社会開発調査部報告書 COOPERATION AGENCY (JICA)
DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS
IN THE PHILIPPINES

No. 52

FINAL REPORT

THE GREATER CAPITAL REGION INTEGRATED PORT DEVELOPMENT STUDY IN THE REPUBLIC OF THE PHILIPPINES

VOL.1

PRESENT SITUATION AND PORT DEVELOPMENT STRATEGIES

OCTOBER 1994

THE OVERSEAS COASTAL AREA DEVELOPMENT INSTITUTE OF JAPAN (OCDI)
OCEAN CONSULTANT JAPAN CO.,LTD.(OCJ)

Exchange Rate

1 US Dollar = 28.0 Peso = 112 Yen

(As of December 1993)

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PREFACE

In response to a request from the Government of the Republic of Philippines, the Government of Japan decided to conduct a Master plan study on THE GREATER CAPITAL REGION INTEGRATED PORT DEVELOPMENT and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent a study team to the Philippines between April 1993 to August 1994. The study team was headed by My. Kano and composed of members of the Overseas Coastal Area Development Institute of Japan (OCDI) and Ocean Consultant Japan Co., LTD. (OCJ).

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

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

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

October 1994

Kimio FUJITA
President
Japan International Cooperation Agency

LETTER OF TRANSMITTAL

October 1994

Mr. Kimio FUJITA
President
Japan International Cooperation Agency

Dear Mr. Fujita,

It is my great pleasure to submit herewith the Report on the Greater Capital Region Integrated Port Development Study in the Republic of the Philippines.

The Study Team which consists of the Overseas Coastal Area Development Institute of Japan (OCDI) and Ocean Consultant, Japan, Co., Ltd.(OCJ) conducted four series of surveys in the Philippines from April 1993 to August 1994 as per the contract with the Japan International Cooperation Agency.

Based on the findings of these surveys as well as the data and information collected and analyzed in Japan, the Study Team held discussions with the Philippine officials of the Department of Transportation and Communications and other authorities concerned, and has formulated development strategies of major ports in the Greater Capital Region, master plans for the Port of Manila, the Port of Batangas, Sangley Point, and the Naic/Cavite New Port, and also has conducted a preliminary evaluation of master plan components for the selected two ports.

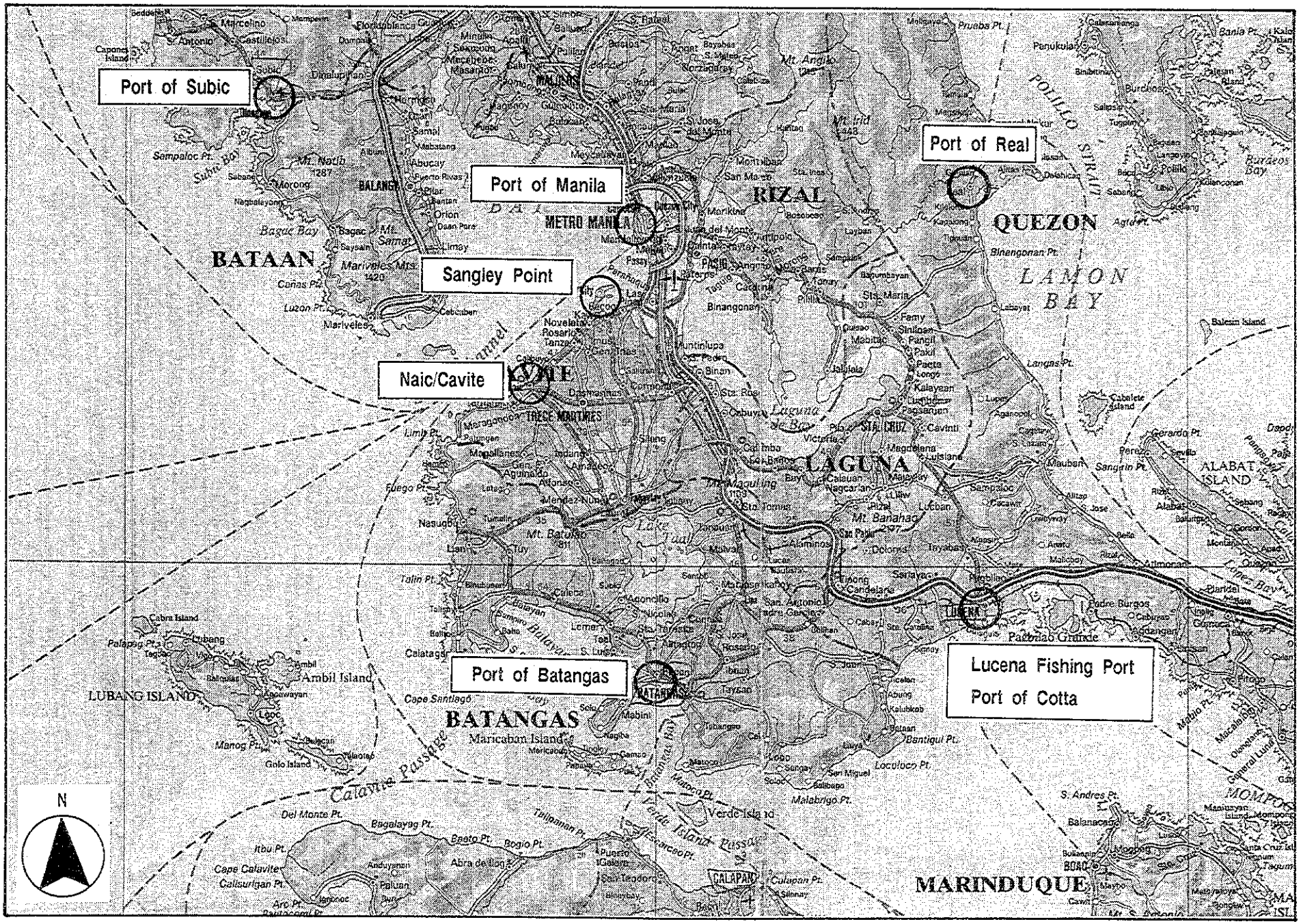
On behalf of the Study Team, I would like to express my deepest appreciation to the Department of Transportation and Communications and to other related agencies of the Philippine Government for their brilliant cooperation and assistance and for the heartfelt hospitality which was extended to the Study Team during our stay in the Philippines.

I am also greatly indebted to the Japan International Cooperation Agency, the Ministry of Foreign Affairs, the Ministry of Transport, and the Embassy of Japan in Manila for giving us valuable suggestions and assistance during the field surveys and the preparation of this report.

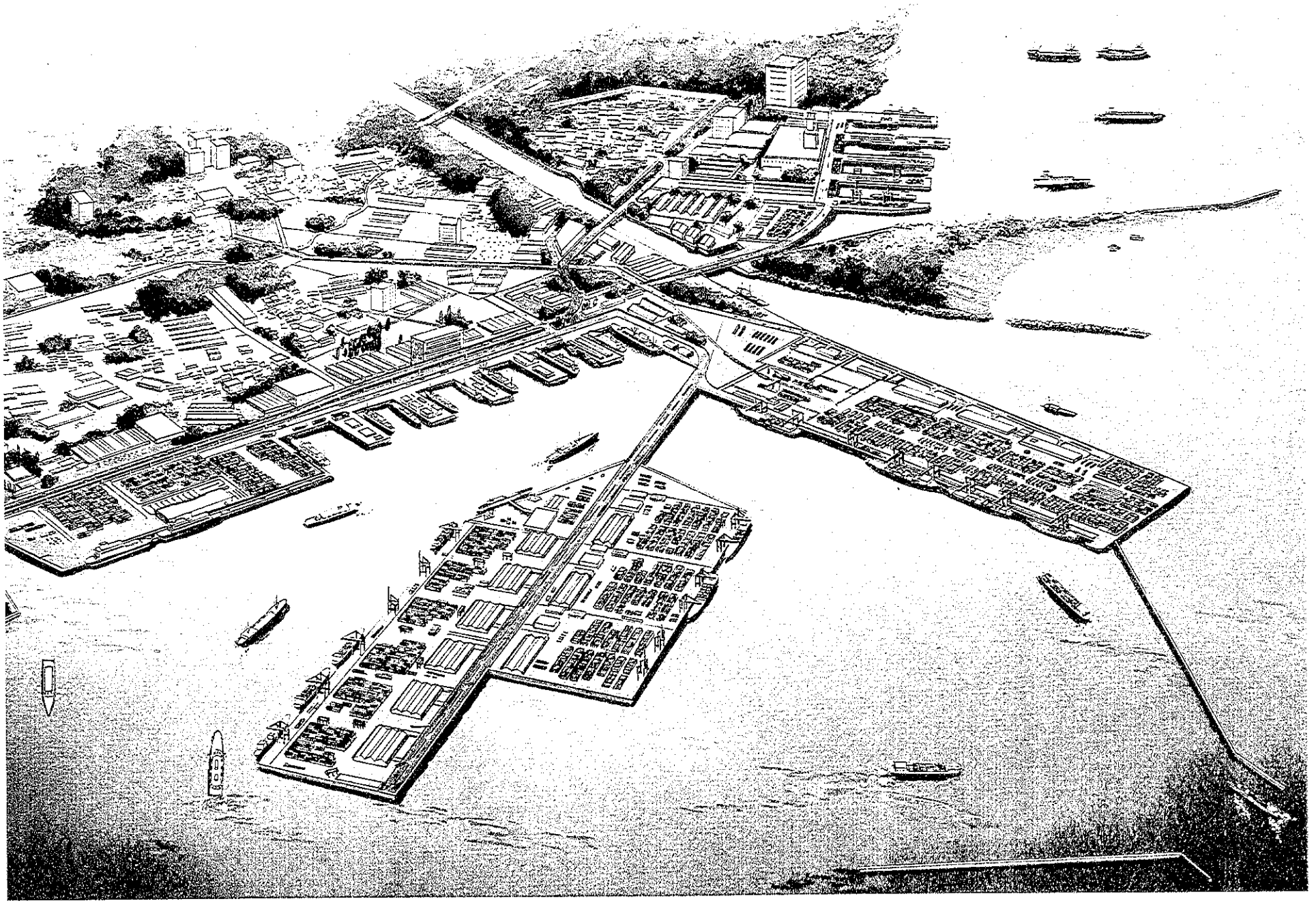
Yours faithfully,

Jiro KANO
Leader of the Study Team for the Greater Capital Region Integrated Port Development Study in the Philippines

