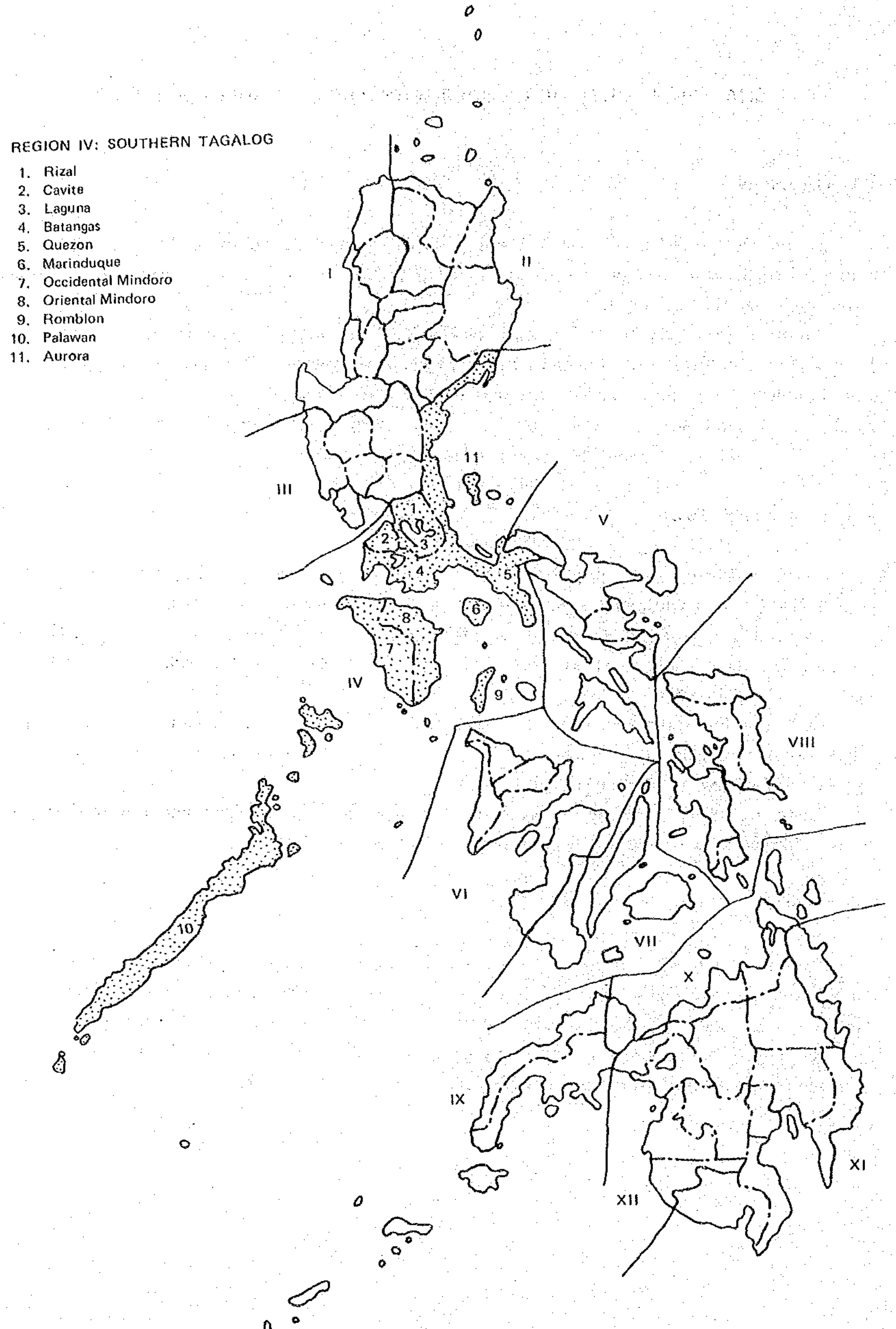

Fig. 1.1.1 Regional Map of the Philippines and Administrative Districts within Region IV

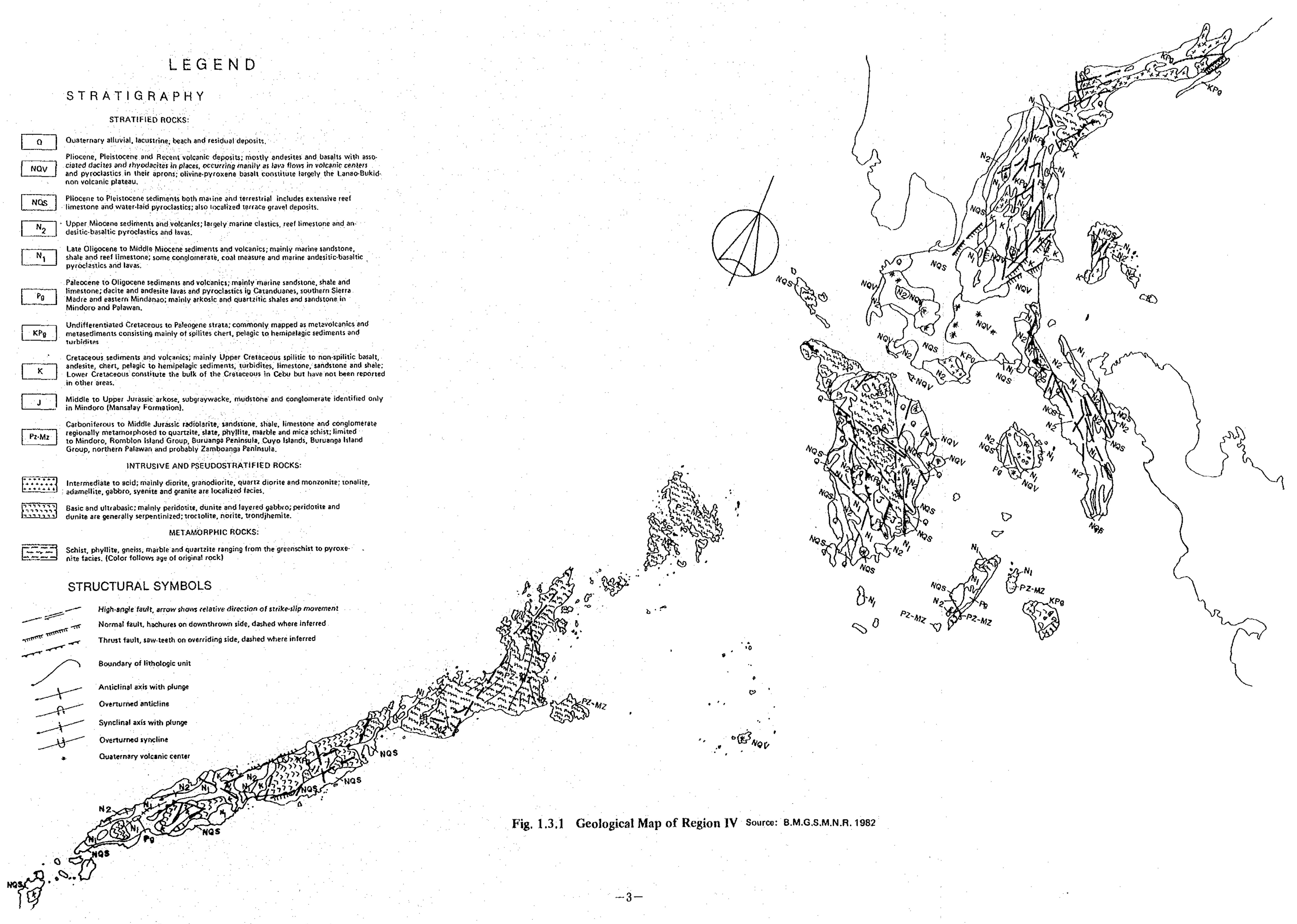

Fig. 1.3.1 Geological Map of Region IV Source: B.M.G.S.M.N.R. 1982

The Southwest Luzon Upland includes Rizal, Batangas, Laguna, Cavite and part of Bulacan and Quezon. Mts. Banahaw (2,177 m) and Makiling (1,109 m) are two prominent peaks; the Tagaytay ridge north of Taal Lake forms the boundary between Cavite and Batangas.

Mindoro Island is divided into Oriental and Occidental provinces by a ridge running north to south including Mt. Calavite (1,521 m), Mt. Halam (2,585 m), Mt. Baco (2,487 m), Mt. Peosevit (1,960 m) and Knob Peak (1,917 m).

The Palawan subprovince includes the Busuanga Island group, Palawan Island and the Balabac Island group. Palawan Island is entirely mountainous. Among the prominent peaks are Cleopatra's Needle (1,993 m), Mt. Kapoo (1,021 m), Victoria Peak (1,727 m) and Mt. Mantalingajan (2,054 m), the highest. A geological map of Region IV is shown Fig. 1.3.1.

1.4 Economic Profile

1.4.1 Gross Regional Domestic Product (GRDP) and Per Capita Output

In 1983, the GRDP of Region IV amounts to 13,877 million pesos (at 1972 prices), which accounts for 13.9% of the GNDP. The Region's GRDP represents a little less than one half of the GRDP of Metro Manila. (Appendix 1.4.1).

In 1982, the GRDP in Region IV is composed of the agricultural sector (3,916 million pesos or 28.8%), the industrial sector (5,503 million pesos or 40.5%), and the service sector (4,179 million pesos or 30.7%). The per capita GRDP is 2,081 pesos, slightly higher than the per capita GNDP of 1,951 pesos (Appendix 1.4.2).

1.4.2 Industrial Structure

Southern Tagalog is endowed with abundant natural resources and the main economic activities of the region are agriculture, fishery, forestry and industry.

(1) Agriculture

Of the total regional land area of nearly 4.7 million hectares, an estimated 1.39 million hectares or close to one third (29.7%) is under cultivation. This proportion is lower than that for the nation (39.4%). The regional effective crop area is over 1.6 million hectares devoted to food grains, vegetables, fruits and commercial crops including coconut and sugar cane.

The region's total output of rice during the crop year 1983 was over 0.80 million metric tons. Corn is next to rice among cereal crops and its output was over 0.26 million metric tons. Coconut and sugar cane are the most important commercial crops in Region IV (Appendix 1.4.2 (1)).

As for livestock, the region is the top-ranked producing area in the nation.

(2) Fishery

The marine waters of Southern Tagalog comprise a total area of 285,200 sq. km., or more than six times the regional land area. Region IV, as a major contributor to the national output of fish, landed 27.0% of the total catch in 1982 (Appendix 1.4.2 (2)).

(3) Forestry

Of all the administrative regions, Region IV has the largest forested area in the Philippines. The forest area in Region IV amounts to 20% of the entire national classified forest land (Appendix 1.4.2 (3)).

As for wood production in Region IV (including Metro Manila), log production is 221 thousand M^3, or 5% of total national production. Lumber production is 137 thousand M^3; or 11.4%, plywood production is 23 thousand M^3, or 5.5%, and veneer production is 20 thousand M^3, or 4.7%. Region IV is the fifth largest producer of wood products (Appendix 1.4.2 (4)).

(4) Mining and Manufacturing

i) Mining

Mineral production in Region IV for 1980 recorded a total value of 1.94 billion pesos, an increase of 3.1% over the 1979 level. Region IV ranked fourth and contributed 15.12% of the country's total mineral production.

Of the 1.94 billion pesos, 52% comes from non-metallic minerals such as cement, sand, gravel and salt, and 48% of the total represents metallic minerals such as copper, gold and nickel.

ii) Manufacturing

Table 1.4.1 shows the numbers, gross output and number of employees of manufacturing establishments by region.

For each of these categories, Region IV ranks second after the national capital region (Metro Manila).

Table 1.4.1 Manufacturing Establishments by Region

	Number of Establishments		Gross Output		Number of Employees	
	Number	%	(₱1,000,000)	%	(1,000 persons)	%
Philippines	85,236	100	137,535	100	1,177	100
Metro Manila	15,568	18.3	64,849	47.2	557	47.3
Region 1	9,454	11.1	1,888	1.4	41	3.5
2	4,584	5.4	672	0.5	25	2.1
3	9,152	10.7	17,407	12.7	94	8.0
4	12,435	14.6	26,137	19.0	145	12.3
5	6,517	7.6	1,183	0.9	32	2.7
6	7,399	8.7	4,653	3.4	63	5.4
7	3,826	4.5	6,400	4.7	59	5.0
8	2,201	2.6	400	0.3	11	0.9
9	2,539	3.0	1,235	0.9	17	1.4
10	3,535	4.1	4,179	3.0	45	3.8
11	5,035	5.9	4,548	3.3	56	4.8
12	2,991	3.5	3,977	2.9	30	2.5

Source: 1980 Annual Survey of Establishments (preliminary), NCSO

Major industries in Region IV include petroleum refining, food manufacturing, and production of textiles, cement, transport equipment, and clothing, followed by production of industrial chemicals, paper and paper products, and electrical machinery. As of 1980, the total number of manufacturing establishments in Region IV is 12,435, most of which are small firms. There are a few large establishments located in Batangas City such as those engaged in petroleum refining and food manufacturing (Appendix 1.4.2 (5)).

1.5 Transportation

1.5.1 Sea Transportation

The region's port system is composed of 82 public ports and 46 private ports in 1983. Of the total number of public ports, 15 are classified as national and the rest are classified as municipal ports.

The port of Batangas is one of the base ports in the region, and there are 55 public ports and 22 private ports under the supervision of PMU Batangas. A total of 8,740 thousand tons of cargo are loaded and unloaded at these ports in 1983. Of these, a total of 400 thousand tons of cargo are loaded and unloaded at the port of Batangas (Base Port).

Most of the cargo is handled by Ro-Ro vessels and ferry boats. The outline of the port of Batangas is described in detail in Chapter 2.

There are three main ports in Region IV other than Batangas: Calapan and San Jose on Mindoro Island and Puerto Pricesa on Palawan Island. The cargo volume handled at these ports and the major facilities of the ports are listed in Table 1.5.1.

Table 1.5.1 Outline of Calapan, San Jose and Puerto Princesa Ports

	Cargo Volume (1983)	Berthing Facilities	Storage Facilities
Calapan	63,000 tons	(-4 m) 104 m	One transit shed (576 m^2) Open storage area (3,430 m^2)
San Jose	192,000 tons	(-4.3 m) 42 m	One transit shed
Puerto Princesa	114,000 tons	(-10.21 m) 92 m	One transit shed (400 m^2) Open storage area (2,400 m^2)

1.5.2 Land Transportation

(1) Railways

Region IV is one of the few regions in the country that is served by the railway system. At present, there are two railway lines operating within the region and they are both owned by the Philippine National Railway (PNR).

One is the line that traverses Laguna, Batangas and Quezon, and the other is the Metro Manila Rail Commuter that runs between Metro Manila and Carmona, San Jose and Cavite, to serve the resettlement communities there.

Another 70 km. railway line runs between Calamba and Batangas City, but this line has not been used since the 1940's. All the existing lines are single track made up of 36 x 6 inch gauge rails.

(2) **Road Transportation**

The present national road networks and their traffic flows in Region IV-A and IV-B are shown in Fig. 1.5.1 to Fig. 1.5.3.

Trunk roads connecting major cities are almost developed. However, roads in rural areas are not yet developed in Region IV-A. Moreover, the national road is not yet connected to circulate around the coast of Mindoro Island.

The traffic flow in Region IV-A is large. Especially, the traffic flow on national road No. 19 connecting Batangas City with Metro Manila and on the South Luzon Expressway between Metro Manila and Canlubang is also very large and contributes to the regional development significantly.

The surface type of the national roads in Region IV-A and Region IV-B is shown in Fig. 1.5.4 to Fig. 1.5.6. Most of the national roads in Mindoro Island are not yet paved.

Road length by classification in Region IV is shown in Table 1.5.2. The pavement conditions of the national roads in Region IV are shown in Table 1.5.3.

Table 1.5.2 Road Length by Classification 1982

Unit: thousand km

Road Classification	National	Provincial	City	Municipal	Barangay	Total
Philippines	23,783	29,544	3,741	12,142	85,264	154,473
Region IV-A	2,131	1,999	219	864	5,380	10,592
(Batangas Province)	(406)	(651)	(–)	(237)	(1,873)	(3,167)
(Batangas City)	(70)	(–)	(20)	(–)	(139)	(229)
Region IV-B	1,452	2,212	67	518	3,747	7,996
(Occ. Mindoro)	(279)	(413)	(–)	(132)	(794)	(1,618)
(Or. Mindoro)	(269)	(751)	(–)	(67)	(235)	(1,322)

Source: MPWH Infrastructure Atlas, 1983

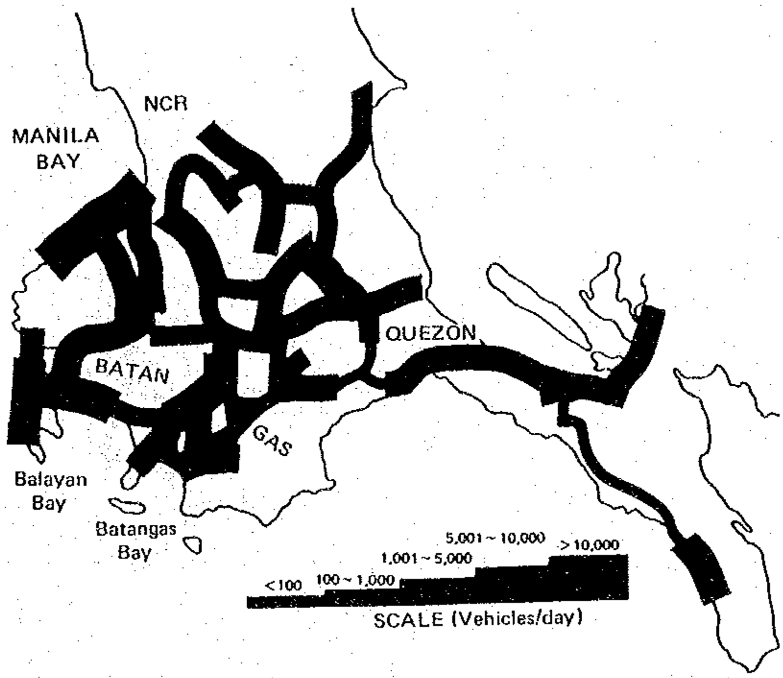

Fig. 1.5.1 Road Traffic Flow in Region IV-A

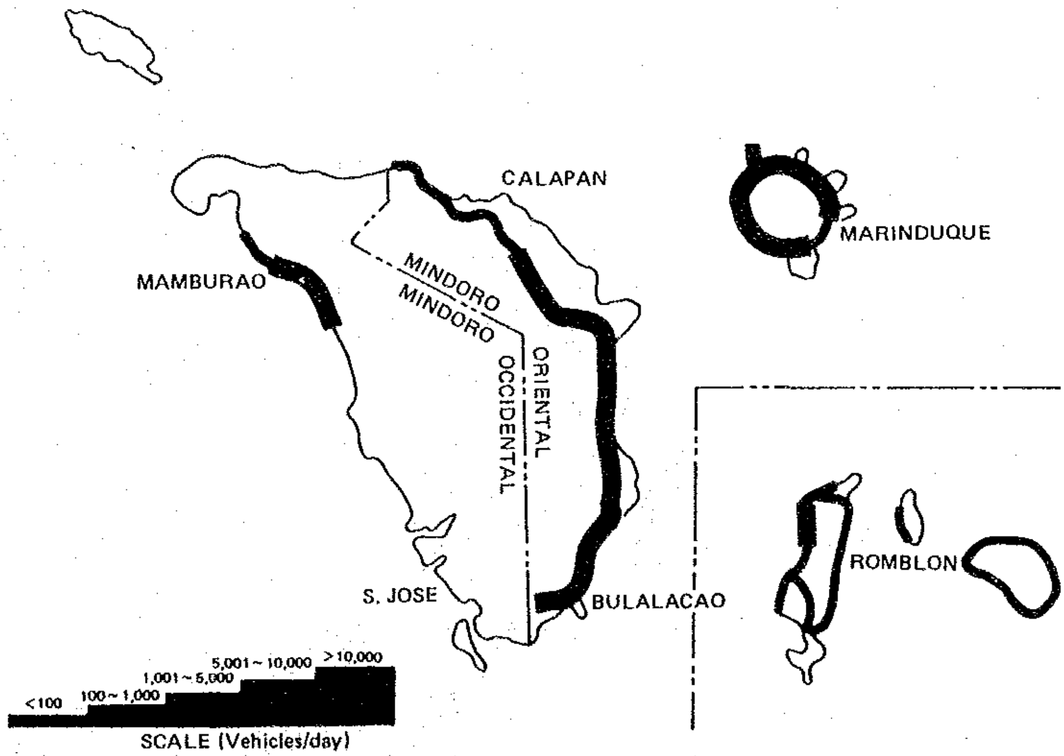

Fig. 1.5.2 Road Traffic Flow in Region IV-B (1)

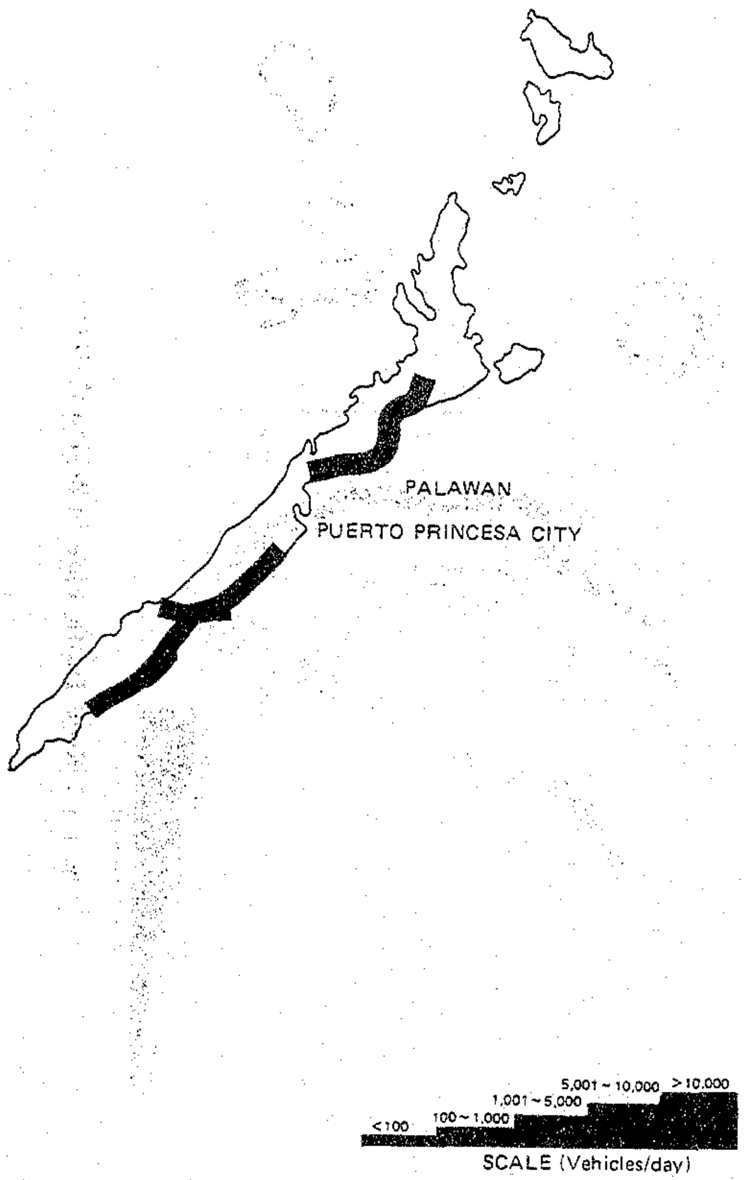

Fig. 1.5.3 Road Traffic Flow in Region IV-B (2)

