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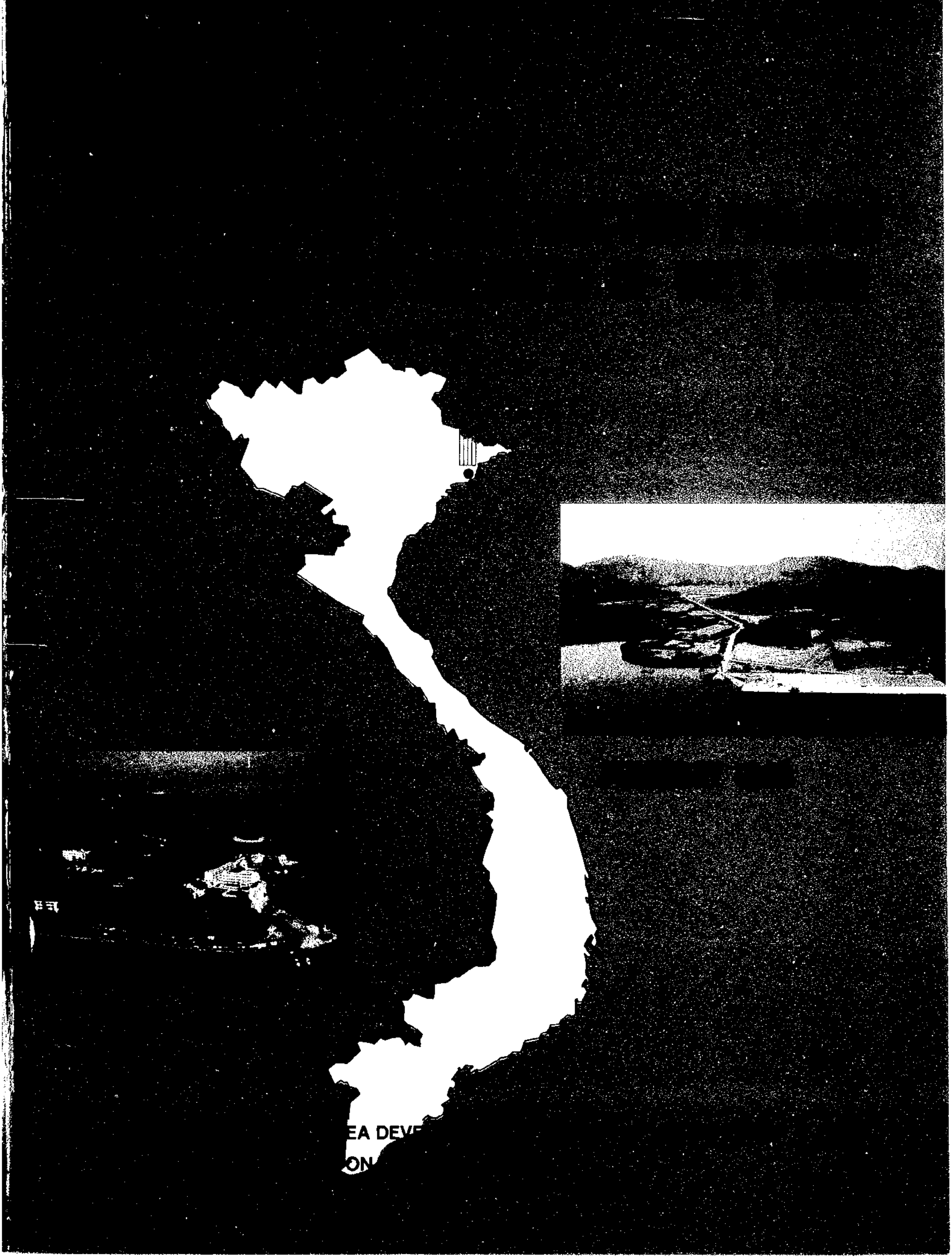


Exchange Rate

US$ 1.00 = 10,953.90 Dong = 100.10 Yen

(As of August 4th, 1994)

FINAL REPORT

THE FEASIBILITY STUDY ON CAI LAN PORT CONSTRUCTION PROJECT IN THE SOCIALIST REPUBLIC OF VIET NAM

FEBRUARY 1995

PREFACE

In response to a request from the Government of the Socialist Republic of Viet Nam, the Government of Japan decided to conduct a Feasibility Study on Cai Lan Port Construction Project and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Viet Nam a study team three times between December 1993 and December 1994, which was headed by Mr. Yoshinori Aoki and was composed of members from the Overseas Coastal Area Development Institute of Japan (OCDI) and Nippon Koei Co., LTD. (NK).

The team held discussions with the officials concerned of the Government of the Socialist Republic of Viet Nam and conducted field surveys in 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 Socialist Republic Viet Nam for the close cooperation they extended to the team.

February, 1995

Kimio Fujita

Kimio FUJITA
President
Japan International Cooperation Agency

LETTER OF TRANSMITTAL

February 1995

Mr. Kimio FUJITA
President
Japan International Cooperation Agency

Dear Mr. Fujita,

It is my great pleasure to submit herewith the Report on the Feasibility Study on Cai Lan Port Construction Project in the Socialist Republic of Viet Nam.

The Study Team which consists of the Overseas Coastal Area Development Institute of Japan (OCDI) and Nippon Koei Co., LTD.(NK) conducted surveys in Viet Nam from December 1993 to December 1994 as per the contract with the Japan International Cooperation Agency.

Based on the finding of these surveys as well as the data and information collected and analyzed in Japan, the Study Team held discussions with the Viet Nam officials of the Transport Engineering Design Incorporated and other authorities concerned, and has formulated the Long-Term Port Development Concept up to the year 2010 and the feasibility of the Short-Term Plan for the period up to the year 2000.

On behalf of the study team, I would like to express my deepest appreciation to the Government of Viet Nam, the Transport Engineering Design Incorporated and other authorities concerned for their brilliant cooperation and assistance and for the heartfelt hospitality which they extended to the study team during our stay in Viet Nam.

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 Viet Nam for giving us valuable suggestions and assistance during the preparation of this report.

Yours faithfully,

Yoshinori AOKI
Leader of the Study Team for the Feasibility Study on Cai Lan Port Construction Project

ABBREVIATIONS

B

B	Biochemical Oxygen Demand
BS	British Standard

C

C.D	Chart Datum
C.I.F.	Cost Insurance and Freight
CBR	California Bearing Ratio
CFC	The Conversion Factor for Consumption
CFS	Container Freight Station
COD	COD Chemical Oxygen Demand
CY	Container Yard

D

D	Deformed
DAP	Di-Ammonium Phosphate
DL	Site Datum Level
Do	Do Dissolved Oxygen
DWT	Dead Weight Tonnage

E

EIA	Environmental Impact Assessment Initial Environment Evaluation
EIRR	Economic Internal Rate of Return
EPZ	Export Processing Zone

F

FCL	Full Container Load
FIRR	Financial Internal Rate of Return
F.O.B.	Freight on board
ft.	foot/feet

G

GDP	Gross Domestic Product
GPA	Gross Product of Agriculture
GPI	Gross Product of Industry
GRP	Gross Regional Product

H

HWL	High Water Level

J

JIS	Japanese Industrial Standard
JICA	Japan International Cooperation Agency

L

LCL	Less than Container Load
LWL	Low Water Level

M

MOTAC	Ministry of Transport and Communication (1993)
MOT	Ministry of Transport (1994)

N

N.A	None Available
NCPFP	The National Committee for Population and Family Planning

P

PETROLIMEX	Vietnam National Petroleum Export-Import Co.

R

R.C	Reinforced Concrete
RWL	Residual Water Level

S

SCF	Standard Conversion Factor
SSP	Single Super Phosphate

T

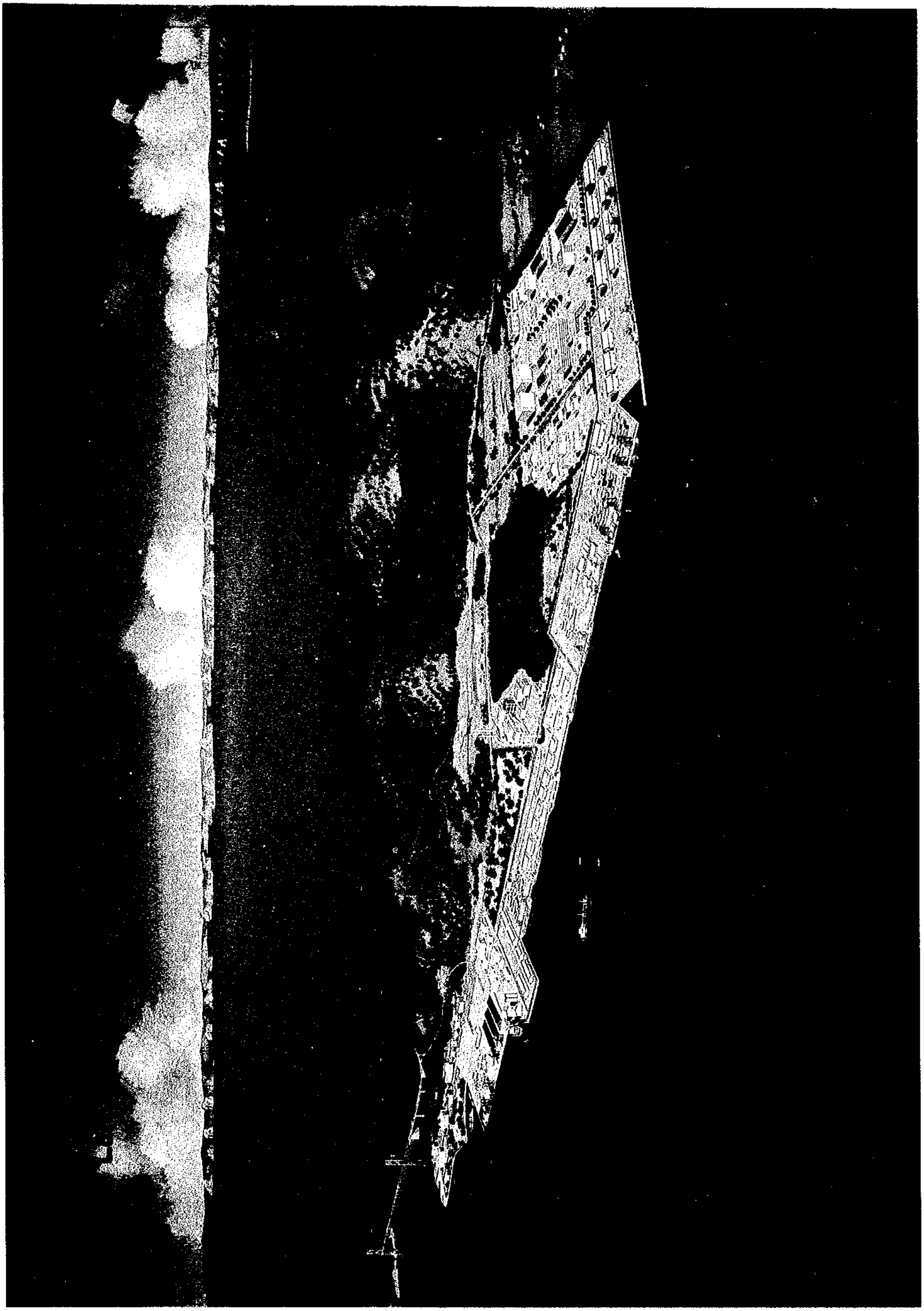
TCVN	Vietnamese Standard
TEDI	Transport Engineering Design Incorporated(1994)
	Transport Engineering Design Institute (1993)
TESI	Transport Science and Economic Institute
TEU	Twenty Equivalent Unit