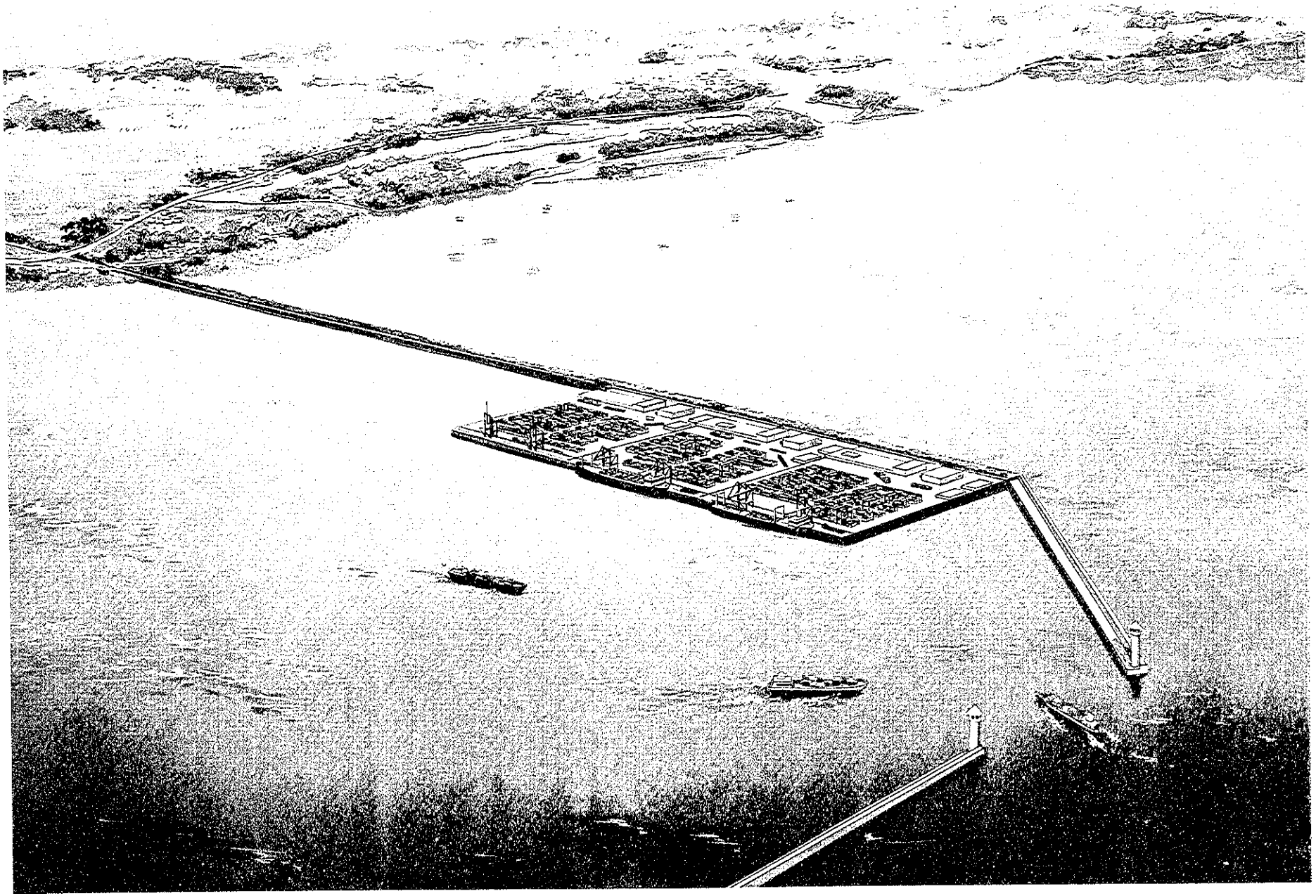
LOCATION MAP



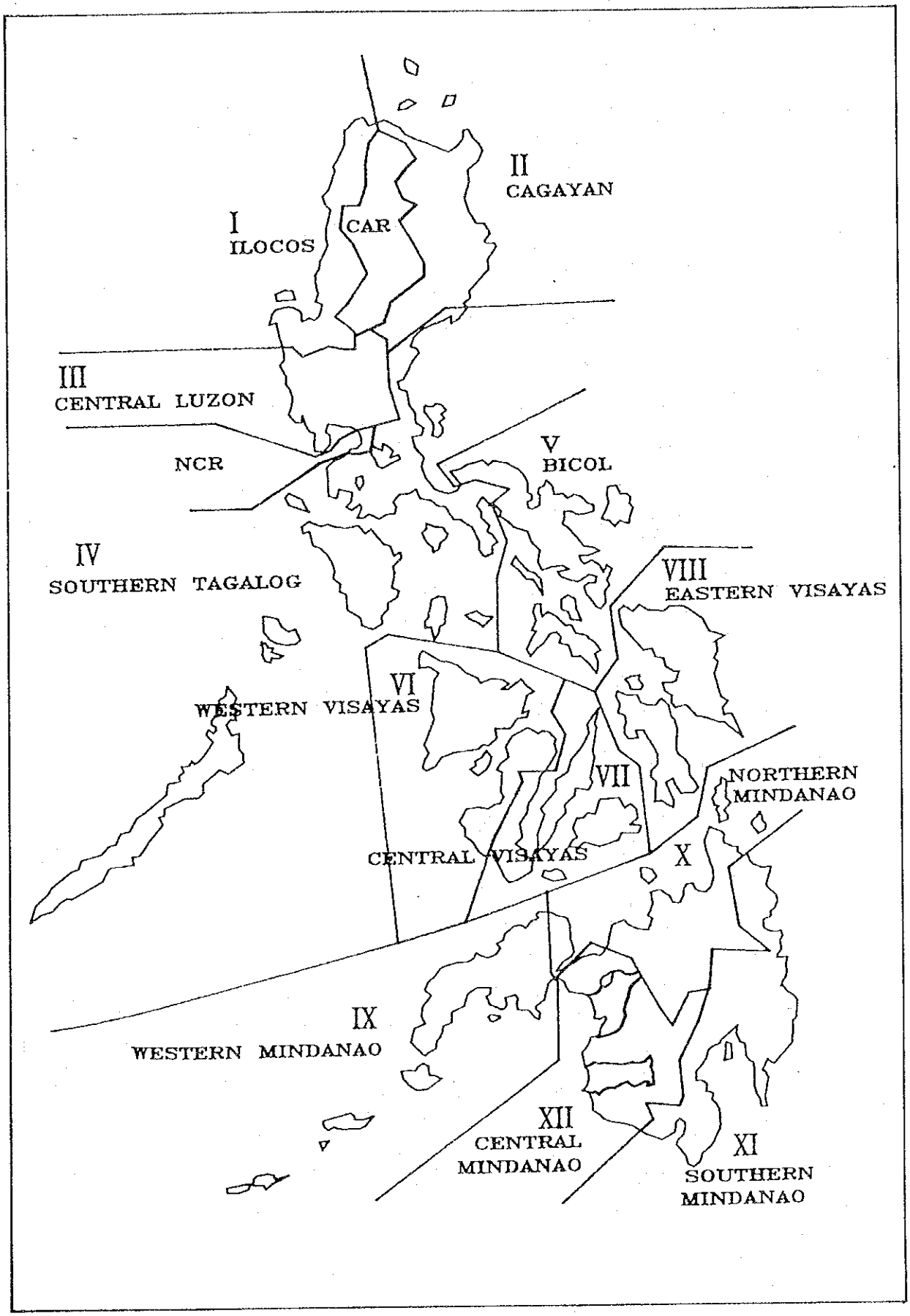
LOCATION MAP OF MAJOR PORTS IN GCR



PORT OF MANILA (MEDIUM ECONOMIC GROWTH CASE)



NAIC/CAVITE NEW PORT (HIGH ECONOMIC GROWTH CASE)



REGIONAL DELINEATION

ABBREVIATIONS

ADB	Asian Development Bank
AG&P	Atlantic Gulf and Pacific Corp. Manila
BAECON	Bureau of Agricultural Economics
BAEX	Bureau of Agricultural Extension
BBTI	Batangas Bay Terminal Incorporation
BCGS	Bureau of Coast Geodetic Survey
BEU	Bureau of Energy Utilization
BFAR	Bureau of Fishery Aquatic Resources
BFD	Bureau of Forest Development
BM	Bench Mark
BMG	Bureau of Mining Group
BOC	Bureau of Customs
BOD	Biochemical Oxygen Demand
CALABARZON	Cavite, Laguna, Batangas, Rizal and Quezon
CB	Central Bank
CFC	Conversion Factor for Consumption
CFS	Container Freight Station
CPA	Cebu Port Authority
DENR	Department of Environment and Natural Resources
DHS	Department of Human Settlements
DOA	Department of Agriculture
DOE	Department of Energy
DOTC	Department of Transportation and Communications
DPWH	Department of Public Works and Highways
DTI	Department of Trade and Industry
DWT	Dead Weight Tonnage
EDSA	Epifanio Delos Santos Ave Extension
EIRR	Economic Internal Rate of Return
EMB	Environmental Management Bureau
EPZ	Export Processing Zone
FPA	Fertilizer and Pesticide Authority
GCR	Greater Capital Region
GDP	Gross Domestic Product

GPS	Global Positioning System
GNP	Gross National Product
GRDP	Gross Regional Domestic Product
GRT	Gross Tonnage
GT	Gross ton(s)
GVA	Gross Value Added
ICD	Inland Container Depot
ICTSI	International Container Terminal Service, Inc.
JETRO	Japan External Trade Recovery Organization
JICA	Japan International Cooperation Agency
JIS	Japan Industrial Standard
LOA	Length of Over All
LO/LO ship	Lift on Lift off ship
MARINA	Maritime Industry Authority
MICT	Manila International Container Terminal
MIRDP	Mindoro Integrated Rural Development Plan
MT	Metric Ton(s)
NEDA	National Economic and Development Authority
NCA	National Coal Authority
NCR	National Capital Region
NCSO	National Census and Statistics Office
NEPC	National Environmental Protection Council
NFA	National Food Authority
NHA	National Housing Authority
NIEP	Nationwide Industrial Estate Planning
NSC	National Steel Corporation
NSCB	National Statistic Cordination Board
NTPP	National Transportation Planning Project
O/D	Origin and Destination
OECF	Overseas Economic Cooperation Fund
PAGASA	Philippine Atmospheric Geographical and Astronomical Service Administration
PASTORA	Planning Assistance Service to Rural Areas
PCA	Philippine Coconut Authority
PCIA	Philippine Cement Industry Authority

PCU	Passenger Car Unit
PFDA	Philippine Fishery Development Authority
PFM	Pacific Flour Mills
PHILSUCOM	Philippine Sugar Commission
PMU	Port Management Unit
PNCC	Philippine National Construction Company
PNOC	Philippine National Oil Company
PPA	Philippine Ports Authority
REGION III	Central Luzon Region
REGION VI	Southern Tagalog Region
RO/RO ship	Roll on Roll off ship
SCF	Standard Conversion Factor
SME	Small & Medium scale Enterprises
SMB	Sverdrup, Munk and Bretschneider
SPT	Standard Penetration Test
TEU	Twenty-foot Equivalent Unit
UNICHEM	United Coconut Chemicals, Inc.