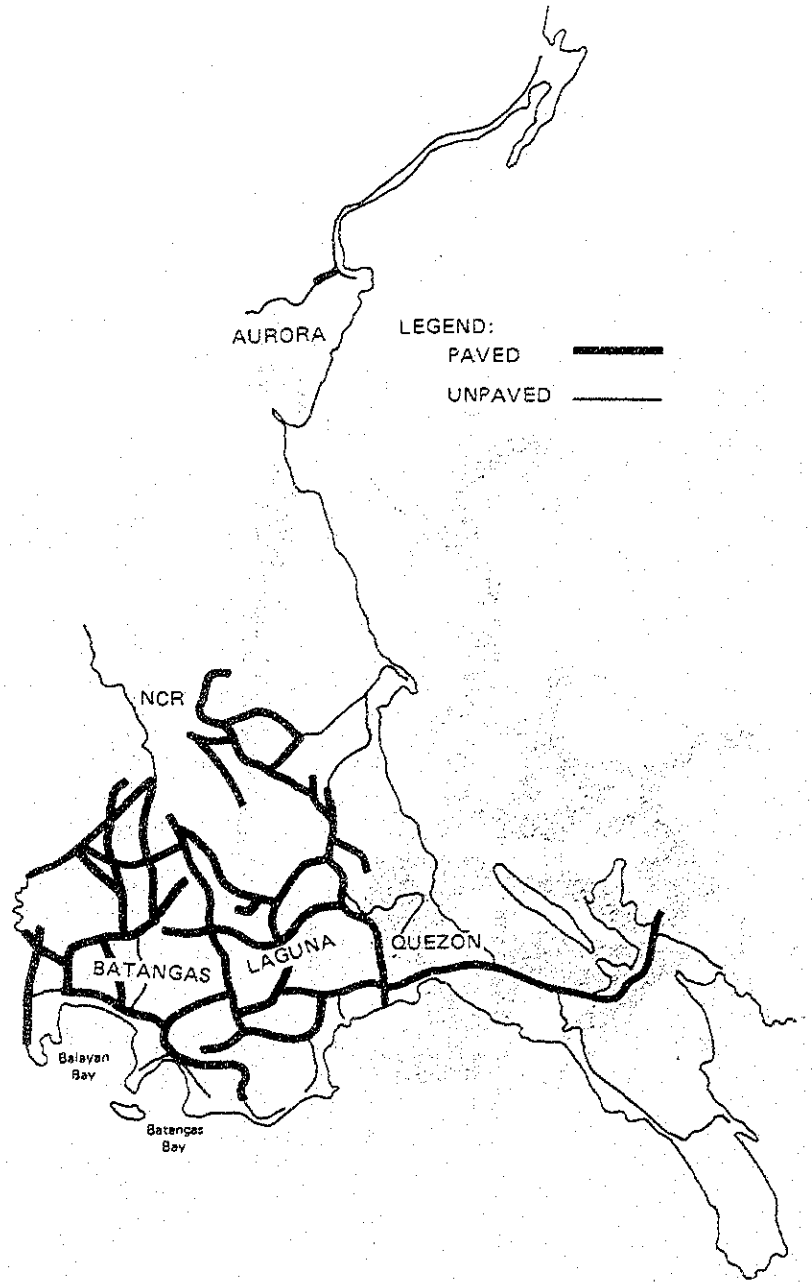

Fig. 1.5.4 National Roads in Region IV-A, 1982

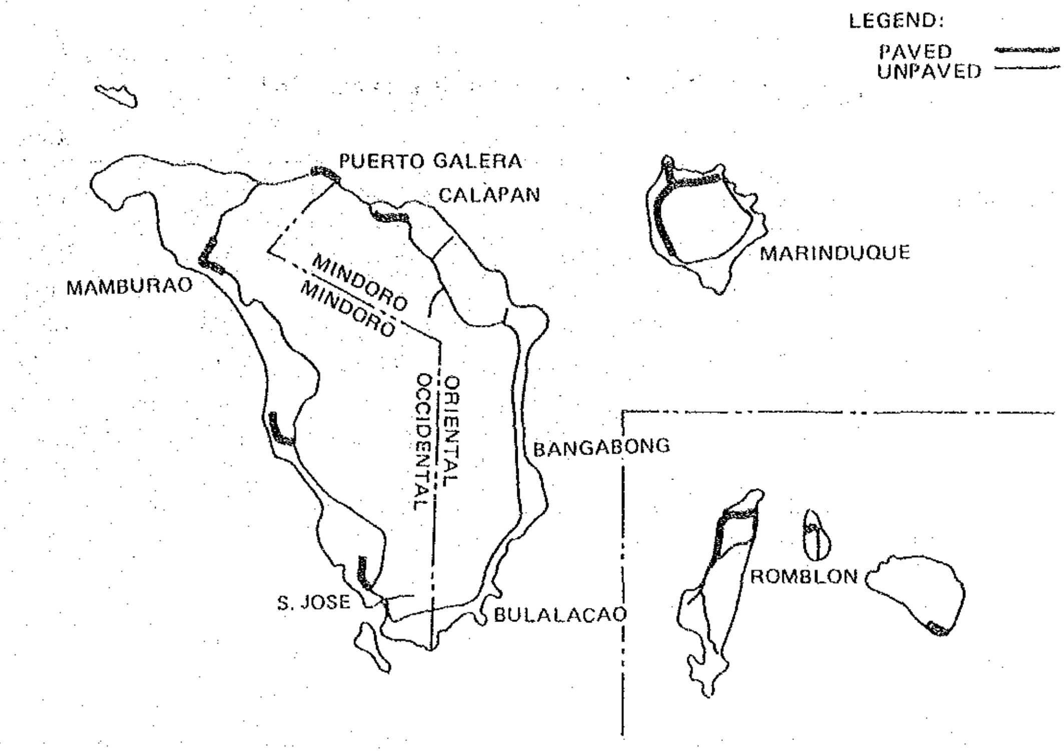

Fig. 1.5.5 National Roads in Region IV-B, 1982 (1)

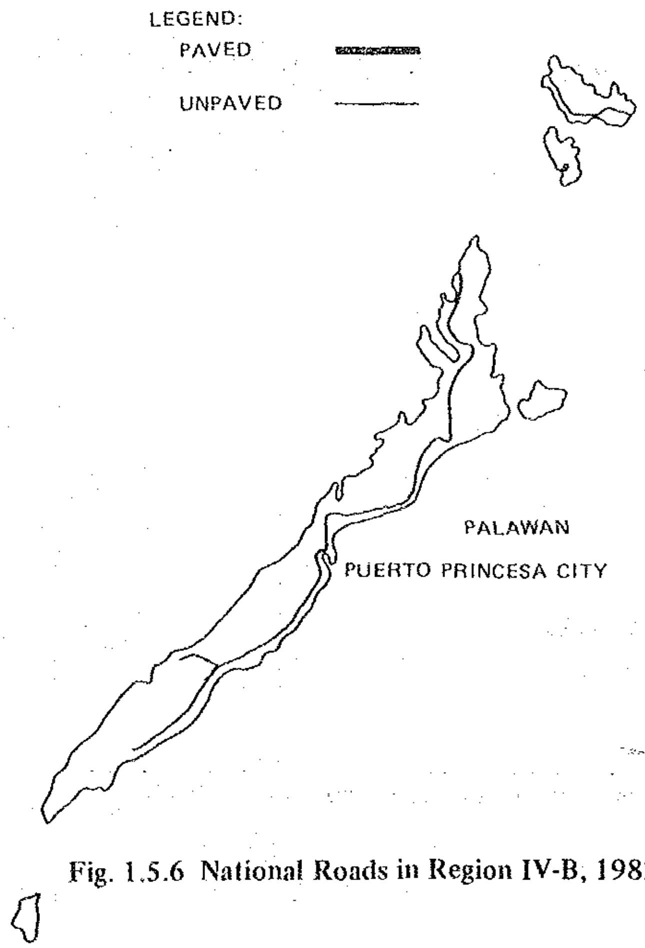

Fig. 1.5.6 National Roads in Region IV-B, 1982 (2)

Table 1.5.3 Road Length by Surface Type, 1982

Unit: km

Surface Type	Concrete	Asphalt	Gravel	Earth	Total
Philippines	5,547	4,918	12,431	886	23,783
Region IV-A	477	930	693	31	2,131
(Batangas Province)	(26)	(302)	(53)	(25)	(406)
(Batangas City)	(4)	(38)	(22)	(6)	(70)
Region IV-B	16	178	1,245	13	1,452
(Occ. Mindoro)	(8)	(15)	(244)	(13)	(280)
(Or. Mindoro)	(–)	(63)	(207)	(–)	(270)

Source: MPWH Infrastructure Atlas, 1983

1.5.3 Air Transportation

Since the Philippines are composed of more than seven thousand island, air transportation is relatively well developed and airports are scattered all over the country. In Region IV, there are 15 airports owned by the government. Of these, 7 are classified as secondary and 8 are feeder airports. Of the 15 airports, 11 or 73% are located in the resource sub-region (the island provinces). (Table 1.5.4)

Table 1.5.4 Existing Airports in Region IV, 1980

	Total Number of Airports
Regional Total	15
Growth Corridor	4
Batangas	–
Cavite	–
Laguna	–
Quezon	3
Rizal	1
Resource Subregion	11
Aurora	1
Marinduque	1
Occidental Mindoro	3
Oriental Mindoro	2
Palawan	3
Romblon	1

Source: Five-year Regional Development Plan (1983 ~ 1987)

CHAPTER 2
PORT ACTIVITIES AROUND BATANGAS BAY

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2.1 PMU Batangas

2.1.1 General Outlook

The project area, the Port of Batangas, is located in Batangas City in the northeast section of Batangas Bay in the southwestern part of Luzon island, approximately 100 km. south of Metro Manila: Latitude: 15°49'00" N; Longitude: 121°03'00" E. as shown in Fig. 2.1.1.

Batangas Bay has a deep crescent shape and faces towards the south. To the west the Calumpan peninsula, up to 500 meters high, and to the east Mt. Pinamucan, 600 meters high, protect the inshore areas and a large low lying plain of paddy fields, separated from the sea by an area of tidal swamps and fish ponds behind a narrow beach of low sand dunes. The Calumpang River forms a delta where it flows into the eastern side of the Bay.

Batangas City has a population of about 154 thousand as of May 1983 and its land area is 28,296 ha. It is the capital of the province of Batangas as well as the regional center of Region IV.

The port of Batangas is a Base Port under the jurisdiction of PMU Batangas and is used mainly for ferry and Ro/Ro boat service to Mindoro Island. The cargo volume handled at the Port is approximately 396 thousand tons in 1983, 4.5% of the total cargo volume of PMU Batangas. Most of the cargo volume at PMU Batangas is handled at private ports located around Batangas Bay.

2.1.2 Present Port Facilities

At Batangas Port, there are four wharfs owned by PPA. The dimensions of the wharfs are shown in Table 2.1.1.

Pier-I and II are used for accommodating Ro-Ro vessels and ferry boats plying between Batangas Port and the ports of Calapan, Puerto Galera, and Abra-de Ilog that are located on the northern periphery of Mindodo Island.

At pier III, it is currently difficult to maintain the necessary depth due to siltation. The cargo volume passing through this pier in 1983 accounted for merely 3% of Batangas' total. This pier is utilized mainly for handling silica sand, gypsum and pyrite by barges.

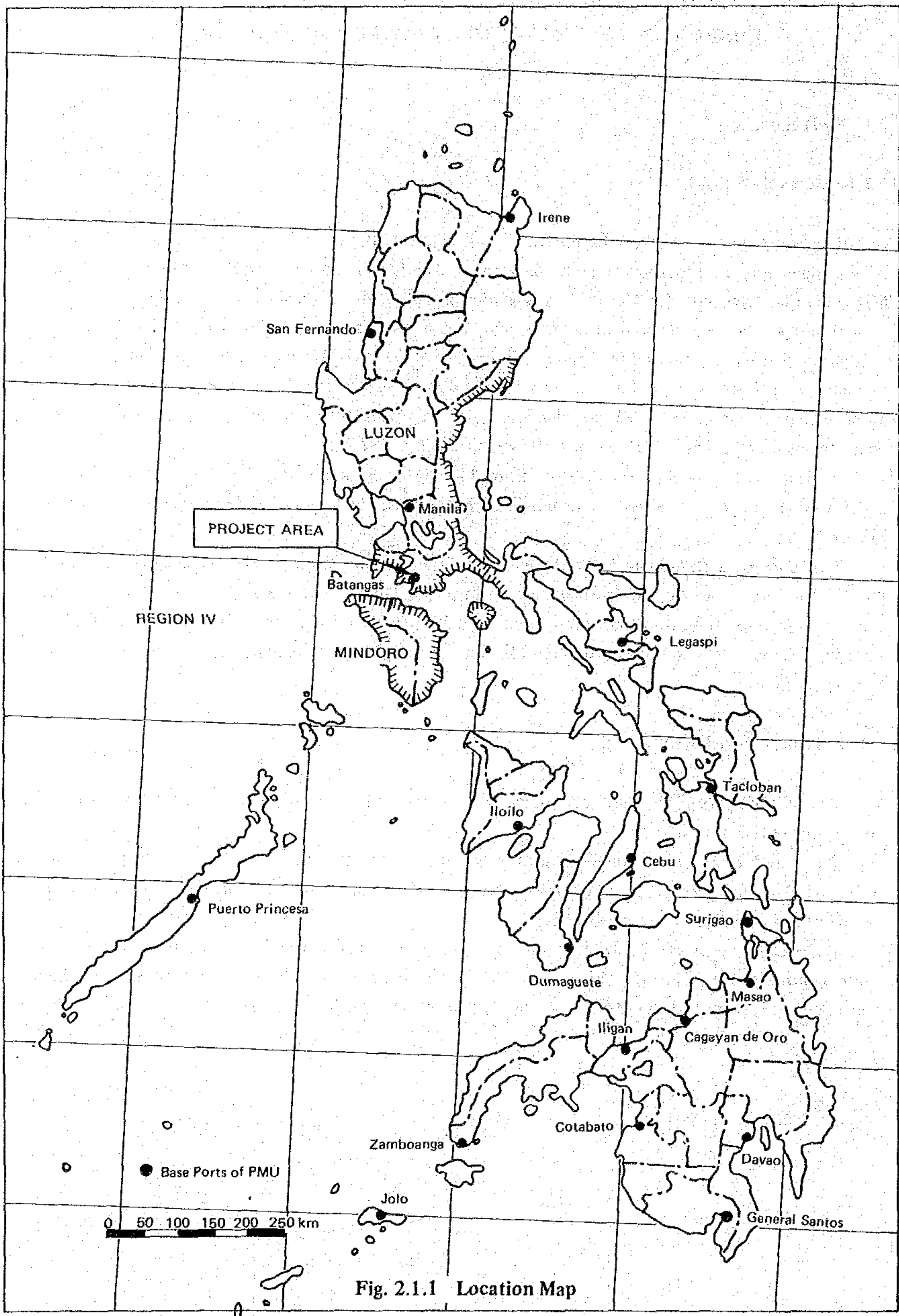


Fig. 2.1.1 Location Map

The marginal wharf connected with pier II is utilized for accommodating large size vessels that carry broken bulk cargoes such as lumber, logs, and general cargoes. The eastern side of the marginal wharf provides a berthing place for small vessels such as tug boats.

Table 2.1.1 Dimensions of Wharfs at Batangas Port

Wharf	Dimensions			Remarks
	L	W	D	
Pier I	135	15	6	Slab level + 2.47 m
Pier II	48	12	4	Slab level + 3.21 m
Pier III	85	15	2.67	Slab level + 3.94 m
Marginal Wharf	93	15	7.5	Slab level + 3.23 m

Note: L: Wharf Length (m) W: Wharf width (m)
D: Control Depth of water below MLLWL (−m)

There is one passenger shed with open sidings and a floor area of 112 m^2.

Behind the PMU Batangas office, an open "back-up" area is being constructed on reclaimed land in order to provide necessary space for smooth cargo handling and a parking lot for Ro-Ro ferry operations.

Fig. 2.1.2 shows the general layout of the Port of Batangas.

2.1.3 Traffic

(1) Cargo Volume

According to the annual statistical reports compiled by PPA, cargo volume handled at the ports under the jurisdiction of PMU Batangas totalled about 10.5 million tons in 1979. In 1981, the total cargo volume decreased to 8.1 million tons, and then slightly recovered to the level of 8.7 million tons in 1983. The most noteworthy feature of the present composition of cargo volume at PMU Batangas is the predominant share of private ports which are, for the most part, situated along Batangas Bay. Private ports handled 9.99 million tons in 1979, 7.35 million tons in 1981 and 7.98 million tons in 1983, as shown in Table 2.1.2. These cargo volume accounted respectively for 95.6%, 90.2% and 91.7% of the totals.

The base port of Batangas shared 225 thousand tons, or 2.2%, of the total cargo volume in 1979. However, the cargo volumes at the base port greatly increased from 1979 to 1983, particularly after the opening of the Ro-Ro shipping route connecting Batangas to Calapan, the capital city of Oriental Mindoro Province. In 1983, the cargo volume handled at Batangas Port increased to about 396 thousand tons with an average growth rate of 15.2% from the year of 1979.

Sub-ports share 3.0% of the total cargo volume in 1983. Judging from the fact that their cargo volumes have been increasing at almost the same growth rate as Batangas Port, it can be

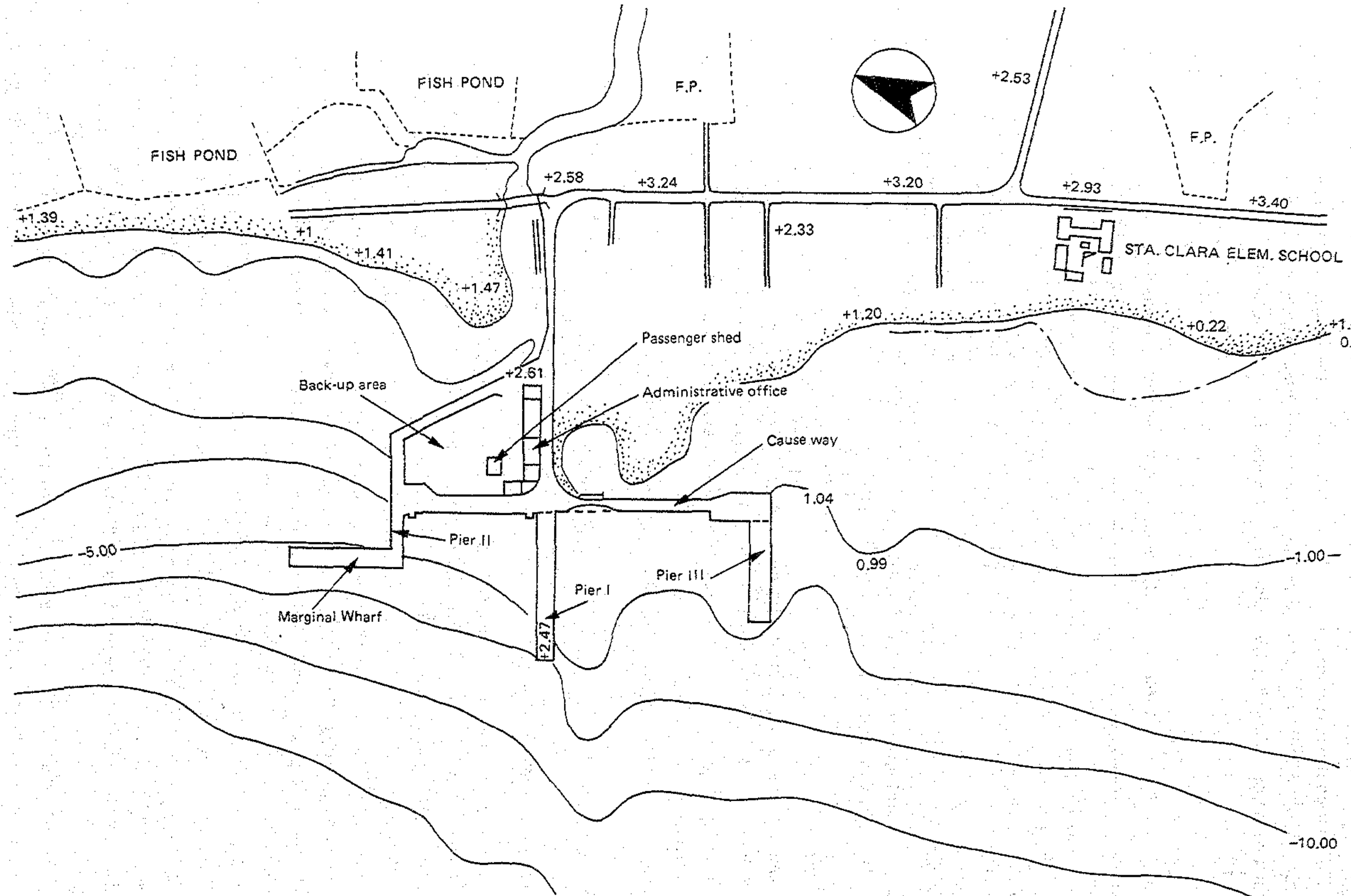


Fig. 2.1.2 General Layout of the Port of Batangas

Table 2.1.2 Summary of Cargo Statistics PMU Batangas 1979 ~ 1983

		Base Port of Batangas	Sub - Ports					Municipal Ports			Private Ports	Total
			Calapan	San Jose	Sta.Cru	Other Ports	Sub-Total	Bauan	Other Ports	Sub-Total		
1979	Domestic	171,744	76,084	-	34,134	39,578	149,796	87,306	-	87,306	3,128,629	3,537,475
	Foreign	53,165	-	-	-	-	-	-	-	-	6,861,622	6,914,787
	Sub-Total	224,909	76,084	-	34,134	39,578	149,796	87,306	-	87,306	9,990,251	10,452,262
1980	Domestic	187,100	133,138	(6,904)*	35,423	36,872	205,433 (* 6,904)	120,278	67,881	188,159	2,897,281	3,477,973 (6,904)*
	Foreign	173,993	-	-	-	-	-	-	-	-	5,877,393	6,051,386
	Sub-Total	361,093	133,138	(6,904)*	35,423	36,872	205,433 (* 6,904)	120,278	67,881	188,159	8,774,674	9,529,359 (6,904)*
1981	Domestic	223,294	194,072	91,014 (12,552)*	24,641	16,130	325,857 (12,552)*	71,459	15,040	86,499	2,351,955	2,987,605 (12,552)*
	Foreign	162,403	-	-	-	-	-	-	-	-	4,994,737	5,157,140
	Sub-Total	385,697	194,072	91,014 (12,552)*	24,641	16,130	325,857 (12,552)*	71,459	15,040	86,499	7,346,692	8,144,745 (12,552)*
1982	Domestic	279,248	253,386	20,053 (20,293)*	24,635	15,020	413,094 (20,293)*	38,247	11,487	49,734	2,372,541	3,114,617 (20,293)*
	Foreign	182,345	-	-	-	-	-	-	-	-	5,046,287	5,228,632
	Sub-Total	461,593	253,386	20,053 (20,293)*	24,635	15,020	413,094 (20,293)*	38,247	11,487	49,734	7,418,828	8,343,249 (20,393)*
1983	Domestic	357,331	662,944	161,557 (30,052)*	23,509	12,095	260,105 (30,052)*	50,885	15,707	66,592	2,614,859	3,298,887 (30,052)*
	Foreign	38,417	-	-	-	-	-	-	-	-	5,368,639	5,407,057
	Sub-Total	395,748	662,944	161,557 (30,052)*	23,509	12,095	260,105 (30,052)*	50,885	15,707	66,592	7,983,498	8,705,943) (30,052)*

* Cargo handled at the anchorage of San Jose Port. This figure is not included in the total.

Source: Annual Statistical Reports, 1979 - 1983, PPA.

said that the sub-ports are closely linked to the base port.

On the other hand, the cargo volume handled at municipal ports has been declining. The 1983 cargo volume of municipal ports has decreased to 66.6 thousand tons, an average annual decrease of 6.5% since 1979.

(2) Passengers

The total number of passengers passing through all the ports in the Philippines amounted to 16,331 thousands people in 1979, of which 1,360 thousand passed through the ports under the jurisdiction of PMU Batangas. In 1983, the total number of passengers in the Philippines increased to 19,068 thousand, of which 1,136 thousand people passed through PMU Batangas' Ports as shown in Table 2.1.3.

Table 2.1.3 Passenger Statistics by Port Management Unit 1979 ~ 1983

(000 persons)

PMU	1979	1980	1981	1982	1983
Manila	2,237	2,356	2,365	2,578	2,881
Cagayan de Oro	479	463	462	625	778
Batangas	1,360	1,358*	1,320*	1,441*	1,136**
Cebu	4,115	4,079	3,857	4,633	5,260
Iloilo	782	1,264*	1,464	1,442	1,822
Davao	213	193	277	208*	200
Iligan	447	483	428	460	477
Zamboanga	2,715	1,837	1,779	1,702	1,810
San Fernando	-	-	-	-	-
Surigao	233*	246*	420	401	426
General Santos	244	115	133	138	136
Tacloban	1,183	1,140	1,104	1,279	1,231
Dumaguete	865	981	1,060	1,039	1,134
Legaspi	373	327	289	275	339
Masao	432	541	397	393	473
Polloc	-	180	207	187	241
Puerto Princesa	28	49	63	67	70
Jolo	625	539	571	579	654
Irene	-	-	-	-	-
Total	16,331	16,151	16,196	17,447	19,068

* - includes transient passengers
** - based on the monthly records of PMU Batangas
Source: Annual Statistical Reports - 1979 - 1983, PPA.

(3) Cargo and Shipping

i) Major Commodities Handled at Batangas Port

According to the cargo statistics compiled by Batangas Port from 1979 to 1983 as shown in Table 2.1.4, inward cargo volume totalled about 119 thousand tons in 1979 and 227 thousand tons in 1983. Among all the commodities except "other general cargo", palay/rice has ranked first as a major commodity for the last five years. As for outward cargo, cement ranked first and bottled cargo second in 1983 (aside from "other general cargo"). The total volume of outward cargo amounted to 130 thousand tons in the same year.

ii) Foreign Cargo

According to the Annual Statistical Reports submitted by PPA, Batangas Port handled a total foreign cargo volume of about 182 thousand tons in 1982, the largest volume in the five years from 1979 to 1983, as shown in Table 2.1.5. However, the 1983 total volume decreased to only 38 thousand tons largely due to a decrease in cement export.

iii) Ferry and Ro-Ro Boat Traffic

In 1983 the total number of voyages and passengers at Batangas Port were 3,137 and 753,593 respectively (Appendix 2.1.1 (1)). The names and size of Ferry Boats and Ro-Ro vessels plying between Batangas and such ports as Calapan, Puerto Galera and Abra de Ilog are shown in Appendix 2.1.1 (2). Their schedules and the numbers of the berths at which they dock are listed in Table 2.1.6.

iv) Conventional Cargo Ships Calling at Batangas Port

According to Batangas Port shipping records for the year 1983, the number of domestic ship calls amounted to 753. Most of these ships were less than 1,000 DWT. The largest ship calling at Batangas Port for domestic trade was 6,000 DWT in 1983. Average tonnage was 942 DWT (Appendix 2.1.1 (3)).

As for foreign vessels calling at Batangas Port, the number of ship calls and the average tonnage of ocean going vessels were respectively, 30 and 16,944 DWT in 1983 (Appendix 2.1.1 (4)). The distribution patterns of the ship size of foreign vessels in 1981 and 1983 are shown together in Fig. 2.1.3.