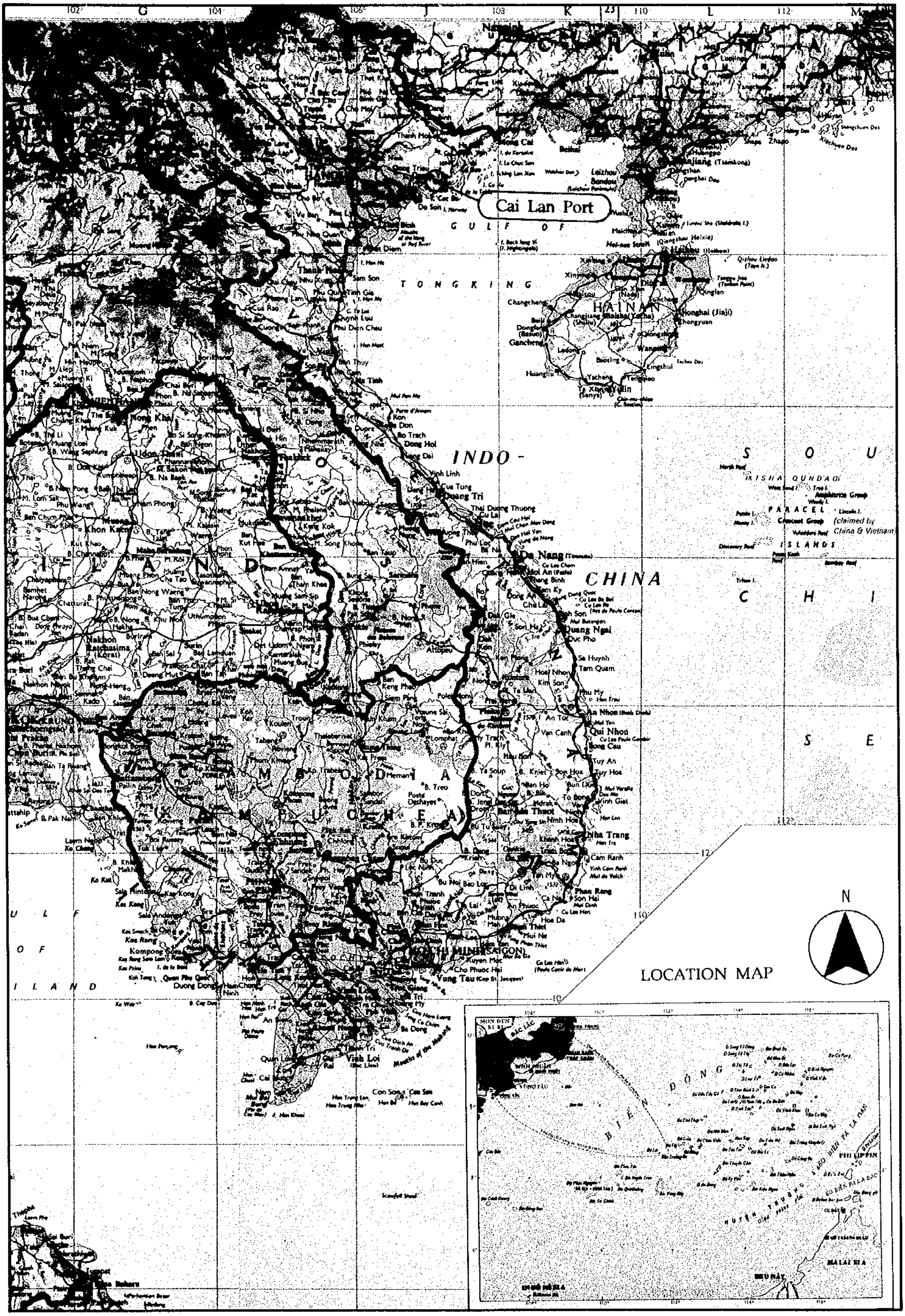
U

UNDP	United Nations Development Program
US$	United States Dollar

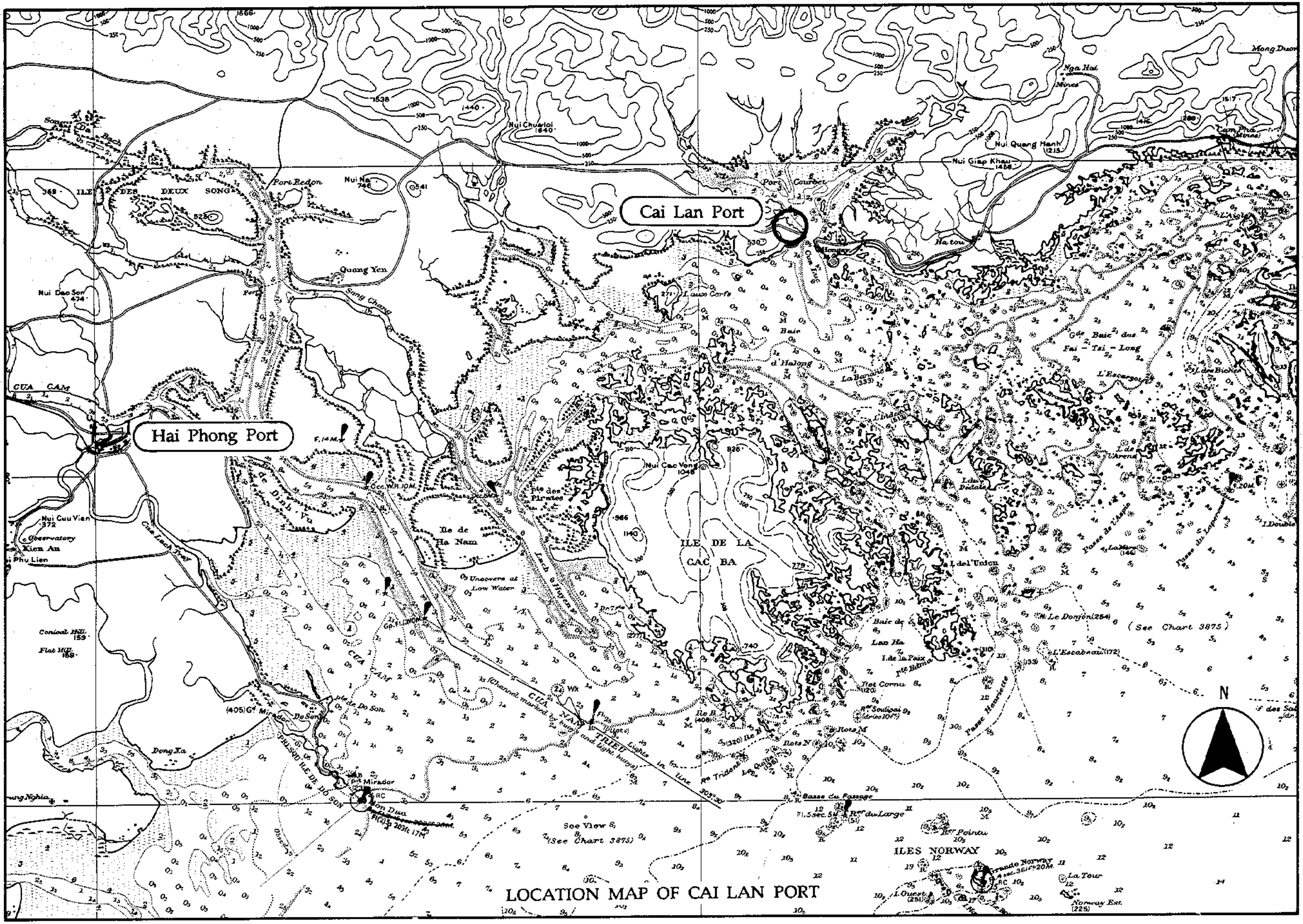
V

VINAFOOD 1	Vietnam Central Food Corporation 1
VINAMARINE	Vietnam National Maritime Bureau
VND	Vietnam Dong





Cai Lan Port
GULF OF
TONGKING
HAINAN
INDO-
CHINA
CAMBODIA
(KAMPUCHEA)
Da Nang
Nha Trang
Qui Nhon
Quang Ngai
Dong Hoi
Quang Tri
Thanh Hoa
Ha Tinh
Phan Rang
Vung Tau
Beihai
Leizhou
Haikou
Nakhon Ratchasima (Korat)
Khon Kaen
Udon Thani
Nong Khai
Con Son
Vinh Loi
SOU
CHI
SE
LOCATION MAP
N
BIỂN ĐÔNG
PHILIPPIN
MALAI XIA



LOCATION MAP OF CAI LAN PORT

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EXECUTIVE SUMMARY

1. Background and Objectives of the Study

Hai Phong port is the sole international major port in the northern part of Viet Nam. However, given that the population of the ports hinterland exceeds 26 million, the port capacity is thought to be extremely low, and thus this large hinterland cannot be properly served.

The heavy siltation of the navigation channel has made it difficult to increase the cargo handling capacity, although an urgent rehabilitation project has been executed with the cooperation of the Japanese government.

To remedy this situation, the construction of a deep sea port, Cai Lan, has been planned. This project will promote the regional development of the triangle zone, which consists of Hanoi, Hai Phong, and Ha long, under the strategy of socio-economic development.

The Japanese government dispatched the study team through the Japan International Cooperation Agency. The Study period was one year, from December 1993 to December 1994; results of the Study are contained in this report.

Main objectives of this Study are as follows.

a. To formulate an optimum port development plan aiming at the year 2000.

b. To confirm feasibility from technological, economical, financial and environmental points of view.

c. To carry out technical transfer to Vietnamese counterparts in the course of the study.

2. Port Development Plan

Before formulating the short term port development plan targeting year the 2000, the long term port development aiming at the year 2010 was studied to ensure the efficacy of the short term plan.

Considering the role and function between Hai Phong port and Cai Lan port, cargo handling volumes of these two ports are estimated as follows.

Unit: 1,000 ton

	2000	2010
Hai Phong port	5,424 (1,200)	8,350 (3,200)
Cai Lan port	2,676 (335)	14,300 (4,000)

Note: ( ) shows container including

Examining the regional development direction of Ha Long City and industries, demand forecast of cargo volume, land use plan and berth planning have been carried out.

Three alternative plans were made and the optimum plan was selected. The contents of the optimum plan are outlined below.

a. Navigation Channel (maximum ship size 40,000DWT)

Water Depth: -11.0m

Channel Width: 130m (at the bottom)

Dredging Volume: outer channel; 5,997 mil.m^3

inner channel; 1,943 mil.m^3

b. Berth

10,000DWT -9.0m	: 2 berth (including existing 1)
15,000DWT-10.0m	: 1 berth
20,000DWT-11.0m	: 1 berth
30,000DWT-12.0m	: 2 berth
40,000DWT-13.0m	: 1 berth
Total:	: 7 berth, Berth Length: 1,461m, Area: 435,950m^2

C. Transit Shed and Open Yard

Transit Shed	; Number: 12, Area: 42.000m^2
CFS	; Number: 1, Area: 9,250m^2
Open Yard	; Number: 3, Area: 9,250m^2
Container Yard	; Number: 1, Area: 30,400m^2

d. Cargo Handling Equipment

Shore Crane Number	: 2
Fork Lift Number	: 37, Fork Lift for Container Number : 7

Truck and Trailer Number	: 2,	Portable Hopper Number	: 4
Shovel Loader Number	: 2,	Mobile Crane Number	: 4
Tug Boat Number	: 2	etc.	

e. Others

Inner Road Length: 1,400m, Office Building Number: 1, Area: 3,000m²
Electricity and Water Supply, Communication Facilities
Green Area 11.5 ha

3. Implementation Plan

Taking subsoil condition into consideration gravity caisson type quay structure is selected.

Based on examination results, the schedule of procurement for construction fund, detail design, procedure of tender and contract are studied. Thus it is concluded that the preparation work could be started in the latter period of 1996 and the first construction work could be started at the end of 1996. All work could be finished by the year 2000.

The total construction cost is estimated using actual unit cost in Viet Nam and foreign countries based on the estimated quantity of each work. The cost can be divided into domestic and foreign portions.

The cost estimation is summarized below.

Unit: 1,000USD

	Domestic Portion	Foreign Portion	Total
a. Channel and Basin	525	25,744	26,269
b. Berth	12,452	41,210	53,662
c. Transit Shed & CFS	3,882	1,822	5,704
d. Open Yard	1,500	439	1,939
e. Road	867	376	1,243
f. Revetment	4,047	3,553	7,600
g. Office Building	462	198	660
h. Others	74	32	106
Sub Total	23,809	73,374	97,183
i. Cargo Handling Equip.	0	36,793	36,793
j. Administration (inc. EIA Monitoring)	100	500	600
k. Engineering	0	11,500	11,500
l. Contingency	5,168	16,468	21,636
Grand Total	28,705	139,008	167,713

4. Evaluation of the Development Plan

Preliminary environment impact assessment is carried out. It shows that Cai Lan port construction project is viable if such appropriate countermeasures as mitigating and reducing the anticipated impact are taken and introducing a strict environment protection plan is introduced prior to commencement of the project.

Economic evaluation is done by cost benefit analysis.
Based on EIRR(economic internal return) the project is evaluated as having enough feasibility. The main benefit is added value which originates from the products of the port oriented industries. The port charge and due are counted as benefits as well.

The result of the calculation is as follows.

EIRR= 21.8%
19.9% (cost increase 10%)
19.7% (benefit decrease 10%)
18.0% (cost increase 10%, benefit decrease 10%)

Financial analysis shows that the loan for the project can be repaid by port income without any problem during the project life.

Financial rate of return (FIRR) is calculated as follows.

FIRR= 5.1%
4.3% (cost increase 10%)
3.7% (income decrease 10%)

While these figures are rather low, they are still higher that the interest rates likely to be applied.

Thus it can be concluded that the project will be sufficiently feasible provided that efforts to increase port income are made.

Taking into consideration indirect benefit such as the effect of employment, increasing tax income etc, the project can be evaluated as feasible and beneficial.

5. Recommendation

(1) Demand Forecast and Regional Plan

Demand forecast in this study is a result of the discussion meeting with the Government of Viet Nam and experts of TESI in July, 1994. However, given Vietnam's rapidly changing economy, cargo demand might be modified according to the new development plan and policy, if necessary.

(2) Port Development Plan

1) The most important thing is to develop ports and industries without causing serious environmental problems and without interfering in the tourism industry. Therefore the following measures should be taken.

- Hon Gai Port, B-12 and small oil jetty should be removed to other areas by the year 2000.

- Hon Gai port should be converted to a passenger wharf.

- After moving B-12 and small oil jetty the area should be utilized as a green park area ; a large berth should not be constructed here.

- Present natural topographical condition should be kept as much as possible. In this sense, small hills behind berths should not necessarily be excavated. These hills can be utilized as shelter green areas, green parks, and marker areas for navigation so on.

2) Grain carriers usually are 40,000 or 50,000DWT class vessels. Silo system using belt-conveyor has been adopted as the cargo handling system. Therefore the wheat mill factory should be located within 500m from the berth from the viewpoint of economical transportation. Behind the berth No.7(B-7), there is space for the wheat mill factory in the recommended plan. This area has a solid foundation and it is suitable for the construction of silos.

If the location of the wheat mill factory could be fixed in another place, the importance of moving it to the area behind Berth No. 7 should be emphasized.

3) Channel depth is determined at -11.0m for 40,000DWT grain carrier. However the number of grain carriers at the beginning of port operation will be small. Therefore the time to start dredging for -11.0m should be carefully examined according to the number of large ships entering and leaving the port.

The siltation volume has been estimated at around 500,000 m^3 per year. Further investigation and observation are necessary.

(3) Port Management

1) Berth No.1 has already been completed. This should be operated as soon as possible for foreign ships:

a. to earn port revenue and

b. to train many workers who will work in Cai Lan Port.

2) The other 6 berths should be constructed and operated successively to earn port revenue as soon as possible.

3) All organizations of VINAMARINE should cooperate to attract more cargoes to Cai Lan port.

(4) EIA Study

Based on the preliminary EIA, we recommend the following to ensure the protection of the environment:

1) Additional environmental investigations:

- Effects of dredging in Cai Lan channel and Ha Long Bay on marine fauna and fisheries.
- Effects of storm surges on water levels in Bai Chay Bay.
- Sedimentation rates in Bai Chay Bay and hydrological characteristics of Bai Chay Bay as a result of existing practices.
- Management plans to be designed. The following plans will need to be designed as part of the engineering design work:
- Storm water management
- Waste water and sewage treatment plants
- Earthworks management
- Sediment management plan for reclamation works
- Dust management plans during road building

In addition, other plans are needed:

- Water quality monitoring plan
- Landscape enhancement plan
- Waste management plan
- Port site contingency plans
- Oil spill contingency plan (including modelling of spill movement)
- Road traffic management
- Cua Luc Strait ship traffic management
- Pagoda relocation

PART I

PRESENT CONDITION

CHAPTER 1 INTRODUCTION

1.1 Background of the Study

In 1989, the Government of the Socialist Republic of Viet Nam embarked on a new economic policy popularly referred to as the "Doi Moi" policy which was both more open and market oriented than in the past. The result of the new policy has gradually materialized in recent years. In 1992 and 1993, GDP growth rate reached 8.3% and 7.5% respectively without any significant inflation. The Government of the Socialist Republic of Viet Nam is now implementing a positive socio-economic development plan, one of the objectives of which is to reduce the gap in GDP per capita between North and South by stimulating growth in the North.

The cargo volume handled at Hai Phong Port, the sole major port in the North, was 2.7 million tons in 1993. Considering the fact that the population of the port's hinterland exceeds 26 million, this level seems extremely low; rapid growth is necessary to support the regional socio-economic development. On the other hand, Hai Phong Port has a limited cargo handling capacity because of obstacles due to its location, in other words it is a river-mouth-port, though an urgent rehabilitation project will be executed with Japanese cooperation. As a consequence it has become necessary to develop a new port in the region.

Together with the situation that construction of a new deep water berth has already begun, Cai Lan has been selected as the best site for a new port for the time being. The regional development of the triangle zone which consists of Hanoi, Hai Phong and Ha Long seems to have become a strategy of socio-economic development for the nation.

In this context, the Government of the Socialist Republic of Viet Nam requested the Government of Japan to conduct a feasibility study on the Cai Lan Port Construction Project under a technical cooperation basis. This project is also identified in the Master Plan Study on the Transport Development in the Northern Part in the Socialist Republic of Viet Nam, which was conducted by the Government of Japan through Japanese International Cooperation Agency (JICA) in advance of this study.

In this study, the reports on the Urgent Rehabilitation Project of Hai Phong Port and the Master Plan Study on the Transport Development in the Northern Part of the Socialist Republic of Viet Nam were referred to. Among findings of these reports, it is noteworthy that this study adcpted the following way of thinking. That is, Hai Phong Port has a long history of operation and is sufficiently equipped with not only physical port facilities but also organizational infrastructure concerning transportation. Furthermore, a large population is supporting or being supported by the port. Therefore it is rational to utilize Hai Phong Port as much as possible from the national economic point of view and it would be also economical as long as excessive investment to overcome the severe natural conditions could be avoided. Considering the facts that access distance to the Capital is shorter from Hai Phong than Cai Lan and the most economical ship size depends on the size of cargo lot and status within the shipping service network. Hai Phong Port would be chosen to a considerable extent by shipping companies or shippers from the economical point of view. From this aspect the perception of Hai Phong Port in this report coincides with those in the above-mentioned reports.

A very important thing to be mentioned here is the matter of environmental consideration. Bai Chay Bay seems to be rather vulnerable to water pollution if comprehensive development around the Bay occurs. In fact, port construction or port operations will have only a very little direct impact on the environment, but it is the various activities accompanied by regional development that directly cause environmental pollution. Ports are sometimes inevitably condemned to be the cause of environmental pollution because they induce regional development. Therefore a comprehensive study for the environmental conservation plan of the whole Bai Chay is recommended herein. And tentative guidelines for discharge to public waters are also proposed. It is strongly recommended that any development should be consistent with the results of the comprehensive study for the environmental consideration plan, waiting completion of the study. Even in the urgent case, at least the tentative guidelines for discharge should be kept. Authors of this report should not be held responsible for any undesirable consequences that arise from development if the above recommendation is ignored.

1.2 Objectives of the Study

The objectives of the Study are as follows

1. To formulate an optimum port plan in Cai Lan aiming at the year 2000.

2. To confirm feasibility from the technological, economic, financial and environmental points of view.

3. To carry out technical transfer to Vietnamese counterparts in the course of the study.

1.3 Scope of the Study

In order to achieve the objectives mentioned above, the study covers the following items.

1. Formulation of planning framework including socio-economic framework, demand forecast of cargo volume handled in the year 2000 and 2010, and long term development concept up to the year 2010.

2. Planning of optimum port for the year 2000, including, preliminary design of related facilities, cost estimation and implementation schedule.