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Part I

EXECUTIVE SUMMARY

Executive Summary

1. Background of the Study

Metro Manila and its surrounding eight (8) provinces (hereinafter referred to as "the Greater Capital Region" or "GCR" for short) is a promising area in terms of economic development, and is expected to become the economic center of the Philippines. In particular, the CALABARZON Region (Southern five (5) provinces) is designated as a large scale regional development area. Industrial development projects are already in progress in some areas of the region.

However, transport infrastructure such as roads, highways, railways and ports in those areas is still undeveloped except for that in Metro Manila. This has been an obstacle in achieving a balanced development of the whole region. Especially, the improvement and development of ports and harbors in the Greater Capital Region is one of the most urgent problems. In other words, port capacities have been unable to catch up with both actual seaborne cargo demand and enlargement of calling vessels for a long time. In addition, a greater amount of seaborne cargo has been concentrating at the Port of Manila. This causes an unfavorable and excessive impact on the land transportation within the hinterland.

On the other hand, the development of other ports in the Greater Capital Region has been retarded in spite of urgent needs for port rehabilitation and extension. In order to improve this situation, it is most essential to establish functional allocation and prioritization among ports in the Greater Capital Region, and to formulate both port development strategies and long-term port master plans from the viewpoint of regional economic development.

Based on this recognition described above, the Government of the Philippines requested the Government of Japan to conduct a study on integrated port development in the greater Capital Region (hereinafter referred to as "the Study"). In response to the request, the Government of Japan conducted the preliminary study in November 1992, which was entrusted to the Japan International Cooperation Agency (JICA). This Study was conducted from March 1993 to October 1994 and the results of the Study are incorporated in this report.

2. Objectives of the Study

The objectives of the Study are as follows:

1) To formulate development strategies of major ports in the Greater Capital Region for the period up to the year 2010 in terms of functional allocation and development requirements of each port.

2) To formulate a master plan for the Port of Manila, Batangas, Sangley Point and Naic/Cavite for the period up to the year 2010; and

3) To conduct pre-liminary evaluation of the master plan components.

3. Outline of the Study Result

3.1 Port Development Strategies

Port development strategies for the Port of Manila, Batangas, Sangley Point, Naic/Cavite and Subic in the target year 2010 are outlined as shown in Table 3-1-1.

3.2 Master Plan

The master plans (Long-term pot facility's plan and introduction of necessary cargo handling equipment) for the Port of Manila, Batangas, Sangley Point and Naic/Cavite are outlined as shown in Table 3-2-1.

4. Project Costs

The construction costs for the projects proposed in this study are outlined as shown in Table 4-1.

Table 3-1-1 Port Development Strategies in the Greater Capital Region

Port	Present Situation	Port Development Strategy
Subic	· Broad calm water area. Former US Naval Base. · American President Lines (APL) has already started international container service, but frequency is low, thus a small amount of container cargo is handled at port. · Industrialization at Subic has been realized by Taiwan group at first. · Free port project has been announced and port authority has begun duty-free sale on a small scale. · Possible project for marine recreation development. Beach is now open for public. · Distant location from Metro Manila, especially poor road link between San Fernando and Olongapo. · Cargo handling system is not modernized, in addition further improvement of port facilities is still needed for efficient cargo handling operation.	· Base port whose hinterland covers the North-west Luzon Island. · In order to develop the Port, road investment connecting with major commercial or industrial centers should have the first priority. · From the very long-term point of view, international container transshipment port is possible. · Industrial port in accordance with industrial development in backward area is also possible. · The Port should play a role as free trade zone, shelter port during storm and other urgent use until the port and road links are fully developed.
Manila	· The busiest port in the Philippines. · Super-hub port connecting with all major islands. · Increasing seaborne cargo recently, in particular container and roll on/roll off cargo. · Obvious trend of vessel-size enlargement · Successful privatization at the Manila International Container Terminal (MICT) · Rail-served Inland Container Depot Project by MICT · Definite limitation of land space for port extension. · Possible impact of port traffic upon urban highway system in Metro Manila without any countermeasure in future.	· The Port of Manila remains unshakable as super-hub port of the Philippines · In accordance with de-centralization of Metro Manila's urban function together with highway improvement extension in surrounding areas, diversion of the port role and function at Manila will be promoted. · The provision of further port facilities for rapidly increasing domestic container and roll on/roll off cargo is very urgent. Countermeasure for vessel-size enlargement is also needed. · Regarding international container cargo, Mict'S NO.5 container terminal and Rail-served Inland Container Depot (both are now projected), can catch up with increasing container demand up to the year 2000. After that, offshore port extension for new container terminals is required. · Further port improvement (port facilities and cargo handling system) for coping with growing international container cargo, especially in high economic case scenario, at the South Harbor should be accelerated. · In order to decrease the impact of port traffic on urban highway system, a port bridge across the Pasig River is needed. In addition, R-10 elevated highway project should be implemented.
Sangley Point	· Broad calm water area. Close to the South Channel in the Manila Bay. · Located in the neighborhood of Cavite Export Processing Zone (EPZ) and Metro Manila as well. · Relocation of the Naval Base is difficult. · Capacity of the access road to the proposed port site is not enough, in addition, widening of the road is infeasible due to fully developed urban district.	· Conversion plan of the Naval Base into an international commercial port is possible if relocation of the Base is achieved. · Wide discussion about the Naval Vase relocation is recommendable, from the national economic point of view. · From the long-term point of view, a construction plan of an international container port surrounding Sangley Point will mature, in spite of unsuccessful relocation of the Naval Base. · Further development of Cavite's EPZ and highway extension to Rosario will accelerate a new port construction.
Naic/ Cavite	· Natural sand beach, very shallow water area. · Small scale fishing activity, and seasonal beach recreation. · Sandy solid foundation at sea bottom. (Good natural condition for port construction) · Poor access road link to the port to cope with heavy container cargo transport. · Distance from commercial or industrial centers in GCR is also in question (Super highway construction is needed)	· High potential to construct a large scale commercial port along the Naic coast according to natural and social conditions. · The port construction plan of a few number of container berths is not recommendable for economic reasons. · Countermeasure for strong wave attack from the north direction should be carefully taken into account, during project implementation. · Countermeasure for drift sand into a port should be also taken into account.
Batangas	· Base port for trade with the Mindoro Island. · Roll on/roll off vessel's cargo and passenger are rapidly increasing. · A deep-sea port is possible without breakwaters. · Super-highway between the Port and the South Super Expressway is necessary. · Increasing demand of port cargo related to progress of the CALABARZON Regional Development Project.	· Base port for trade with the Mindoro Island is strengthened. · Provision of further port facilities for growing container cargo is accelerated after the completion of Phase-I project. Further port extension is not urgent until the target year 2010. · Improvement of cargo handling system to cope with modern container and roll on/roll off vessel arrival at the port. · The most promising port to assist the CALABARZON Regional Development Project.

Table 3-2-1 GCR Port Master Plan in the Target Year 2010 (1)