Table 2.1.5 Foreign Cargo Statistics by Commodity Classification Port of Batangas (At Berth) 1979 ~ 1983

(M. ton)

COMMODITY	1979	1980	1981	1982	1983
IMPORT					
Minerals	-	5644	-	4000	-
General Cargo	3206	23	6056	17	1217
Sub-Total	3206	5667	6056	4017	1217
EXPORT					
Cement	49958	157041	132141	159207	35200
Minerals	-	-	-	1500	2000
General Cargo	1	11285	24206	17621	-
Sub-Total	49959	158326	156347	178328	37200
TOTAL FOREIGN TRADE	53165	168326	162403	182345	38417

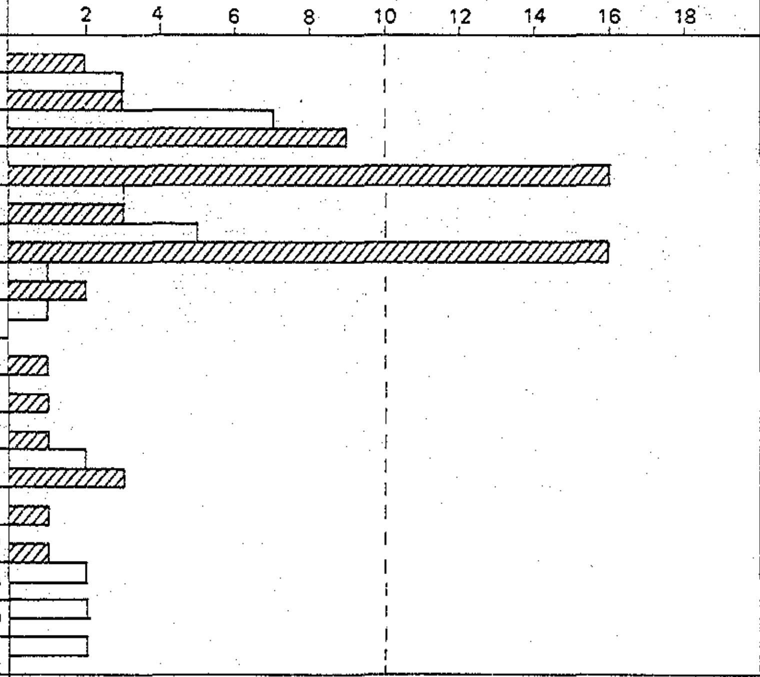
Source: Annual Statistical Reports, 1979-1983, PPA

Table 2.1.4 Domestic Cargo Statistics by Commodity Classification Port of Batangas (At Berth) 1979 ~ 1983

(M. ton)

Commodity	1979	1980	1981	1982	1983
INWARD					
Live Animals	10,690	12,605	9,409	6,659	4,782
Palay/Rice	25,350	38,791	32,414	37,706	33,831
Corn	4,498	4,080	4,162	5,808	4,635
Other Cereals	407	674	181	287	216
Calamansi	17,347	19,560	17,905	16,916	20,039
Bananas	4,498	7,810	9,105	3,584	13,960
Fruits & Vegetables	4,013	2,589	5,821	4,986	8,220
Bottled Cargo	10	68	–	182	134
Empty Bottles	1,246	1,880	3,203	8,634	9,337
Other Cons. Goods	89	53	263	104	345
Copra	4,706	6,393	13,406	15,032	19,969
Cement	40	–	8	27	3,593
Chemicals	611	1,819	3,284	2,700	–
Logs/Lumber	14,596	19,955	14,046	14,665	16,854
Animal Feeds	1,776	3,355	2,895	2,935	2,851
Plywood/Veneer	2,507	1,789	3,057	1,967	1,436
Metal Products	133	64	15	1,175	187
Fish	752	716	805	636	597
Other Gen. Cargo	9,396	6,865	25,474	39,518	65,178
Fertilizer	–	–	12	32	26
Minerals	16,343	14,883	8,997	15,218	21,030
Oil Products	75	61	6	6	–
Sugar	11	7	–	4	1
Sub-total	119,094	144,017	154,468	178,781	227,221
OUTWARD					
Live Animals	32	6	11	8	13
Palay/Rice	157	142	9	15	17
Corn	30	9	10	133	80
Other Cereals	1,468	1,502	1,731	1,863	1,686
Fruits & Vegetables	1,271	1,303	1,729	1,588	1,299
Sugar	4,428	3,902	2,983	2,923	2,403
Bottled Cargo	5,016	5,072	7,737	11,448	15,640
Empty Bottles	28	45	6	184	122
Copra	2	–	100	2	119
Other Cons. Goods	2,603	4,159	6,073	5,340	6,436
Cement	21,467	8,057	11,990	17,691	20,491
Fertilizer	3,957	2,886	2,901	4,163	4,606
Minerals	56	–	1	3	1
Chemicals	154	1,486	1,310	116	391
Logs/Lumber	443	88	47	346	2,558
Plywood/Veneer	139	37	107	280	208
Animals Feeds	747	783	1,019	961	1,079
Metal Products	304	183	424	280	352
Oil Products	53	26	27	32	340
Fish	156	70	107	35	285
Other Gen. Cargo	10,139	13,327	30,504	53,056	71,984
Sub-total	52,650	43,083	68,826	100,467	130,110
Total Domestic Trade	171,744	187,100	223,294	279,248	357,331

Source: Annual Statistical Reports, 1979 ~ 1983, PPA.



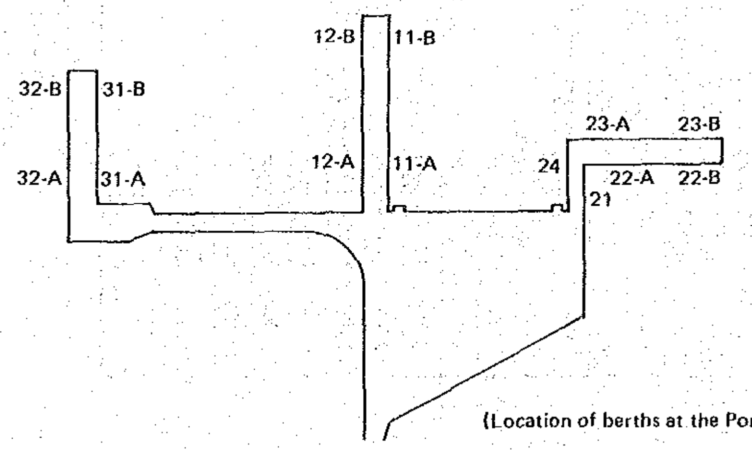
DWT	Number 1981	Number 1983	Accumulated (%) 1981	Accumulated (%) 1983
< 1,000	2	2	3.4	6.7
1,000 < 2,000	3	3	8.5	16.7
2,000 < 3,000	9	7	23.7	40.0
3,000 < 4,000	16	–	50.8	40.0
4,000 < 5,000	3	3	55.9	50.0
5,000 < 6,000	16	5	83.1	66.7
6,000 < 7,000	2	1	86.4	70.0
7,000 < 8,000	–	1		73.3
8,000 < 9,000	1	–	88.1	
9,000 < 10,000	1	–	89.8	
10,000 < 12,000	1	–	91.5	
12,000 < 15,000	3	2	96.6	80.0
15,000 < 20,000	1	–	98.3	
20,000 < 30,000	1	–	100	
30,000 < 50,000	–	2		86.7
50,000 < 75,000	–	2		93.3
75,000 <	–	2		100
Total	59	30	100	100

Note: (hatched): 1981 (blank): 1983
Average tonnage (DWT): 8,580 DWT (1981), 16,944DWT (1983)
Source: Monthly Records, PMU Batangas, 1981 and 1983

Fig. 2.1.3 Distribution of Ship Size of Oceangoing Vessels

Table 2.1.6 Arrival and Departure of Ferry Boats at Batangas

Ship Name	Origin and Destination	Berth No.
	Departure from Batangas to Calapan	
Viva 44 –	0745 H	12-A
Maynilad II (Ro-Ro) –	0900 H	11-A
Peñafrancia (Ro-Ro) –	0900 H	24
Viva 66 –	1200 H	12-B
Sto. Niño (Ro-Ro) –	1730 H	24
Viva 99 –	2100 H	12-A
Maynilad III (Ro-Ro) –	2100 H	11-A
	Arrival from Calapan to Batangas	
Sto. Niño (Ro-Ro) –	1130 H	24
Maynilad III (Ro-Ro) –	1130 H	11-A
Viva 99 –	1430 H	12-A
Maynilad II (Ro-Ro) –	2000 H	11-A
Peñafrancia (Ro-Ro) –	2000 H	24
Viva 44 –	2230 H	12-A
Viva 66 –	0030 H	12-B
	Arrival from PTO. Galera to Batangas	
Queen AC II or Princess AC IV –	0945 H	12-B
	Departure from Batangas to PTO. Galera	
Queen AC II or Princess AC IV –	1245 H	12-B
	Arrival from Abra de Ilog to Bats.	
Doña Matilde or Doña Paula –	1300 H	21
	Departure from Bats. to Abra de Ilog	
Doña Matilde or Doña Paula –	1200 H	21



(Location of berths at the Port of Batangas)

2.1.4 Management and Operations

(1) Organization

The Philippines Ports Authority (PPA) was created in July 1974 under Presidential Decree No. 505 and subsequently amended by P.D. 857 in December 1975.

The PPA has administrative and operational branches which are called Port Management Units (PMU), and there exist at present 19 PMUs all over the nation. (Fig. 2.1.1).

PMU Batangas controls the ports located in the Province of Batangas, and in the Provincess and sub-provinces of Quezon and Aurora, Oriental Mindoro, Occidental Mindoro and Marinduque. PMU Batangas is managed and operated by the port manager, under whom there are six main sections:

i) Port Operations Section	iv) Engineering Section
ii) Administrative Section	v) Finance Section
iii) Security Section	vi) Development Section

Organizational charts of PPA and PMU Batangas are shown in Figure 2.1.4.

PMU Batangas also supervises and monitors municipal ports (50), private ports (22), and national ports (5) located in the above mentioned provinces as follows: the Port of Batangas (Batangas city) and the sub-ports of Calapan (Calapan, Oriental Mindoro), San Jose (San Jose, Occidental Mindoro), Siain (Plaridel, Quezon), Balanacan (Mogpog, Marinduque) and Sta. Cruz (Marinduque). Of the national ports, the port of Batangas ranks number one in terms of ship and cargo traffic.

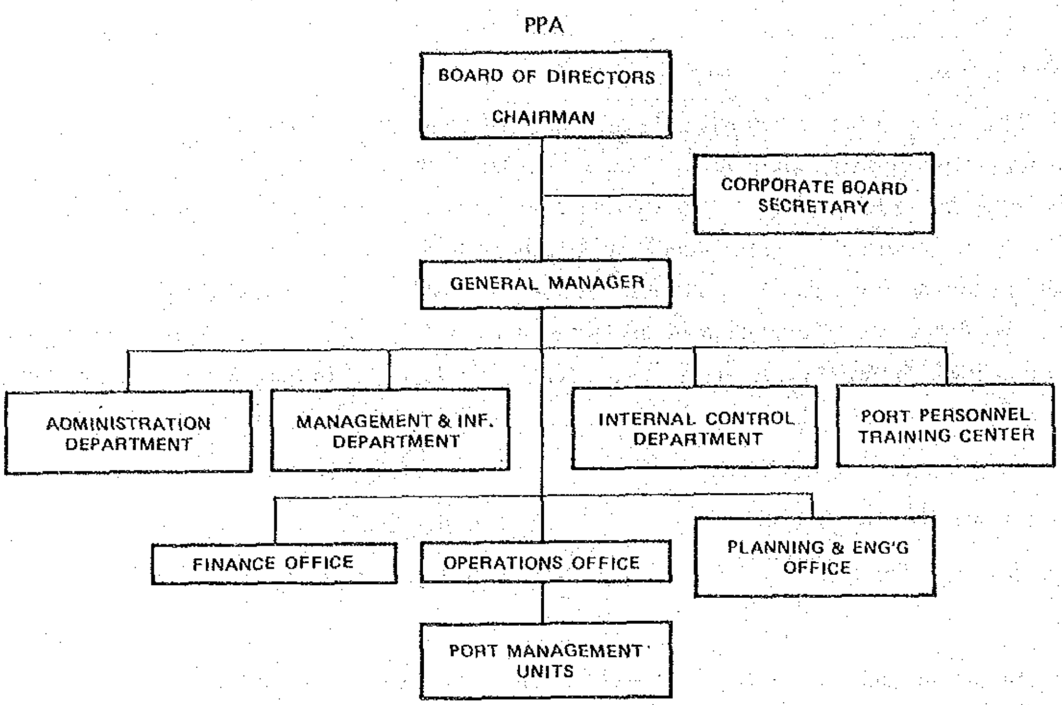
(2) Port Tariffs

New port tariffs were approved by the President of the Philippines on June 27, 1983 and have been effective since August 1, 1983. This amendement accompanied approval of port tariff increases totalling 135% in the following 6 steps:

1st step on August 1, 1983	15%
2nd step on October 1, 1983	20%
3rd step on April 1, 1984	20%
4th step on October 1, 1984	20%
5th step on April 1, 1985	30%
6th step on October 1, 1985	30%

This amendment includes not only an increase in rates but also a restructing of the former complex schedule of charges. Details of the current port tariffs are presented in Appendix 10.4.3.

Meanwhile, it is noted that some of the import and export cargoes are exempt from payment of port charges because they are shipped for governmental institutions or in order to promote exports. Table 2.1.7 shows entities enjoying exemption from payment of port charges at PMU Batangas.



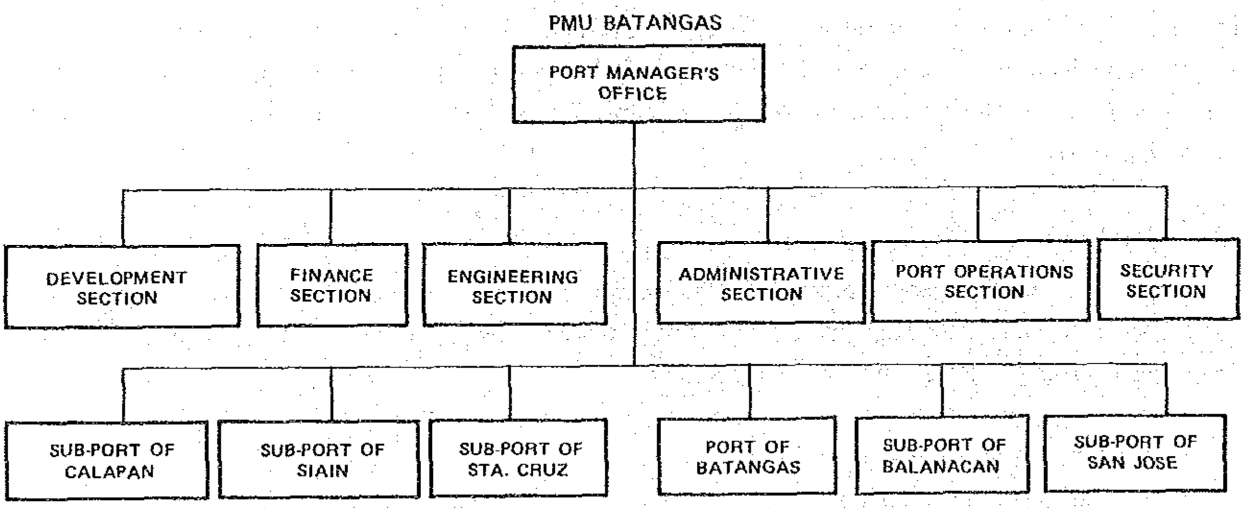


Fig. 2.1.4 Organizational Charts of PPA and PMU Batangas

Table 2.1.7 List of Entitles Enjoying Exemption from Payment of Port Charges
(Regular Callers at PMU Batangas)

ENTITIES	DOCUMENT OF EXEMPTION	EXEMPTION	COVERED BY EXEMPTION
1. National Food Authority (formerly NGA)	Presidential Decree No. 1770	All port charges including the 10% gov't share	All transactions (Pls. refer also to PPA Memo Circular No. 40-78)
2. Philippine Veterans Investment Development Corporation	Presidential Decree No. 1491	Wharfage dues only	Raw materials, supplies, article, equipment, Machineries, spare parts and wares except those prohibited by law, brought in the areas after Jan. 1, 1977 through piers or wharves constructed by the importer and utilized in production, storing and packing and shipment of goods meant for foreign market.
3. Philippine Coal Authority	Presidential Decree No. 1722	All port charges including 10% gov't share	All transactions
4. National Power Corporation	Presidential Decree No. 1360	All port charges including 10% gov't share	All transactions
5. United Coconut Chemicals Inc.	Omnibus Investment Code	Wharfage dues only	Referring to wharfage only
6. BOI Registered Export (Fortune Commodities Inc. or Fortune Cement)	Republic Act 6135 Presidential Decree 1789	Export wharfage only	Registered export products. (Pls. refer also to PPA Memo Circular No. 9-77.)
7. Petroleum Products: 1. Phil. National Oil Co. 2. Shell Refinery (PSPC) 3. Mobil Oil 4. Caltex (Phils.) Inc.	Presidential Decrees 1609, 1610 and LOI 839 (Subsequently, LOI 1135 5.25/81 and LOI 1068 2/23/80 were issued lifting exemptions of petroleum products except diesel fuel)	Import wharfage only	
8. Export Processing Zone (Cargoes of firms registered with the Export Zone Authority.)	Presidential Decree No. 66	Wharfage dues	Referring to wharfage dues (Pls. refer to PPA Memorandum Circular 30-83.)

(3) Present Situation of Cargo Handling Operations

The overall cargo handling efficiency at the base port of Batangas in 1983 is summarized by pier in Table 2.1.8.

Total working time is recorded at about 97,500 hours in 1983. The notable feature in cargo handling operations is that there is a great deal of idle time due to the cargo handling operations directly loading and unloading to and from trucks at the pier. Interruptions of cargo handling operations such as those caused by waiting for arrival of trucks greatly deteriorate the overall cargo handling efficiency at Batangas Port. As can be seen in the Table, the overall 1983 gross cargo handling rate is only 3.23 tons per hour. This overall productivity is exceedingly low; it is even less than the current per gang cargo handling volume for domestic conventional vessels, which is only 4.73 tons per hour. The average cargo handling volumes per gang-hour from 1980 through 1984 are presented in Table 2.1.9.

Table 2.1.8 Port Operations in 1983

Berth Name		Berth Dimensions			Data on Cargo Handling at Pier				Cargo Handling Rate		Cargo Volume	Cargo Volume per Ship	Berthing Hours per Ship	Remarks
Pier	Number of Berth	Length (a)	Water Depth	Width	Ship Calls (b)	Cargo Volume (c)	Working Time (d)	Idle Time (e)	Net (c)/(d)	Gross (c)/(d+e)	per Unit Length (c)/(a)	(c)/(b)	(d+e)/(b)	
		(m)	(m)	(m)					(ton/hour)	(ton/hour)	(ton/m)	(ton)	(hour)	
Pier I	4	270	−3 ~ −6	15	2,607	241,773	39,702	–	6.09	–	895	93	15.2	( ) indicates Ro-Ro services
					(519)	(180,929)						(174)		
Pier II	2	96	−4	12	1,301	192,762	56,939	8,430	1.63	1.42	462	71	50.2	Marginal wharf
	1	105	−7.5	15	(248)	(52,752)						(106)		
Pier III	4	170	−2.67	15	21	23,447	830	4,805	28.25	4.16	138	1,117	268.3	
Total	11	641			3,929	357,981	97,471	13,235	3.67	3.23	558	91	38.2	

Source: PMU Batangas

Table 2.1.9 Per Gang Cargo Handling Volume 1980 ~ 1984

Tons/Gang · hour		Number of Gangs	
(at Berth)		Domestic	Foreign
Domestic Trade o Overall average 14.68	Foreign Trade o Overall average 16.29	6	18
(Special cases) o Ro-Ro Vessels 70.25		6	–
o Self-sustaining (using a conveyor) 7.58		7	–
o Conventional Vessels 4.73		5	–
(at anchorage)			
Domestic Trade –	Foreign Trade 5.94	–	18

Source: PMU Batangas

(4) **Cargo Handling Capacity Using Present Facilities**

The present roles of Batangas Port are comprised mainly of three functions: (a) the shipment of daily consumer goods and agricultural products to and from Mindoro Island mainly through Roll on-Roll off operations; (b) passenger transportation using ferry boats and partial Ro-Ro vessels which connect Batangas to the ports located on the northern shoreline of Mindoro; and (c) shipment of cargoes which are domestically transported by the conventional cargo vessels plying between Batangas and the soutern islands of the Philippines, shipment of the industrial products which are exported from the factories in the hinterland, and shipment of the raw materials and general cargoes which are imported from abroad.

In line with these present roles, the capacities of the facilities used for Roll on-Roll off operations and general cargo handling activities are examined here to establish the basis for determining the scale of future port development and for evaluating the economic feasibility and financial viability of such development.

(A) Cargo handling capacity for Roll on-Roll off operations

As Roll on-Roll off vessels and ferry boats generally provide regular services on special shipping lines and are operated based on their timetables, the wharves for these vessels are usually used exclusively. Particularly Roll on-Roll off vessels need specialized ramp facilities for loading and unloading vehicles. As the demand for such specialized operations increases, these wharves can no longer accommodate other types of vessels.

Estimating the maximum Ro-Ro cargo volume that can pass through the current facilities can be done by determining the maximum number of daily Ro-Ro services which can be offered considering various conditions at Batangas including the number of available berths, as well as the conditions at the ports of destination.

Another point which should be considered is the possibility of larger vessels calling at the current facilities. At Batangas, however, the berths currently being used for Ro-Ro vessels are too shallow to accommodate larger vessels, and even if these berths were deepened by means of dredging, they would be subject to siltation and there might be structural difficulties. Thus, it is not practical to alter the facilities which are currently used for Ro-Ro vessels.

As of 1983 two shipping companies, Viva Shipping Lines, Inc. and Maynilad Shipping Corporation, each provide two Ro-Ro shuttle services per day on the shipping route between Batangas and Calapan. The companies operate four Ro-Ro vessels, and these are all of the 500 GT class. Judging from the water depth at the wharves and the structural type of the pier, 500 GT class vessels are the maximum size ship which can utilize the current facilities.

When estimating the maximum possible number of services per day, the following premises must be taken into consideration:

i) The economic activities of the firms which utilize the Ro-Ro services are largely based upon the Ro-Ro schedule. These customers have developed a wide range of daily business activities which are dependent on the Ro-Ro services, and thus the current Ro-Ro schedule cannot easily be changed.

ii) Considering the convenience of the Ro-Ro customers, the potential daily service is realistically limited to the time period from 8:00 AM to midnight.

iii) A minimum of two and a half hours per port call is necessary for vessels to load and unload cargo, for passengers to get on and get off, and for necessary items such as fuel oil and water to be supplied to the vessels.

iv) Calapan Port can accommodate a maximum of two Ro-Ro vessels at the same time.

v) The present schedule of Ro-Ro trips licensed by MARINA are 4 trips per day for Viva Shipping and 2 trips per day for Maynilad. (Viva is also licensed to operate 5 ferry trips per day).

Based on the above premises, a maximum of 5 Ro-Ro shuttle services can be scheduled per day utilizing the present berths, 11-A and 24.

Assuming that the average ship load per trip is 180 metric tons (refer to Appendix 7.2), the maximum possible transportation capacity of the Ro-Ro service is 315,000 tons per annum, one way. If cargo demand were equal in both directions, a maximum capacity of 630,000 tons per annum could be carried inboth directions in total.

(B) Cargo Handling Capacity for Conventional Vessels

The cargo handling capacity for conventional vessels calling at the Port of Batangas can best be estimated by examining the current conditions of cargo handling at the port. There are various factors which limit the cargo handling capacity for both foreign trade and domestic vessels.

i) Factors affecting the cargo handling capacity for foreign trade

There are no wharves in Batangas Port that can accommodate oceangoing vessels over 10,000 DWT. The cargo of such vessels is handled at anchorage utilizing barges that carry the cargo between the vessels and Pier III. According to the data obtained from PMU Batangas, the cargo handling rate at anchorage was approximately six tons per gang-hour over the last four years (as presented in Table 2.1.9). It is unlikely that this rate will improve.

Vessels less than 5,000 DWT can berth at the marginal wharf which has a water depth of 7.5 meters. The cargo handling rate at berth is approximately 15 tons per gang-hour. However, the number of hatches at which stevedoring work can take place is limited to two due to the narrow width of the pier and approach road, and to the traffic congestion at the entrance of the marginal wharf.

ii) Factors affecting the cargo handling capacity for domestic trade

Based on the actual shipping records compiled by PMU Batangas, logs and lumber are shipped from the southern islands of the Philippines by ships of 5,000 to 6,000 DWT. These ships which ply the inter-island shipping routes generally dock at the marginal wharf.

As for the great number of small boats which carry small cargo loads, they could dock at any berth due to their shallow drafts and short working hours. Here, for evaluation purposes, we assume that they all dock at berth II-B on Pier I. Further, as the water depth at this berth is 5 meters, inter-island vessels which have to wait for the marginal wharf can also be accommodated at this berth.

Judging from actual data, we estimate that the cargo handling rate for domestic vessels is 5 tons per ship per hour for the smaller boats and 7 to 14 tons per ship per hour for the larger inter-island vessels.

iii) Estimate of cargo handling capacity for conventional vessels

Batangas Port has very little flexibility due to the small number of berths. This makes it difficult to provide exclusive berths for foreign and domestic cargo handling. Rather than estimating the capacity for handling cargo from conventional vessels solely on the basis of the number and capacity of existing facilities, it may be more accurate to take into account the various factors introduced above and to estimate the capacity using simulation tests which employ queuing theory.

From these tests, the capacity is evaluated in terms of ship waiting time and berth occupancy ratio. Based on the results, we conclude that the cargo handling capacity of the Port for conventional cargo is essentially equal to the forecast 1987 cargo volume of 189,000 tons. This cargo volume will have an especially great impact on the berth occupancy ratio at the marginal wharf and at berth 11-b. Overall, the berth occupancy ratio at the Port will reach 60% in 1987 (refer to Section 7.4.6 and Appendix 7.3).

In conclusion, the cargo handling capacity of the Port for conventional (non Ro-Ro) vessels is about 190,000 tons of which 110,000 tons is foreign trade cargo and 80,000 tons is domestic trade cargo.

(5) Present Management Problems

In this section, the principal problems at the Base Port are pointed out. Consideration of these problems is a pre-requisite for planning the port facilities and layout. The problems are presented here, and appropriate facilities and policies to help alleviate these problems are proposed in the Short-term Development Plan.

i) Squatter Problem

There are actually some 500 – 600 squatter households located in the Port District of the Base Port. These squatters are a obstacle to the efficient operation of the port, and especially to the expansion of port facilities in the future.

PPA (PMUs) is legally authorized by Presidential Decree 857 to license, control, regulate and supervise any and all construction and structures located within port districts. However, this system does not function effectively at the Port of Batangas.

ii) Congested Pier Areas

Pier I is used by cargo vessels, Ro-Ro vessels and ferry vessels. Thus the flow of passengers, cars and cargoes at this pier and in its back-up area is quite complicated. This situation is not conductive to efficient handling of cargo and safe passage of passengers. Similar problems also exist at Pier II.

iii) Lack of Appropriate Back-up Areas

There are currently no appropriate cargo handling areas such as storage yards and warehouse areas. Cargo can only be moved efficiently when wharves function in conjunction with appropriate cargo handling equipment and cargo handling areas.

Furthermore, the facilities for passengers are also inadequate. Batangas is a passenger port as well as a cargo port, and it functions as the gateway to Mindoro Island. There is a definite need for a comfortable passenger terminal with sufficient parking space in order to accommodate the passengers.

iv) Others

A) Although some Ro-Ro vessels are operated at night, there are no lighting facilities.

B) Design data and other information relating to the existing port facilities are not available. Such data are necessary for the detailed design of rehabilitation works.

2.2 Private Ports along Batangas Bay

2.2.1 Present Private Ports

There are 22 private ports under PMU Batangas, 13 of which are situated along Batangas Bay because of its good harbor (Table 2.2.1). These thirteen private ports handle 86 percent of the total cargo of PMU Batangas (including the volume for the base port, sub-ports, municipal ports and private ports) as of 1983.