3. Environmental Impact Analyses

4. Project evaluation based on economic and financial analyses

As to Environmental Impact Analyses, though environmental impact induced by total regional development which is triggered by the construction of the Cai Lan Port of the 1st stage is much more significant for preservation of the environment of the region, only EIA for the 1st stage port construction and its operation is included in this study. The impact from the total development of the region is considered but not given comprehensive treatments. A comprehensive EIA for the total development of the region is beyond the scope of this study, because it would take a substantial amount of time to complete, while the study of the 1st stage of Cai Lan Port construction project is urgent.

Therefore a comprehensive EIA will separately be conducted in a later stage, perhaps even in conjunction with construction work of the 1st stage of the project. The necessary environmental regulations or guidelines, instead, are proposed tentatively, and will be finalized when the comprehensive EIA is completed.

1.4 Schedule of the Study

Preparation for the inception report began in December 1993. Through 2 series of field surveys, the interim report was prepared at the end of the second series of field surveys at the beginning of August 1994.

The final draft report was presented in December 1994. The final report will be submitted at the end of March 1995.

1.5 Organization of the Study Team

Mr. Yoshinori AOKI	Team Leader, Overall Management
Mr. Takahisa SOGABE	Port and Channel Planning/Environmental Consideration
Mr. Jun SAITO	Regional Development
Mr. Shingo SHIRATORI	Demand Forecast/Socio-economic Analysis
Mr. Heiroku HANADA/ Mr. Tsutomu UEDA	Cargo Handling System
Mr. Tsuyoshi SASAKI	Management and Operation Planning/ Financial Analysis
Mr. Kiyokuni OKUBO	Natural Condition
Ms. Ruth Miriam BARTLETT	Environment Impact Analysis
Mr. Gordon S. MAXWELL	Mangrove ecosystem
Mr. Katsumi NAITO	Facility Design
Mr. Teruo ONUKI	Implementation Plan and Cost Estimation

1.6 Organizations Concerned

- Ministry of Transport & Communications
- Transport Engineering Design Inc.
- People's Committee of Quang Ninh Province
- State Planning Committee
- State Committee for Cooperation & Investment
- Office of Government
- Ministry of Science, Technology & Environment
- Ministry of Finance
- Ministry of Construction
- Economic Scientific Institute of Communication & Transport
- Hai Phong Port
- Vietnam National Maritime Bureau
- Ministry of Heavy Industry
- Ministry of Agriculture

- Ministry of Energy
- Vietnam Steel Corporation
- Cement Consulting, Investment and Development Company
- Ferchemco
- Vitranschart
- Vietfrach
- Hai Phong office for External Economic Relations
- Quang Ninh import export Company
- Pha Rung shipyard Company
- Chinh Fong Hai Phong Cement Corporation
- Renong Berhd
- Vietnam Central Food Corporation 1
- Petronas

1.6.1 Counterparts

TEDI (Transport Engineering Design Incoporated)

1. Dr. Dao Xuan Lam
   Director, General
2. Dr. La Noi
   Deputy General Director
3. Mr. Dang Quang Lien
   Chief Engineer
4. Mr. Le Toan Thanh
   Manager, International Cooperation Section
5. Mrs. Tran Thi Thu Huong
   General director secretary
6. Mr. Vu Thi Suu
   Chief Accounter
7. Mr. Ngo Trong Hue
   Chief of Planning Division
8. Mr. Ngo Ngoc Tran
   Eng., Port Department
9. Mr. Le Van Chinh
   Eng., Port and Channel Planning

PORT AND WATERWAY SERVEY AND DESIGN ENTERPRISE

10. Mr. Tran Van Dung
    Acting Director,
11. Mr. Pham Trong Toan
    Vice Director
12. Mr. Nguyen Minh Anh
    Chief of Port Department
13. Dr. Nguyen Ngoc Hue
    Port Department
14. Ms. Pham Thi Nhuong
    Eng., Port Department
15. Mr. Bui Trong Hien
    Eng., Port Department
16. Mr. Luong Phuong Hop
    Eng., Port Department
17. Mr. Ngu Van Mui
    Eng., Port Department
18. Ms. Pham Tuyet Mai
    Eng., Port Department
19. Mr. Bui Anh Tuan
    Eng., Port Department
20. Mr. Nguen Aue Dung
    Eng., Port Department
21. Mr. Nguen Cung
    Eng., Port Department
22. Mr. Pham Quang Vinh
    Eng., Port Department
23. Mr. Nguyen Van Phuc
    Chief of Waterway Department
24. Mr. Nguyen Anh Tuan
    Technical Department
25. Mr. Pham Huu Thai
    Executive Engineer of Port Construction
26. Ms. Nha Nam
    Eng., Port Department

CHAPTER 2 OUTLINE OF NORTHERN PART OF VIETNAM

2.1 General

The Socialist Republic of Vietnam is located at the geographical center of Southeast Asia, and is bordered by Cambodia to the west and southwest, Laos to the West and China to the north. Vietnam has a continuous coastline of 3,260 km, and occupies a land area of 331 thousand km^2 (Figure 2-1-1).

Forests and mountains make up three-fourths of the land area of Vietnam, which may be divided into three main topographical regions: the Red River Delta, with mountains on three sides which lies to the north; an extensive plateau with a narrow coastal plain to the south; and the southern Mekong Delta plain extending to the Cambodian border.

The north of Vietnam experiences four distinct seasons: a hot summer, dry autumn, cold winter and humid spring. In the center and the south of Vietnam there are only two seasons: a rainy season from May to October, and a dry season from October to April.

The Feasibility Study deals with Cai Lan Port which is located in Quang Ninh province in the northern area of Vietnam. The area consists of two cities under direct central control and 18 provinces (Figure 2-1-2).

2.2 Geographic and Natural Conditions (*)

2.2.1 Geological Structure

The territory of Vietnam stands on the edge of the Euro-Asian continent which begins with the Himalayas - the highest mountain range in the world. It is also contiguous to the largest ocean - the Pacific - and not far from the deepest point of the globe - the Marianas Trench. This is the meeting point of the two big tectonic and mineralogical belts - the Pacific and Mediterranean.

(*) Descriptions in this section are adopted from 'Geography of Vietnam' by Nguyen Trong Dieu, THE GIOI, Foreign Languages Publishing House, Hanoi-1992.

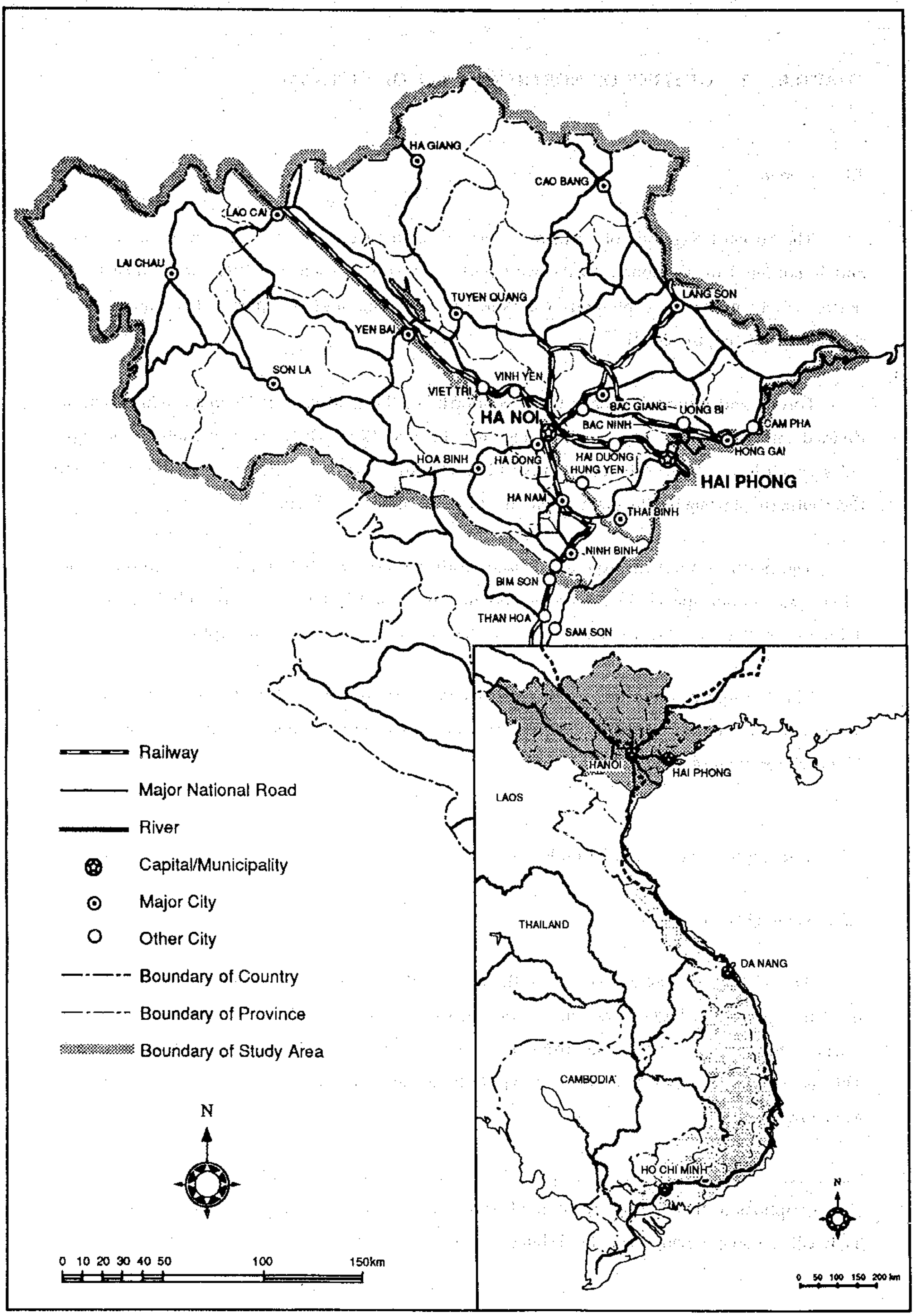


Figure 2-1-1 Viet Nam and Northern Part of Viet Nam

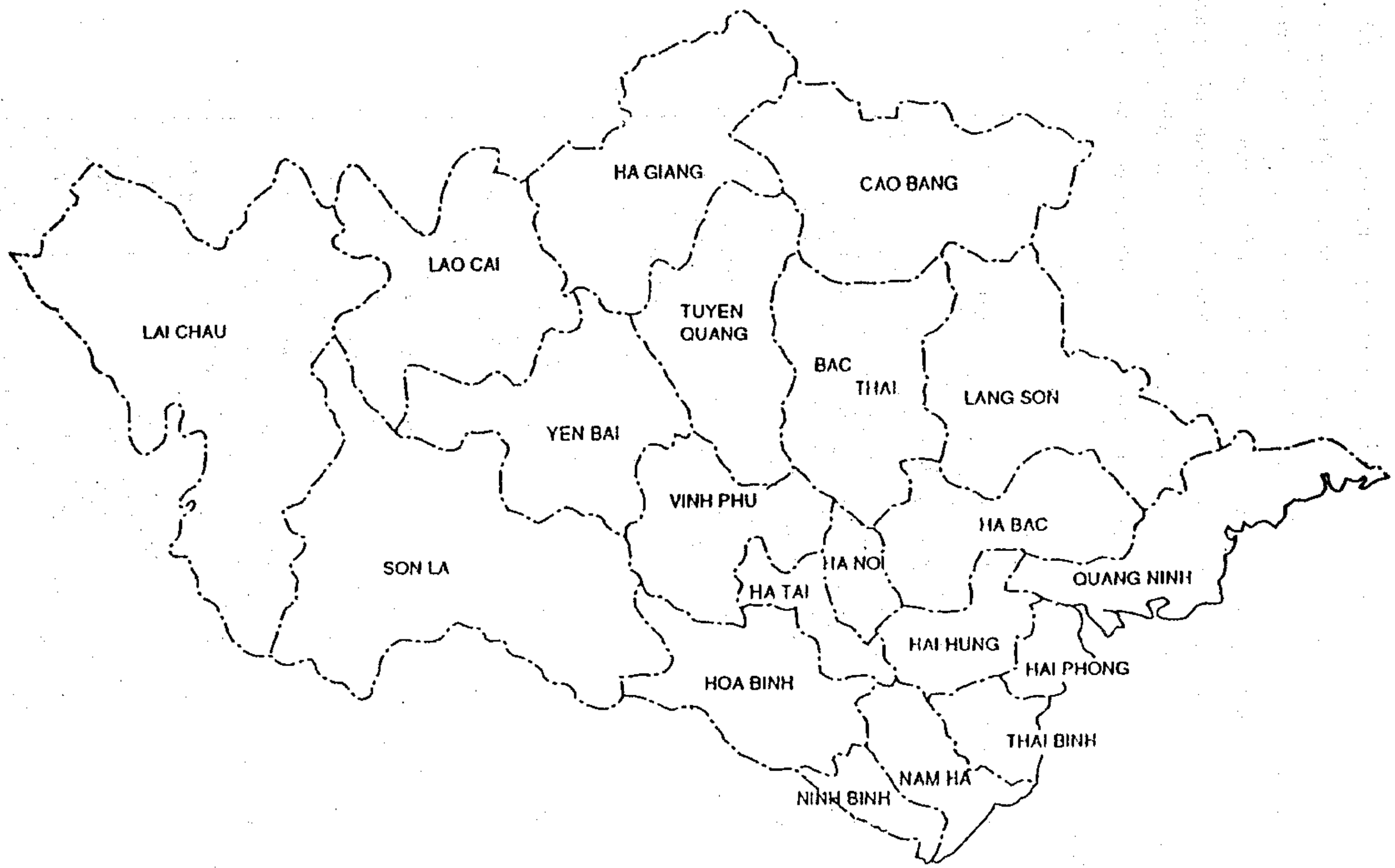


Figure 2-1-2 Cities and Provinces in Northern Part of Viet Nam

2.2.2 Minerals

Geological studies of the formation and development of geological structures and the process of intrusion and sedimentation have shown that there are two types of mineral deposits - endogenic and sedimentary - in the territory of Vietnam. In Vietnam, 2,000 mines and ore deposits of various kinds have now been discovered (Figure 2-2-1). Of this number, 300 contain 50 types of minerals (30 minerals at 120 mines are being exploited and 90 being investigated). The structure of these deposits is complex. The majority of mines have limited potential, but some possess large reserves with major industrial value. In the northern part of Vietnam these are as follows:

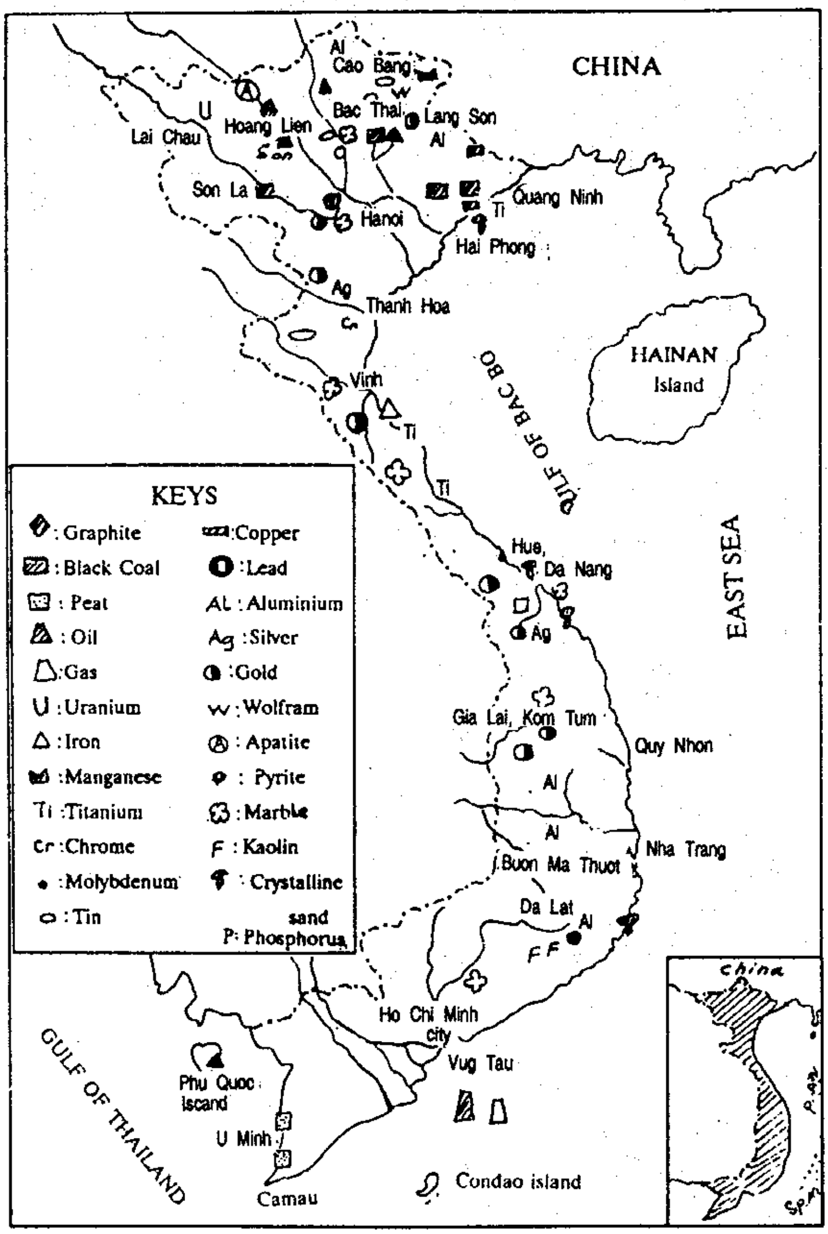


Figure 2-2-1 Distribution of Mineral Deposit in Viet Nam

* Late triassic coal
Northeast basin from Cai Bau Island to the Thai Nguyen, concentrated in Quang Ninh (5 - 6 billion tons)

* Meager and volatile coal
Scattered deposits between Ninh Binh and Quynh Nhai, all small mines, except at Na Duong, where brown coal is being extracted from a medium-sized mine.