Port	Project	Low Economic Growth Case (GDP 4%)		Medium Economic Growth Case (GDP 5.5 %)		High Economic Growth (I) Case (GDP 7~7.5%)		High Economic Growth (II) Case (GDP 7~7.5%)		High Economic Growth (III) Case (GDP 7~7.5%)		Assumptions of Scenario
		Cargo Through put	Requirement	Cargo Though put	Requirement	Cargo Through put	Requirement	Cargo Through put	Requirement	Cargo Through put	Requirement	
MANILA	South Harbor Int'l Container Terminal	4,210 (Thousand Tons)	<Facility> Int'l container yard: 7.5 ha	4,440 (Thousand Tons)	<Facility> Int'l container yard: 7.5 ha	10,430 (Thousand Tons)	<Facility> Int'l container terminal: 3 berths (Depth -13 m; Length 300 m) and container yard: 35.4 ha Int'l container yard: 7.5 ha Dredging for access channel and turning basin: 5.3 Mil m^3 Port access road: 1,850 m <Equipment> Container Crane: 6 Nos. Transfer Crane: 15 Nos.	4,200 (Thousand Tons)	<Facility> Int'l container yard: 7.5 ha	4,200 (Thousand Tons)	<Facility> Int'l container yard: 7.5 ha	· All Surface and elevated highway projects are timely implemented according to DPWH's Highway Development Program.
	Manila Int'l Container Terminal (MICT)	12,090 (Thousand Tons)	<Facility> Int'l container Terminal: 1 berth (Depth -13 m; Length 300 m) Int'l container yard: 10 ha Dredging for access channel and turning basin: 1.98 Mil m^3 <Equipment> Container Crane: 2 Nos. Transfer Crane: 5 Nos.	17,800 (Thousand Tons)	<Facility> Int'l container Terminal: 3 berths (Depth -13 m; Length: 300 m) Int'l Container yard: 30.2 ha Dredging for access channel and turning basin: 3.48 Mil m^3 <Equipment> Container Crane: 6 Nos. Transfer Crane: 15 Nos.	20,570 (Thousand Tons)	<Facility> Int'l container Terminal: 4 berths (Depth -13 m; Length 300 m) Int'l container yard: 39.5 ha Breakwater extension: 400 m Dredging for access channel and turning basin: 5.02 Mil m^3 <Equipment> Container Crane: 8 Nos. Transfer Crane: 20 Nos.	20,570 (Thousand Tons)	<Facility> Int'l container Terminal: 4 berth (Depth -13 m; Length 300 m) Int'l container yard: 39.5 ha Breakwater extension: 400 m Dredging for access channel and turning basin: 5.02 Mil m^3 <Equipment> Container Crane: 8 Nos. Transfer Crane: 20 Nos.	20,570 (Thousand Tons)	<Facility> Int'l container Terminal: 4 berths (Depth -13 m; Length 300 m) Int'l container yard: 39.5 ha Breakwater extension : 400 m Dredging for access channel and turning basin: 5.02 Mil m^3 <Equipment> Container Crane: 8 Nos. Transfer Crane: 20 Nos.	· MICT's NO.5 int'l container terminal project will have been completed by the year 2000. · MICT's rail-served inland container depot project will have been compled without delay.
	North Harbor Dom'c Container Terminal	10,140 (Thousand Tons)	<Facility> Dom'c container terminal: 5 berths (Depth -10 m; Length 180 m) Dom'c container yard: 21 ha Dredging for access channel and turning basin: 3.7 Mil m^3 Port access road: 1,340 m Port bridge: 6 lanes <Equipment> Container crane: 5 Nos. Straddle carrier: 15 Nos.	13,750 (Thousand Tons)	<Facility> Dom'c container terminal: 6 berths (Depth -10 m; Length 180 m) Dom'c container yard: 26 ha Dredging for access channel and turning basin: 3.96 Mil m^3 Port access road: 1,520 m Port bridge: 6 lanes <Equipment> Container crane: 6 Nos. Straddle carrier: 18 Nos.	13,000 (Thousand Tons)	<Facility> Dom'c container terminal: 6 berth (Depth -10 m; Length 180 m) Dom'c container yard: 26 ha Dredging for access channel and turning basin: 3.96 Mil ^{3} Port access road: 1,520 m Port bridge: 6 lanes <Equipment> Container crane: 6 Nos. Straddle carrier: 18 Nos.	13,000 (Thousand Tons)	<Facility> Dom'c container terminal: 6 berths (Depth -10 m ; Length 180 m) Dom'c container yard: 26 ha Dredging for access channel and turning basin; 3.96 Mil m^3 Port access road: 1,520 m Port bridge: 6 lanes <Equipment> Container crane: 6 Nos. Straddle carrier: 18 Nos.	13,000 (Thousand Tons)	<Facility> Dom'c container terminal: 6 berths (Depth -10 m; Length 180 m) Dom'c container yard: 26 ha Dredging for access channel and turning basin; 3.96 Mil m^3 Port access road: 1,520 m Port bridge: 6 lanes <Equipment> Container crane: 6 Nos. Straddle carrier: 18 Nos.	· NHA's reclamation project is for mixed use, not for port facility only.
	Smokey Mount'n Dom'c Container Terminal					8,440 (Thousand Tons)	<Facility> Dom'c container terminal: 4 berths (Depth -10; Length -180 m) Dom'c container yard: 17 ha Dredging for access charnel and turning basin: 4.2 Mil m^3 Port access road: 3,500 m <Equipment> Container crane: 4 Nos. Straddle carrier: 12 Nos.	8,440 (Thousand Tons)	<Facility> Dom'c container terminal: 4 berths (Depth -10 m; Length -180 m) Dom'c container yard: 17 ha Dredging for access charnel and turning basin: 4.2 Mil m^3 Port access road: 3,500 m <Equipment> Container crane: 4 Nos. Straddle carrier: 12 Nos.	8,440 (Thousand Tons)	<Facility> Dom'c container terminal: 4 berths (Depth -10 m; Length -180 m) Dom'c container yard: 17 ha Dredging for access charnel and turning basin: 4.2 Mil m^3 Port access road: 3,500 m <Equipment> Container crane: 4 Nos. Straddle carrier: 12 Nos.	· Smokey Mount'n Development and Reclamation Project will have been completed by the year 2010.
	North Harbor Dom'c RO/RO Terminal	9,160 (Thousand Tons)	<Facility> Dom'c RO/RO terminal: 1 berth (Depth -9 m ; Length 220 m) Dom'c RO/RO yard: 14.6 ha Dredging for access channel and turning basin: 0.04 Mil m^3	12,400 (Thousand Tons)	<Facility> Dom'c RO/RO terminal: 2 berths (Depth -9 m; Length 220 m) Dom'c RO/RO yard: 14.6 ha Dredging for access channel and turning basin: 0.24 Mil m^3	15,040 (Thousand Tons)	<Facility> Dom'c RO/RO terminal: 3 berths (Depth -9 m; Length 220 m) Dom'c RO/RO yard; 14.6 ha Dredging for access channel and turning basin: 0.47 Mil m^3	15,040 (Thousand Tons)	<Facility> Dom'c RO/RO terminal: 3 berths (Depth -9 m ; Length 220 m) Dom'c RO/RO yard: 14.6 ha Dredging for access channel and turning basin: 0.47 Mil m^3	15,040 (Thousand Tons)	<Facility> Dom'c RO/RO terminal: 3 berths (Depth -9 m; Length 220 m) Dom'c RO/RO yard: 14.6 ha Dredging for access channel and turning basin: 0.47 Mil m^3	· NO.1 and NO.2 dom'c RO/RO terminals (both are on-going projects) will have been constructed by the year 1995. · NO.3 dom'c RO/RO terminal project will have been completed by the year 1997.

Table 3-2-1 GCR Port Master Plan in the Target Year 2010 (2)

Port	Project	Low Economic Growth Case (GDP 4%)		Medium Economic Growth Case (GDP 5.5 %)		High Economic Growth (I) Case (GDP 7~7.5%)		High Economic Growth (II) Case (GDP 7~7.5%)		High Economic Growth (III) Case (GDP 7~7.5%)		Assumptions of Scenario
		Cargo Through put	Requirement	Cargo Though put	Requirement	Cargo Through put	Requirement	Cargo Through put	Requirement	Cargo Through put	Requirement	
SANGLEY POINT	Int'l Container Terminal									6,230 (Thousand Tons)	<Facility> Int'l container terminal: 3 berths (Depth -13 m; Length 300 m) Int'l container yard: 27.9 ha Dredging for access channel and turning basin: 8.5 Mil m^3 Port access road: 4,300 m <Equipment> Container crane: 6 Nos. Transfer crane: 15 Nos.	· Cost for the Naval Base relocation is not borne by the port sector. · Manila-Cavite highway project will have been completed by the year 2010
NAIC/ CAVITE	Int'l Container Terminal							6,230 (Thousand Tons)	<Facility> Int'l container terminal: 3 berths (Depth -13 m; Length 300 m) Int'l container yard: 27.9 ha Breakwater : 2,020 m Dredging for access channel and turning basin: 5.65 Mil m^3 Port access road: 3,800 m <Equipment> Container crane: 6 Nos. Transfer crane: 15 Nos.			· Both DPWH's urban highway development projects and MICT's rail-served inland container depot project will not have been completed by the year 2010. · Relocation of the Naval Base at Sangley Point will not have been achieved.
BATANGAS	Int'l Terminal					1,200 (Thousand Tons)	<Facility> Int'l container terminal: 1 berth (Depth -10 m; Length 180 m) Int'l container yard: 2 ha Dredging for access channel and turning basin: 0.35 Mil m^3 Port access road 490m <Equipment> Container crane: 1 No. Straddle carrier: 3 Nos.	1,200 (Thousand Tons)	<Facility> Int'l container terminal: 1 berth (Depth -10 m; Length 180) Int'l container yard: 2 ha Dredging for access channel and turning basin: 0.35 Mil m^3 Port access read 490 m <Equipment> Container crane: 1 No. Straddle carrier: 3 Nos.	1,200 (Thousand Tons)	<Facility> Int'l container terminal: 1 berth (Depth -10 m; Length 180 m) Int'l container yard: 2 ha Dredging for access channel and turning basin: 0.35 Mil m^3 Port access road: 490 m <Equipment> Container crane: 1 No. Straddle carrier: 3 Nos.	· Phase-I project will have been completed without delay. · South Super Expressway's extension to Batangas will have been implemented by the year 2000.
						400 (Thousand Tons)	<Facility> Int'l conventional terminal: 1 berth (Depth -10 m; Length 170 m)	400 (Thousand Tons)	<Facility> Int'l conventional terminal: 1 berth (Depth -10 m; Length 170 m)	400 (Thousand Tons)	<Facility> Int'l conventional terminal: 1 berth (Depth -10 m; Length 170 m)	
	Dom'c Terminal	1,300 (Thousand Tons)	<Facility> Dom'c container terminal: 1 berth (Depth -10 m; Length 150 m) Dom'c container yard: 2.6 ha Dredging for access channel and turning basin: 0.4 Mil m^3 <Equipment> Container Crane: 1 No. Straddle Carrier: 3 Nos.	2,170 (Thousand Tons)	<Facility> Dom'c container terminal: 1 berth (Depth -10 m; Length 150 m) Dom'c container yard: 2.6 ha Dredging for access channel and turning basin: 0.4 Mil m^3 <Equipment> Container crane: 1 No. Straddle carrier: 3 Nos.	3,300 (Thousand Tons)	<Facility> Dom'c container terminal: 1 berth (Depth -10 m; Length 150 m) Dom'c container yard: 2.6 ha Dredging for access channel and turning basin: 0.4 Mil m^3 <Equipment> Container crane: 1 No. Straddle carrier: 3 Nos.	3,300 (Thousand Tons)	<Facility> Dom'c container terminal: 1 berth (Depth -10 m; Length 150 m) Dom'c container yard: 2.6 ha Dredging for access channel and turning basin: 0.4 Mil m^3 <Equipment> Container crane: 1 No. Straddle carrier: 3 Nos.	3,300 (Thousand Tons)	<Facility> Dom'c container terminal: 1 berth (Depth -10 m; Length 150 m) Dom'c container yard: 2.6 ha Dredging for access channel and turning basin: 0.4 Mil m^3 <Equipment> Container crane: 1 No. Straddle carrier: 3 Nos.	· Phase-I project will have been completed without delay. · South Super Expressway's extension to Batangas will have will have been implemented by the year 2000.
						2,400 (Thousand Tons)	Dom's RO/RO terminal: 1 berth (Depth -5.5 m; Length 120 m) Dredging for access channel and turning basin: 0.05 Mil m^3	2,400 (Thousand Tons)	Dom'c RO/RO terminal: 1 berth (Depth -5.5 m; Length 120 m) Dredging for access channel and turning basin: 0.05 Mil m^3	2,400 (Thousand Tons)	Dom'c RO/RO terminal: 1 berth (Depth -5.5 m; Length 120 m) Dredging for access channel and turning basin: 0.05 Mil m^3	