The private ports along Batangas Bay include the following:

a) PNOC Energy Supply Base (PESB)

b) Engineering Equipment, Inc. (EEI)

c) Atlantic Gulf & Pacific Co. of Manila (AG & P Pole Creosoting Plant)

d) Batangas Bay Terminal, Inc. (BBTI)

e) Keppel Ship Yard, Inc.

f) PNOC Marine Corp. (PMC)

g) United Coconut Chemicals, Inc. (UNICHEM)

h) Caltex Philps., Inc.

i) PNOC Ship and Transport Corp. (PSTC)

j) Philippinas Shell Petroleum Corp.

k) National Food Authority (NFA).

l) Pacific Flour Mills, Inc. (PFM)

m) Himmel Industries, Inc.

Some of these private ports such as PESB, PMC, PSTC, and NFA are not privately owned. They are, however, classified as private ports according to PPA because they handle their own cargoes.

Fig. 2.2.1 indicates the locations of the various private ports along Batangas Bay. Table 2.2.2 shows the cargo handling activities at the said private ports for the last five years, and Table 2.2.3 shows the 1983 share of each private port cargo throughout to the total cargo throughput of all the private ports under PMU Batangas. The same table indicates that the cargo movement of crude oil and petroleum products of the bi refineries, Caltex and Shell, dominated the cargo handling activities at the private ports (about 86% of the total cargo).

Following are short profiles of the private ports along Batangas Bay:

(1) **PNOC Energy Supply Base (PESB)**

PESB is located in Mabini, Batangas, and its operation is in line with the government program of energy self-reliance. It serves as a supply base for energy-related operations like exploration, development and production of indigenous energy resources. Hence, the company is engaged in supply of drilling equipment, chemical stuffs, fuel and the like for energy-related activities such as off-shore oil exploration, geothermal energy development, and coal production.

According to PPA Annual Statistical Report, PESB handled 129,499 M.T. in 1983.

PRIVATE PORTS

1. PNOC Energy Supply Base (PESB)
2. Engineering Equipment Inc. (EEI)
3. Atlantic Gulf & Pacific Co. of Manila (AG & P Pole Creosoting Plant)
4. Batangas Bay Terminal Inc. (BBTI)
5. Keppel Phil. Shipyard Inc.
6. PNOC Marine Corp. (PMC)
7. United Coconut Chemicals, Inc. (UNICHEM)
8. Caltex Phils., Inc.
9. PNOC Shipyard Transport Co. (PSTC)
10. Pilipinas Shell Petroleum Co.
11. National Food Authority (NFA)
12. Pacific Flour Mills, Inc. (PFM)
13. Himmel Industries, Inc.
14. AG&P-BMFY
15. National Coal Authority (NCA)

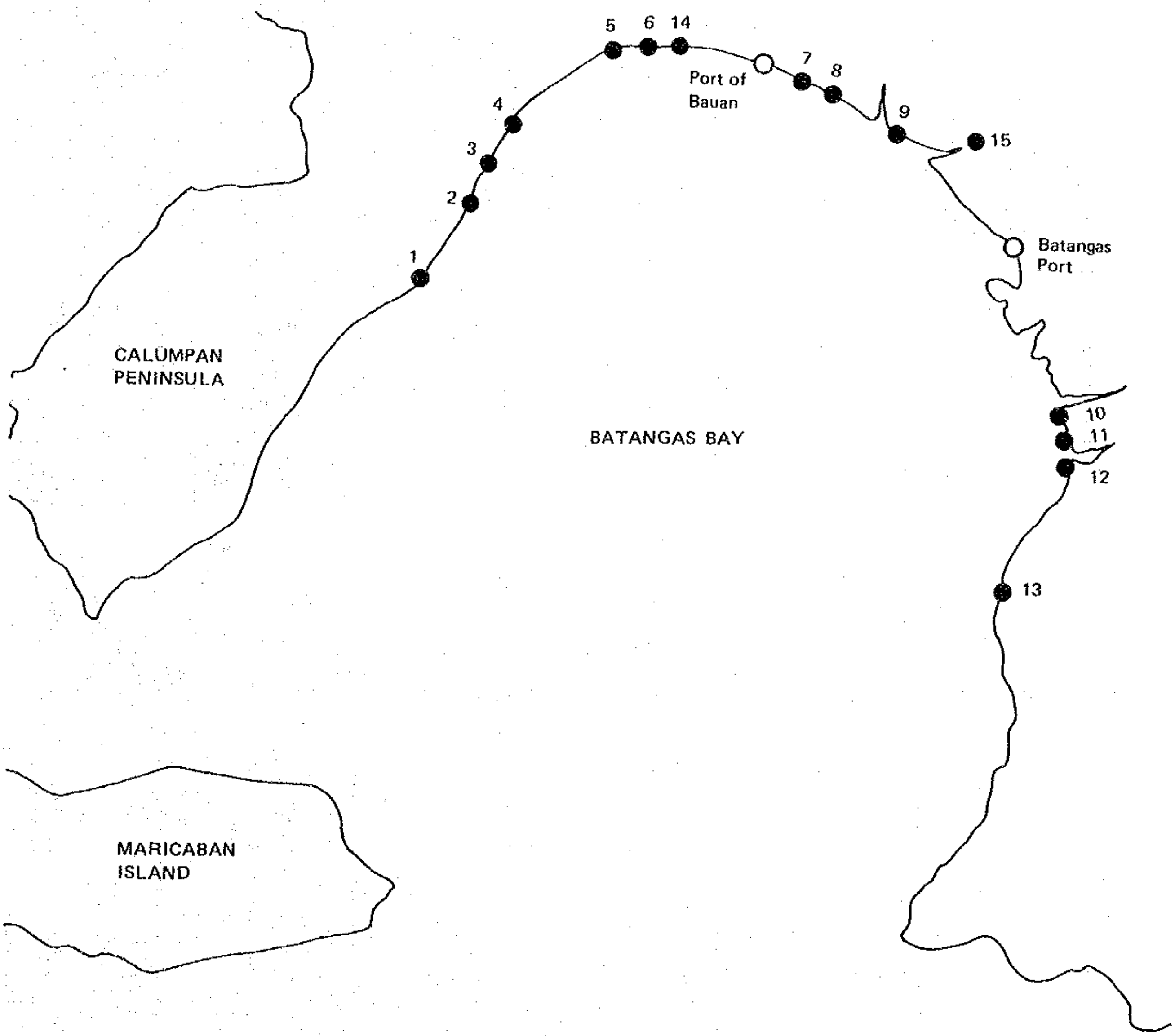


Fig. 2.2.1 Private Ports Along Batangas Bay as of November, 1984

Table 2.2.1 Private Ports Along Batangas Bay as of November 1984

Owner's Name	Location	Type of Industry or Activity	Construction Year of Pier	Cargo Handled. (MT) 1983	Number of Employees (Persons)	Land Area (Ha.)	Pier/Wharf Length (M)	Water Depth of Pier/Wharf (M)
PNOC Energy Supply Base (PESB) 1/	Mabini Batangas	Supply base for energy-related operations	Triangle Wharf: 1972 Marginal Wharf: 1979	129,499	10	20	Trianglar Pier: 63.1 Marginal Wharf: 73.2	-10 - 8.8
Engineering Equipment, Inc. (EEI)	Mabini, Batangas	Steel fabrication	N.A.	1,064	N.A.	N.A.	N.A.	N.A.
Atlantic Gulf & Pacific Co. of Manila (AG&P Pole Creosoting Plant)	Bauan, Batangas	Creosoting plant	N.A.	8,917	48 (before Feb. of 1984)	1.7	14.5	-3.7
Batangas Bay Terminal, Inc. (BBTI)	San Miguel Bauan, Batangas	Lease of the facilities to private firms; importing/exporting bulk cargoes	1972	173,484	100	7	Interval of Breasting Dolphins: 60.0	-12.8
Keppel Phil. Shipyard, Inc.	Bauan, Batangas	Ship repair/ building	1978	2,434	300	20	73.0	N.A.
PNOC Marine, Corp. (PMC) (PMC)1/2/	Bauan Batangas	Ship repair/ building	1972	39,134	1,735	54 (including Keppel's lease of 20 has.	174.0	N.A.
United coconut Chemicals, Inc. (UNICHEM)	New Danglayan Bauan, Batangas	Coconut chemical industry	1983	10,635	150	53	48.0	-14.0
CALTEX Phils. Inc.	San Pascual Bauan, Batangas	Oil refinery	Oil Wharf: 1954 Island Wharf. 1974	4,044,118	390	120	Island Wharf: 113.4 Finger Wharf: 83.8	-24.4 -10.0
PNOC Ship and Transport Corp.1/ (PSTC)	San Pascual Batangas	Ship repair, (loading/unloading terminal for Caltex)	N.A.	46,122	N.A.	N.A.	N.A.	N.A.
Pilipinas Shell Petroleum Corp.	Tabangao Batangas City	Oil refinery	1962 (extention: 1966)	2,976,497	214	173	(Length of Steel Berthing Beam) Jetty 1: 56 Jetty 2: 56	-17 -14

Owner's Name	Location	Type of Industry or Activity	Construction Tear of Pier	Cargo Handled. (MT) 1983	Number of Employee (Persons)	Land Area (Ha.)	Pier/Wharf Length (M)	Water Depth of Pier/Wharf (M)
National Food Authority 1/ (NFA)	Tabangao Batangas City	Purchase, storage & transportation of grains and other foods	1980	34,011	40	2	30.0	-12.5 ~ -14.0
Pacific Flour Mills, Inc. (PFM)	Tabangao Batangas City	Flour milling	1975	109,021	180	32	94.2	-14.6 ~ -15.8
Himmel Industries Inc.	Pinamucan, Batangas City	Purchase storage & transportation of chemicals	1981	1,030	22	4	Interval of Breasting Dolphins: 75.0	-12.8

1/ PNOC (Philippine National Oil Company) and National Food Authority are not purely private firms, but a government-owned company and a government agency respectively. According to PPA, in addition to the port owned by private firms, the ports which are owned/operated by government agencies for their exclusive use are also classified as "private ports".

2/ National Coal Authority (NCA) has taken the land on a lease from PNOC Marine Corp. (PNC)' for operating Batangas Interim Terminal (coal distribution center). NCA has had a temporary coal-receiving pier, but the cargo statistics for NCA Batangas Interim Terminal are included in those for PMC according to PPA Annual Statistical Report. NCA's temporary facilities are to be turned over to PMC when the permanent terminal which is planned to be constructed next to Caltex becomes operational.

Table 2.2.2 Cargo Statistics of Private Ports Along Batangas Bay by Commodity 1979 ~ 1983

	1979	1980	1981	1982	1983
TOTAL CARGO THROUGHPUT	9,425,437	8,326,634	7,087,417	6,985,210	7,576,006
TOTAL DOMESTIC TRADE	2,917,637	2,726,753	2,255,761	2,217,290	2,452,352
INWARD	679,847	989,201	821,959	868,734	1,158,208
Refined Petroleum Products	510,228	810,811	576,890	599,197	693,493
Chemicals	1,480	940	142,823	38,646	8,237
Crude Oil	94,040	57,453	1,239	185,316	258,051
Coal				4,209	116,311
Palay/Rice			2,753	14,478	23,033
Corn				496	10,016
Soybeans					3,487
Wheat	574	1,168	6,979		
Other Cereals				4,546	
Animal Feeds				77	
Live Animals			10		20,958
Coconut Oil			12,446		
Minerals	2,067	11,125	180	8,549	2,030
Logs/Lumber			2,064	2,144	885
Plywood & Veneer				150	
Cement		200	820	1,495	420
Metal & Products	2,070	379	2,807	3,380	310
Other General Cargo	69,388	107,125	72,948	6,051	20,977
OUTWARD	2,237,790	1,737,552	1,433,802	1,348,556	1,294,144
Refined Petroleum Products	2,181,175	1,613,381	1,383,867	1,312,937	1,203,009
Chemicals	29,907	87,761	29,999	21,836	8,410
Crude Oil	4,981	188			
Palay/Rice					1,149
Corn					750
Soybeans					3,817
Wheat	1,000		814	900	
Other Cereals			3,330	4,535	1,181
Flour	3,770		11,627		
Live Animals					4,770
Coconut Oil			254		
Copra	5,588	6,032			
Copper Concentrate		1,940			
Minerals		681	620	924	
Logs/Lumber			2,629	2,357	1,784
Plywood & Veneer				611	
Cement			13	192	1,040
Metal & Products	780			18	66,205
General Cargo	10,589	27,569	649	4,246	2,029

	1979	1980	1981	1982	1983
TOTAL FOREIGN TRADE	6,507,800	5,599,881	4,831,656	4,767,920	5,123,654
IMPORT	6,292,822	5,358,626	4,587,300	4,299,861	4,691,944
Refined Petroleum Products	1,486,553	1,455,969	1,872,958	642,382	168,572
Chemicals	51,800	141,429	39,545	70,978	76,491
Crude Oil	4,661,408	3,682,612	2,573,426	3,472,538	4,312,344
Coal					32,857
Wheat	56,339	55,080	66,967	70,999	55,672
Soybeans					30,555
Other Cereals			16,002		
Flour	3,476		328		
Copra			10,000		
Minerals			1,580		
Log/Lumber	2,888			32,411	
Cement			1,293		
Metal Products	2,035	3,666	1,848		
Sugar		4,300			
General Cargo	28,343	15,570	3,353	10,553	15,453
EXPORT	214,978	241,255	244,356	468,059	431,710
Refined Petroleum Products	73,614	93,011	98,029	319,458	275,196
Chemicals		8,000	11,506	27,584	4,100
Crude Oil	13,000		76,994	84,706	38,412
Flour	750				
Coconut Oil		15,684	22,644	5,932	82,517
Copra & Copra Products	26,162	6,500	20,500	25,000	27,750
Logs/lumber			1		
Cement			1,800		
Sugar	100,817	107,531	4,550		
Wheat				3,104	
Soybeans					1,000
Other Cereals					1,900
General Cargo	635	10,529	8,332	2,275	835

Source: PPA Annual Statistical Reports 1979-1983.

Table 2.2.3 Share of Private Port Cargo Throughput to Total Cargo Throughput of Private Ports Under PMU Batangas (1983)

	Name of Private Port	Cargo Throughput (MT)	Share (%)
Batangas Bay Area	PESB	129,499	1.6
	EEI	1,064	0.0
	AG&P (Pole Creosoting Plant)	8,917	0.1
	BBTI	173,484	2.2
	KEPPEL	2,434	0.3
	PMC	39,134	0.5
	UNICHEM	10,635	0.1
	CALTEX	4,044,118	50.7
	PSTC	46,122	0.6
	SHELL	2,976,497	37.3
	NFA	34,011	0.4
	PFM	109,021	1.4
	HIMMEL	1,070	0.0
	Sub-Total	7,576,006	94.9
Outside Batangas Bay	Others	404,142	5.1
Total		7,980,148	100.0

Source: PPA Annual Statistical Report for 1983.

(2) **Engineering Equipment, Inc. (EEI)**

EEI is also situated in Mabini, Batangas. The company is primarily engaged in steel fabrication. The cargo throughput of EEI was 1,064 M.T. in 1983.

(3) **Atlantic Gulf & Pacific Co. of Manila (AG & P Pole Creosoting Plant)**

The plant was engaged in the production/treatment of creosoted poles used for electric poles, and the construction of piles and fenders. However, the company has stopped operations since February of 1984 because of a shortage of raw materials and high overhead costs. At present it has no intention to use the facilities for any industrial purposes in the future.

(4) **Batangas Bay Terminal, Inc. (BBTI)**

BBTI is located in Bauan, Batangas. The facilities were primarily constructed for exportation of sugar. However, the firm gradually diverted into foreign-trade oriented bulk-handling activities. The sugar exportation has stopped since the government took over the sugar business. At present the principal export commodities are copra pellets and coconut oil of

UNICOM. On the other hand, the main import commodity is industrial chemicals for FLYSIN, UNION CARBIDE PHILS., MABUHAY VINYL CORP., BAY TANK YARD, INC., SC TANK YARD, INC., and POLYPHOSPHATE, INC. in 1983 BBTI handled approximately 173,000 M.T. of cargoes.

(5) **Keppel Phil. Shipyard, Inc.**

Keppel is also located in Bauan, Batangas and it is engaged in ship repair and shipbuilding. According to an interview with the company officials, most of its raw materials are brought by truck trailers from Manila, while a small portion are transported by barges. This is reflected in the total cargo throughput of 2,434 M.T. for 1983.

(6) **PNOC Marine Corp. (PMC)**

Adjoining Keppel is the shipyard of PMC. It is likewise engaged in ship building and repair, and in industrial fabrication as well. Most of its raw materials are also transported from Manila by truck. At present the National Coal Authority (NCA) has its interim coal terminal within the PMC compound. Pending the construction of its permanent terminal, NCA unloads coal at this temporary coal receiving pier, and sometimes at the other private ports. The unloaded coal is then transported by truck to cement plants in the Manila area. When NCA's permanent coal terminal is constructed and operational, the interim terminal will be turned over to PMC. In 1983, the total cargo throughput of PMC is 39,134 M.T., about half of which is coal.

(7) **United Coconut Chemicals, Inc. (UNICHEM)**

UNICHEM is situated between Bauan municipal port and Caltex. It is a newly-organized Filipino-owned corporation registered with the BOI (Board of Investments) as a preferred pioneer producer of coconut-based chemical derivatives such as fatty acids, fatty alcohol and glycerine. It just started its operations in April 1984.

The main raw material, crude coconut oil, is expected to be transported by coco-oil tankers from the southern Philippines. The fuel oil is brought by tank-lorries from Caltex.

The fatty acids and glycerine are for export, while the fatty alcohol is for the domestic market. The latter is transported by barges to the Manila area.

The expected throughput of the company is estimated at 130,000 – 140,000 M.T. per annum when it comes into full operation.

(8) **Caltex Phils., Inc.**

Caltex, which is located in San Pascual, Batangas is one of the three big oil refineries in the Philippines. The original complex which was the first oil refinery in the country, was constructed in 1954. At present, its rated capacity is 70,500 barrels per stream day.

According to an interview with company representatives, most of the incoming crude oil and refined petroleum products are handled at its port facilities. On the other hand, some 60 – 70 per cent of the outgoing refined petroleum products are transported to the Manila Area by pipelines. The rest is shipped to southern islands such as Visayas, Mindanao and Bicol, and exported to Hong Kong, Singapore and elsewhere. In 1983, Caltex is believed to have had a domestic market share of approximately 35 per cent.

The PPA Annual Statistical Report indicates that the total cargo throughput of Caltex in 1983 was 4,044,118 M.T. This accounts for about 53 per cent of the total cargo throughput of all the private ports along Batangas Bay.

(9) PNOC Ship and Transport Co. (PSTC)

PSTC, which is situated in San Pascual, Batangas, is engaged in ship repairing. Since PSTC is located adjacent to Caltex, the port facilities are utilized as a supplementary loading/unloading terminal for crude oil and petroleum products.

(10) Pilipinas Shell Petroleum Co.

Shell is located in Tabango, Batangas City. It is also one of the three big oil refineries in the Philippines. The refinery was built in 1962. At present, its rated capacity is 68,000 barrels per stream day.

According to an interview with company officials, most of the incoming crude oil and petroleum products are handled at its port facilities. However, some 60 per cent of the outgoing refined products are piped to the Manila area.

The rest is shipped to the southern part of the Philippines, and exported to countries such as Hong Kong and Japan. In 1983, Shell is believed to have captured a domestic market share of some 25 per cent.

According to the PPA Annual Statistical Report, the total cargo throughput of Shell in 1983 was 2,976,497 M.T. This accounted for 39 percent of the total cargo throughput of all the private ports along Batangas Bay.

(11) National Food Authority (NFA)

The NFA's grain terminal is located in Tabangao, Batangas City. It handles domestic grains as well as imported ones such as soybeans. Among the domestic grains handled by NFA, rice accounts for the largest portion, about 30 percent. This rice comes from eastern and western Mindoro. Soybeans, on the other hand, are imported from the U.S.A.

While the rice unloaded at the terminal is transported to NFA's warehouse in Bauan, the imported soybeans are directly stored at the NFA terminal warehouses. These soybeans are for the production of the soybean oil of Phil-Asia which is located next to NFA. The soybeans are transported from NFA's warehouses to Phil-Asia by a conveyor. About 34,011 M.T. of cargo passed through the NFA port in 1983.

(12) Pacific Flour Mills, Inc. (PFM)

PFM is located adjacent to NFA. The mill has a rated production capacity of 300 M.T. per day. According to an interview, about 95 percent of the flour is transported by land to the Manila market.

In 1983, 109,021 M.T. of cargoes passed through the port. However, about 50 percent of the total cargo handled was for NFA and other nearby firms.

(13) **Himmel Industries, Inc.**

Himmel is located in Pinamucan, Batangas City. It is an imported chemicals depot composed of a receiving pier and storage tanks with a total capacity of 12 million liters. These imported chemicals are transported to Manila users by tank lorries.

According to an interview with Himmel representatives, the estimated importation of chemicals for 1984 is about 8,000 M.T.

2.2.2 Additional Private Ports

There are two additional private ports which are expected to operate along Batangas Bay. They are the Atlantic Gulf and Pacific of Manila, Inc.-Batangas Marine and Fabrication Yard (AG&P-BMFY), and the National Coal Authority (NCA) permanent coal terminal. The two companies are likely to operate in 1985 and 1986 respectively.

(14) **Atlantic Gulf and Pacific of Manila, Inc.-Batangas Marine Fabrication Yard (AG&P-BMFY)**

AG&P-BMFY has a plan to construct a steel fabrication yard at San Andres, Bauan, Batangas, just between PNOC Marine Co. and Bauan municipal port.

The fabrication will produce steel products for off-shore oil structures (export), drilling equipment (export), steel frameworks for industrial plants and high-rise buildings (domestic) and other heavy structural steel frameworks.

The steel raw materials for fabrications will consist of local and imported steel. The said materials will be transported by sea from Iligan (for local steel) and Manila (for imported materials). The mixture of the material input for steel manufacturing will depend on the type of structures or the needs of the end users. But for finished products for export such as the offshore oil structure and drilling equipment, about 40 – 50 percent of all the raw materials will be imported ones.

All the finished materials for exports or 100 percent will be handled at the pier. On the other hand, about 50 per cent of the finished products for domestic consumption will pass through the pier and the rest will be moved by land.

The company is projected to produce approximately 45,000 M.T. of finished products in 1990. About 40 – 50 percent of those will be for exportation.

(15) **National Coal Authority (NCA) Permanent Coal Terminal**

In continuation of the NCA's nationwide coal distribution program, the company has a plan to construct a permanent coal terminal (loading/unloading and blending facilities) at Sta. Rita, Batangas City, some 5 km. away from its present interim facility at Bauan, Batangas (in PMC's compound).

The said terminal will serve as a terminal distribution point for the 11 cement plants located in the Luzon Island. (Fig. 6.3.2)

According to the interview made with the Coal Authority, the permanent facility will have a handling capacity of 2.3 million M.T. of coal per year and a blending rate of 500 M.T. per hour. The company will handle imported and local coal. Imported coal will come from Australia, China and Canada, while the local one will come from the Southern part of the country like Cebu. The blending or mixture of imported and domestic coal will depend on the needs and availability of coal and the priority of the government. However, according to the interview with the Philippine Cement Authority, the present ratio of imported to local coal is 80 percent to 20 percent.

Out of the total blended coal of the NCA's terminal, about 80 percent will be transported to nine (9) cement plants located in Balacan, Rizal and Batangas by coal haulers. The rest will be transhipped to NCA Poro terminal in San Fernando, La Union to supply the cement plants of Northern and Bacnotan. The terminal is projected to handle 500,000 – 1,000,000 M.T. of coal for cement plants in 1990.

CHAPTER 3
NATURAL CONDITIONS IN BATANGAS PORT

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3.1 Topographical Features

(1) Classification

Classification were undertaken based on the 1978 Aerial Photographs. Since the Aerial Photographs used for classifications were taken six years ago, it has been noted that new improvements do not appear on the photographs thus making field classification a more tedious task. Our field classifiers were likewise not allowed to enter the compounds of some of the big facilities located along the shoreline of Batangas Bay. To cope with the problem, classifiers had to use binoculars as well as a Rangematic Range Finder Model Ranging 1,000.

Coastline length of the classification area is about 35 kilometers covering an area of about 70 square km. The mapping area is shown in Fig. 3.1.1.

(2) Mapping

A topographic map, scale 1/25,000 was prepared by the aerial photogrammetric method using the aerial photographs of the Bureau of Land taken in 1978 at an approximate scale of 1/16,000.

3.2 Hydrographical Conditions

3.2.1 Wind Conditions

Wind data analysis at the Port of Batangas is based on data from the Final Report on the Siltation Study.

Records of wind velocity and direction are indicated as wind roses in Fig. 3.2.1.

Concerning wind with velocities from 5 ~ 10 m/sec, the prevailing wind direction is NNE-ENE from November to Janauary, and generally WSW from July to September. Wind with velocities over 10 m/sec also blows predominantly from the WSW from July to September. According to the Final Report on the Siltation Study, PCI, March 1984, maximum wave height occured during the period when prevailing wind direction was W-SSW. The maximum wind velocity of 26.5 m/sec was observed in August and the second highest wind velocity of 15.5 m/sec was observed in September.

