- Removal of Hon Gai coal handling facility
- Coal screening factory in Hon Gai move to Cam Pha

9.3 Industrial Development Direction

9.3.1 Future Industries of Bai Chay Bay Area

Based on our survey, cement industry will be the fastest growing industry in Bai Chay Bay Area by the year 2010. Though present capacity of cement factories is less than 20 thousand tons in Quang Ninh Province, it will be nearly 3 million tons by 2000, and over 4 million tons by 2010. At least 2000 additional workers will be required.

Coal industry, the major industry at present, is still increasing its capacity. Estimated total capacity will be 7.1 million tons in 2000, and 7.5 million tons in 2005(source Ministry of Construction). Three major mines, Hon Gai, Uong Bi and Cam Pha are exploited. Since present quality of coal products is not suitable for export, present coal selecting and screening equipment should be improved. In the near future one of the major mines, Hon Gai, will reduce its reserves, thus the share of Cam Pha coal mine will increase .

Coal handling ports are dispersed around Bai Chay Bay Area: Sa To port, Hon Gai port and Cam Pha port for export, Coc Nam, Nam Cau Trang and Cang Kms port for domestic. These ports, except domestic ports, should be merged into one port.

Other building material industries, brick, tile, sand and gravel, will increase their capacity. For the brick & tile industries, the capacity is estimated at more than 8 times larger than present based on the Ha Long City Master Plan in which many projects, including port, bridge, road and hotels, will be constructed.

When the new port is constructed, many port related industries will move to the Bai Chay Bay area. Steel industry, food-processing industry and other export-oriented industries will be located near the port. The shipbuilding industry, the present capacity of which is no more than 5000 DWT, will expand its capacity to over 30000 DWT to repair and build the larger ships that will call Cai Lan Port.

Tourism industry has become the major industry of Quang Ninh Province. In the future Bai Chay will be the international tourist center. According to the Ha Long City Master Plan, number of tourists to visit Ha Long City will increase from 840 thousand (1992) to over 2 million by the year 2010, of which foreigner tourists will increase from 15000 to nearly one million. The master plan recommends developing Tuan Chau island and Yen Lap lake to accommodate these tourists. While we agree with this vision, we have also planned some tourism facilities in Cai Lan Port.

In Bai Chay town, as the base and center of regional sightseeing activities, many tourist accommodations and facilities, hotels, restaurants, holiday houses, berths for sightseeing boats, will be constructed. However Bai Chay town has little open space to develop tourism facilities. More efficient space utilization, for example high-rise buildings, is necessary for future expansion.

Commercial and trade services will become very important industries. Heavy industries, port, port related industries and tourism industries will attract many labors and their families to Bai Chay bay area. Business opportunities will increase for both foreign and domestic companies.

Table 9-3-1 Forecasted Factories of Future Industrial Development

(by 2000)

(source : Ha Long City master plan)

Industry	Present Capacity	Estimated Capacity	Labor Demand
Coal	1 mil.ton	1.8 mil.	11600
Cement	5 thou.	5 mil.	10000
Brick&Tile	55 mil.pcs	400 mil.	10500
Export industry	no	200 ha	90000
Shipbuilding	5 thou.DWT	50thou.DWT	1500
Hi-tech	no	100 ha	30000
C.B. Service			18000
Health care			7000

Table 9-3-2 Forecast of number of tourists

(source : Ha Long city master plan : MOC)

Items	year 1992	1995	2005 - 2010
Number of tourists	840,000	1,200,000	1,300,000-2,700,000
of which			
international	15,000	230,000	650,000-1,000,000
domestic	825,000	920,000	1,650,000
Number of rooms	900	4,720	9,940
Number of beds	2,200	11,800	23,600

9.3.2 Cai Lan Export Processing Zone (CLEPZ)

(1) Location & Access

Cai Lan Export Processing Zone (CLEPZ) is located behind the Cai Lan port between Genh Tau and the Ha Long Shipyard. Access to the CLEPZ is very convenient. Improved railway and roads are available for the factories in the CLEPZ and in the near future an international airport will be constructed 10 km away from the CLEPZ. The highway 18A will be graded up to a four-lane national road by the year 2000 and cargo will be carried between Cai Lan and Ha Noi without ferries. Road to Hai Phong will also be improved. New route No.10 will improve transportation to Hai Phong. Railway between Cai Lan and Ha Noi will be improved by the year 2010.

(2) Principles

According to the Ha Long City Master Plan, the principles of CLEPZ are :

a. Production of CLEPZ shall aim mainly at export (export to the domestic markets is included).
b. Utilization of domestic materials to some extent.
c. Creating jobs for native people.
d. Application of advanced technologies and technological processes.
e. Small and large scaled factories.
f. Minimizing environmental pollution (especially water)

We follow this principle in this report.