Table 4-1 Project Cost

(Unit: Million Peso)

Port	Project	Medium Economic Growth Case [GDP 5.5%]	High Economic Growth (I) Case [GDP 7~7.5%]	High Economic Growth (II) Case [GDP 7~7.5%]	High Economic Growth (III) Case [GDP 7~7.5%]
Manila	South Harbor Int'l Container Terminal	1,424 (353)	11,545 (5,120)	1,424 (353)	1,424 (353)
	Manila Int'l Container Terminal (MICT)	9,748 (4,783)	12,931 (6,458)	12,931 (6,458)	12,931 (6,458)
	North Harbor Dom'c Container Terminal	7,786 (3,998)	7,749 (3,969)	7,749 (3,969)	7,749 (3,969)
	Smokey Mount's Dom'c Container Terminal	- (-)	7,609 (2,561)	7,609 (2,561)	7,609 (2,561)
	North Harbor Dom'c RO/RO Terminal	875 (689)	1,141 (899)	1,141 (899)	1,141 (899)
	Sub-total	19,833 (9,823)	40,975 (19,007)	30,854 (14,240)	30,854 (14,240)
Sangley Point	-	-	-	-	15,825 (4,753)
Naic/ Cavite	-	-	-	11,351 (4,747)	-
Batangas	Int'l Terminal	-	1,203 (417)	1,203 (417)	1,203 (417)
	Dom'c Terminal	1,037 (461)	1,133 (537)	1,133 (537)	1,133 (537)
	Sub-total	1,037 (461)	2,336 (954)	2,336 (954)	2,336 (954)
Total		20,870 (10,284)	43,311 (19,961)	44,541 (19,941)	49,015 (19,947)

Remark: Figures within parenthesis indicate cost for port facility construction only

5. Preliminary Evaluation

5.1 Preliminary Economic Analysis

5.1.1 Preliminary Economic Analysis for the Port of Manila in the Medium Economic Growth Case

The following three port development projects at the Port of Manila for the period up to the year 2010 are evaluated from the national economic point of view.

(1) Additional three (3) international container berths at Manila International Container Terminal (MICT).

(2) Initial three (3) domestic container berths at the North Harbor, which should be constructed urgently by the year 1999.

(3) Three (3) more domestic container berths and additional two (2) roll on/roll off (RO/RO) berths at the North Harbor.

As for benefits from the projects, four kinds of economic benefits are estimated through the so-called "With" and "Without" comparison.

(1) Savings in vessel waiting cost.

(2) Savings in ocean transport costs by means of improvements of ship operation schedule.

(3) Savings in time cost of cargoes.

(4) Savings in additional cargo handling equipment costs

The economic internal rate of return (EIRR) of each project is calculated as 17 to 20%. This exceeds the required minimum level of 15%, which is generally adopted to assess the economic justifiability of a project in the Philippines. Accordingly, the above three projects at the Port of Manila are considered economically feasible.

Table 5-1-1 Economic Internal Rate of Return (EIRR) of Master Plan Components at the Port of Manila
(Medium Economic Growth Case; GDP 5.5%)

Project	Costs Billion Peso	Benefits Billion Peso	EIRR (%)
International Container Terminal at MICT (3 Berths)	15.7	76.6	20
Domestic Container Terminal at North Harbor (First 3 Berths)	6.1	28.2	18
Domestic Container Terminal (3 Berths) and RO/RO Terminal (2 Berths)	7.0	34.5	17

5.1.2 Preliminary Economic Analysis for the Port of Batangas in the Medium Economic Growth Case

The following port development project at the Port of Batangas for the period up to the year 2010 is evaluated from the national economic point of view.

(1) Domestic container berth (Depth -10m; Length 150m; 1 Container Crane and straddle Carriers)

As for benefits from the project, two kinds of economic benefits are estimated through the so-called "With" and "Without" comparison.

(1) Savings in vessel waiting cost.

(2) Savings in time cost of cargoes.

The economic internal rate of return (EIRR of the project is calculated as 28%. This

exceeds the criterion of 15%, which is generally adopted to assess the economic justifiability of a project in the Philippines. Accordingly, the above project at the Port of Batangas is considered economically feasible.

Table 5-1-2 Economic Internal Rate of Return (EIRR) of Master Plan Components at the Port of Batangas
(Medium Economic Growth Case; GDP 5.5%)

Project	Costs Billion Peso	Benefits Billion Peso	EIRR (%)
Domestic Container Terminal (1 Berth)	1.8	17.2	28

5.2 Environmental Consideration

Project sites are located in water areas surrounded by existing breakwaters, where the extension of breakwaters, and dredging for channel deepening and maintenance are carried out throughout the year; the environment is duly considered and necessary countermeasures are taken concerning the above activities. Accordingly, construction of additional port facilities within the port will hardly make an impact on the environment surrounding the port.

However, the possible increase of economic activities as a result of port development may cause a general increase in the basic load on the environment system. PPA should establish an environmental conservation policy in respect to port development and take necessary measures such as careful selection of port construction machines and constant monitoring of port environment.

6. Outline of Recommendations

It is recommended that all projects at major ports in the Greater Capital Region which have been formulated by the Study on the basis of the master plan for the period up to the year 2010, be implemented in accordance with a staged construction schedule in order to achieve economical, efficient, safe and reliable management and operations of the ports. When implementing projects, it is proposed to take the following measures:

(1) It is concluded that PPA's privatization policy is sound and successful at present from the viewpoint of port management and operation. Accordingly, privatization can be extended to newly-constructed terminals at major ports in GCR.
At the same time, PPA should recognize the importance of public port's role in terms of efficient port management and operation. In this respect, PPA should fully enhance its port administrative function when promoting further privatization.

(2) Land and water area as well as basic port facilities necessary to PPA's port administration should be managed by PPA.

(3) PPA should take the initiative in utilizing some foreign soft loans with low interest rates in order to secure better financial soundness as the official executing agency of port development projects.

(4) In view of further port development in the Greater Capital Region beyond the target year 2010, it is recommended that Sangley Point and the Naic/Cavite New Port be considered the most promising project sites for a newly-constructed international container port instead of the further port extension at Manila.
In this connection, further port development study at Sangley Point and Naic/Cavite should be conducted when the extent of the rapidly growing economic activities and seaborne cargo and passenger demand is clearly grasped.

OGRANIZATION OF THE STUDY TEAM

ORGANIZATION OF THE STUDY TEAM

The study team is comprised of 10 specialists. Their names and responsibilities are listed below.

[Name]	[Responsibility]
Jiro KANO	Overall Management/ Port Highway Planning (OCDI)
Koichiro HAYASHI	Port Facilities Allocation Planning / Port Planning (I) (OCDI)
Kazuki YAMAGUCHI	Port Planning (II)/ Environmental Consideration (OCDI)
Takeshi SOEJIMA	Regional Development Planning / Demand Forecast (I) (OCDI)
Toshihiko KAMEMURA	Demand Forecast (II)/ Economic Analysis (OCDI)
Tetsuro ICHISE	Management and Operation (OCDI)
Takeaki HOSHINO	Facility Design (OCJ)
Nobuya FURUHASHI	Natural Conditions (I) (OCJ)
Toshinori OHSHITA	Natural Conditions (II) (OCJ)
Masahiro YOKOGAWA	Construction Method/ Cost Estimation (OCJ)
Chitose KAWAKAMI	Coordinator (OCDI)

PART I

PRESENT SITUATION AND PORT DEVELOPMENT STRATEGIES

CHAPTER 1 INTRODUCTION

1.1 History

Long before the coming of the Spaniards, some Malay settlements were clustered around Manila Bay and along the banks of the Pasig River in the island of Luzon. The Malays had migrated in clans from the Malay Peninsula and Indonesia in their sailing vessels called barangays, a name later applied to the kinship group or village.

The largest of these settlements was Tundo, but the political and military center of the region was Maynila along the banks of the Pasig River. Modern day Manila is said to have derived from this early settlement.

Fifty (50) years after Ferdinand Magellan explored the coast of Samar in 1521 a Spaniard expedition arrived in Manila. Then, in 1595, Manila celebrated its founding of the city as the capital of the archipelago. They constructed Intramuros and a port at the river mouth of the Pasig River.

The galleon trade, lasting from 1571 to 1815, mostly used Manila as a west terminal port opposite to the east terminal of Acapulco, Mexico. By this regular trade every year, the city of Manila became one of the finest in the world and by far the best in the Far East.

Another result of the galleon trade was the heavy influx of Chinese immigrants to Manila. By the seventeenth (17) century, an annual average of fifty (50) Chinese junks were making their way to Manila, and contributing to the galleon trade with the Chinese immigrants. The Chinese were called "**Sangleyes**" by the Spaniards.

After the British siege and conquest of the City of Manila 1762-1764, additional fortifications were made to the Intramuros, which made Manila the best fortified city in the Orient.

In the nineteenth (19) century, English and American trading companies helped shape the growth of the Philippines. For example, the Manila-Dagupan railroad, which linked Manila with the vital cities of the north, was built in 1892 entirely through British financing. In 1890, a Spanish-Filipino group founded the Compania Maritima, the biggest

shipping conglomerate in the country at the time.

In 1910, the Manila harbour was enlarged and equipped with modern facilities, and Manila acquired the reputation of being the best port in the Far East. Automobiles were introduced in 1906.