* Quaternary peat
Found in many places, but mainly concentrated in Minh Hai; large deposit recently discovered in the Red River Delta area.

* Oil and gas
Nam Bo continental shelf (oil now being recovered); gas also found on the Bac Bo continental shelf (now being exploited on a small scale).

* Uranium
Phong Tho (Lai Chau) and several other locations (recently discovered).

* Iron Ore
Thai Nguyen, the "iron area" of the Red River and Ha Giang, and most importantly Thach Khe, Nghe Tinh and many smaller mines.

* Titanium
Bac Thai, Quang Ninh, mainly concentrated in the coastal provinces of Trung Bo (medium-size).

* Lead, Zinc, Silver
Cho Dien, Lang Hit (Bac Thai)

* Copper
Ban Sang (Son La)

* Gold
Has been exploited at Bong Mieu (Bac Thai); has been discovered and is being extracted on various scales in many locations - Van Quan, Bac Son (Lang Son), Bac Thai, Hoa Binh, Thanh Nghe Tinh, Binh Tri Thien, Gia Lai-Kon Tum and others.

* Rare earths

Central Highlands, eastern Nam Bo and the northwest - deposits of world significance and considerable potential.

* Apatite

Cam Duong (Lao Cai), the biggest in Southeast Asia, with reserves of billions of tons.

* Limestone

Bac Bo, northern Trung Bo, found in many different locations, large reserves.

* Marble

Bac Thai, Vinh Phu, Hoa Binh, Thanh Hoa, Nghe Tinh, Quang Nam-Da Nang, Central Highlands and others.

* Kaolin

Many locations.

* Crystalline sand

Many locations, concentrated in Van Hai (Quang Ninh), Quang Binh, Quang Nam-Da Nang, Thuan Hai.

* Clay Many locations.

* Mineral water

More than 70 locations with significant reserves, Hai Ba, Kenh Ga, Vinh Hao and other places.

Ninety percent of these mines are of local significance only, because they are located in places difficult to access and of medium or small size.

2.2.3 Topography

Topographic structure (Figure 2-2-2) is diverse in Vietnam, with three constituent parts: mountains, plains and sea. These result from cycles of tectonic activity and from exposure to the effects of a humid tropical monsoonal climate.

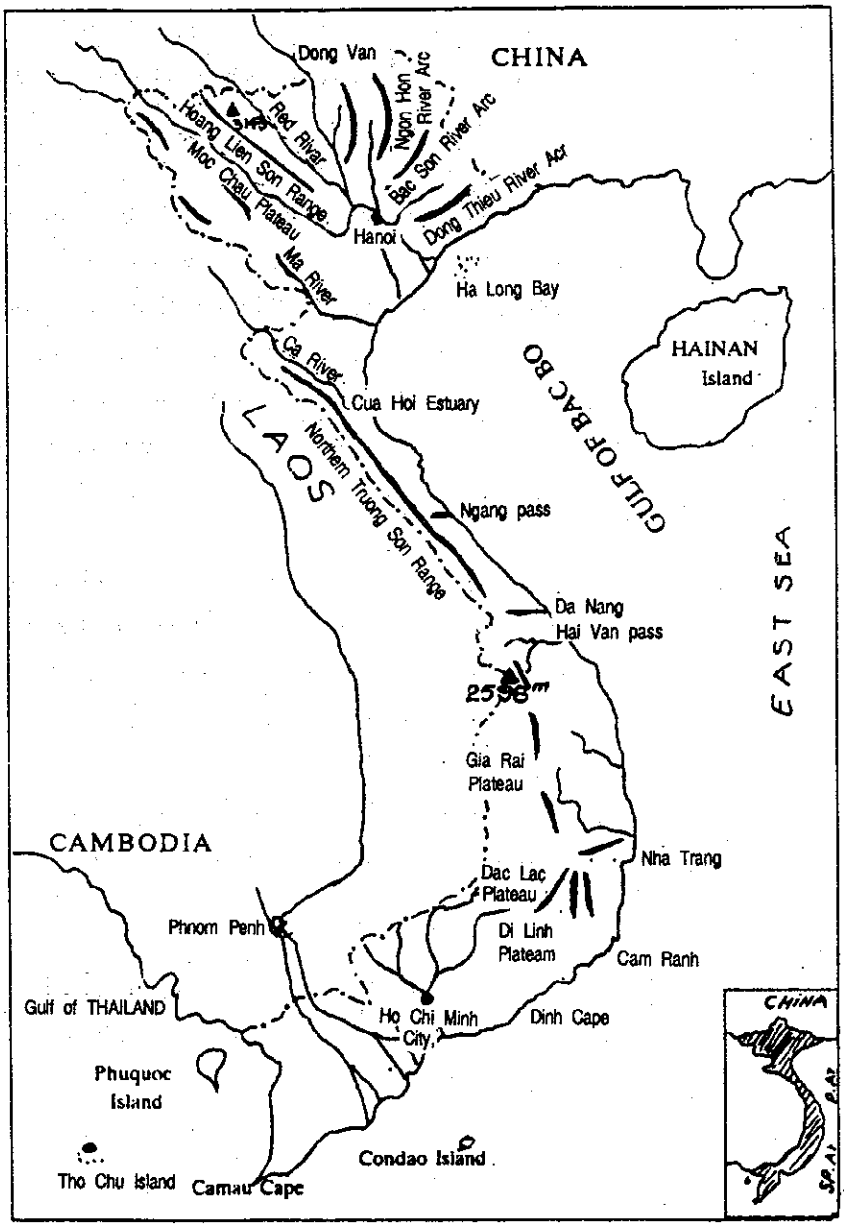


Figure 2-2-2 Topology of Viet Nam

In the northeast is an area of low mountains mostly 600 - 700 m high, the highest peak being Tay Con Linh at 2,419 m, and the lowest being the area of coastal plain in Mong Cai (1 m). High mountain ranges are generally concentrated along the Sino-Vietnamese border and the altitude decreases gradually as one moves towards the sea.

In the northwest, by comparison, the mountains have unique features owing to tectonic activity. Moving from east to west, first of all one meets the Hoang Lien Son Range. This is narrow in width and 180 km long, with Fansipan (3,143 m) being the highest point in the country. Between the mountain masses are famous basins such as Than Uyen, Nghia Lo and Quang Huy.

Vietnam has three plains systems - Bac Bo, the Trung Bo coast and Nam Bo. The plains of Bac Bo are 16,000 km^2 in area and the second largest after the Nam Bo plains. The surface is quite flat, and most of the land was deposited in the Cenozoic sedimentary era. These sediments are several thousand meters thick in some places and run northwest to southeast, inclining towards the southeast. Some of the hills that remain are 50 m to 70 m in height. The alluvial plains are between 10 m and 0.3 m high. Altitude never exceeds 25 m and decreases gradually nearer the sea.

Nearer to the sea appear lines of sand dunes 2 m or 3 m high, with up to 25 parallel lines forming a dune system, 30 km wide, as can be seen between the Tra Ly and Red Rivers. The dunes often rise one or two meters above the level of nearby rice fields. Villages and productive fields are concentrated there, and lines of casuarina trees grow close to the sea.

Vietnam's sea, covering approximately one million square kilometers, is three times larger than the mainland. It is the most important component part of the East China Sea. The coastline is 3,200 km long.

The islands and archipelagoes of the East China Sea were formed by the extension of continental mountain ranges and from coral. Almost all the smaller islands are concentrated in the Gulf of Bac Bo and the Gulf of Thailand.

2.2.4 Climate

Owing to differences in climatic factors, Vietnam can be divided it into two zones with one common element - tropical monsoon humidity - and separated by a buffer zone. The zone north of the 18th Parallel has two contrasting seasons - cold and hot - but with tropical humidity all the time. South of the 18th Parallel, the climate is hot all year round with two seasons - dry and humid (Figure 2-2-3). Depending on topography and altitude, each zone can be divided into many subzones.

A unique characteristic in the northern climatic zone is the existence of a cold and humid winter caused by the tropical monsoon. The uneven temperature and humidity distribution and the contrasting directions of atmospheric currents in the two seasons are unusual phenomena in tropical climates. The northern zone reveals a significant variation in climatic elements, and this climatic instability is much greater than in other subtropical regions; it also brings unfavorable and complex conditions which usually restrict ecological variation compared to the southern zone.

This northern zone can be divided into subzones with different ecological characteristics: the northwest, northeast, Bac Bo plains and northern Trung Bo.

2.2.5 Hydrography

The hydrographic system in Vietnam comprises a network of rivers and streams (Figure 2-2-4), lakes and ponds, underground water and the sea. This system is a clear reflection of the combined effects of rainfall, topography, geological structure, vegetation, and human intervention as well.

The greater part of the territory of Bac Bo is watered by the Red River-Thai Binh River system, linked by the Duong and Luoc Rivers. The Red River is 1,149 km long. It rises in the Nguy Son Mountain Range near Dai Ly Lake (Yunnan, China), and enters Vietnam in the Ha Khau area (Lao Cai). It flows on Vietnamese territory for a distance of 550 km and has many tributaries. To the right is the Da, 910 km in length, which joins the Red River at Trung Ha; to the left are the Chay, Lo and Gam Rivers which join the Red River at Viet Tri. From here, the Red River flows through the middle of the plain and is joined by more tributaries: to the right are the Day (linked to the Red River by the Nam Dinh River) and the Ninh Co which flows out from it at Xuan Truong; and to the left are the Duong and Luoc which carry water from the Red River to the Thai Binh River. Near the sea, the Red River divides giving rise to the Tra Ly River at Thuong Ho. The Red River flows into the sea through four estuaries - Tra Ly, Ba Lat, Lach Giang and Day.