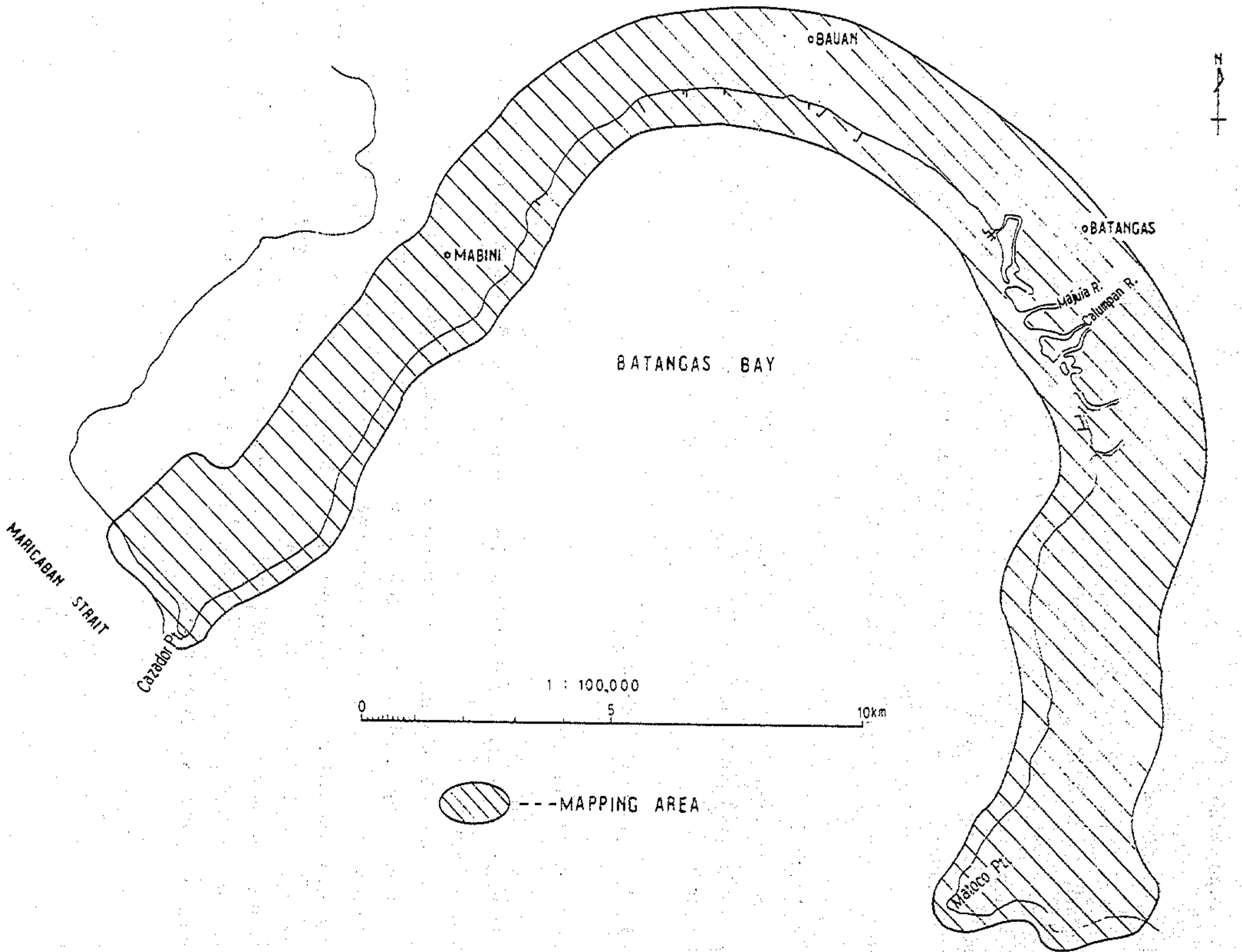


Fig. 3.1.1 Mapping Area

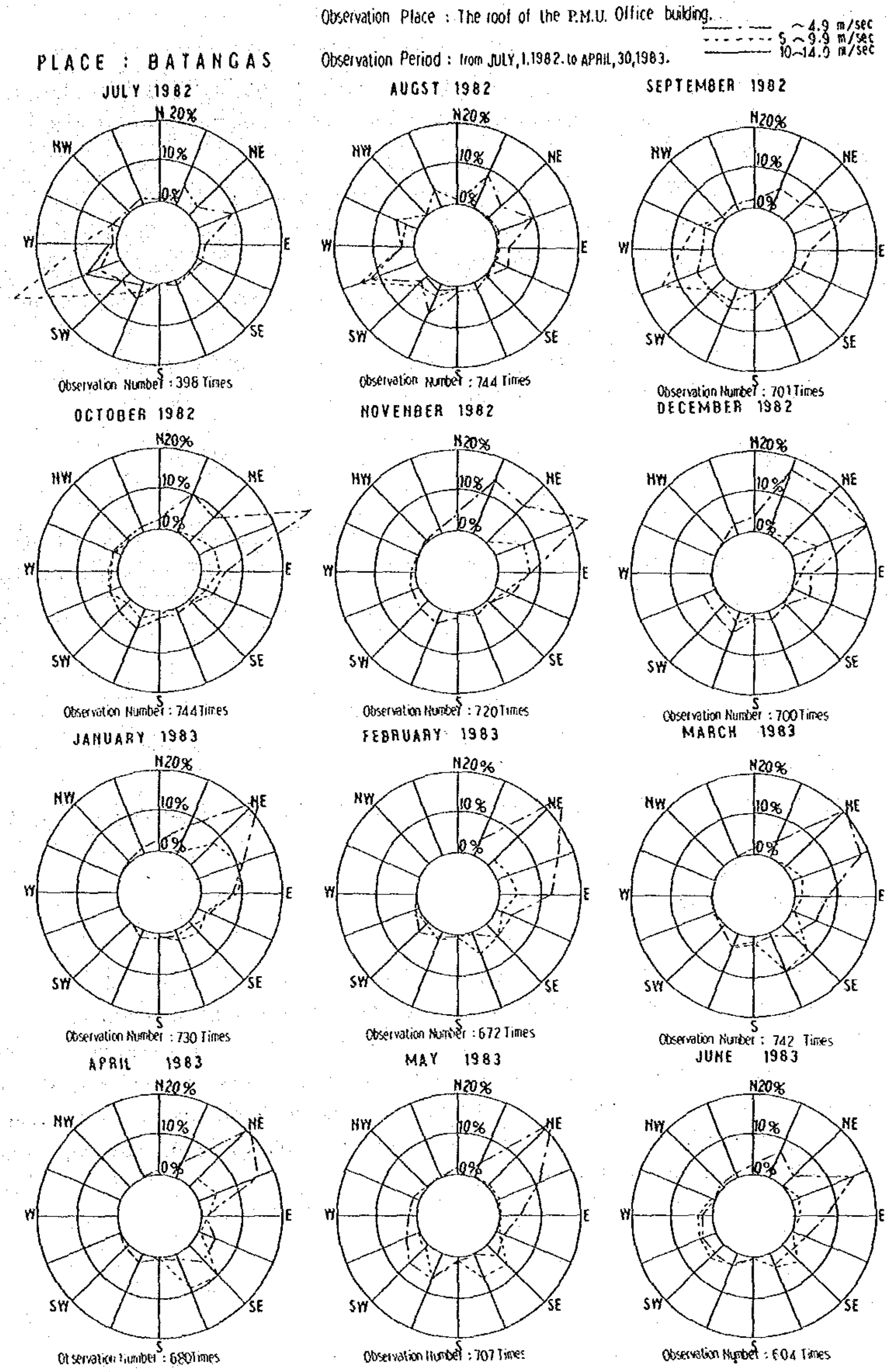


Fig. 3.2.1 Wind Roses

3.2.2 Wave Conditions

A wave observation staff was attached near Pier III of Batangas Port. Location is N 13°-45'.4, E 121°-02'.4. Observation was continuously performed from October 3 to November 1, 1984.

The correlation between wave height and period is indicated in Table 3.2.1.

According to the observation, waves at Batangas Port were generally calm and maximum wave height was 0.75 meters. This height, however, was affected by typhoon "Toyang". Waves generally come from the SW, and wave period was 2.0 to 4.3 sec. with a corresponding wave height of 0.2 meters to 0.75 meters.

Frequency of wave height of 0.01 meters to 0.4 meters was 88% and 0.41 meters to 0.70 meters was 10% (from July 1, 1982 to June 30, 1983, See Appendix 3.2.13(18)).

3.2.3 Tide Conditions

A tide staff was installed at the approach to Pier III of Batangas Port. Tide readings were recorded 24 hours daily from October 4, 1984 to November 4, 1984. Tide readings were taken every 15 minutes. The results of tide analysis are indicated in Table 3.2.2.

3.2.4 Tidal Current

Current observations were carried out by B.C.G.S (Bureau of Coast and Geodetic Survey) in 1976 and the Siltation Study in 1982 ~ 1983.

The results of the observations are indicated in Fig. 3.2.2 (Refer to appendixes 3.2.3(1) ~ (4)).

3.2.5 Submarine Features

A Raytheon Echo Sounder Fathometer Model DE-719 with a maximum depth capacity of 200 feet was used for the hydrographic survey. A total of 42 sounding lines with an aggregate length of about 30 kilometers covering an area of about 2.3 sq. km were surveyed. To control sounding positions, secondary traverse stations were established. These stations were also used for in-shore topography. To determine corrections on sounding depth due to tide fluctuation, a tide staff was established at the Pier. Sounding on the surf zone was done either by levelling or lead depending on existing field conditions.

Table 3.2.1 Correlation Between Wave Height and Period*1

Period (sec) / H⅓ (m)	T⅓ 0.16 >	1.0~2.0	2.1~3.0	3.1~4.0	4.1~5.0	5.1~6.0	Total	Ratio (%)	Ratio (%)
0.00 ~ 0.15	104						104	58.10	58.10
0.16 ~ 0.20		1	17				18	10.05	68.15
0.21 ~ 0.25			28				28	15.64	83.79
0.26 ~ 0.30			19				19	10.61	94.40
0.31 ~ 0.35			2	1			3	1.68	96.08
0.36 ~ 0.40				1			1	0.56	96.64
0.41 ~ 0.45				2			2	1.12	97.76
0.46 ~ 0.50				1			1	0.56	98.32
0.51 ~ 0.55					2		2	1.12	99.44
0.56 ~ 0.60							0	0.00	99.44
0.61 ~ 0.65					1		1	0.56	100.00
0.65 ~ 0.70									
Total	104	1	66	5	3		179	100.00	100.00
Ratio (%)	58.10	0.56	36.87	2.79	1.68		100.00		

*1 This data is based on the wave observation made by the Study Team from October 3 to November 1, 1984. The wave observation was carried out near Pier No. 3.

Table 3.2.2 Results of Tide Analysis

Port of Batangas

Primary Tide	Calculated Value		Tide and Current Tables Philippines 1984
	Study Development*1 *3	Siltion Study*2	
M.H.H.W.	1.35	1.14	1.21
M.H.W.	1.16	0.99	1.01
M.S.L.	0.76	0.56	0.63
M.L.W.	0.35	0.15	0.10
M.L.L.W.	0.11	0.03	0.00
C.D.L.	-0.12	–	–
Highest Water Level During Observation Period	1.66	1.66	–
Lowest Water Level During Observation Period	0.10	-0.52	–
H.W.L.	1.55	1.43	1.40
L.W.L.	0.07	-0.19	-0.32

M.H.H.W. (Mean Higher High Water)
M.H.W. (Mean High Water)
M.S.L. (Mean Sea Level)
M.L.W. (Mean Low Water)
M.L.L.W. (Mean Lower Low Water)
H.W.L. (Mean Spring High Water Level)
L.W.L. (Mean Spring Low Water Level)
C.D.L. (Chart Datum Level)

*1 STUDY DEVELOPMENT: Study Team (from October 4, to November 4, 1984).
Tide observation was carried out near Pier No. 3. Based on the consultation with PMU Batangas representatives, zero meter of the tide staff for tide analysis is taken on the level 2.41 m below the existing bench mark located at the base of the Batangas Port Lighthouse.

*2 Siltation Study: Final Report on the Siltation Study. (from July 1, 1982 to June 28, 1983)

*3 In Japan, the C.D.L. (Chart Datum Line) is defined as the hypothetical lowest low water level and is used as a base water line for port planning. Determination of the C.D.L. is very important in the sense that it is used to secure the water depth of such facilities as wharves, channels, anchorages and basins.
The C.D.L. is calculated based on the mean sea water level. However, the absolute value of the C.D.L. could not be determined in the study, because the mean sea water level varies over years and the observation period of the Study Team was only one month.
For the port planning and preliminary designs of the study, a water level of 0.0 m was regarded as the C.D.L. in accordance with the advice of PMU Batangas representatives. When detailed designs are carried out, the C.D.L. should be determined exactly and be used as the base water line for the detailed designs of the facilities.

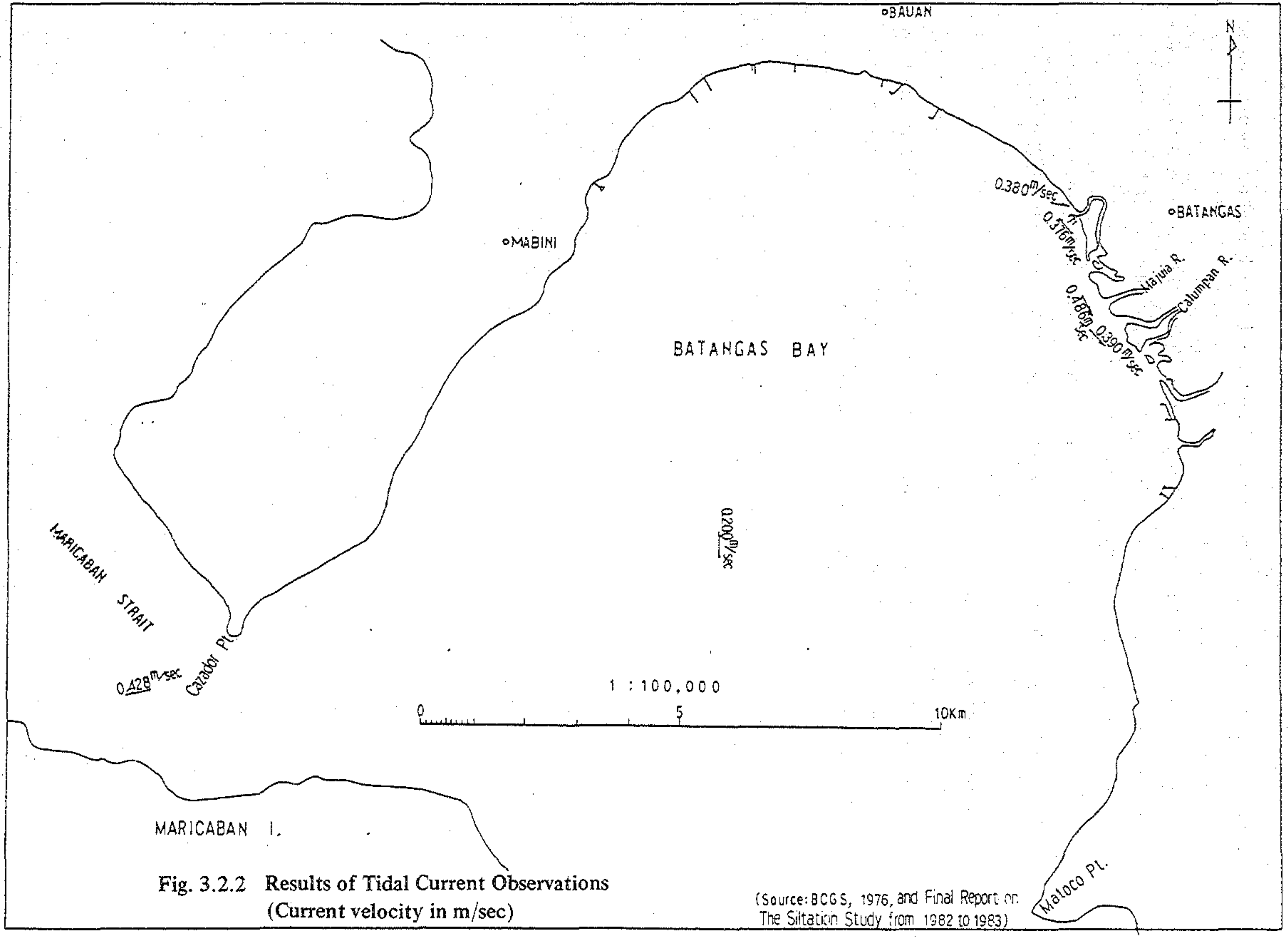


Fig. 3.2.2 Results of Tidal Current Observations
(Current velocity in m/sec)

(Source: BCGS, 1976, and Final Report on The Siltation Study from 1982 to 1983)

The hydrographic chart was determined through analysis of the sounding graph. The results are shown in Fig. 3.2.3. (Refer to appendix 3.2.7).

Submarine features in Batangas Port and its vicinity can be subdivided into two sea areas:

1) South sea area of Batangas Port

A flat area below 1 meter in sea depth extends up to 500 meters from the coastline at the southern edge of this sea area, but the shallow area extends only about 90 meters from the coastline further north, at Pier III.

The slope is about 8/100 between the sea depth of 5 meters and 15 meters, but this sea area includes the mouth of the Calumpan River, so the submarine feature will vary by season.

2) North sea areas of Batangas Port

A flat area below 1 meter in sea depth extends up to 170 meters from the coastline at Pier II of Batangas Port, and narrows to 40 meters from the coastline at the northern edge of this sea area. The slope is about 20/100 between the sea depth of 5 meters and 15 meters, and is steeper than the slope of the southern sea area.

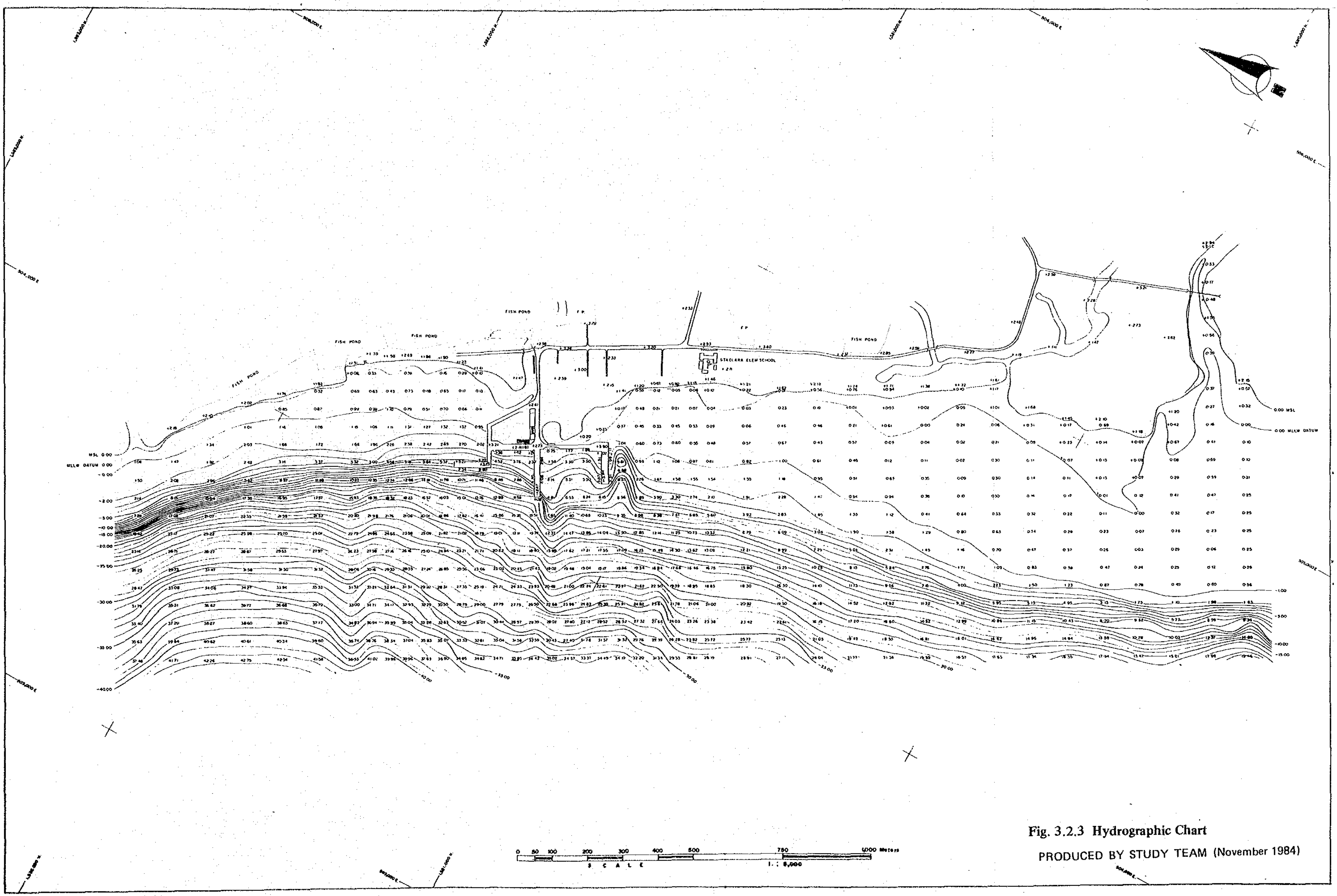


Fig. 3.2.3 Hydrographic Chart

PRODUCED BY STUDY TEAM (November 1984)

3.2.6 Analysis of Littoral Drift

A flow chart of the analysis of littoral drift is shown in Fig. 3.2.4.

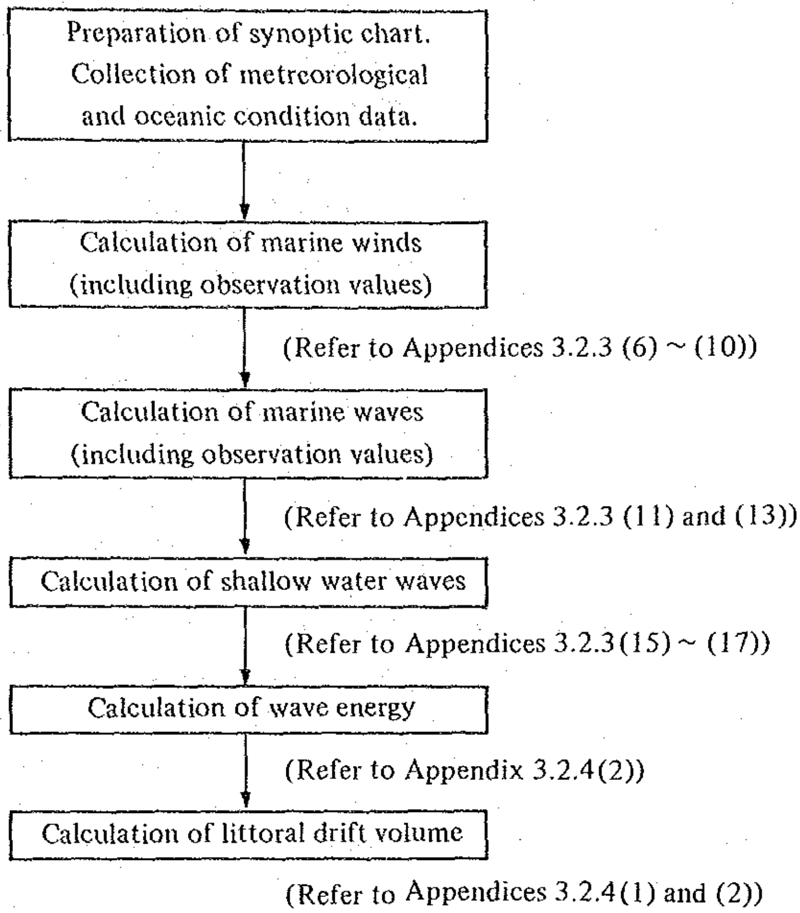


Fig. 3.2.4 Flow Chart of Analysis of Littoral Drift

Batangas Port is situated about 100 km south of Manila. The entrance to Batangas Bay is open to the southwest. The estuary of the Calumpan River is located about 1.5 km southeast of Batangas Port. The load sediment transported by this river influences the port considerably as the source of littoral drift causing siltation through longshore currents produced by wave and tidal action. According to the Siltation Study, the annual soil outflow volume from the Calumpan River is supposed to be 0.6 to 0.8 million cu. meters. Bottom materials near the estuary consist of medium grain size sand of 1.0 mm to 1.3 mm, but the other areas along the seashore consist of fine sand of 0.01 mm to 0.2 mm. (Appendix 3.2.1.) Littoral drift along the coastline consists mostly of sediment transported by the longshore currents induced by wind-generated waves in Batangas Bay. The wind velocity reaches 15 m/sec on stormy days, causing wave heights of about 1.4 m. However, waves of more than 2.0 m in significant wave height can also be expected during typhoons.

The littoral drift volume is estimated assuming that the littoral drift consists of suspended load and bed load.

(1) Calculation of Suspended Load Volume

Coastal sands or silts are transported as suspended load. The relation between suspended load volume and wave height is shown in the following formula (modified from Irie's formula, 23rd Symposium on Coastal Engineering in Japan.):

$$c = 10^3 Z - \frac{1}{u^* - 1}$$

$$u_*^2 = \sqrt{\frac{2\pi f}{T}} \cdot \frac{\pi H}{T \cdot \mathrm{Sinh}\,\frac{2\pi h}{L}}$$

where
- c : suspended load volume
- h : depth
- Z : height on sea bottom of objective area
- u_* : maximum friction velocity
- H, T, L : wave height, wave period, wave length
- f : 0.015 cm^2/sec.

(2) Calculation of Bed Load Volume

The component of wave energy along the coastline is indicated by the following formula:

$$E_x = 21{,}600 \times 0.05\, To \cdot H^2 \cdot \sinh 2\alpha_b \quad (\text{in which } H = K_r \cdot Ho)$$

where
- E_x : component of wave energy transported along the coastline with width and unit time near the breaker line
- α_b : angle between wave crest and shoreline at the breaker line
- To, Ho : wave height, wave period
- K_r : coefficient of refraction.

And, also, the following formula is proposed for the calculation of littoral drift volume along the foreshore by wave energy.

$$Q_x = \alpha E_x$$

where
- E_x : wave energy along the foreshore.
- α : coefficient obtained from direct observation.

(3) Results

The results of the suspended and bed load volume calculations are shown in Table 3.2.3.

Table 3.2.3 Results of Suspended and Bed Load Volume Calculations

Suspended Load Volume	Bed Load Volume
1,998 m^3/year	8,514 m^3/year

Generally, there are many unsolved problems concerning the phenomena of littorial drift. The formulas used at present for estimating the littoral drift volume are experimental formulas based on the observation results at each test field. The analysis of bottom sediment in the design area and continued study of meteorological and oceanic conditions will be essential. However, overall, littoral draft along the coastline will be sufficiently intercepted by the jetties jutting out offshore across the surf zone.

According to Table 3.2.3, the volume of siltation at the port area does not seem to be large.

3.2.7 Wave Analysis Based on Computer Analysis

The flow chart of wave hindcasting analysis is shown in Fig. 3.2.5.