Since the first national census taken in 1903, the population of the Manila City has grown rapidly. In 1975, the National Capital Region (NCR), comprising Manila, Rizal and Bulacan was created. NCR population and its share of the entire country are shown below.

Table 1-1 NCR Population and Share

YEAR	N C R Manila		PHILIPPINES		SHARE A/B (%)
	10,000 (A) (persons)	RATE (%)	1,000 (B)	RATE (%)	
1903	329	-	7,635	-	4.31
1918	461	2.27	10,314	2.03	4.47
1939	994	3.73	16,000	2.11	6.21
1948	1,569	5.20	19,234	2.07	8.16
1960	2,462	3.38	27,088	2.89	9.09
1970	3,967	4.89	36,684	3.08	10.81
1975	4,990	4.70	42,071	2.78	11.81
1980	5,926	3.50	48,098	2.71	12.32
1990	7,929	2.95	60,685	2.35	13.06

NOTE: 1. NCR is National Capital Region
2. RATE is annual rate of increase

SOURCE: 1992 YEARBOOK BY NSCB

1.2 National Economy

The Philippine economy looks to be on the verge of entering a high growth period. This is very similar to the situation of Japan in the early 1960s, thirty (30) years ago. The following three points support the idea that the Philippine economy is poised to take off.

(1) Smooth industrialization with foreign investment is going on, through both national and private initiatives. EPZA effort and private industrial sites show this.

(2) Car sales increased by more than fifty (50%) percent increase in the first half of 1993 over that of 1992.

(3) Government sources remain confident that GNP will maintain a high growth rate, more than six percent in late 1994.

This of course paints an extremely optimistic picture, but there is need for caution. Again, this is also very similar to that of the debates held in the early 1960s in Japan. Anyway, we should understand the statistical fact that actual figures will be cleared two years later. This means that the actual GNP growth rate this year will only be known by the people in late 1995.

The economy of Thailand took off around 1987, and per capita GNP marked US$1,420 in 1990. Per capita GNP of the Philippines in 1990 (US$760) is comparable to that of Thailand in 1987. In the ensuing five or six years, Thailand saw its economy grow rapidly, doubling GNP. Now, the Philippines is followed by Indonesia, at the per capita GNP (US$550), at the starting point of taking off toward high growth period.

It should be pointed out, however, that excessively high growth rates over an extended period are not necessarily good for a national economy. Experiences in Japan or Thailand will be of some reference to the Philippines. A growth rate of around six to seven present is most desirable, though it is sometimes very difficult to maintain.

One of the characteristics of the Philippine national economy is the extreme concentration in the Greater Capital Region and Metro Manila. For example, in Metro Manila, the land area of which accounts for only 0.2 percent (636 sq.km.) of the entire

country, 13.1 percent of the population and 32.4 percent of Gross Domestic Production (GDP) in 1990 are concentrated. This economic concentration is visualized in the next figures.

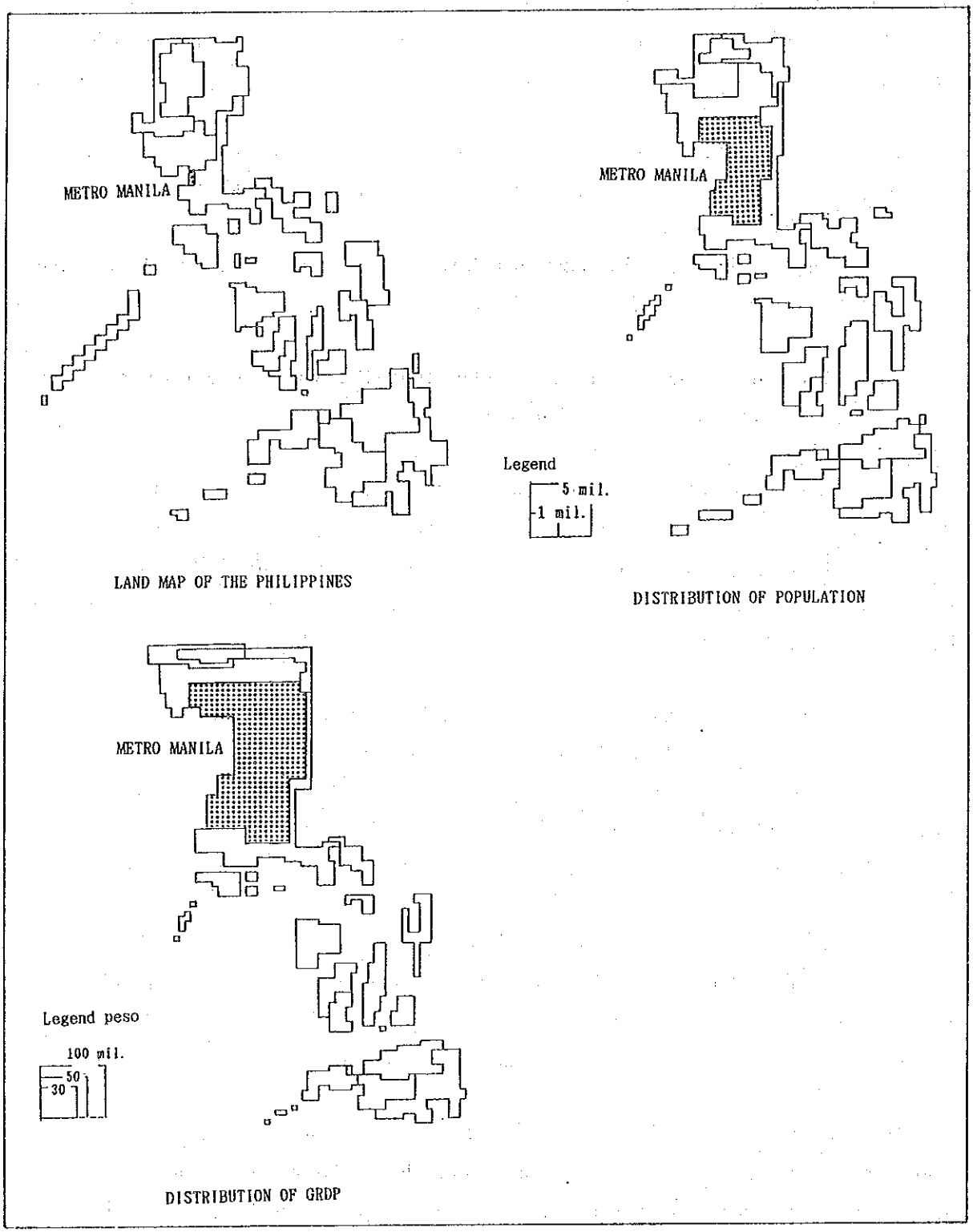


Figure 1-1 Economic Map of Metro Manila in the Nation

1.3 Major Container Ports in ASEAN Area

Containerization is now expanding, particularly in the Far East area. Number of container berth is increasing, and new berths will require a depth of at least 14 meters.

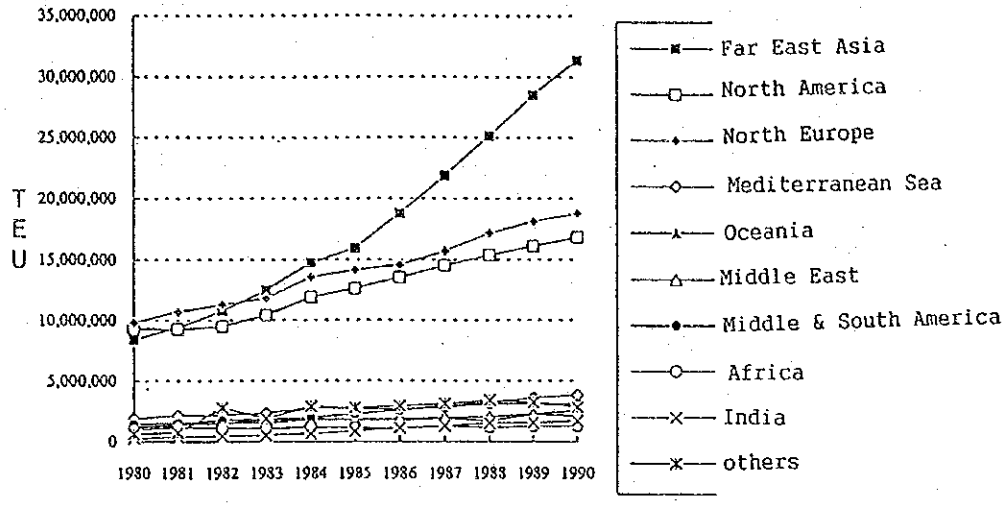
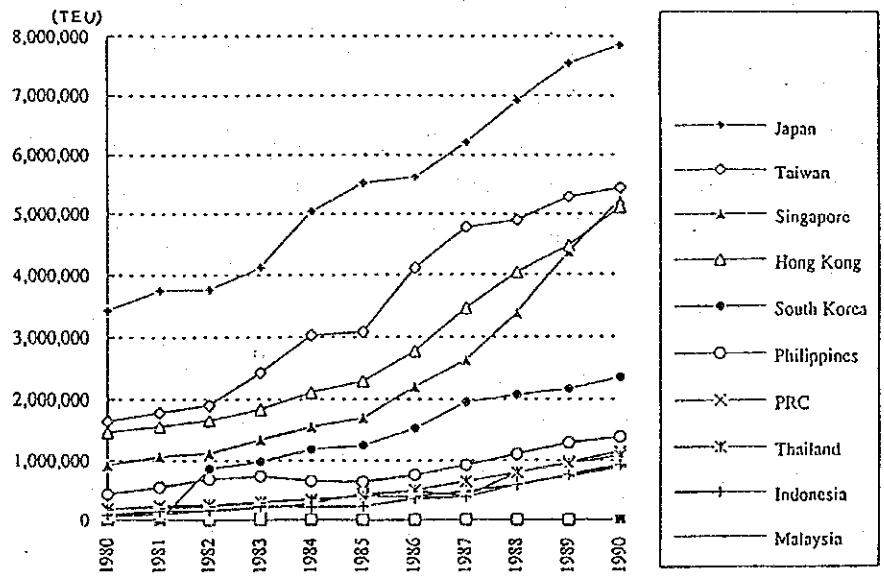


Figure 1-2 Container volume by region

As shown in Figure 1-3 and Table 1-2 and 1-3 average annual rate of container volume increase by countries is 14.1% and the Philippines ranked top among the lower five countries.