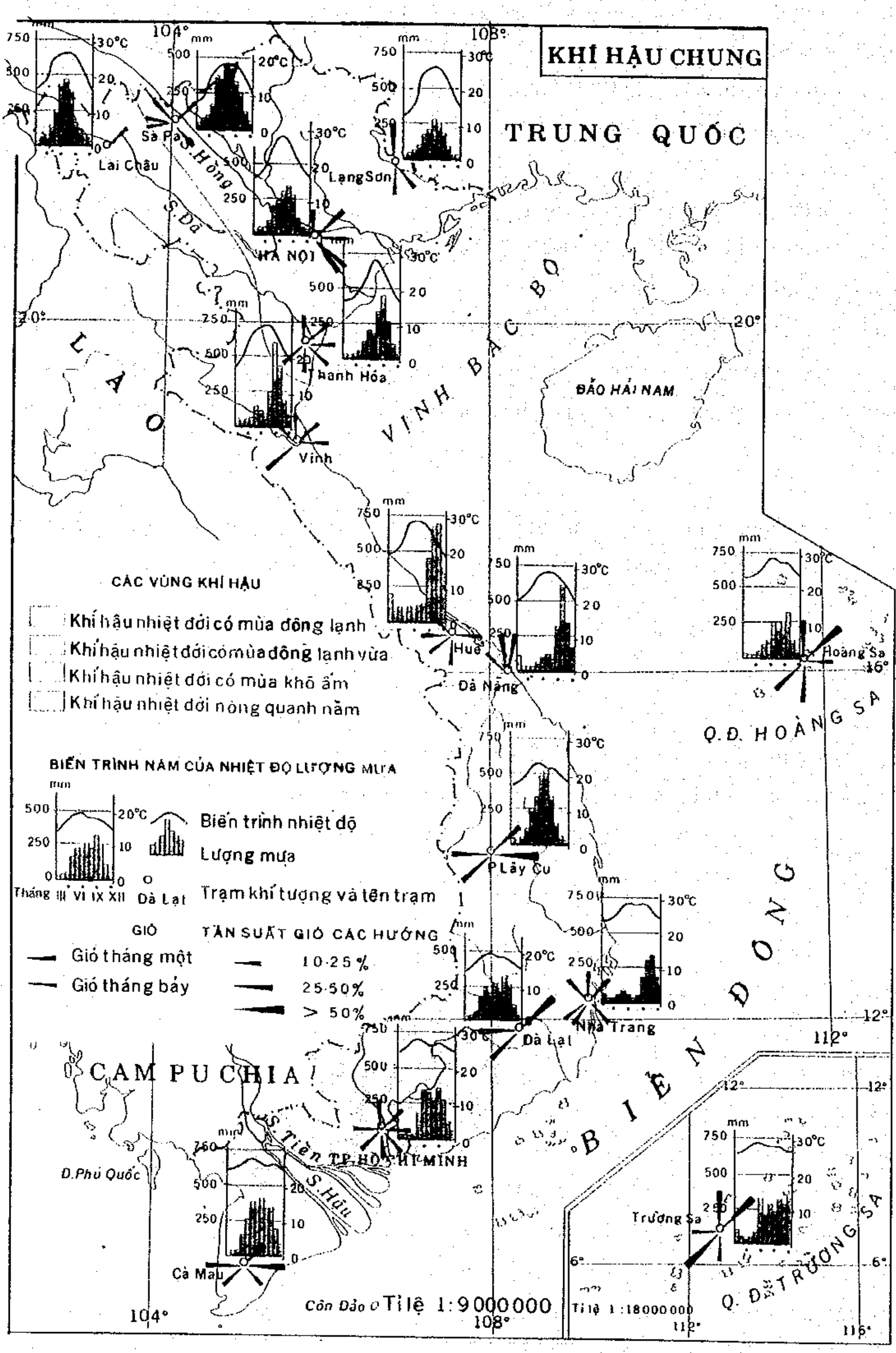


Figure 2-2-3 Average Temperature and Rainfall throughout Years

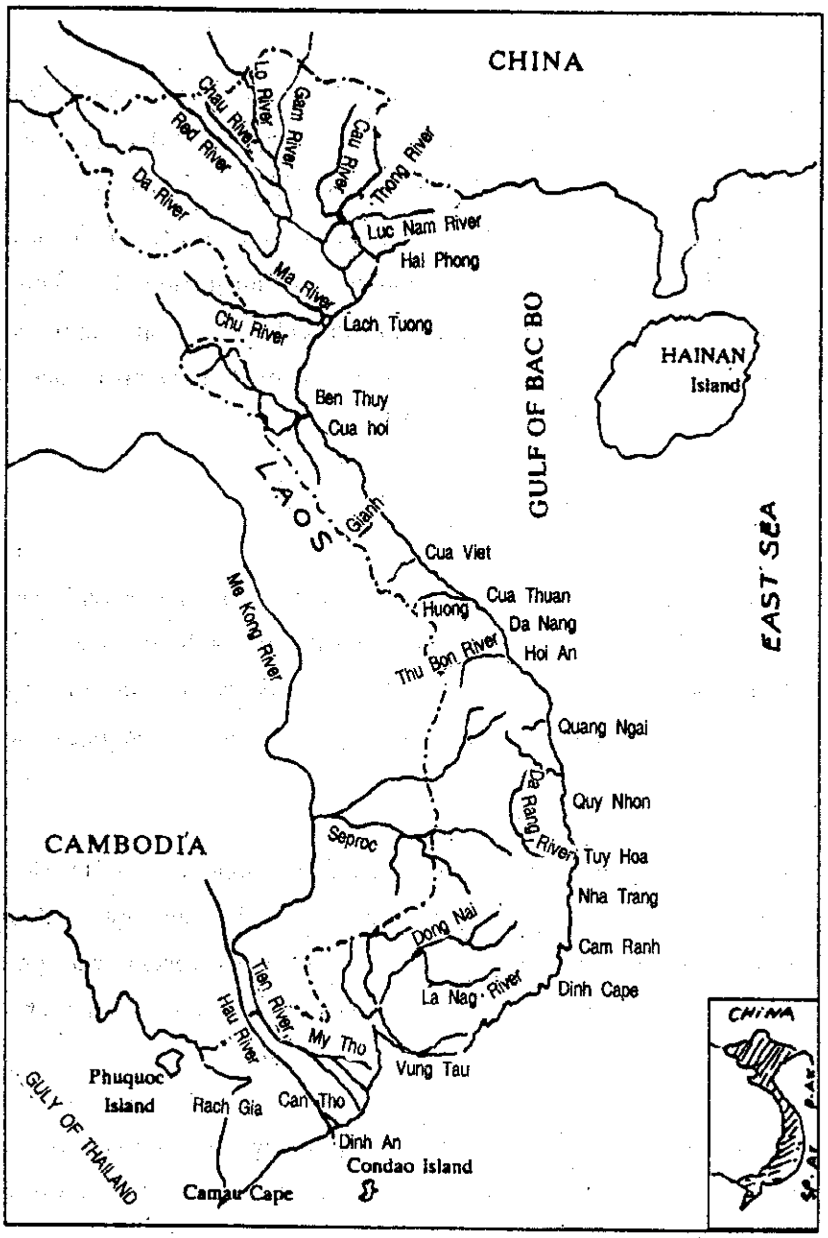


Figure 2-2-4 Rivers of Viet Nam

The Thai Binh River comprises the Cau (300 km), Thuong and Luc Nam (180 km) Rivers - all flowing from the northeast and converging at Pha Lai. The Duong and Luoc allow the Thai Binh to divide into several smaller rivers flowing through an area which is half water and half land surface, and empties into the sea through four estuaries: Nam Trieu, Cua Cam, Van Uc and Thai Binh (the ports of Pha Rung and Hai Phong are situated on the banks of the Thai Binh).

The rivers are highly significant in terms of both hydraulic systems and river transport.

2.2.6 Soils

The land territory of Vietnam has developed on an ancient geological foundation, composed of rock which metamorphosed between the primary and tertiary eras. Tectonic processes caused the appearance of many kinds of rock from different ages -limestone is widespread in the highlands of Bac Bo while basalt covers a large area of the southern Truong Son Range. Then, through a process of erosion and sedimentation the plains took shape. Through the action of climatic conditions - hot tropical humidity - of topography, vegetation and animals, and of human intervention, various types of soil made their appearance in Vietnam.

2.2.7 Flora

The flora of Vietnam has a long history and includes many species and classes unique to the country. The country's location in the humid tropical zone, with Southeast Asian monsoons, and a high level of heat, rain and humidity results in a diverse covering of vegetation. This ranges from tropical and broad-leaved forests to coniferous forest, on high mountains, and mangrove forests on the coast.

Mangroves occur right along Viet Nam's coast from Mong Cai to Ha Tien and around islands as well, not in a continuous line and varying in size and area. Almost all have undergone a process of natural selection and comprise different genera and species, but with genetic features and physical adaptations suited to environmental conditions such as salt water, mud, tides and waves.

Vietnam has one of the world's richest reserves of mangroves, concentrated in three zones - the coast of Bac Bo, Thanh Hoa, Nghe Tinh and particularly Nam Bo, exceeding 200,000 hectares in area in eight provinces.

2.2.8 Fauna

The fauna living on Vietnam's territory and in its waters are no less diverse than its flora. Viet Nam's waters form the breeding grounds of many aquatic creatures. Shoals of fish enter these waters from the East China Sea and Sea of Japan, as well as northwards form Malaysia and Indonesia. This boosts the number of species in all three zones - fresh water, brackish, and especially salt water.

According to preliminary statistics, Vietnam has no less than 2,000 species of fish. Among these, 1,000 or so species are found in large numbers and are of great economic value. In the Gulf of Bac Bo alone there are 900 species, among them 50 of great economic value such as hong, khe, moi, phen, song and so on.

2.3 Socio-economic Activities

In 1992, the northern part of Vietnam had a land area of 115,406 km^2, comprising about one third of the whole country. Its population is 25.4 million, a little more than one third of the country's total.

It is inevitable to look out over the whole country of Vietnam in order to characterize the northern part of Vietnam. Various provincial socio-economic data are, therefore, presented on a map of Vietnam to understand easily geographical characteristics of each district or province. All data are based on "VIETNAM -ECONOMY AND FINANCE OF VIETNAM- 1986-1992"(CENTRAL STATISTICAL OFFICE, STATISTICAL PUBLISHING HOUSE, HA NOI-1994). Many figures are contained in the Appendix.

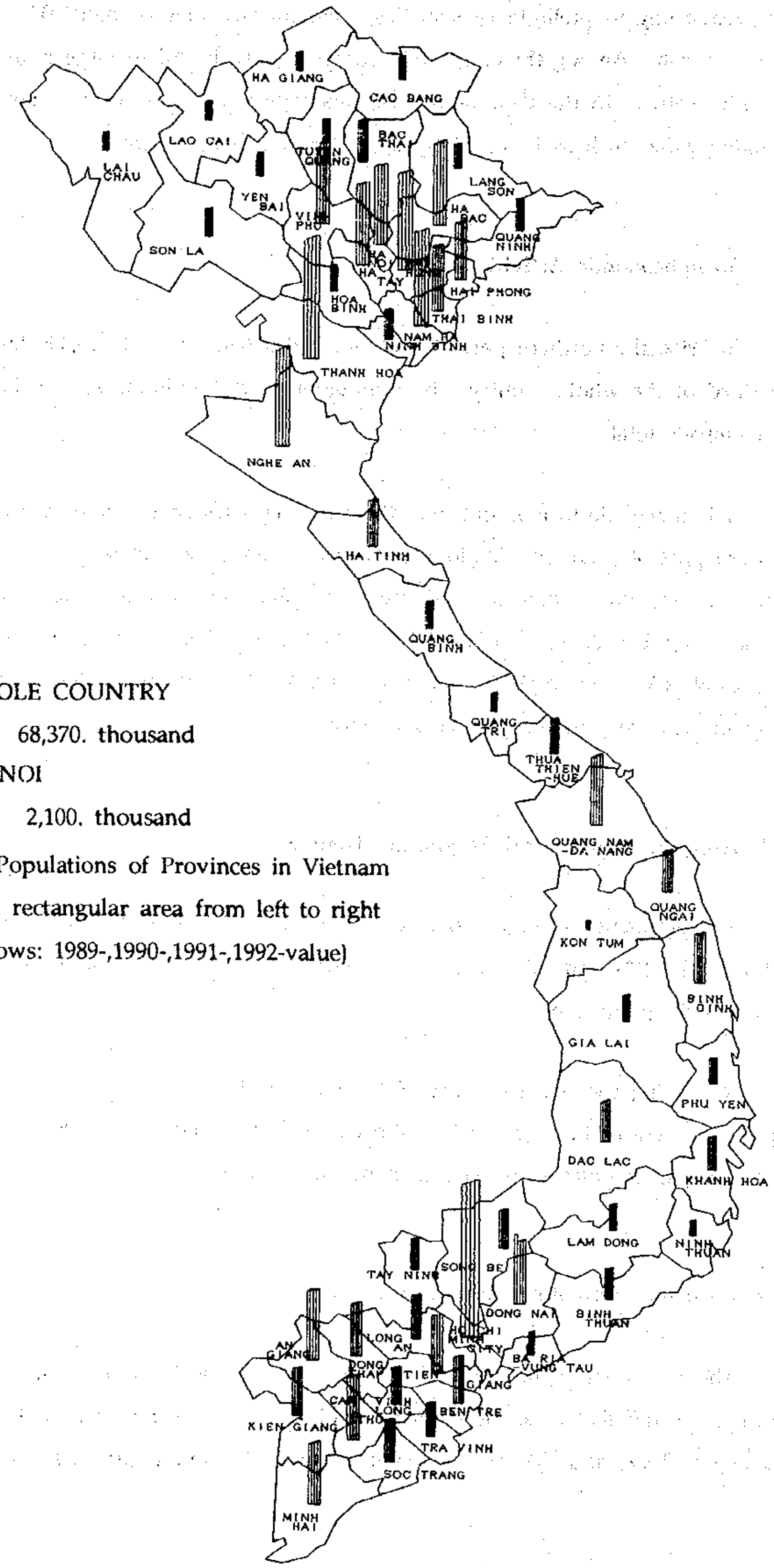
2.3.1 Area, Population and Population Density

The population of each province in Vietnam and in the northern part of Vietnam is shown in Figure 2-3-1(1) and Figure 2-3-1(2) respectively. The north and south delta areas are the most heavily populated.

Regarding the northern part of Vietnam, its land area is shown in Figure 2-3-2 and its population density in Figure 2-3-3. Provinces in the Red River delta are more populous and have a higher population density than mountainous provinces.

2.3.2 Industry, Agriculture and Rice Production

The industrial values of each province in the northern part of Vietnam are shown in Figure 2-3-4 and that of all of Vietnam in Figure 2-3-7, their agricultural values in Figure 2-3-5 and Figure 2-3-8, and rice production in Figure 2-3-6 and Figure 2-3-9 respectively.



In 1992

WHOLE COUNTRY

68,370. thousand

HA NOI

2,100. thousand

Figure 2-3-1(1) Populations of Provinces in Vietnam (Each rectangular area from left to right shows: 1989-,1990-,1991-,1992-value)