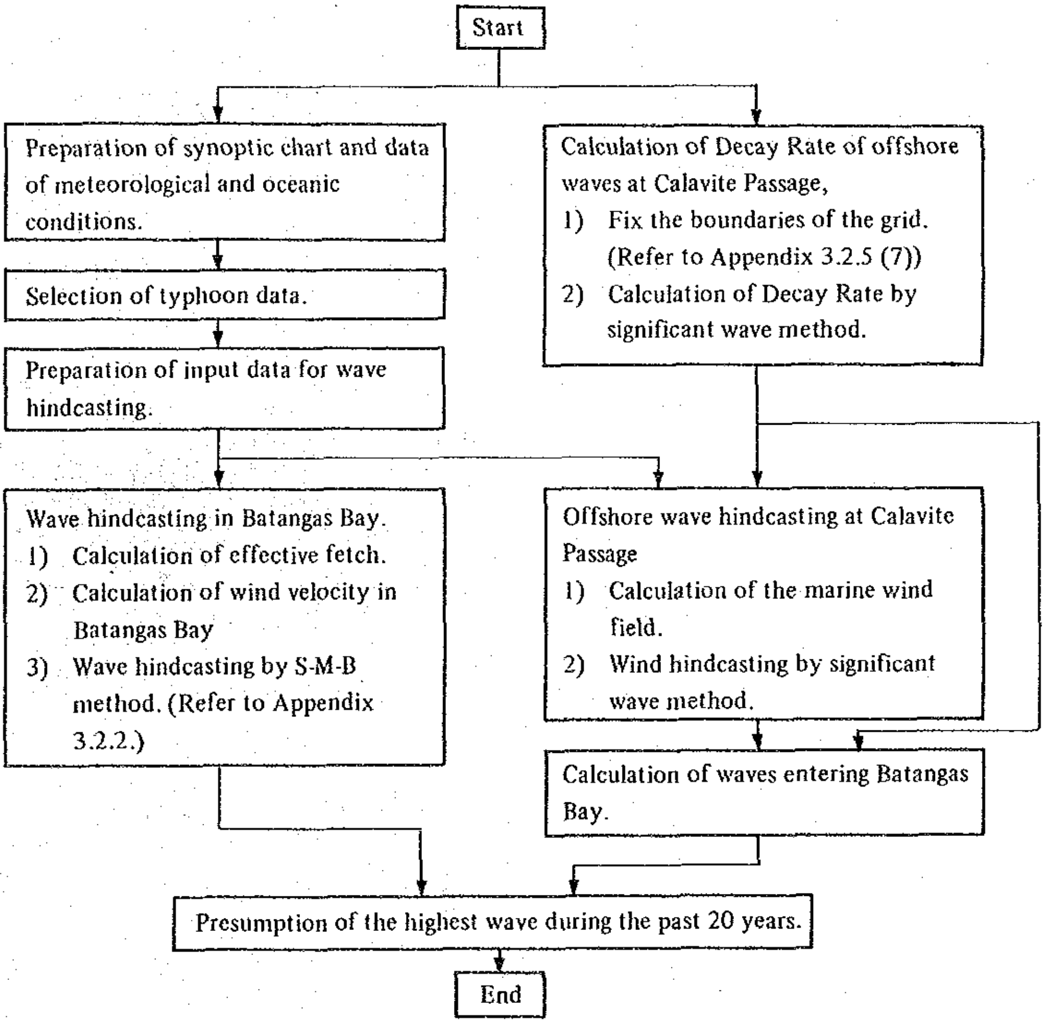
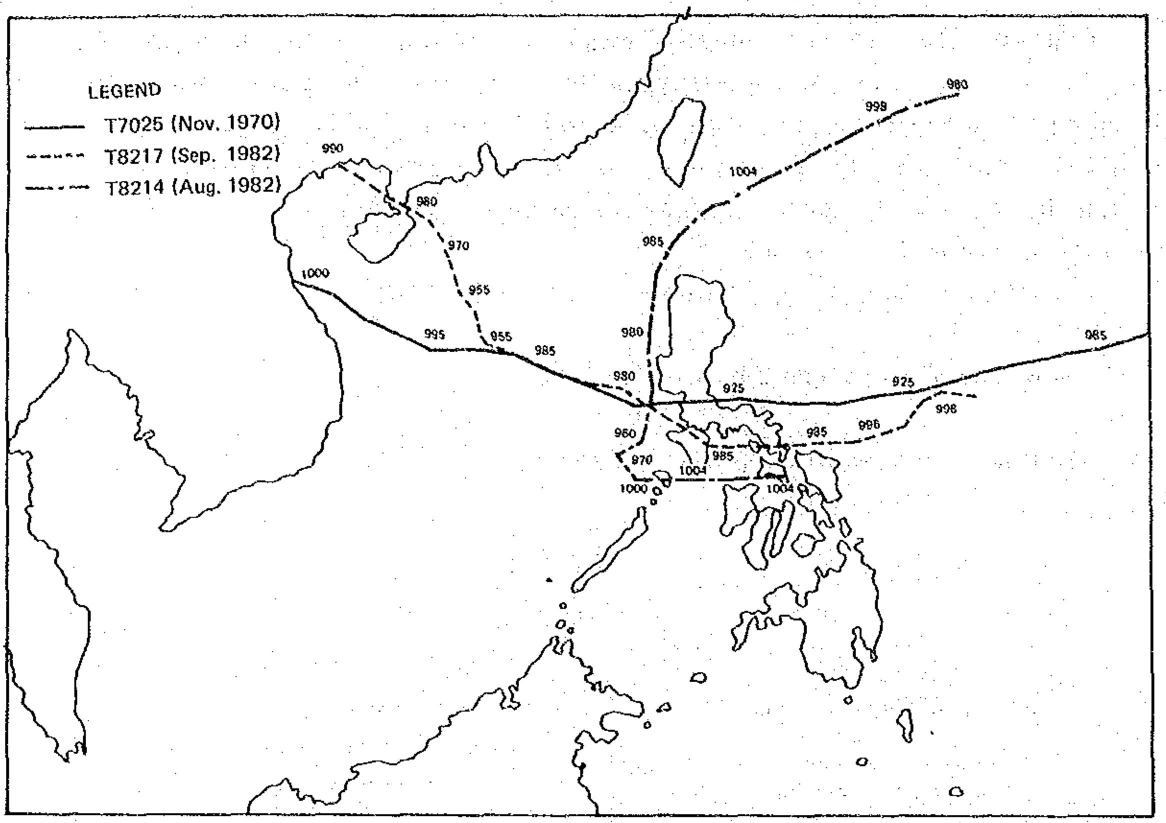


Fig. 3.2.5. Flow Chart of Wave Hindcasting

Among typhoons during the last twenty years, the typhoons No. 7025, 8214 and 8217 are selected for wave hindcasting. The chart of typhoon courses is shown in Fig. 3.2.6.

The calcualtion grid and boundary conditions for wave hindcasting are shown in Fig. 3.2.7.



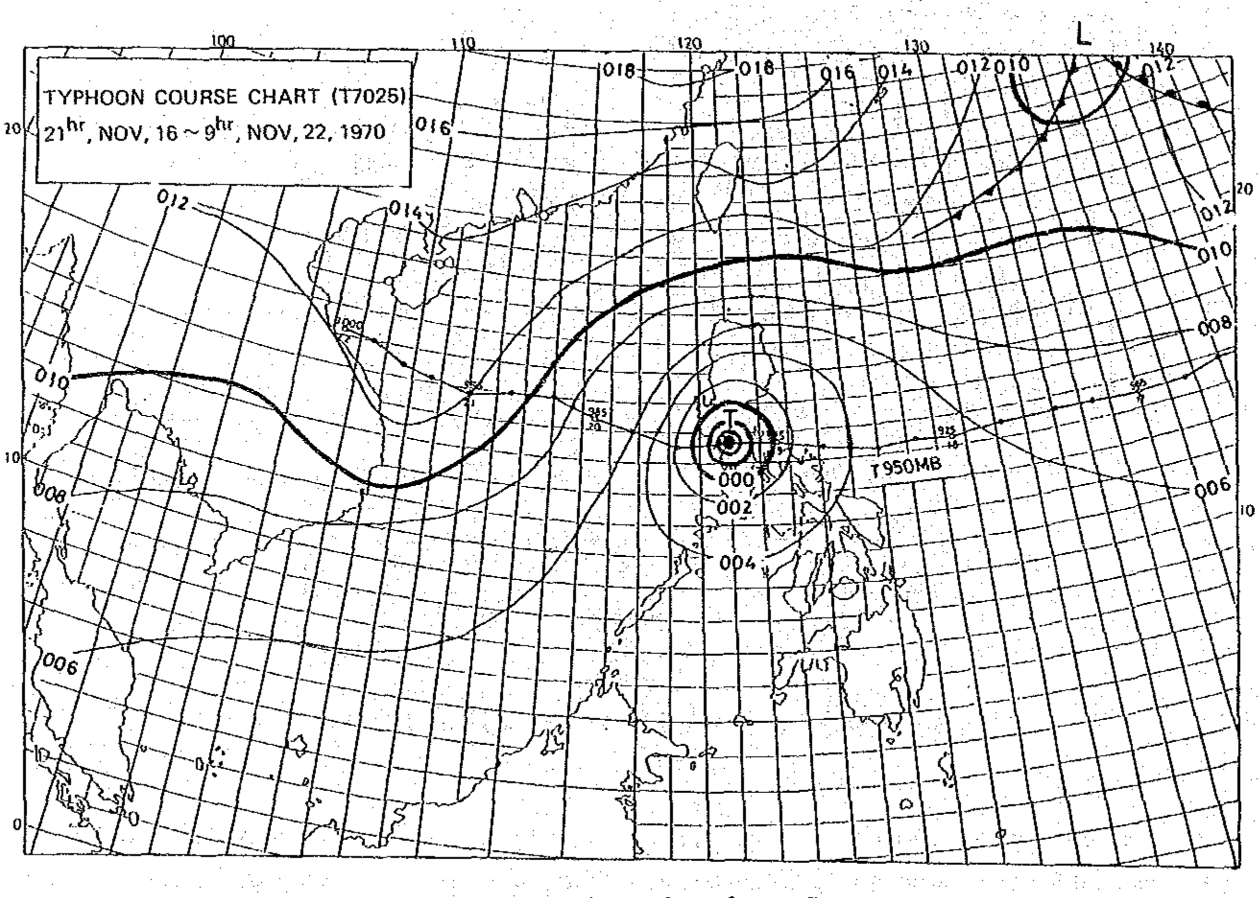
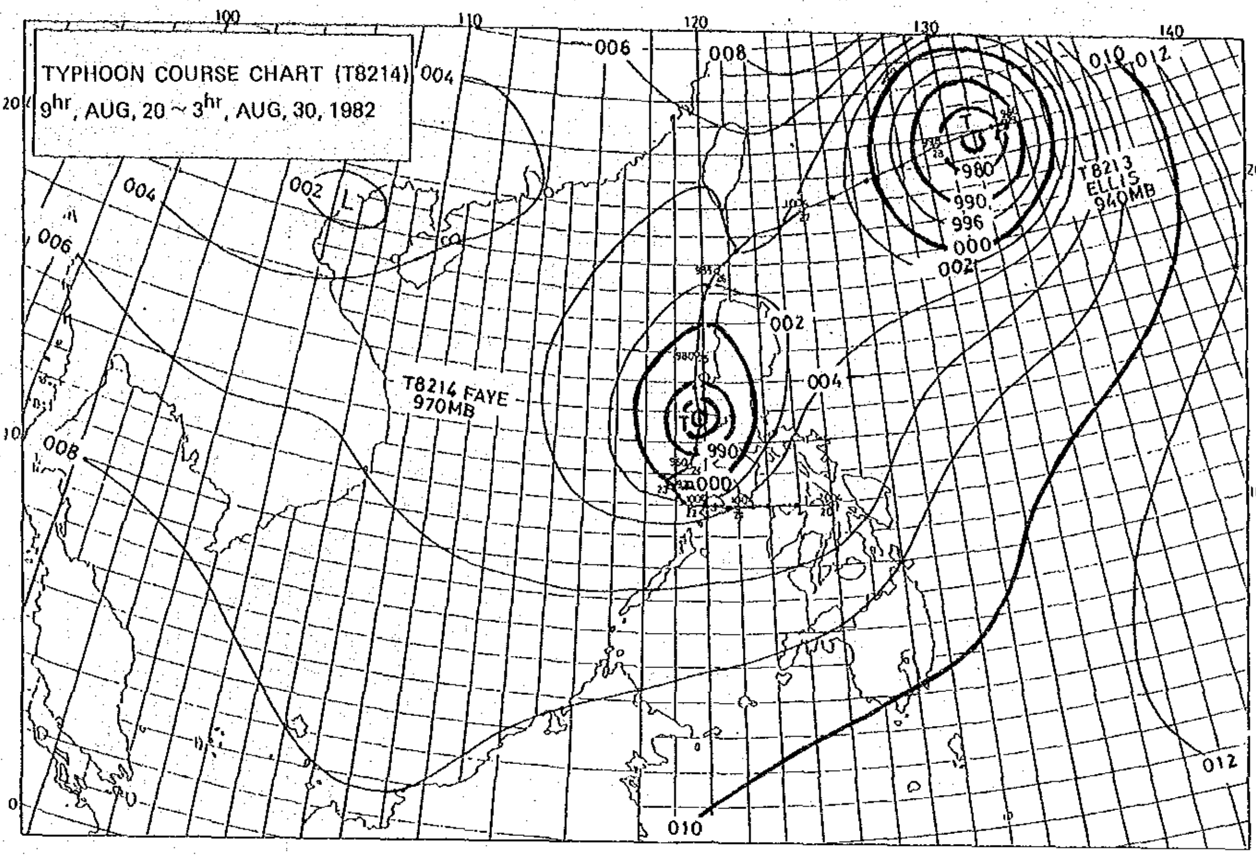


Fig. 3.2.6 (1) Chart of Typhoon Courses



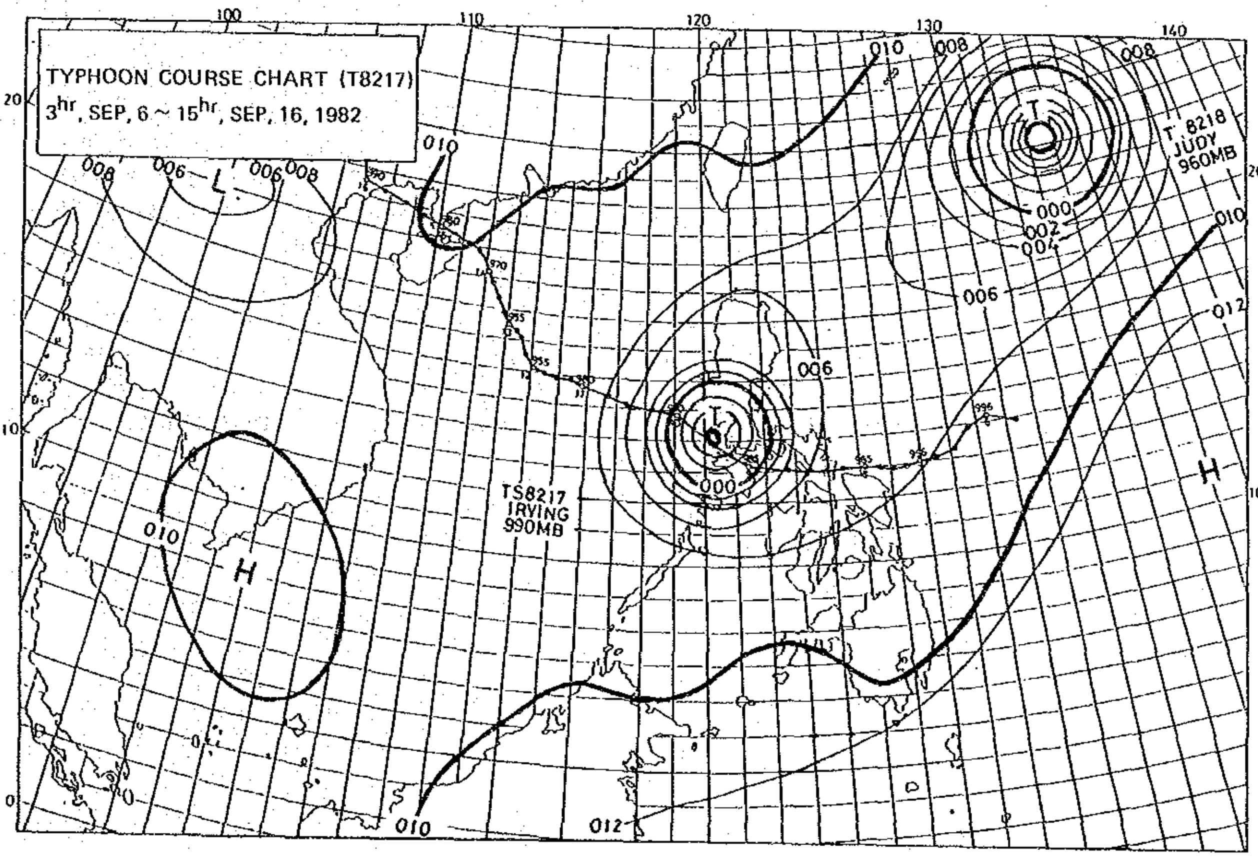


Fig. 3.2.6 (2) Chart of Typhoon Courses

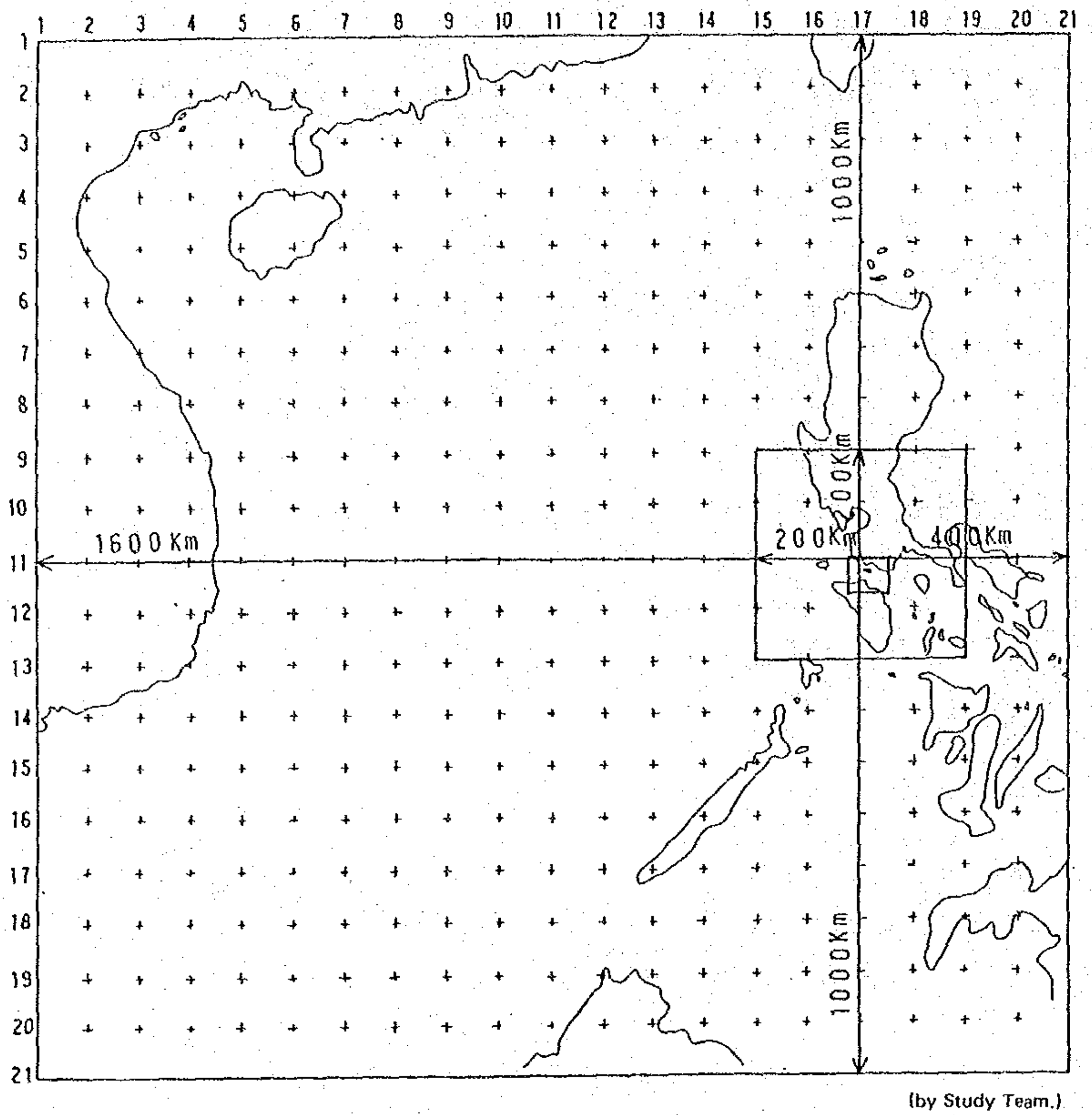


Fig. 3.2.7 Calculation Grid and Boundary Conditions for Wave Hindcasting

(1) Hindcasting of Marine Wind

Marine winds can be assumed by calculating gradient winds from isobar intervals on the synoptic charts. The formula is as follows:

$$V_g = \frac{-c + \sqrt{c^2 + \frac{4}{r} \cdot \frac{1}{\rho_a} \cdot \frac{\partial P}{\partial r}}}{\frac{2}{r}}$$

where V_g : gradient wind
c : Corioli's coefficient
r : distance from center of typhoon to study point
ρ_a : air density
P : air pressure in the typhoon

Moreover, to convert gradient wind into wind velocity at 10 meters above the sea surface wind, the following formula is used:

$$U_{10} = \alpha V_g$$

where U_{10} : wind velocity at 10 meters above the sea surface
α : coefficient.

(2) Wave Hindcasting

Wave hindcasting is carried out in relation to predominant meteorological disturbances such as typhoons. In this study, calculation is based on the significant wave method.

(3) Results of Wave Hindcasting

As the results of wave hindcasting, the following values for station 7 (S7) are to be used for the Master Plan of Batangas Port. (See Fig. 3.2.8)

Item / Typhoon	Wave Height	Wave Period	Wave Direction
7025	3.24 m	5.20 sec	SW

But the highest wave in Batangas Bay is estimated as 4.3 m in wave height, 6.2 sec. in significant wave period and S wave direction, and this wave is obtained at station 5 (S5).

Station 5 is located about 5 km WNW from Batangas Port, and conditions do not seem to influence Batangas Port. (See Fig. 3.2.8.)

Typhoon \ Item	Wave Height	Wave Period	Wave Direction
8217	4.33 m	6.2 sec	S
7025	3.94 m	6.1 sec	S
8214	2.90 m	5.4 sec	S

A calculation grid of 2.5 km mesh is shown in Fig. 3.2.8.
Time variations of wave height are shown in Fig. 3.2.9.

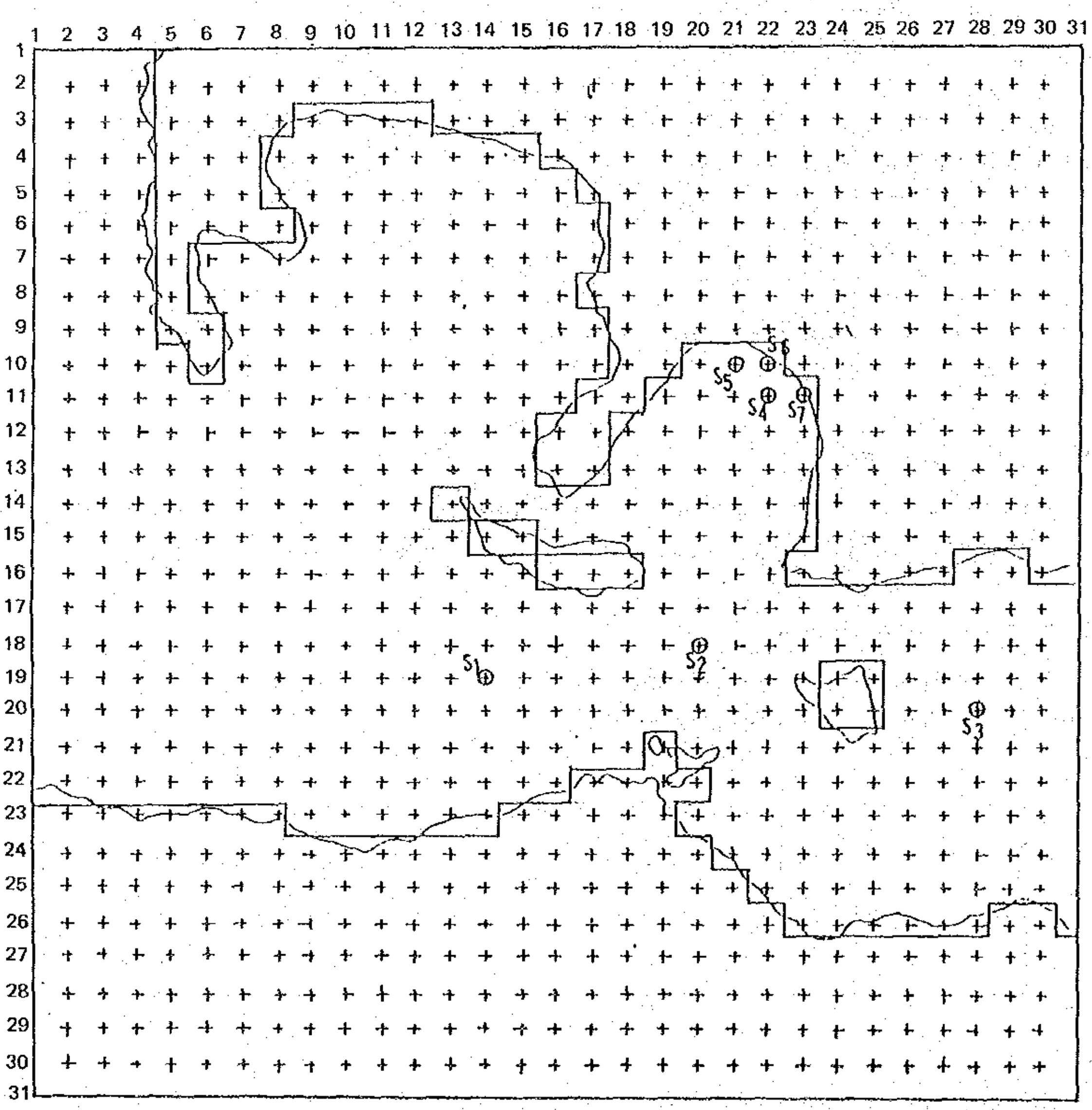


Fig. 3.2.8 Calculation Grid (2.5Km) for Wave Hindcasting

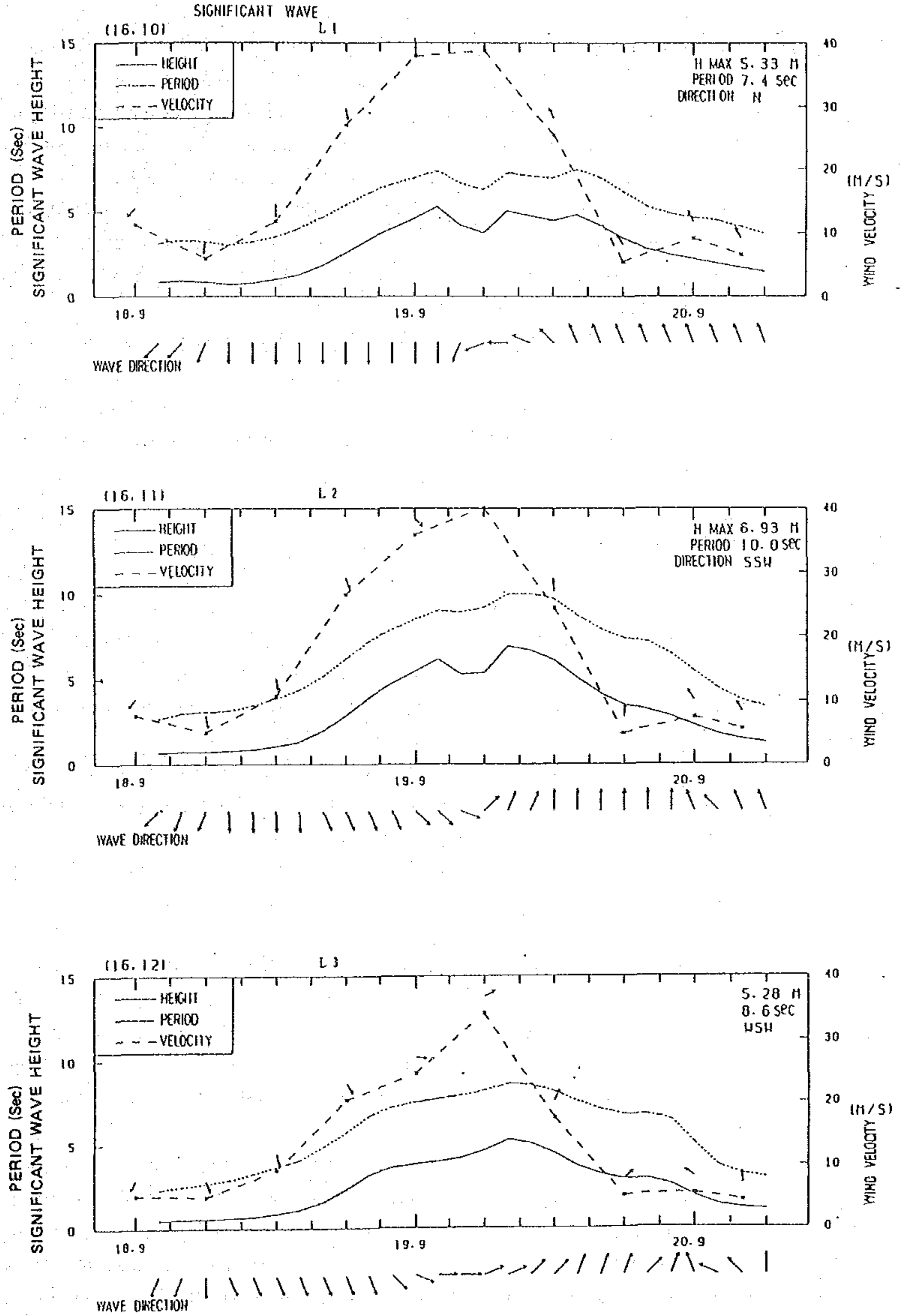


Fig. 3.2.9 Time Variation of Wave Height

3.3 Soil Conditions

3.3.1 Outline of the Soil Survey

The soil survey points were determined by the assumed future development plan of Batangas Port. At the north sea area off No. 2 Pier and at the south sea area off No. 3 pier respectively three points were surveyed. Bore hole locations are shown in Fig. 3.3.1.