Note: Container Volume in Philippines includes domestic containers at the North harbor in Manila

Figure 1-3 Container volume by nation

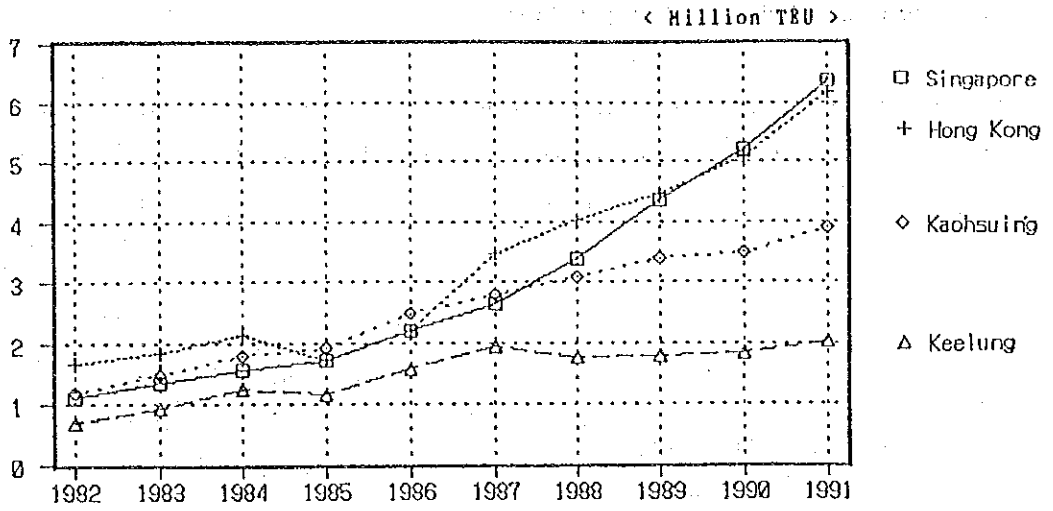


Figure 1-4 Number of containers handled at major 4 ports

As shown in Table 1-4, water depth of new berths being planned in Singapore and Hong Kong exceeds thirteen (13) meters, and several ports in the United States and Singapore have already had berths of more than 15 meters in depth.

At present, the port with plenty of container berths is Kaohsiung (19), followed by Singapore (16), and Hong Kong and Keelung (14).

Also in Kaohsiung, six (6) berths with depths of fourteen (14) or fifteen (15) meters are under construction and are expected to be completed by 1995.

The Port of Singapore is now constructing five (5) new main berths and four (4) feeder berths which will be completed in 1994. Hongkong is also constructing six (6) berths with a water depth of fifteen (15) meters.

Table 1-2 Container Handling Volume in the Far East

(Unit: TEU)

No	Country	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1	Japan	3,417,118	3,740,864	3,753,667	4,113,749	5,033,897	5,517,009	5,614,703	6,210,011	6,909,050	7,539,316	7,851,608
2	Taiwan	1,644,322	1,787,753	1,902,260	2,429,304	3,026,839	3,075,151	4,104,953	4,772,339	4,889,091	5,278,227	5,430,039
3	Singapore	916,989	1,064,504	1,116,288	1,340,009	1,552,184	1,698,800	2,203,100	2,634,500	3,375,100	4,364,400	5,223,500
4	Hong Kong	1,464,961	1,559,819	1,659,943	1,837,047	2,108,583	2,288,753	2,779,025	3,457,182	4,033,427	4,463,709	5,100,569
5	South Korea			861,971	977,661	1,177,866	1,245,538	1,532,911	1,949,143	2,065,462	2,158,828	2,348,475
6	Philippines	437,220	552,473	684,575	735,159	657,792	638,471	754,168	913,909	1,096,743	1,286,208	1,383,525
7	PRC	54,038	90,528	142,877	191,651	273,154	446,473	487,416	406,906	793,706	968,860	1,143,898
8	Thailand	189,430	241,500	259,424	304,524	341,021	400,419	511,264	643,530	795,301	939,040	1,078,290
9	Indonesia	87,110	140,157	158,352	233,379	219,093	228,619	364,008	393,131	588,267	762,256	922,547
10	Malaysia	171,693	204,644	223,534	293,403	362,399	389,279	401,908	489,077	589,128	723,933	881,741
		8,382,881	9,382,242	10,762,891	12,455,886	14,752,828	15,928,512	18,753,456	21,869,728	25,135,275	28,484,777	31,364,192

Table 1-3 Growth Rate of Containers in the Far East

(Unit: %)

No	Country	80-81	81-82	82-83	83-84	84-85	85-86	86-87	87-88	88-89	89-90	AVE.
1	Japan	9.5	0.3	9.6	22.4	9.6	1.8	10.6	11.3	9.1	4.1	8.8
2	Taiwan	8.7	6.4	27.7	24.6	1.6	33.5	16.3	2.4	8.0	2.9	13.2
3	Singapore	16.1	4.9	20.0	15.8	9.4	29.7	19.6	28.1	29.3	19.7	19.3
4	Hong Kong	6.5	6.4	10.7	14.8	8.5	21.4	24.4	16.7	10.7	14.3	13.4
5	South Korea			13.4	20.5	5.7	23.1	27.2	6.0	4.5	8.8	10.9
6	Philippines	26.4	23.9	7.4	-10.5	-2.9	18.1	21.2	20.0	17.3	7.6	12.8
7	PRC	67.5	57.8	34.1	42.5	63.5	9.2	-16.5	95.1	22.1	18.1	39.3
8	Thailand	27.5	7.4	17.4	12.0	17.4	27.7	25.9	23.6	18.1	14.8	19.2
9	Indonesia	60.9	13.0	47.4	-6.1	4.3	59.2	8.0	49.6	29.6	21.0	28.7
10	Malaysia	19.2	9.2	31.3	23.5	7.4	3.2	21.7	20.5	22.9	21.8	18.1
		11.9	14.7	15.7	18.4	8.0	17.7	16.6	14.9	13.3	10.1	14.1

Table 1-4 Selected Container Ports along the Pacific Coast

No.	Item	A Terminal Space (ha)	B Number of Berths	C Number of Terminal	D Total Quay Length	E Depth alongside (m)	F -ditto- (Future Plan)	G Number of Quay Crane	H -ditto- (Post Panamax)	I CNTRs handled 1991(TEU)
1	LA	316.0	18	10	6,734	10.7~15.6		36	13	2,038,363
2	LB	229.8	16	7	4,452	11.0~15.2	13.7	35	15	1,838,236
3	Oakland	176.9	15	9	4,524	10.7~12.2	13.7	28	9	1,194,718
4	Seattle	147.4	11	6	4,709	12.0~15.0		24	8	1,154,584
5	Tacoma	113.4	9	6	2,257	12.2~15.2		17	2	1,020,708
	Subtotal	983.5	69	38	22,676	-	-	140	47	7,246,609
	Average	196.7	13.8	7.6	4,535	-	-	28.0	9.4	1,449,322
1	Singapore	147.0	16	3	4,718	9.9~15.0	15.0	57	40	6,190,000
2	Hongkong	161.7	14	7	4,679	12.2~14.0	15.0	40	17	4,514,000
3	Kaohsiung	207.0	19	4	5,507	10.5~14.0	14.0&15.0	41	15	3,913,108
4	Keelung	33.0	14	3	3,229	9.5~13.5	-	20	0	2,007,752
	Subtotal	548.7	63	17	18,133	-	-	158	72	16,624,860
	Average	137.2	15.8	4.3	4,533	-	-	39.5	18.0	4,156,215
1	Osaka	79.9	11	8	3,015	10.0~13.0	13.0&14.0	17	2	561,557
2	Kobe	202.6	22	11	6,825	10.0~14.0	14.0&15.0	42	15	2,635,426
3	Kitakyushu	30.9	5	3	1,475	10.0~12.0	13.0&14.0	7	0	282,211
	Subtotal	313.4	38	22	11,315	-	-	66	17	3,401,749
	Average	104.5	12.7	7.3	3,772	-	-	22.0	5.7	1,133,916

Note 1: CNTRs handled 1991(TEU) of Singapore is the value at Tanjong Pagar Terminal including Keppel Terminal and Brani Terminal.

Note 2: CNTRs handled 1991(TEU) of Hong Kong is the value at Kwai Chung Container Terminal.

No.	Item	J A/B (ha/Berth)	K D/B (m/Berth)	L G/B (U./Berth)	M G/B (U./m)	N I/A (TEU/ha)	O I/B (TEU/Berth)	P I/D (TEU/m)	Q I/G (TEU/Crane)
1	LA	17.6	374	2.0	0.005	6,451	113,242	303	56,621
2	LB	14.4	278	2.2	0.008	7,999	114,890	413	52,521
3	Oakland	11.8	302	1.9	0.006	6,754	79,648	264	42,669
4	Seattle	13.4	428	2.2	0.005	7,833	104,962	245	48,108
5	Tacoma	12.6	251	1.9	0.008	9,001	113,412	452	60,042
	Subtotal								
	Average	14.3	329	2.0	0.006	7,368	105,023	320	51,761
1	Singapore	9.2	295	3.6	0.012	42,109	386,875	1,312	108,596
2	Hongkong	11.6	334	2.9	0.009	27,916	322,429	965	112,850
3	Kaohsiung	10.9	290	2.2	0.007	18,904	205,953	711	95,442
4	Keelung	2.4	231	1.4	0.006	60,841	143,411	622	100,388
	Subtotal								
	Average	8.7	288	2.5	0.009	30,299	263,887	917	105,221
1	Osaka	7.3	274	1.5	0.006	7,028	51,051	186	33,033
2	Kobe	9.2	310	1.9	0.006	13,008	114,584	386	62,748
3	Kitakyushu	6.2	295	1.4	0.005	9,133	56,442	191	40,316
	Subtotal								
	Average	8.2	298	1.7	0.006	10,854	87,224	301	51,542

CHAPTER 2 NATURAL CONDITIONS

Introduction

During the second site survey period from November 1993 to January 1994, natural conditions survey was performed at Port of Manila and Naic/Cavite. The contents of survey and data analysis are explained in this Chapter's 2.2, 2.4, 2.5 and Appendix-A of this report.