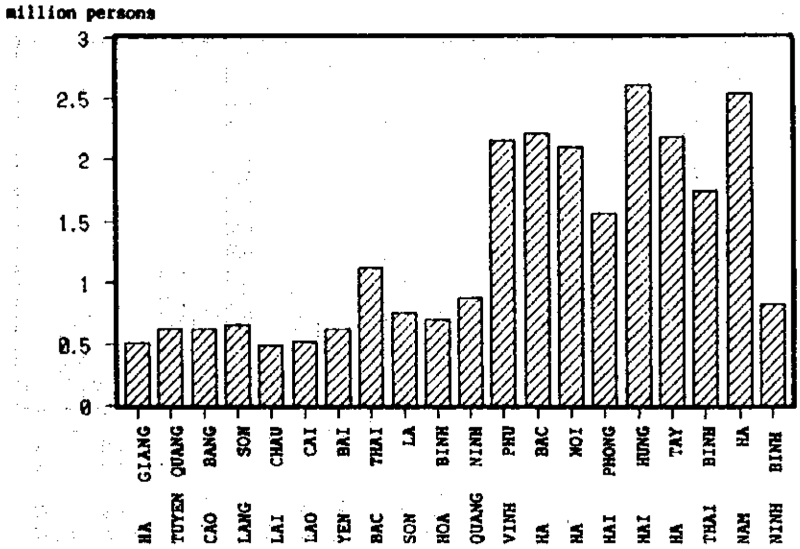


Figure 2-3-1(2) Populations(1992) of Provinces in Northern Part of Vietnam

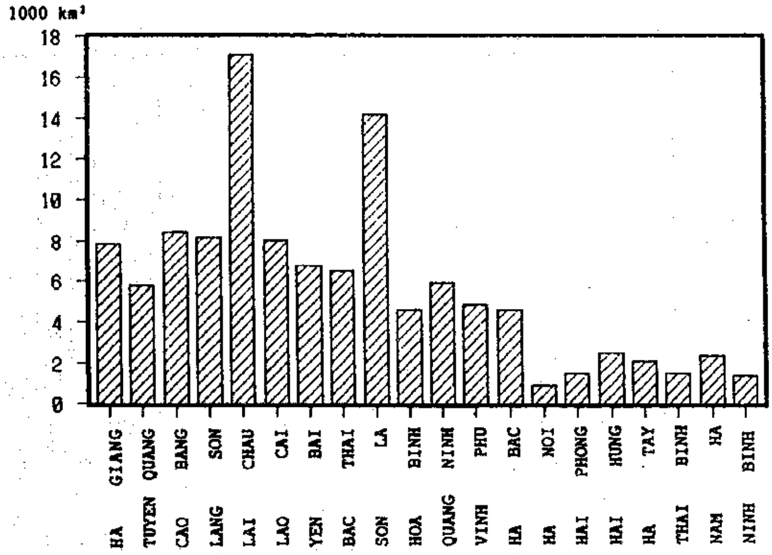


Figure 2-3-2 Land Area(1992) of Provinces in Northern Part of Vietnam

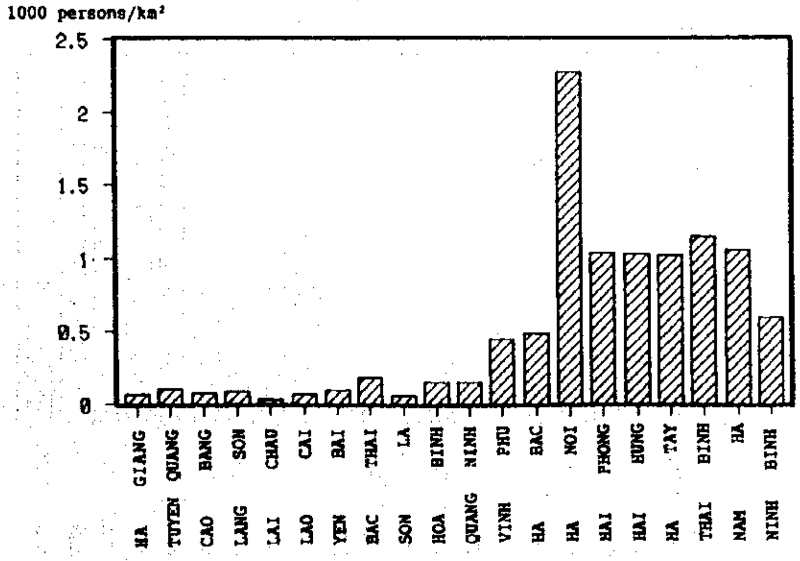


Figure 2-3-3 Population Density(1992) of Provinces in Northern Part of Vietnam

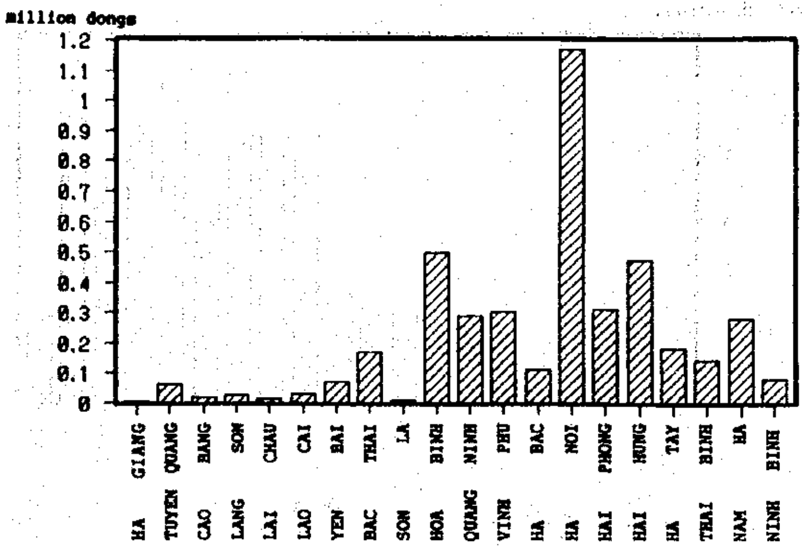


Figure 2-3-4 GPI(1992) of Provinces
in Northern Part of Vietnam

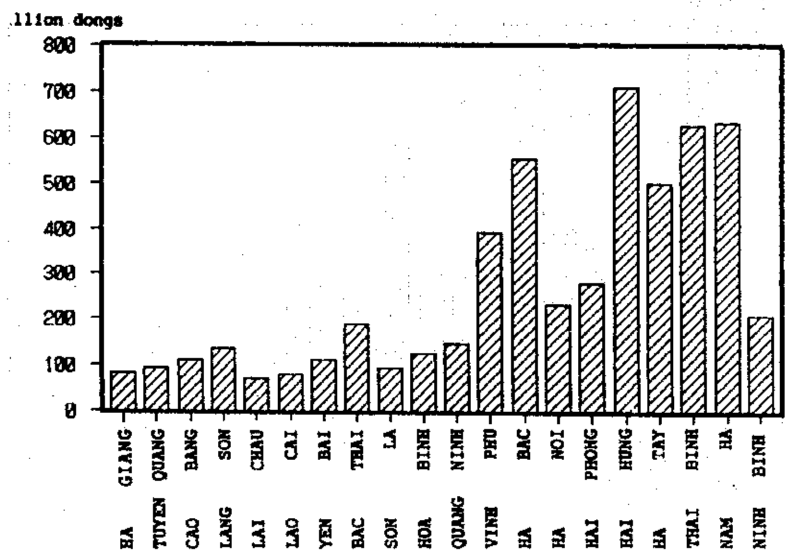


Figure 2-3-5 GPA(1992) of Provinces
in Northern Part of Vietnam

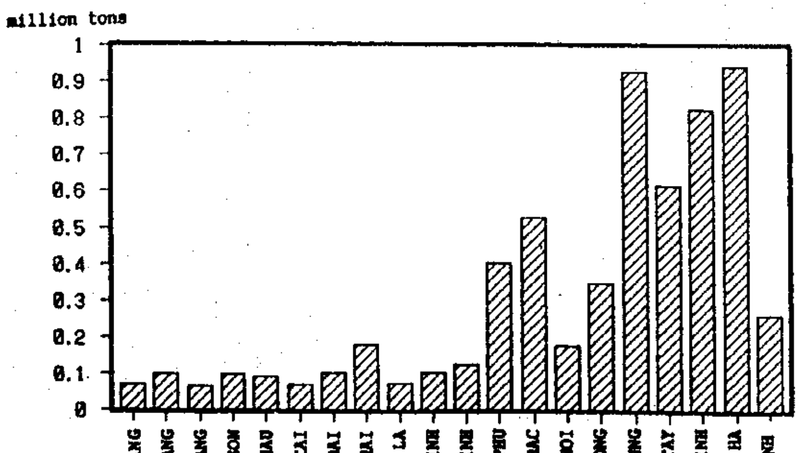


Figure 2-3-6 Rice Production(1992) of Provinces
in Northern Part of Vietnam

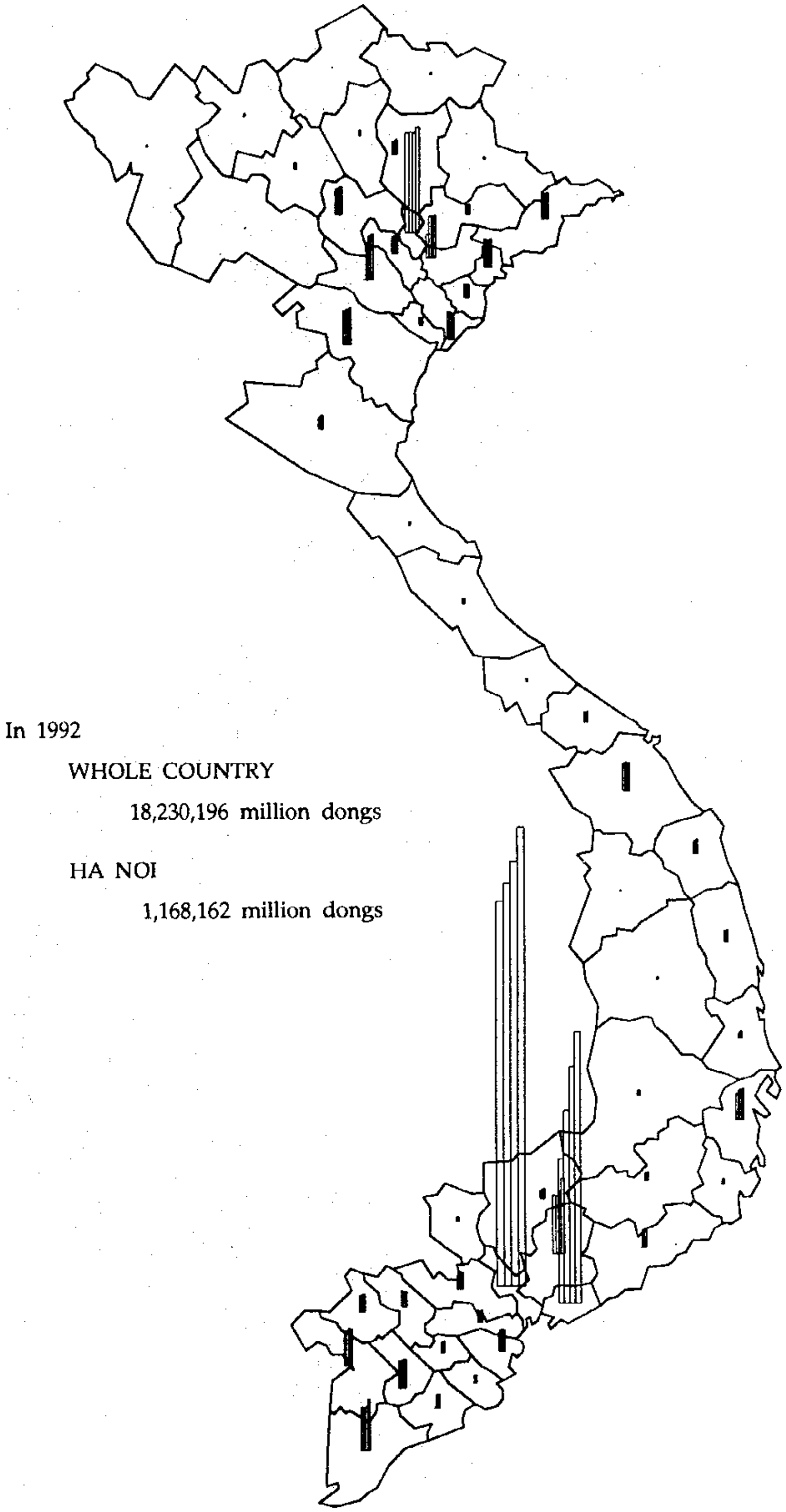


Figure 2-3-7 GPI of Provinces in Vietnam
(Each rectangular area from left to right shows: 1989-,1990-,1991-,1992-value)

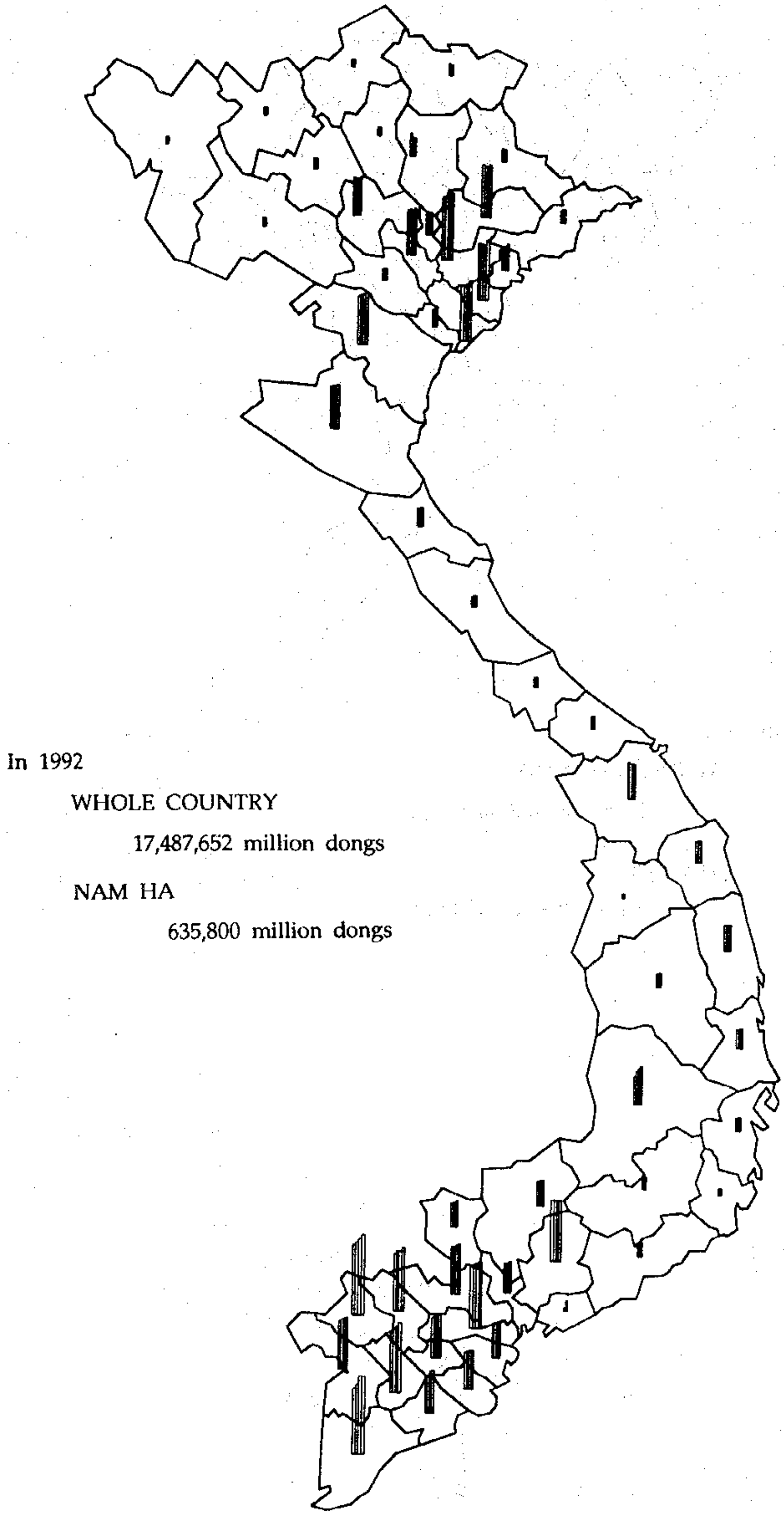


Figure 2-3-8 GPA of Provinces in Vietnam
(Each rectangular area from left to right shows: 1989-,1990-,1991-,1992-value)

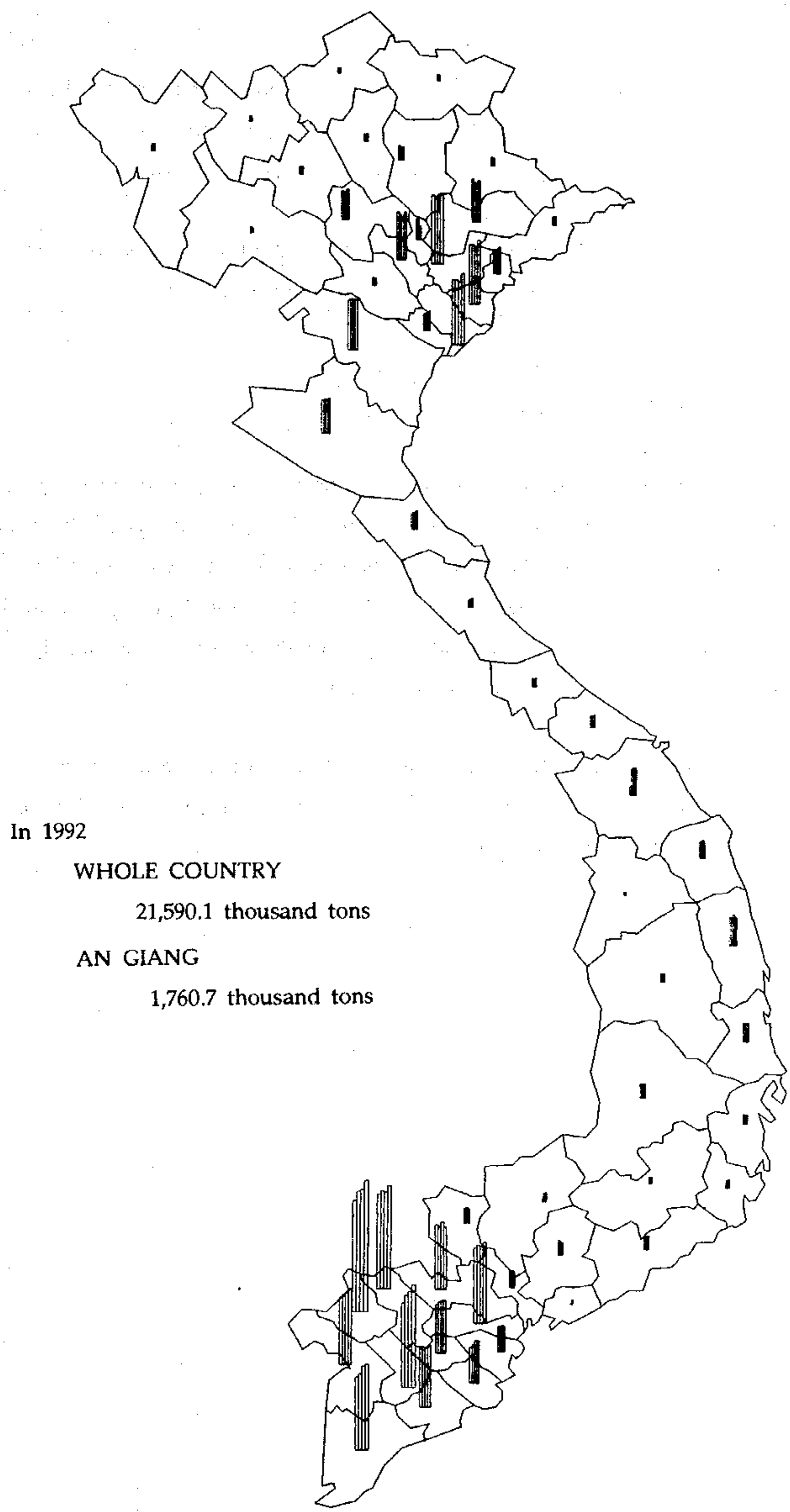


Figure 2-3-9 Rice Production of Provinces in Vietnam (Each rectangular area from left to right shows: 1989-,1990-,1991-,1992-value)

In every case, the value of the southern part is much larger than that of the northern part. But in the most recent information, growth rate of the gross production of industry of the northern part of Vietnam has caught up with that of the southern part.

Provinces in the Red River delta register a higher agricultural value, except for Hanoi and Hai Phong. Hanoi has a very high industrial productivity as well.

2.3.3 Construction and Foreign Trade

Construction investment in each province in the northern part of Viet- nam and in the whole country is shown in Figure 2-3-10 and Figure 2-3-13 respectively. Export and import value of each province in the northern part of Vietnam is shown in Figure 2-3-11 and Figure 2-3-12. Value of each province in the whole country is shown in Figure 2-3-14 and Figure 2-3-15. State construction investment in the northern part of Vietnam has been slightly greater than in the southern part, especially investment in Ha Noi.

Hanoi and Hoa Binh are attracting a great deal of construction investment. Hanoi, Hai Phong and Quang Ninh are the three largest exporting cities and provinces. Hanoi, Hai Phong and Lan Song import the most products.