The bores were made to grasp the conditions of ground distribution, to confirm the existence of poor layers, to grasp the character of soil mechanics of the cohesive soil layer, and to determine the physical properties and N-values of the sandy layer. The survey took place between September and December in 1984.

The soil survey was made with a hand feed type rotary boring machine. Standard Penetration Tests (JIS-A 1219, measurement of N-value and decision of soils) were done principally in one meter intervals, and the samples were obtained for laboratory tests. When cohesive soils were found, undisturbed soil samples were collected with a stationary-piston type thin-wall sampler for the laboratory tests.

3.3.2 Soil Conditions around Batangas Port

The investigated area is located in the center of Batangas Bay. This area is characterized by alluvial lowland from river deposits carried by the Calumpan River from the taal-taff bed behind Batangas City. The geological time of this area is diluvium to alluvium of the quaternary, and the sea bed is extremely steep dropping sharply from off the coastline to the mouth of the Bay. The geology of Batangas Bay is explained in Appendix 3.3.1.

The soil investigation points of Batangas Port show alluvial lowland in the small swamp at the back, and the sea bed from the coastline to 200 m to 250 m (at MLLW-0.00 m to MLLW-5.00 m) offshore has a gentle slope, but thereafter the slope becomes quite steep.

The composition of strata from the upper layer down is alluvium clayey soil, No. 1 Alluvium sandy soil, No. 2 Alluvium sandy soil, Diluvium clayey soil, and Diluvium sandy soil.

Brief descriptions of the individual strata are as follows:

Ac-Alluvium clay consists of very soft silt or sandy silt. Traces of broken shells and organic materials can be found in the lower layer. The color is dark gray. N-value is almost zero. Water content varies from 75% to 85%. Unit weight is less than 1.5 g/cm^3. Specific gravity of soil particles is about 2.50. The accumulation becomes deeper from the coastline to the areas offshore. The distribution of the layer is about 5 m thick at around MLLW-2 m, and at MLLW-10 m it is 10 m to 15 m in thickness.

As1-No. 1 Alluvium sandy layer consists of very fine sand, traces of shells and volcanic ash. The color is dark gray. N-value is 1 to 9. Water content varies from 40% to 70%. Unit weight is 1.5 to 1.6 g/cm^3. Specific gravity is about 2.5. Angle of shearing resistance has been estimated as from 19° to 25° from the calculation based on the N-value. The accumulation at B.H. No. 5 is MLLW-0.00 m to MLLW-16 m but at B.H. No. 4 (100 m towards the No. 3 Pier Site from B.H. No. 5) is thinner (about 1/3) than at B.H. No. 5.

As2-No. 2 Alluvium sandy layer consists of fine sand and traces of many light weight stones

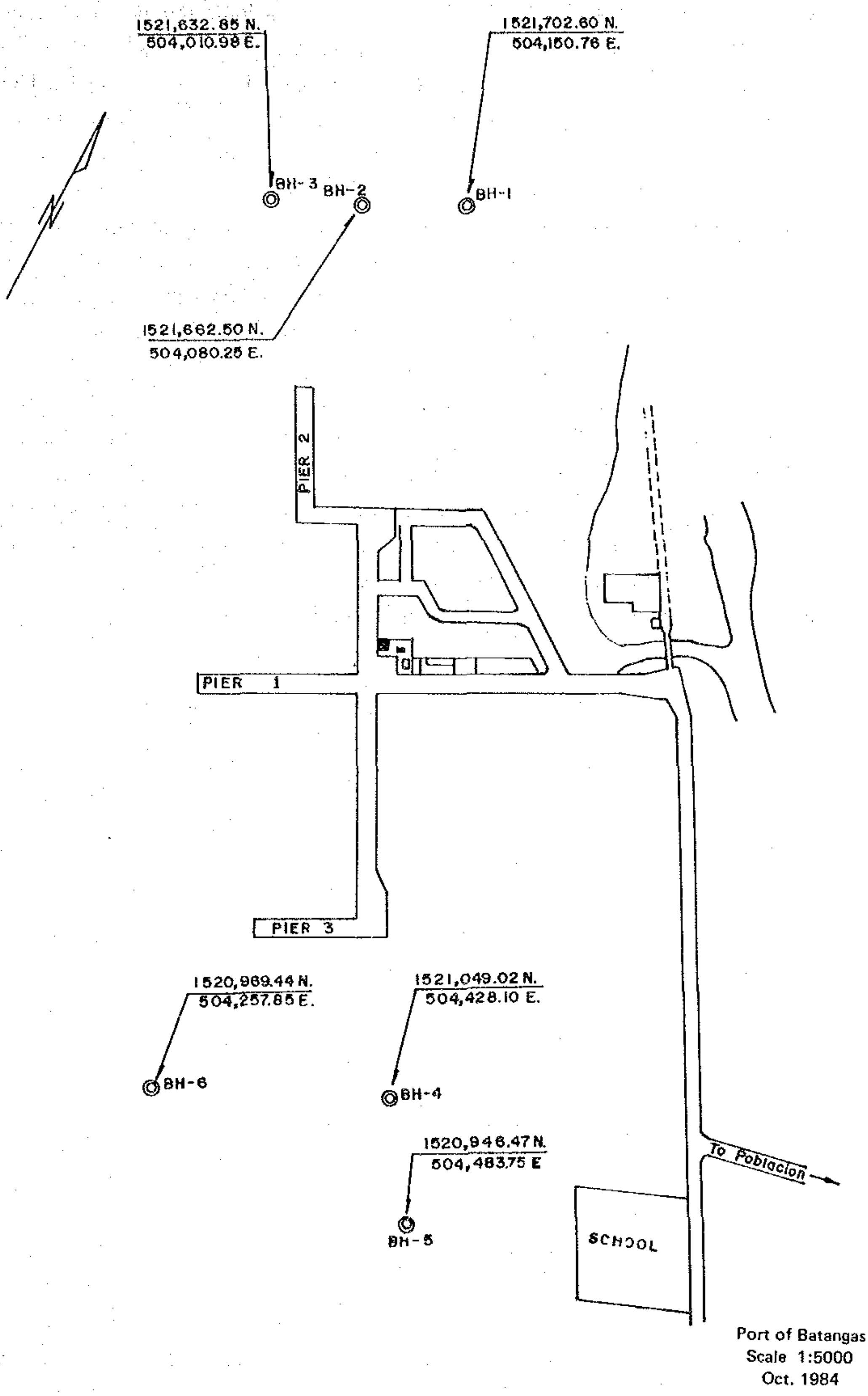


Fig. 3.3.1 Bore Hole Locations

(pumice). The color is dark gray, and N-value is 6 to 25. Water content varies from 40% to 50%. Unit weight ranges from 1.6 to 1.7 g/cm^3. Specific gravity is 2.4 to 2.5. Angle of shearing resistance has been estimated as from 27° to 30° from the calculation based on the N-value. The layer at the south site of government pier No. 3 is deeper, from 10 m to 15 m thick.

Dc-Diluvium clay consists of soft to stiff silt or clay, including traces of shells. The color is dark or greenish-gray. N-value ranges from 4 to 18 at the north site of government pier No. 2 and about 30 at the south site of No. 3 pier. Water content is about 40%. Unit weight varies from 1.5 to 1.7 g/cm^3, and specific gravity is 2.4.

Ds-Diluvium sandy layer consists of fine sand or coarse sand with medium density, including traces of broken shells and porous gravel. The color is dark gary. N-value is over 20. Water contents is about 40%. Unit weight is about 1.6 g/cm^3. Specific gravity is about 2.5. Angle of shearing resistance has been estimated as about 30° from the calculation based on the N-value.

The cross sections of this soil investigation are shown in Fig. 3.3.2, 3.3.3 and 3.3.4.

In general, accumulation of poor soils which are composed of Ac becomes deeper from the coastline offshore at both sides of the existing piers. And the layers of As1 and As2 can be found from the sea bed in shallow areas with water depths less than 2 meters on both sides. The layer As1, which is younger and poorer soil than As2, seems to become thicker southward. On the other hand, the layer As2 seems to get thinner southward. Thus, in the shallow areas, the north side provides higher N-value distribution than the south side.

Soil characteristics at each bore hole are summarized in Table 3.3.1.

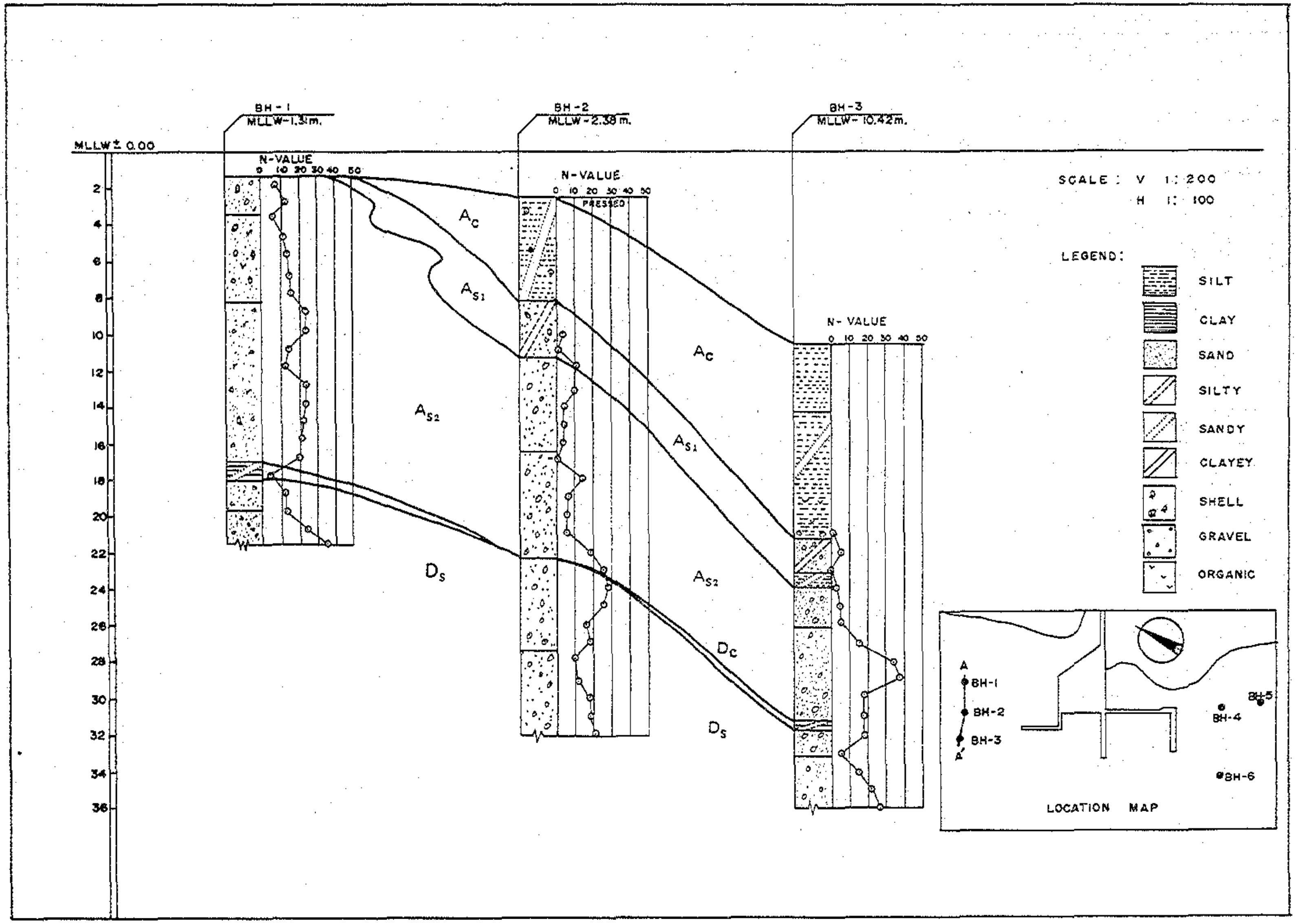


Fig. 3.3.2 Cross Section A-A'

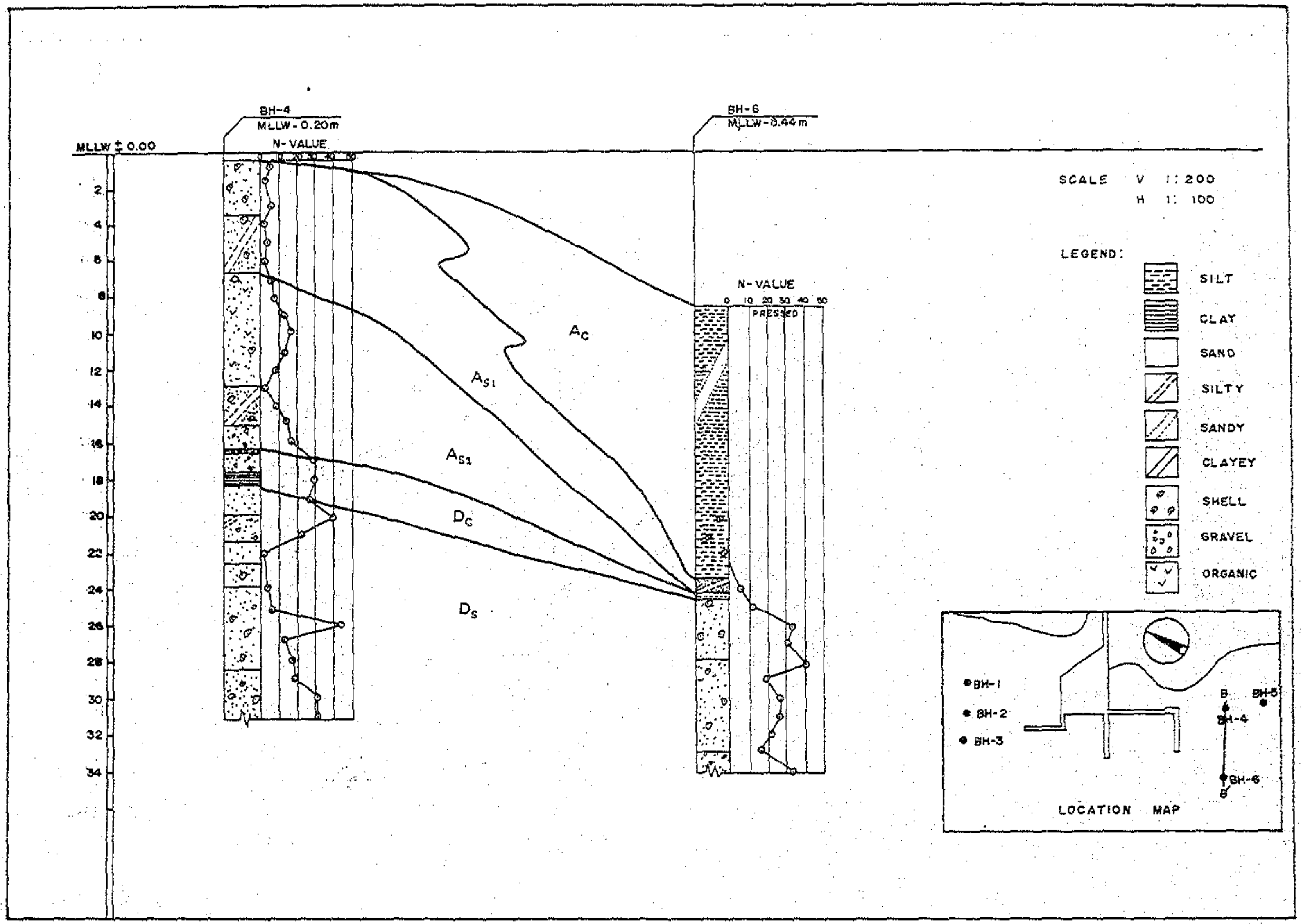


Fig. 3.3.3 Cross Section B-B'

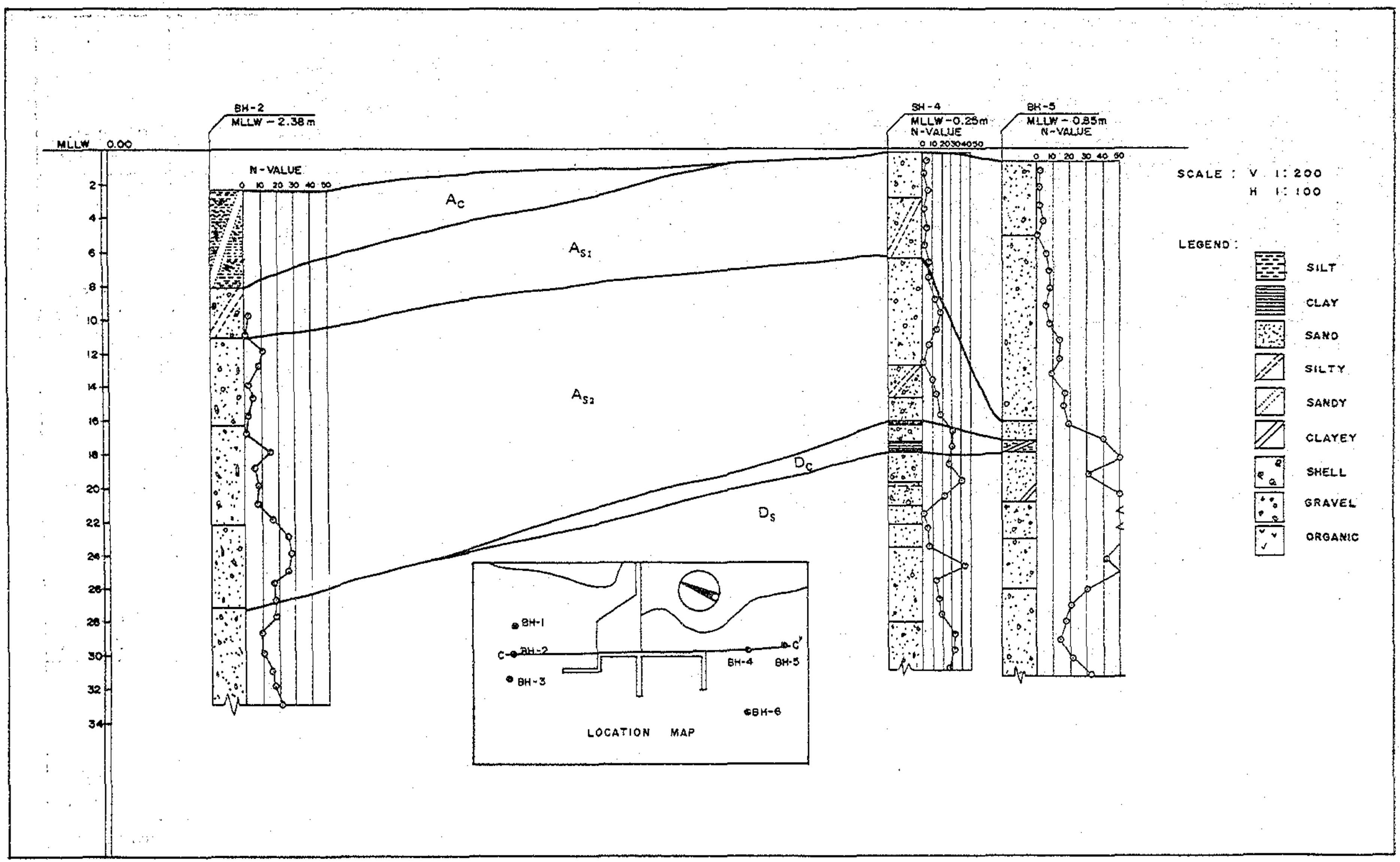


Fig. 3.3.4 Cross Section C-C′

Table 3.3.1 Soil Characteristics at Each Bore Hole

Classification	Symbol	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6
Alluvium Clay layer	Ac		Sandy silt N-value ≒ 0 γt = 1.5 g/cm³ qu = 0.16 kgf/cm² M.L.L.W −2.38 ~ −8.08 m	Silt to Sandy silt N-value ≒ 0 γt = 1.5 g/cm³ qu = 0.015Z + 0.18 kgf/cm² M.L.L.W −10.42 ~ −21.22 m			Silt to Sandy silt N-value ≒ 0 γt = 1.5 g/cm³ qu = 0.012Z + 0.08 kgf/cm² M.L.L.W −8.44 ~ −23.34 m
No. 1 Alluvium Sandy layer	As 1		Silty fine sand with volcanic ash. N-value = 0 ~ 3 γt = 1.7 g/cm³ ϕ = 30° M.L.L.W −8.08 ~ −11.13 m	Silty sand N-value = 0 ~ 5 γt = 1.5 g/cm² ϕ = 31° M.L.L.W −21.22 ~ −23.82 m	Silty fine sand with volcanic ash N-value = 1 ~ 6 γt = 1.7 g/cm³ ϕ = 28° M.L.L.W −0.29 ~ −6.44 m	Fine to coarse sand with volcanic ash N-value = 1 ~ 16 γt = 1.5 ~ 1.7 g/cm³ ϕ = 26° ~ 31° M.L.L.W −0.85 ~ −16.25 m	Silty sand N-value = 6 γt = 1.6 g/cm³ ϕ = 28° M.L.L.W −23.34 ~ −24.04 m
No. 2 Alluvium Sandy layer	As 2	Fine to coarse sand Traces of organic materials N-value = 6 ~ 24 γt = 1.5 ~ 1.6 g/cm³ ϕ = 30° ~ 41° M.L.L.W −1.31 ~ −17.16 m	Fine to coarse sand N-value = 0 ~ 15 γt = 1.7 g/cm³ ϕ = 30° M.L.L.W −11.13 ~ −22.18 m	Fine to gravelly sand N-value = 6 ~ 38 γt = 1.6 g/cm³ ϕ = 41° M.L.L.W −23.82 ~ −31.22 m	Fine sand traces of organic materials N-value = 1 ~ 17 γt = 1.7 g/cm³ ϕ = 31° M.L.L.W −6.44 ~ −16.09 m	Fine sand traces of organic materials N-value = 39 γt = 1.7 g/cm³ ϕ = 41° M.L.L.W −16.25 ~ −17.35 m	
Dilluvium Clay layer	Dc	Fine sandy silt with traces of shells N-value = 4 γt = 1.7 g/cm³ W = 56% M.L.L.W −17.16 ~ −18.21 m		Silty sand with traces of shells N-value = 5/10 cm γt = 1.6 g/cm³ M.L.L.W −31.22 ~ −31.62 m	Silt and clay N-value = 30 γt = 1.6 g/cm³ M.L.L.W −16.09 ~ −17.99 m	Clayey silt N-value = 39 γt = 1.5 g/cm³ M.L.L.W −17.35 ~ −18.05 m	Silt with traces of pumice stone M.L.L.W −24.04 ~ −24.44 m
Dilluvium Sandy layer	Ds	Fine to coarse sand N-value = 12 ~ 35 γt = 1.7 ~ 1.8 g/cm³ ϕ = 31° ~ 44° M.L.L.W −18.21 m ~	Fine to coarse sand with traces of light weight stone N-value = 11 ~ 29 γt = 1.6 ~ 1.7 g/cm³ ϕ = 35° M.L.L.W −22.18 m ~	Fine to gravelly sand with traces of light weight stone N-value = 6 ~ 27 γt = 1.6 g/cm³ ϕ = 36° M.L.L.W −31.62 m ~	Fine to coarse sand with traces of light weight stone N-value = 1 ~ 32 γt = 1.6 g/cm³ ϕ = 41° M.L.L.W −17.99 m ~	Fine to coarse sand with traces of light weight stone N-value = 16 ~ 50 γt = 1.7 g/cm³ ϕ = 42° M.L.L.W −18.05 m ~	Fine to coarse sand with traces of light weight stone N-value = 14 ~ 43 γt = 1.7 g/cm³ ϕ = 37° M.L.L.W −24.44 m ~

(by the study team)

3.3.3 Results of Soil Tests

Collected disturbed soil samples by standard penetration test were tested to grasp the physical properties of the sandy layer. Also undisturbed soil samples obtained using a stationary-piston type thin-wall sampler were used for getting information on the soil mechanics and physical properties of the clayey layer. The laboratory tests were carried out according to the items shown in the following table.