2.1 Meteorological Condition

The Philippines is one country considered to have the greatest frequency of tropical cyclones in the world and is located in the Asia Monsoon Zone.

Its climate is greatly affected by the tropical cyclones and monsoons, the Southwest and Northwest monsoons, and the atmospheric pressure arrangement of the Asian Continent.

Its temperature and humidity are high throughout the year.

There are many rainfall stations operating within GCR, namely 20 in Laguna Lake, 8 in Taal Lake, 4 in Quezon basins and etc., all managed by the Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA).

Estimated annual rainfall over the basins vary from 1,900 mm to 2,500 mm with the highest precipitation observed in the Sierra Madre range.

The mean annual rainfall has been estimated to be 2,100 mm in Laguna Lake, 2,000 mm in Taal Lake and 2,300 mm in Quezon basins.

According to the climate map of PAGASA, the GCR is classified into two types, namely type 1 and type 2. Most of the GCR is classified as type 1 except Quezon. Quezon is classified as type 2.

Type 1 has two pronounced seasons, dry from December to May and wet from June to November. Maximum rain period is from June to September.

Area characterized by this climate type are generally exposed to the southwest monsoon and get a fair share of the rainfall brought about by the tropical cyclones occurring especially during the maximum rain period.

Type 2 has no dry season with a very pronounced maximum rain period in winter.

Maximum rainfall generally occur in December and January, although there is not a single dry month.

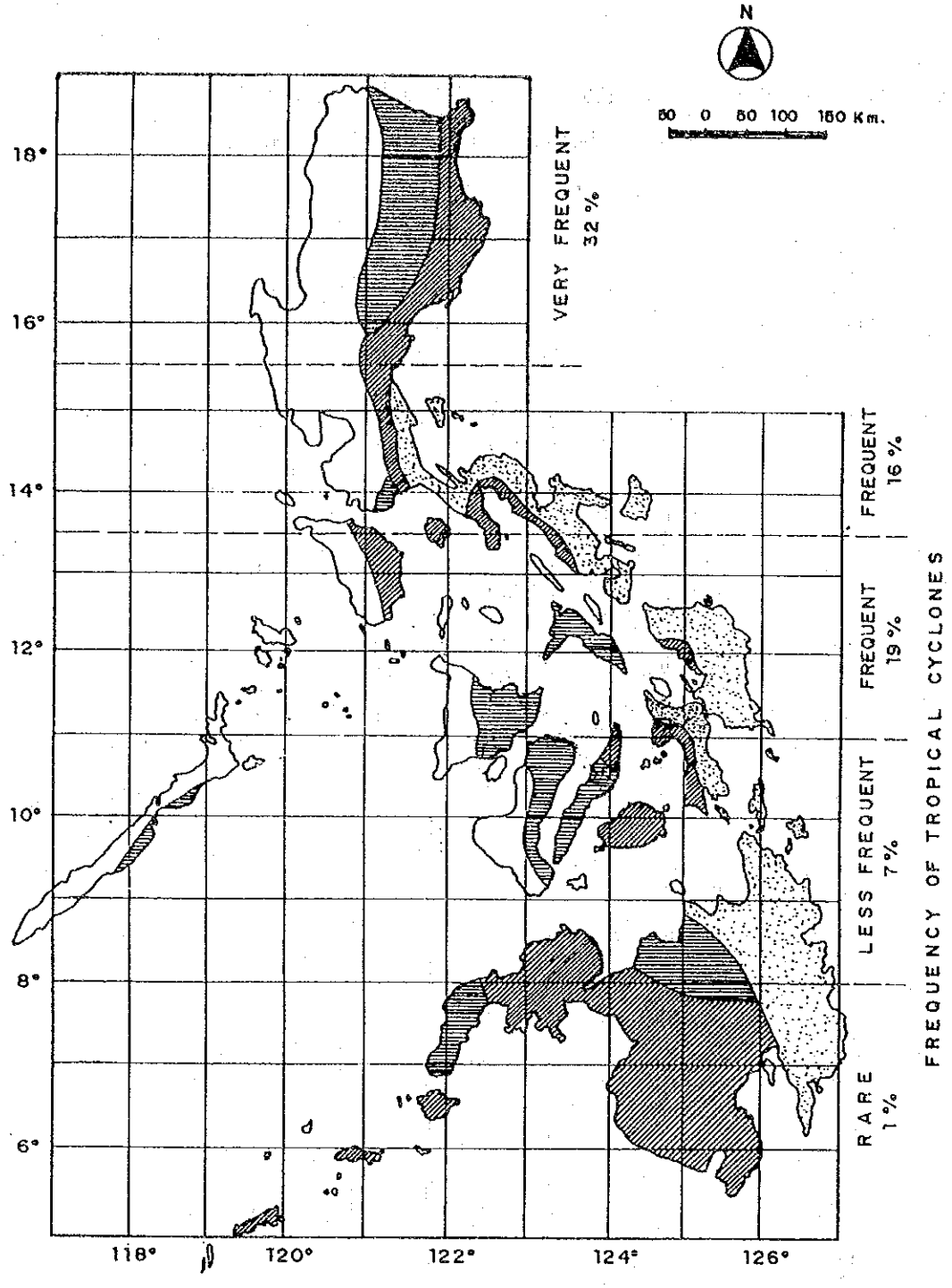
Areas characterized by this climate type are generally along or very near the eastern coast, thus are open to the northeast monsoon.

Frequency of Tropical Cyclones crossing the Philippines from 1948 to 1992 is shown in Table 2-1. Climate classification in Philippines is shown in Figure 2-1.

Table 2-1 FREQUENCY OF TROPICAL CYCLONES CROSSING THE PHILIPPINES (FROM 1948 TO 1992 - 45 YR PERIOD)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1948	0	0	0	0	0	0	2	1	1	1	4	2	11
1949	0	0	0	0	0	0	1	0	2	2	2	2	9
1950	0	0	0	0	0	0	0	1	1	1	1	1	5
1951	0	0	0	0	1	0	1	2	2	0	1	1	8
1952	0	0	0	0	0	3	1	2	1	3	2	4	16
1953	0	1	0	0	1	1	0	1	2	2	2	0	10
1954	0	0	1	0	1	0	0	1	0	2	3	1	9
1955	1	0	0	0	0	0	0	1	1	0	1	0	4
1956	0	0	0	2	0	0	2	2	1	1	2	2	12
1957	1	0	0	0	0	2	1	1	2	1	1	0	9
1958	0	0	0	0	0	0	0	0	1	1	2	0	4
1959	0	0	0	0	0	0	0	1	1	0	2	2	6
1960	0	0	0	1	1	1	0	2	1	2	0	0	8
1961	0	0	0	0	1	0	2	2	1	0	1	1	8
1962	0	0	0	0	1	0	1	2	1	0	2	0	7
1963	0	0	0	0	0	2	1	1	1	0	0	1	6
1964	0	0	0	0	0	1	2	1	4	3	2	2	15
1965	1	0	1	0	1	1	2	0	1	0	0	0	7
1966	0	0	0	0	2	0	6	0	0	1	2	2	13
1967	0	0	0	1	0	1	0	3	0	1	2	0	8
1968	0	0	0	0	0	0	0	2	1	0	3	0	6
1969	0	0	0	0	0	0	3	0	2	0	0	0	5
1970	0	0	0	0	0	1	1	1	2	4	2	0	11
1971	0	0	0	2	2	2	4	1	1	4	0	0	16
1972	1	0	0	0	0	1	1	0	1	0	1	1	6
1973	0	0	0	0	0	1	1	1	1	3	1	0	8
1974	0	0	0	0	0	1	1	1	1	5	2	2	13
1975	1	0	0	0	0	0	0	0	1	2	1	1	6
1976	0	0	0	0	1	1	0	1	0	0	0	2	5
1977	1	0	0	0	0	0	2	1	3	0	2	1	10
1978	0	0	0	1	0	1	0	1	3	3	0	1	10
1979	0	0	0	1	1	1	2	1	1	2	1	1	11
1980	0	1	1	0	2	2	4	2	1	1	2	0	16
1981	0	0	0	0	0	1	1	0	2	1	2	1	8
1982	0	0	2	0	0	0	2	1	1	1	0	2	9
1983	0	0	0	0	0	0	3	1	2	3	1	0	10
1984	0	0	0	0	0	0	2	3	0	2	1	0	8
1985	0	0	0	0	0	1	1	0	3	3	0	0	8
1986	0	0	0	1	0	0	1	1	0	4	2	2	11
1987	0	0	0	0	0	0	0	2	1	1	2	1	7
1988	1	0	0	0	0	2	1	0	1	2	2	0	9
1989	0	0	0	0	1	1	3	0	0	3	1	0	9
1990	0	0	0	0	0	3	0	1	1	0	1	0	6
1991	0	0	0	1	0	1	2	0	1	1	3	0	9
1992	0	0	0	0	0	0	2	0	1	1	0	0	4
TOTAL	7	2	5	10	16	32	59	45	55	67	62	36	396
%OF TOTAL	1.77	0.51	1.3	2.5	4.0	8.1	14.9	11.4	13.9	16.9	15.7	9.1	100
RANK	10	11	10	9	8	7	3	5	4	1	2	6	-
MODE	0	0	0	0	0	0	0	1	1	0.1	2	0	9.8
MEDIAN	0.5	0.5	1	1	1	1.5	2.5	1.5	2	2.5	2	1.5	9.5
MEAN	0.50	0.04	0.11	0.22	0.36	0.71	13.1	1.00	1.22	1.49	1.38	0.80	8.84
STD DEV	0.36	0.21	0.38	0.51	0.60	0.84	13.1	0.82	0.87	1.35	0.98	0.94	3.16

Source: PAGASA



LEGEND :

- TYPE I – Two pronounced seasons: dry from Nov. to April, wet during the rest of the year.
- TYPE II – No dry season with a very pronounced maximum rainfall from Nov. to Jan.
- TYPE III – Seasons not very pronounced, relatively dry from Nov. to April and wet during the rest of the year.
- TYPE IV – Rainfall more or less evenly distributed throughout the year.

Source : PAGASA

Figure 2-1 CLIMATE CLASSIFICATION IN PHILIPPINES