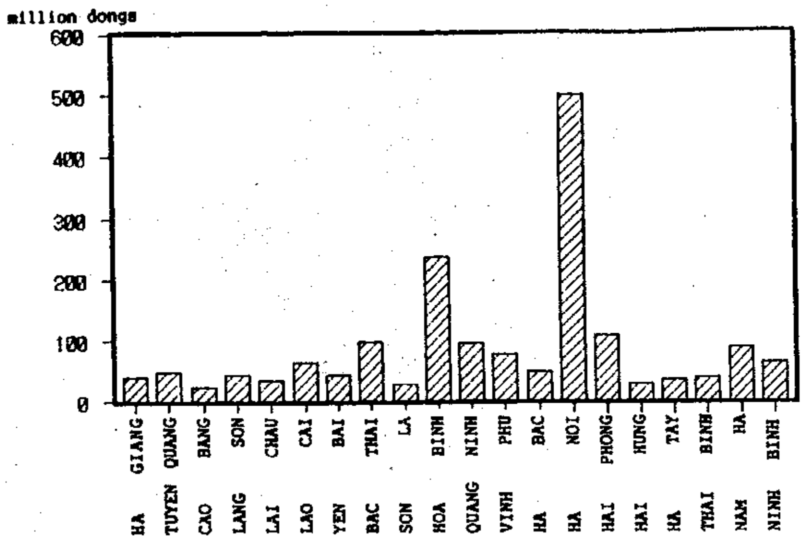


Figure 2-3-10 Construction Investment(1992) of Provinces in Northern Part of Vietnam

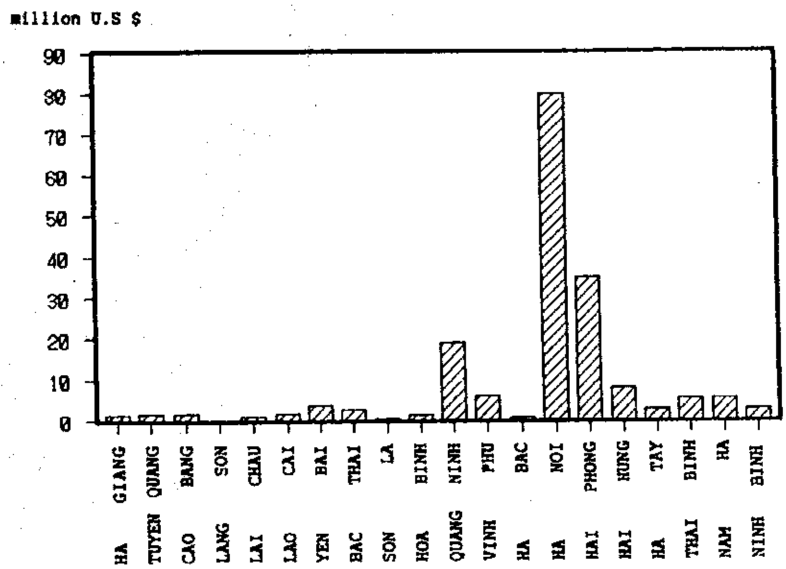


Figure 2-3-11 Export(1992) of Provinces in Northern Part of Vietnam

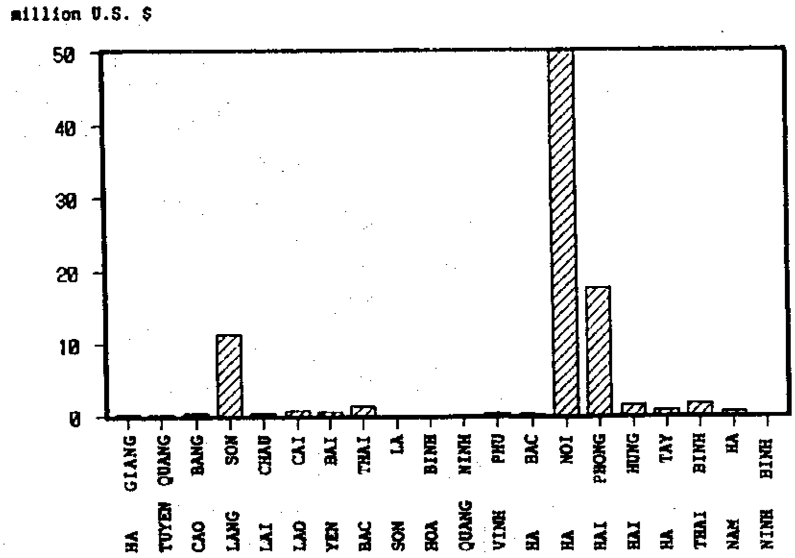
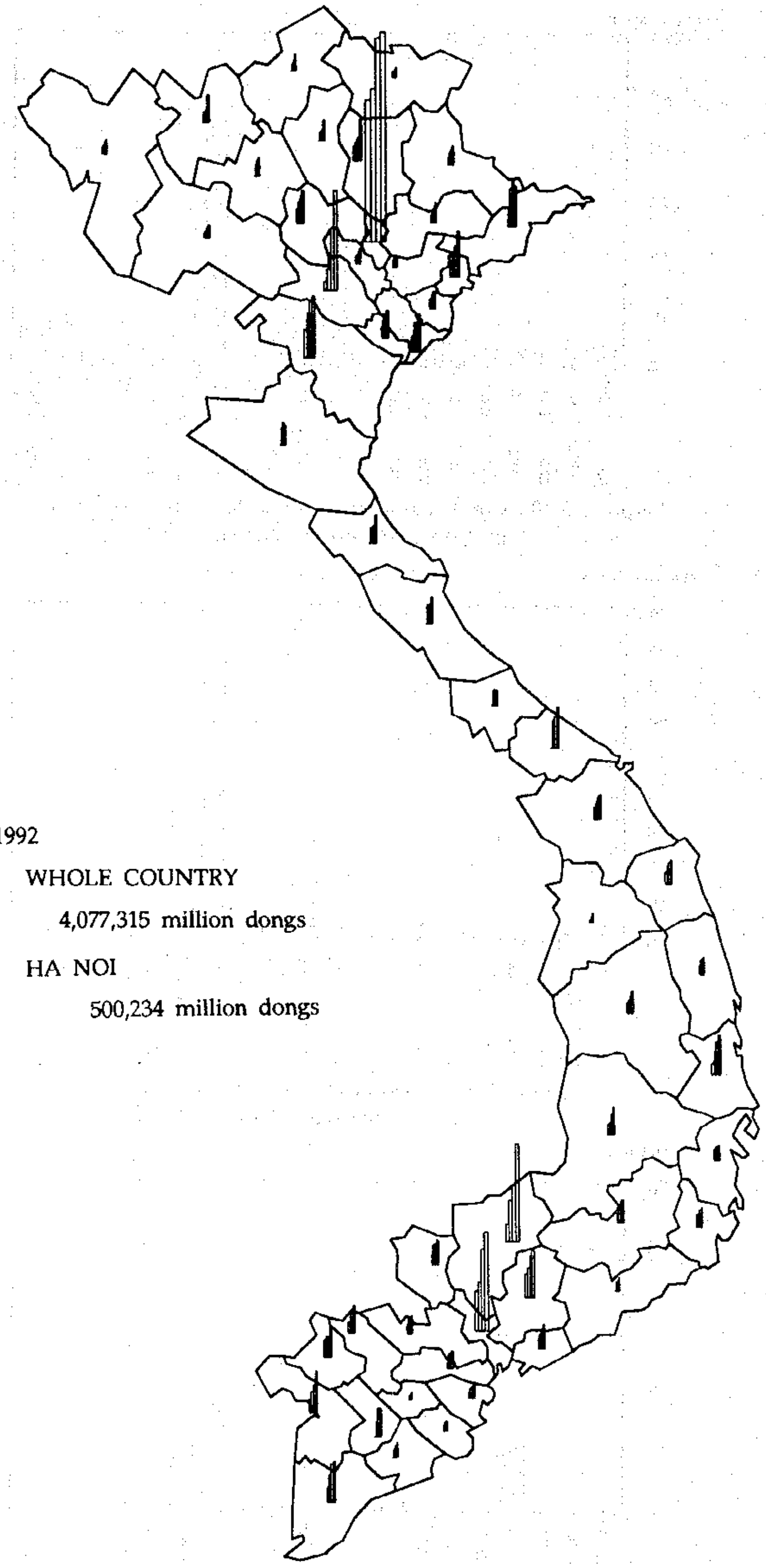


Figure 2-3-12 Import(1992) of Provinces in Northern Part of Vietnam



In 1992

WHOLE COUNTRY

4,077,315 million dongs

HA NOI

500,234 million dongs

Figure 2-3-13 State Construction Investment of Provinces in Vietnam
(Each rectangular area from left to right shows: 1989-,1990-,1991-,1992-value)

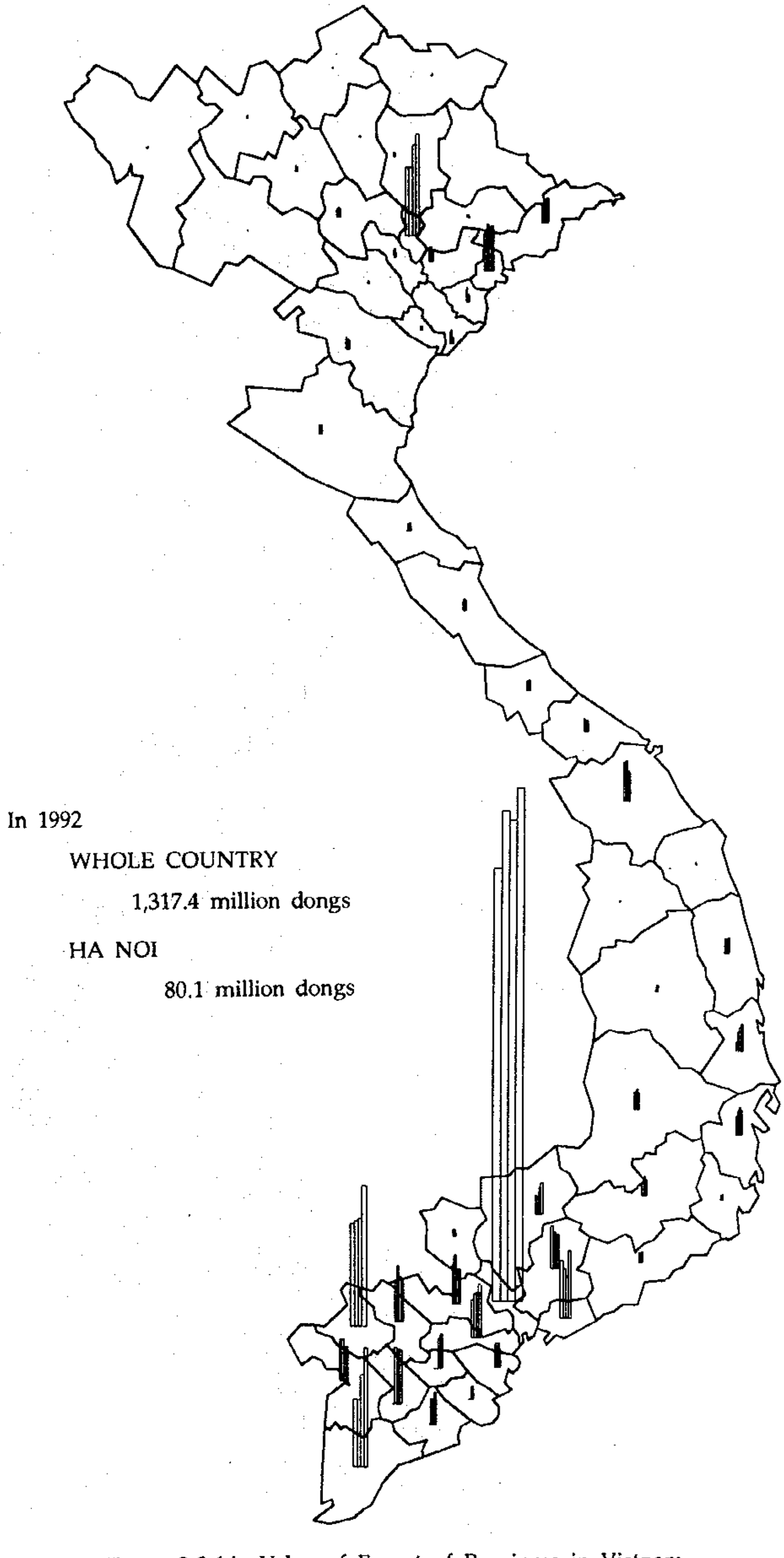


Figure 2-3-14 Value of Export of Provinces in Vietnam
(Each rectangular area from left to right
shows: 1989-,1990-,1991-,1992-value)

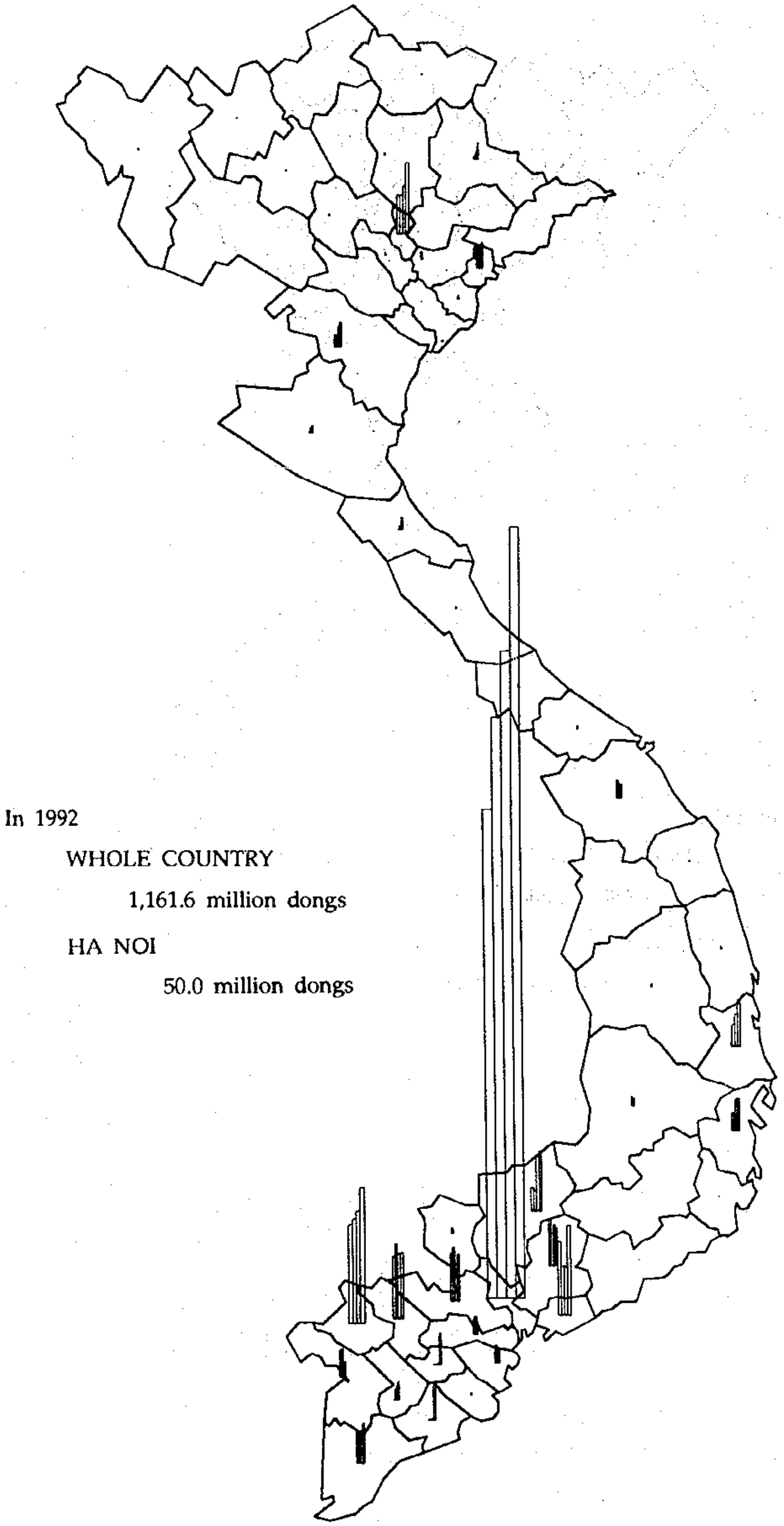


Figure 2-3-15 Value of Import of Provinces in Vietnam (Each rectangular area from left to right shows: 1989-,1990-,1991-,1992-value)

2.4 Transport System

The transport system in the northern part of Vietnam consists of roads, railways, waterways (including both sea and inland) and airways.

2.4.1 Roads

The road network (Figure 2-4-1) in the northern part of Vietnam had a total length of 49,202 km as of January 1993. Roads types and lengths are given in Table 2-4-1.