Test items	Standards
Specific Gravity of Soils	JIS-A-1202
Moisture Content of Soils	JIS-A-1203
Grain-Size Analysis of Soils	JIS-A-1204
Unit Weight of Soils	J.S.S.M.
Unconfined Compression of Soils	JIS-A-1216

Note: J.S.S.M. --- Provisions of the Japanese Society of Soil Mechanics and Foundation Engineering

The overall characteristics of the soils from the results of the laboratory tests are as follows: The coefficient of uniformity (Uc) representing characteristics of grain-size distribution is low in the upper layers and high in the lower layers (well-graded texture at the lower layers). Results of the laboratory tests are shown in Appendix 3.3.2.

The unit weight of all the soils (γt) is small; the distribution of the γt values is shown in Fig. 3.3.5.

The angle of shearing resistance (ϕ°) is shown in Fig. 3.3.6. It was calculated based on the N-value, using the formula, $\phi = \sqrt{12N} + 20$ (Japanese Standard).

The unconfined compressive strength (qu) of the alluvium clay in the upper layer is qu = 0.015Z + 0.18 at B.H. No. 3 and qu = 0.012Z + 0.08 at B.H. No. 6. Distribution of qu-value versus depth is shown in Fig. 3.3.7.

Possibility of the liquefaction of sand is estimated by the grain size distribution curve and the critical N-values which are shown in Fig. 3.3.8. The upper layer has a slight possibility of liquefaction, so it is preferable to consider this when designing significant structures (Appendix 3.3.3).

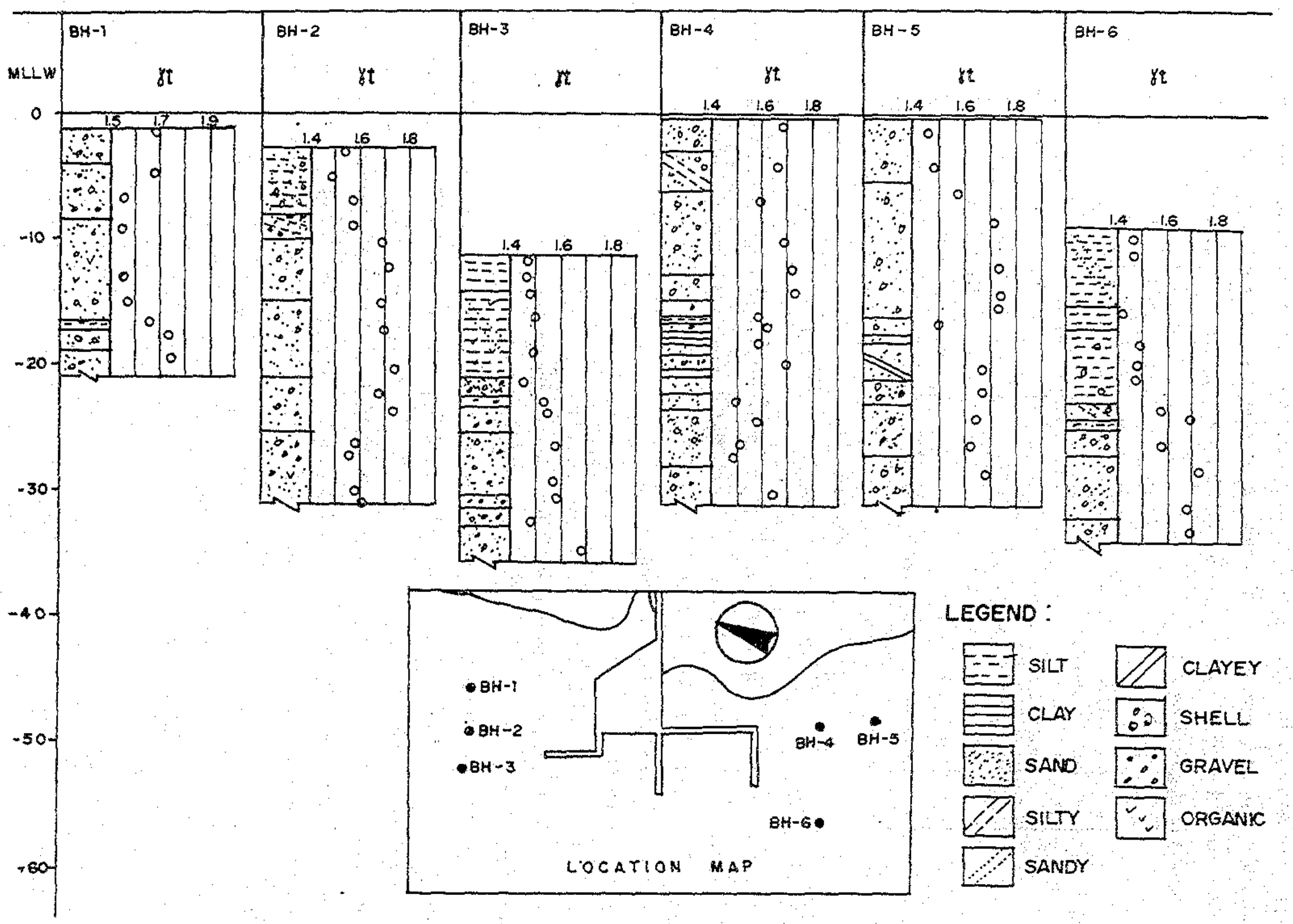


Fig. 3.3.5 Distribution of γt-Values

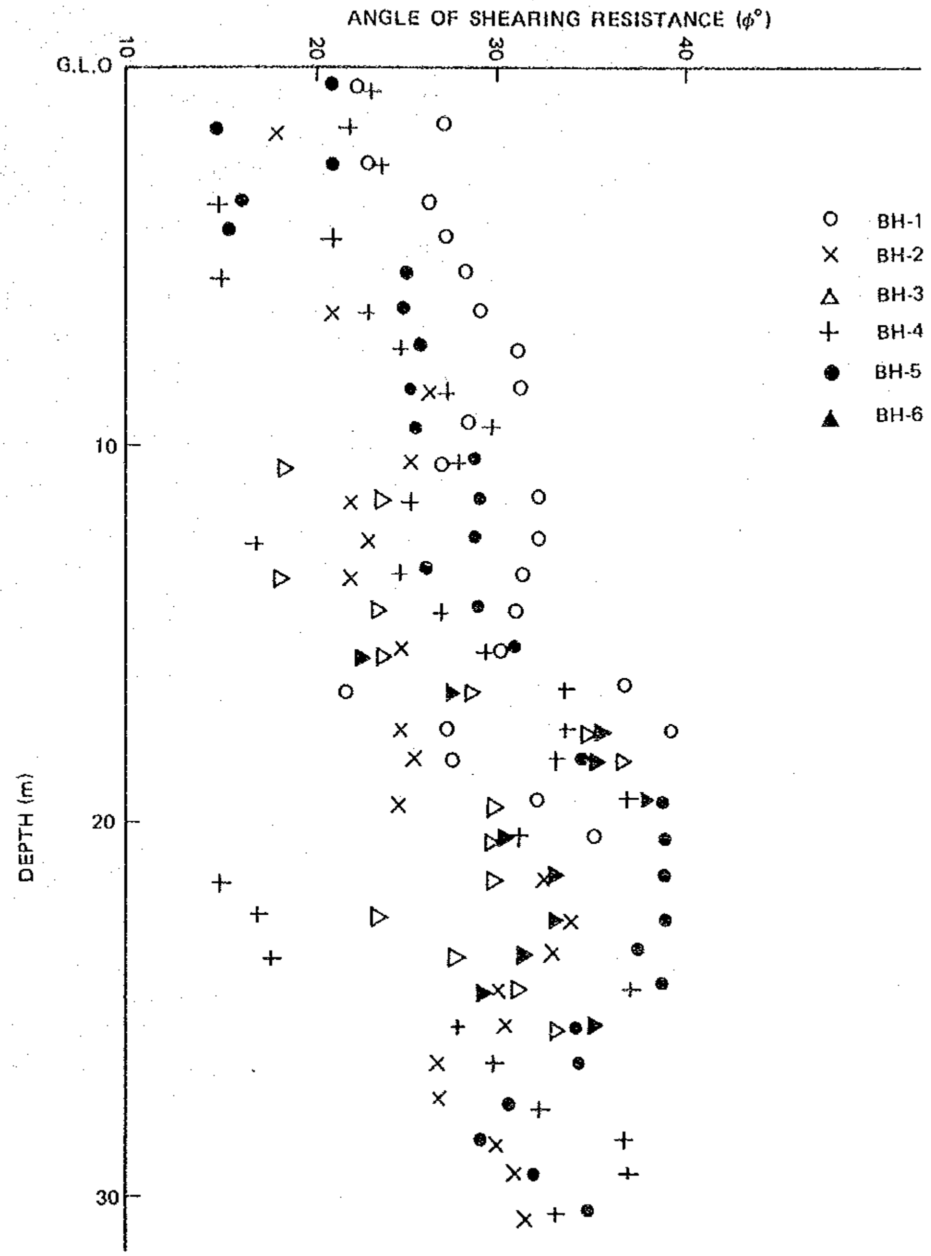


Fig. 3.3.6 Distribution of Angle of Shearing Resistance

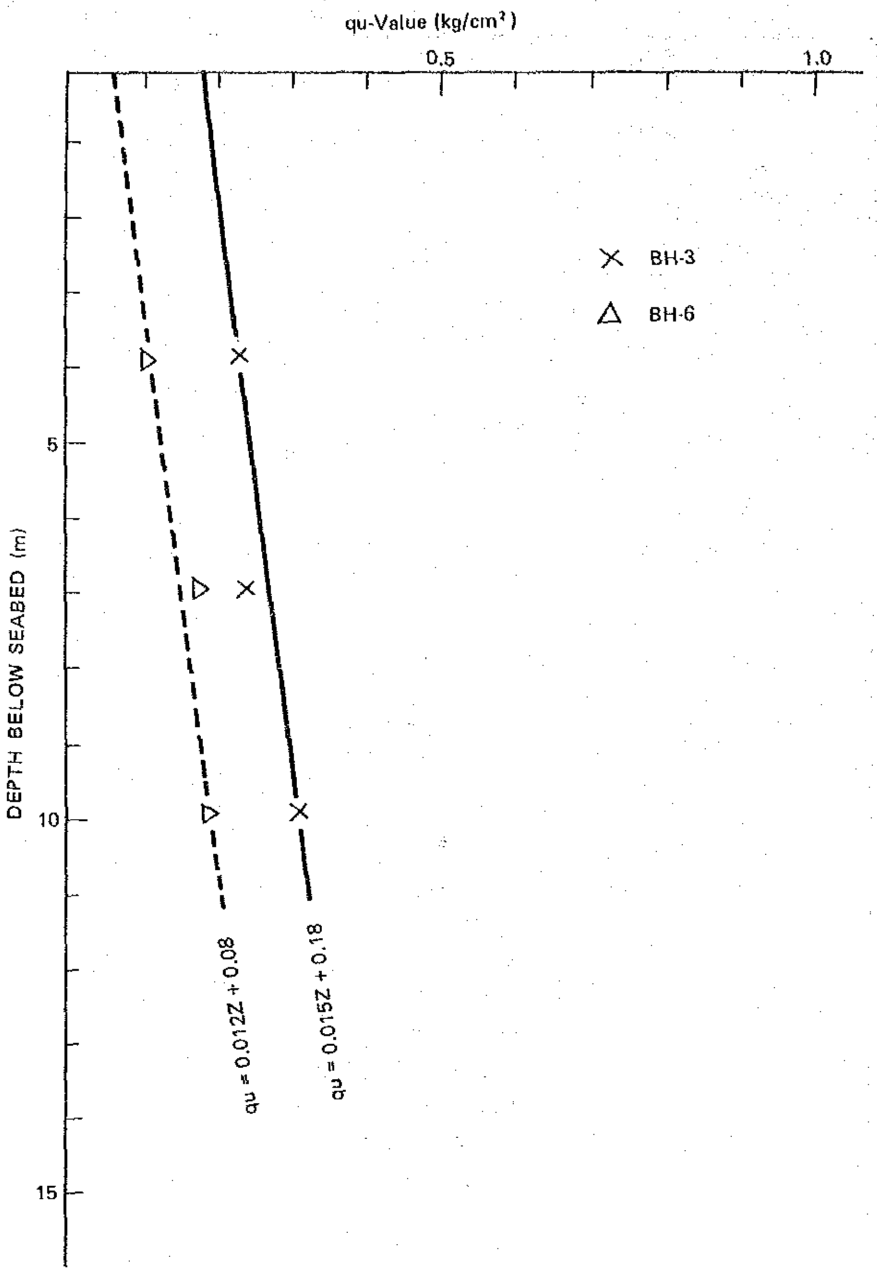
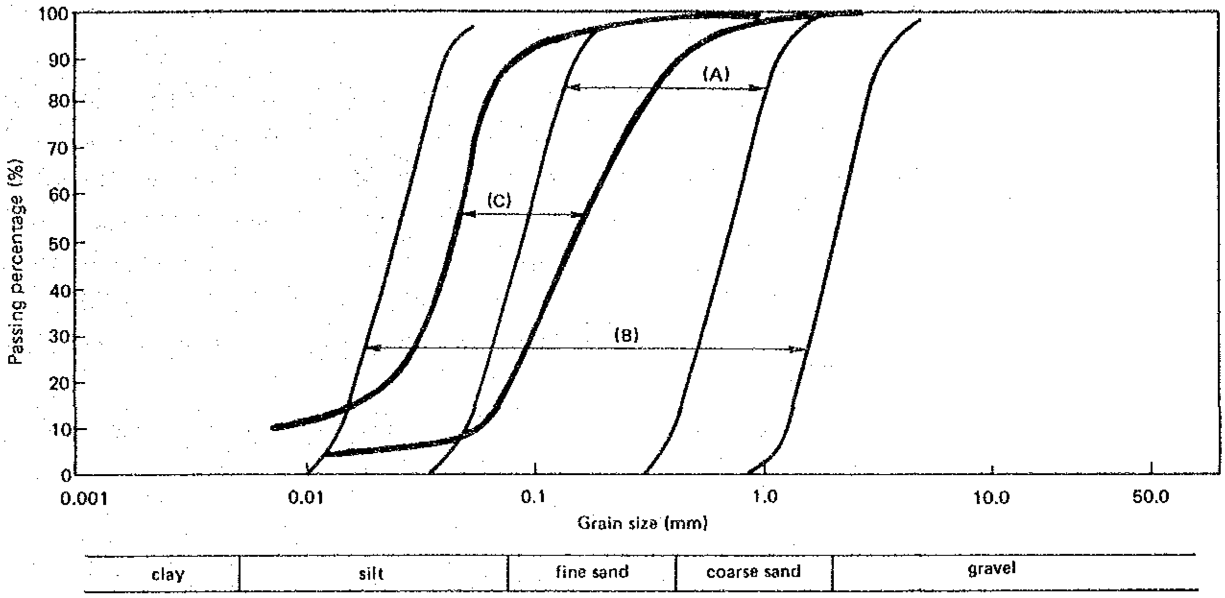


Fig. 3.3.7 Distribution of qu-Value versus Depth



Liquefaction criterion by grain size distribution curve
Note: (A) ···· Range of high possibility of liquefaction
(B) ···· Range of possibility of liquefaction
(C) ···· Range of soil investigation results at Batangas

Source: Technical Standards for Port and Harbour Facilities in Japan

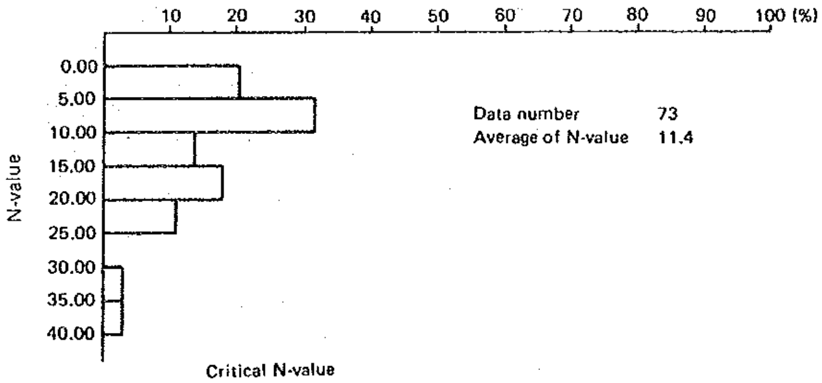


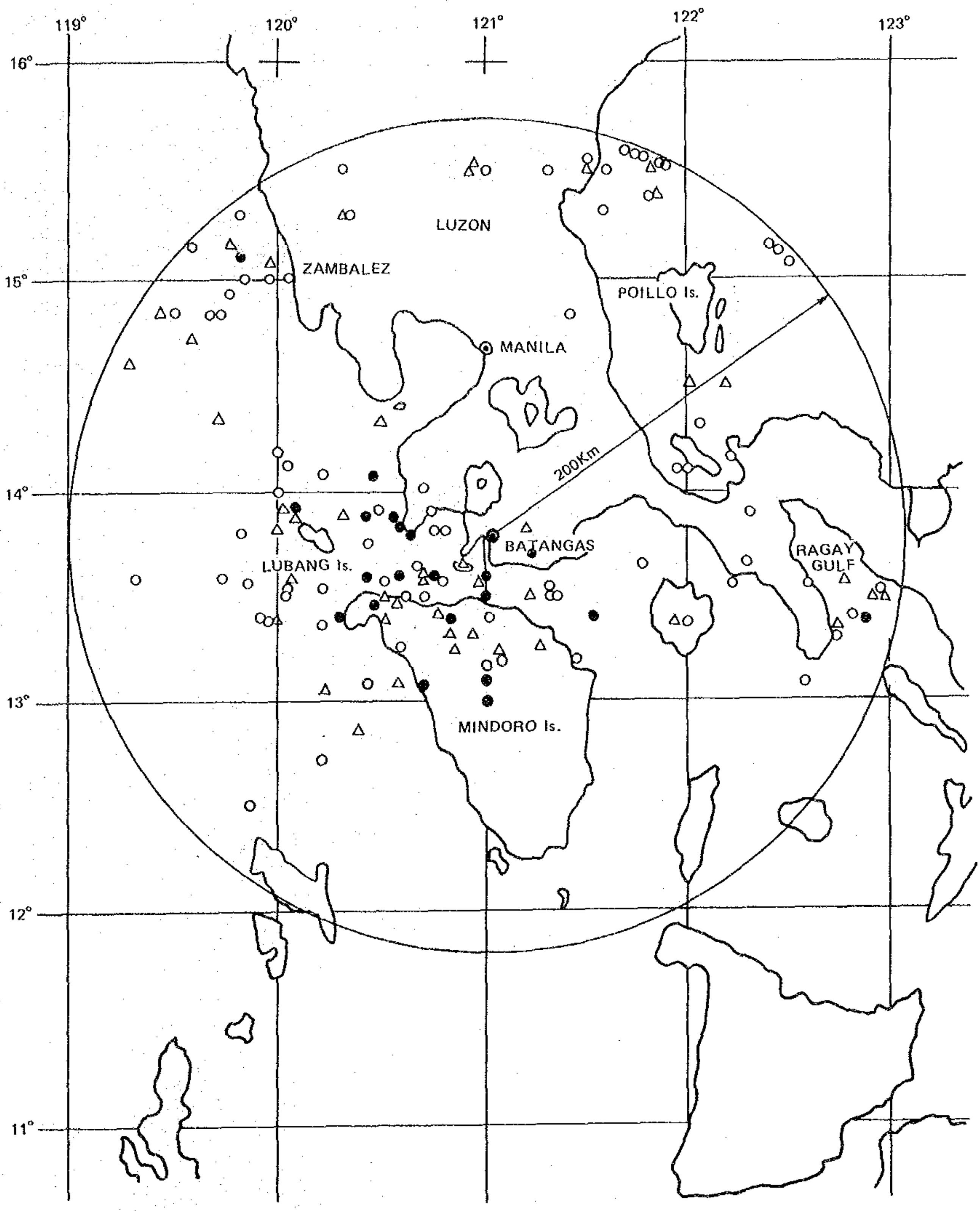
Fig. 3.3.8 Data for Estimation of Liquefaction

3.3.4 Earthquakes

141 earthquakes with epicenters located within 200 km from Batangas City were recorded over the last 32 years, according to data from PAGASA Philippines 1949 to 1981. Fig. 3.3.9 shows the location of the epicenters, and the earthquake data are presented in Appendix 3.3.4.

As the Figure indicates, areas where epicenters frequently occur are located in all directions from Batangas City. To the north, these include the north sea area of Pilillo Island and the west coast of Zambales Pr.; to the south, these include the central and northern portions of Mindoro Island; to the west, the main area is around Lubang Island; and to the east the main area is in the Raggay Gulf.

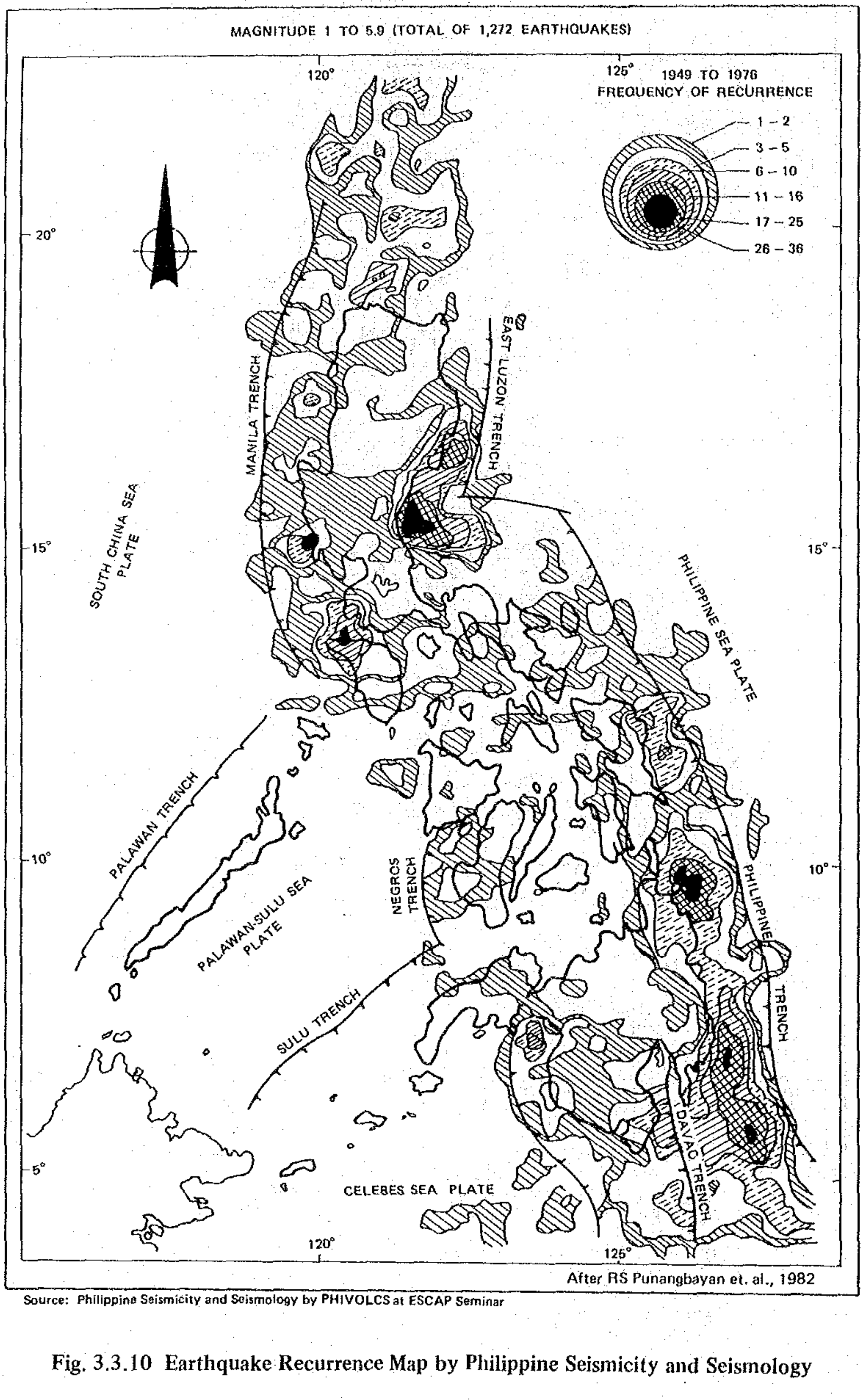
Earthquake occurrences in the Batangas area are higher than the national average in the Philippines. An earthquake recurrence map is presented as Fig. 3.3.10.



Note: △ Intensities I ~ III
Magnitude 2.0 ~ 3.5
○ Intensities IV ~
Magnitude 3.5 ~
● Effect on Batangas City
Intensity IV ~
Magnitude 3.5 ~

Data From: PAGASA
1949 to 1981

Fig. 3.3.9 Location of Epicenters



Source: Philippine Seismicity and Seismology by PHIVOLCS at ESCAP Seminar

Fig. 3.3.10 Earthquake Recurrence Map by Philippine Seismicity and Seismology