Table 2-4-1 Classified Road Length

Road Type	Length (km)
National Roads	11,353
Provincial Roads	14,014
District Roads	25,004
Village Roads	46,910
Urban Roads	2,825
Special Roads	5,451
Total Length	105,557

The roads in the northern part of Vietnam account for 46.6 % of the national road length. Road density is 0.426 km/km^2 which is above the national average.

There are 16 sites where ferries presently operate on national roads in the northern part of Vietnam (Table 2-4-2). Most important are 8 sites
of Route 10, 18, and 32. The use of ferries severely limits road traffic capacity. Ferries should be replaced by bridges especially on roads with high traffic volumes. Table 2-4-3 shows the road surface types and their length broken down by national, provincial, district, village, urban and special roads. The pavement ratio of all types of roads is less than 10 % and is less than 55 % even for national roads. At minimum, the main roads should be paved as soon as possible.

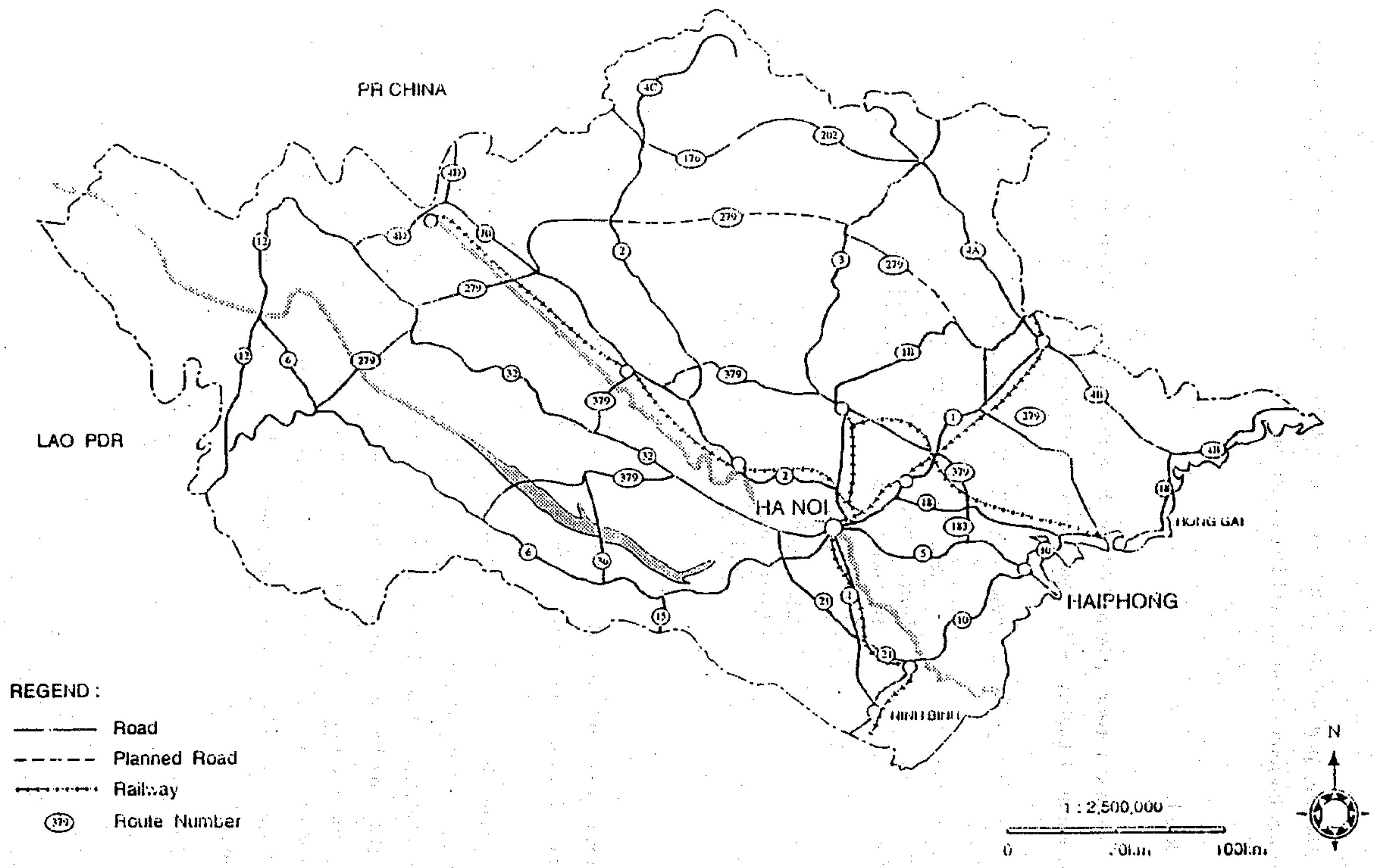


Figure 2-4-1 Road Network in the Northern Part of Viet Nam

Table 2-4-2 Ferries on National Roads in the Northern Part of Viet Nam

National Road No.	No. of River Crossing	Location of River Crossing (River width)
10	5	Rung(1,200m), Binh(480m), Tien Cuu(250m), Quy Cao(560m), Tan de(500m)
18	2	Pha lai(350m), Bai Chay(400m)
32	1	Trung Ha (300m)
36		Gia Phu(50m), Xon Lom (50m), Van Yen (250m)
276	4	Chung(100m), Bac Cuong(50m) Tan An(250m), Pac Uom(250m)
379	1	Ta Khoa(300m)
TOTAL		

Table 2-4-3 Road Surface Type and Length in the Northern Part of Viet Nam

Classification	Asphalt Concrete		Macadam Penetration		Gravel		Earth/ Gravel		Earth		Total	
	km	%	km	%	km	%	km	%	km	%	km	%
National Road	256.4	4.7	2,629.2	48.1	1,147.3	21.0	1,044.1	19.1	383.9	7.0	5,460.9	100.0
Provincial Road	0.0	0.0	1,422.9	23.2	1,143.4	18.6	1,688.1	27.5	1,881.7	30.7	6,136.1	100.0
District Road	0.0	0.0	138.3	1.2	2,144.8	19.3	1,004.8	9.0	7,828.1	70.4	11,116.0	100.0
Village Road	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25,444.5	100.0	25,444.5	100.0
Urban Roads	0.0	0.0	284.4	72.3	109.2	27.7	0.0	0.0	0.0	0.0	393.6	100.0
Special Roads	0.0	0.0	0.0	0.0	130.0	29.9	0.0	0.0	305.2	70.1	435.2	100.0
TOTAL	256.4	0.5	4,474.8	9.1	4,674.7	9.5	3,737.0	7.6	35,843.4	73.2	48,986.3	100.0

2.4.2 Railways

The railway network in the northern part of Vietnam is shown in Figure 2-4-2. The most serious problem of the Vietnamese railway is the coexistence of different gauges, these being meter gauge and standard gauge (MG and StG respectively). The existence of both gauges on some routes means that rehabilitation will be needed so that goods can pass, for example, from Cai Lan Port to the northern provinces. This may prove to be very expensive.

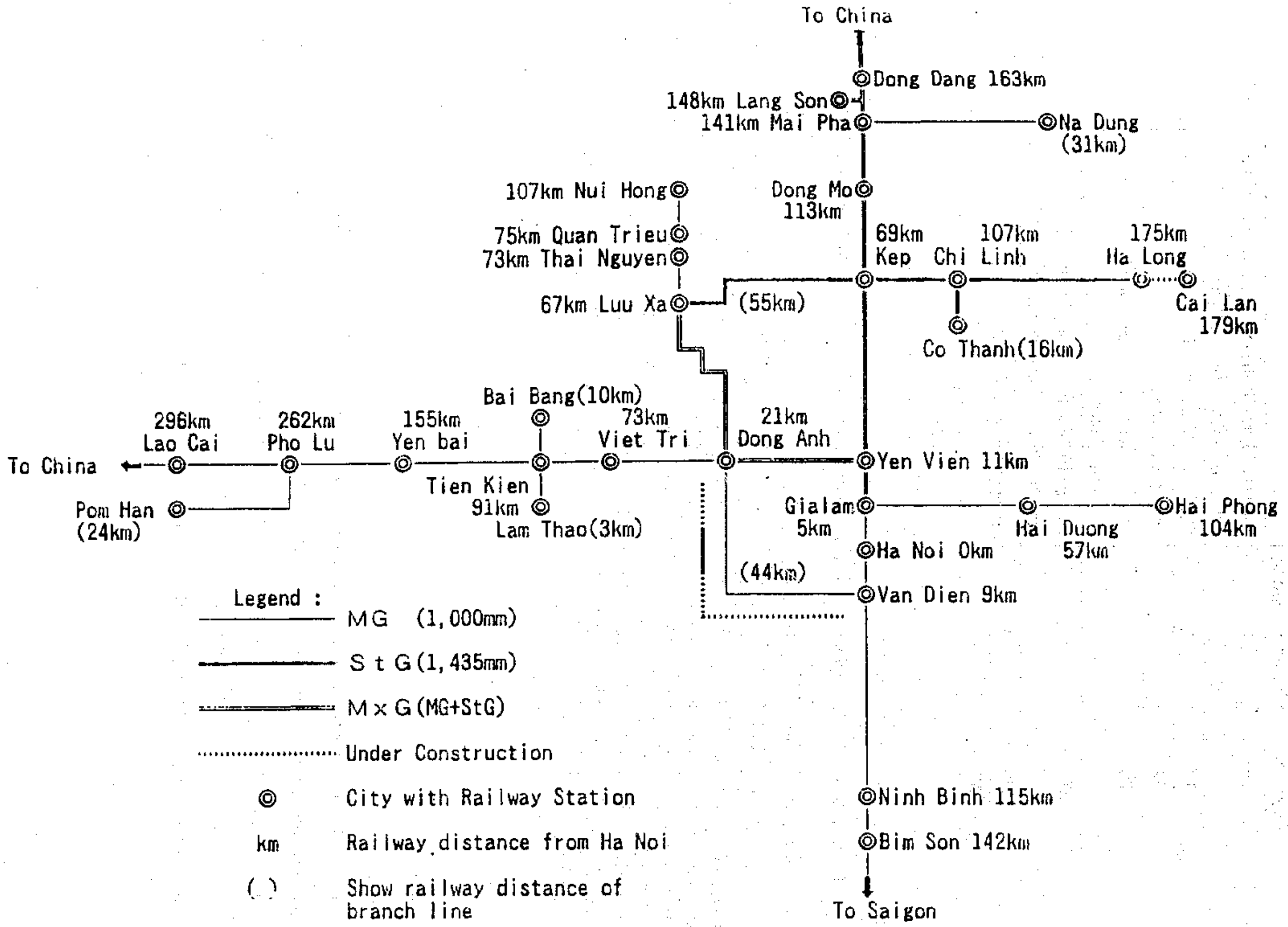


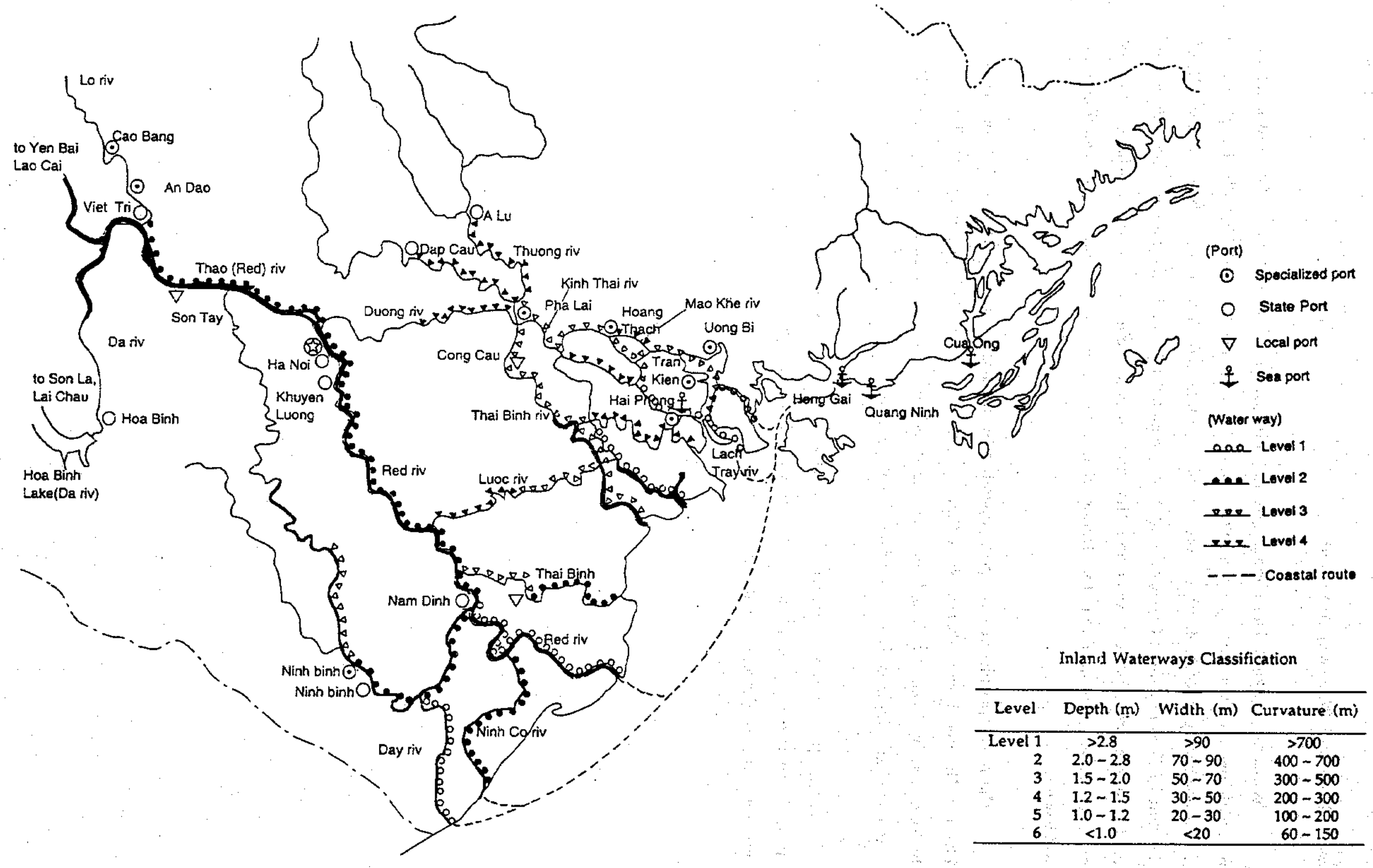
Figure 2-4-2 Railway Network in the Northern Part of Viet Nam

2.4.3 Ports and Waterway Transport

Six major sea ports (Hai Phong, Quang Ninh, Cai Lan, Cam Pha, Hong Gai and B-12) and five State-owned river ports (Hanoi, Ninh Binh, Viet Tri, Ha Bac and Hoa Binh) are operated in the northern part of Vietnam (Figure 2-4-3). The total length of natural rivers is about 41,000 km and 2,500 km of inland waterway (out of a national total of 11,000 km) has been developed for transportation. The Red River and Thai Binh are the main river networks which are linked by two canals. In addition, the Duong and Luoc rivers in the north are also important waterways.

The main specialized river ports operated by specific enterprises are Pha Lai (operated by Pha Lai Thermal Power Plant), Ninh Binh (operated by Ninh Binh Water Power Plant), Uong Bi (operated by Uong Bi Coal Plant), Hoang Thach (operated by Hoang Thach Cement Plant) and Bac Giang (operated by Bac Giang Fertilizer Plant).

Large populations of people and various economic activities are concentrated along the rivers, because the traffic efficiency of waterways is high, especially for bulk cargo such as coal, limestone and construction material.



Inland Waterways Classification

Level	Depth (m)	Width (m)	Curvature (m)
Level 1	>2.8	>90	>700
2	2.0 ~ 2.8	70 ~ 90	400 ~ 700
3	1.5 ~ 2.0	50 ~ 70	300 ~ 500
4	1.2 ~ 1.5	30 ~ 50	200 ~ 300
5	1.0 ~ 1.2	20 ~ 30	100 ~ 200
6	<1.0	<20	60 ~ 150

Figure 2-4-3 Ports and Main Inland Waterway Routes