(3) Production Fields

Based on the master plan, the suitable industries are :

a. Processing & manufacturing of wooden works, bamboo, non-metal, glass, cut glass ware, knitting, garments jewels, cosmetics.
b. Production from tanned leather
c. Manufacturing paper & printing
d. Food & beverage processing
e. Plastic

f. Electronics, cooling electro-mechanics, micro electronics, fundamental metals.
g. Heavy equipment fabrication, assembly, maintenance and overhaul facilities.

However we think other non-polluting industries or industries which have only a slight impact on the environment can be located within the CLEPZ. Since the location of CLEPZ is close to the port, port oriented industries are suitable for the CLEPZ, for example fishery products and folk crafts.

(4) Layout plan of CLEPZ (Ministry of Construction suggestion)

According to the master plan, CLEPZ extends from the border of Cai Lan port to the present brick plant. Access road runs parallel to the railway. Industrial zone is in the center of the area, divided in two zones, half of the industrial zone is for rent and other half is for multi-purpose, warehouse or other industrial use. Southern part is for management and business services. Warehouses and other industries will be located along the northern waterfront. Internal road connects each function in grid pattern.

(5) Model Factories

The model factories for CLEPZ are as follows :

Table 9-3-3 Model Factory of CLEPZ

	No of employee	Scale	Water demand
Furniture	80	7200m^2	29m^3/d
Glass	160	26000	996
Garments	79	3100	18
Cosmetics	170	11600	697
Leather	116	4700	100
Printing	84	2300	52
Paper	207	133400	31757
Beverage	54	127700	8408
Wheat mill	101	15700	253
Fish processing	150	6800	767
Plastic	294	118300	45528
Electronics	163	13500	240
Micro electronics	737	34200	452
Manufacturing equipment	128	16900	76
producing box	70	8900	40

(based on statistics from Japanese factories)

(6) Land Use Plan Around Cai Lan Port

In the northern part of Bai Chay peninsula, land use will be concentrated. Cai Lan port, Cai Lan Export Processing Zone, Ha Long Shipyard will be located next to each other. Steel Billet factory and wheat mill factory, whether included in EPZ or not, will also be located in that area.

A residential area and a waterway are also found in this area. On rainy days water flows down between the shipyard and Cai Lan port. Development is restricted along the Genh Tau stretch which is located in the center of this area.

We propose three alternatives of land use.

1. *Alternative 1* (Figure 9-3-1)

CLEPZ and the port is divided by canal. Residential area for port related industries is concentrated south of the canal. Steel billet factory is located on the northern tip of CLEPZ. In this alternative and next alternative, we can preserve the existing stretch Genh Tau.

Advantage :

- Port area is over 300 ha including Genh Tau mountain.
- Water flow direction changes slightly.
- Residential area is located at the center of the industrial zone.
- CLEPZ keeps area for future expansion.

Disadvantage

- Existing residential area has to be relocated.
- Distance between the steel factory and the berth substantially increases.
- Sedimentation of the port by river flow

2. *Alternative 2* (Figure 9-3-2)

CLEPZ is located adjacent to the port. Canal is located between residential area and CLEPZ. Steel billet factory is located next to the port.

Advantage :

- Existing residential area is kept and also expanded.
- Residential area is kept for CLEPZ.
- No obstacles between CLEPZ and the port.
- The port area is nearly 300 ha. If Genh Tau mountain is preserved, an area over 40 ha is left for future expansion of the port.

Disadvantage :

- Water flow direction changes.
- Genh Tau mountain separates CLEPZ and the port.

3. *Alternative 3* (Figure 9-3-3)

Land reclamation scale is minimized in this alternative. Steel billet factory is located next to the existing berth. However the Genh Tau mountain has to be eliminated.

Advantage :

- Reclamation area is minimized.
- Existing water flow is kept.
- Environmental impact to the residential area is minimized.
- Water surface for CLEPZ is maximum.

Disadvantage :

- No future expansion area for CLEPZ and Cai Lan port
- Genh Tau mountain has to be cut.

Note : To compare these alternatives, further survey and calculation is necessary. For example, impact of the reclaimed land on the existing waterway or sedimentation to the port cannot be estimated without further analysis.

As for all alternatives, waterfront area of CLEPZ and steel billet factory is preserved for the future port expansion, because waterfront suitable for large vessels is limited in this area.

Among these alternatives, alternative 1 or 2 is preferable from the port development point of view, because generally port and port related industries are developing reciprocally and expansion space has to be kept as large as possible at the beginning.

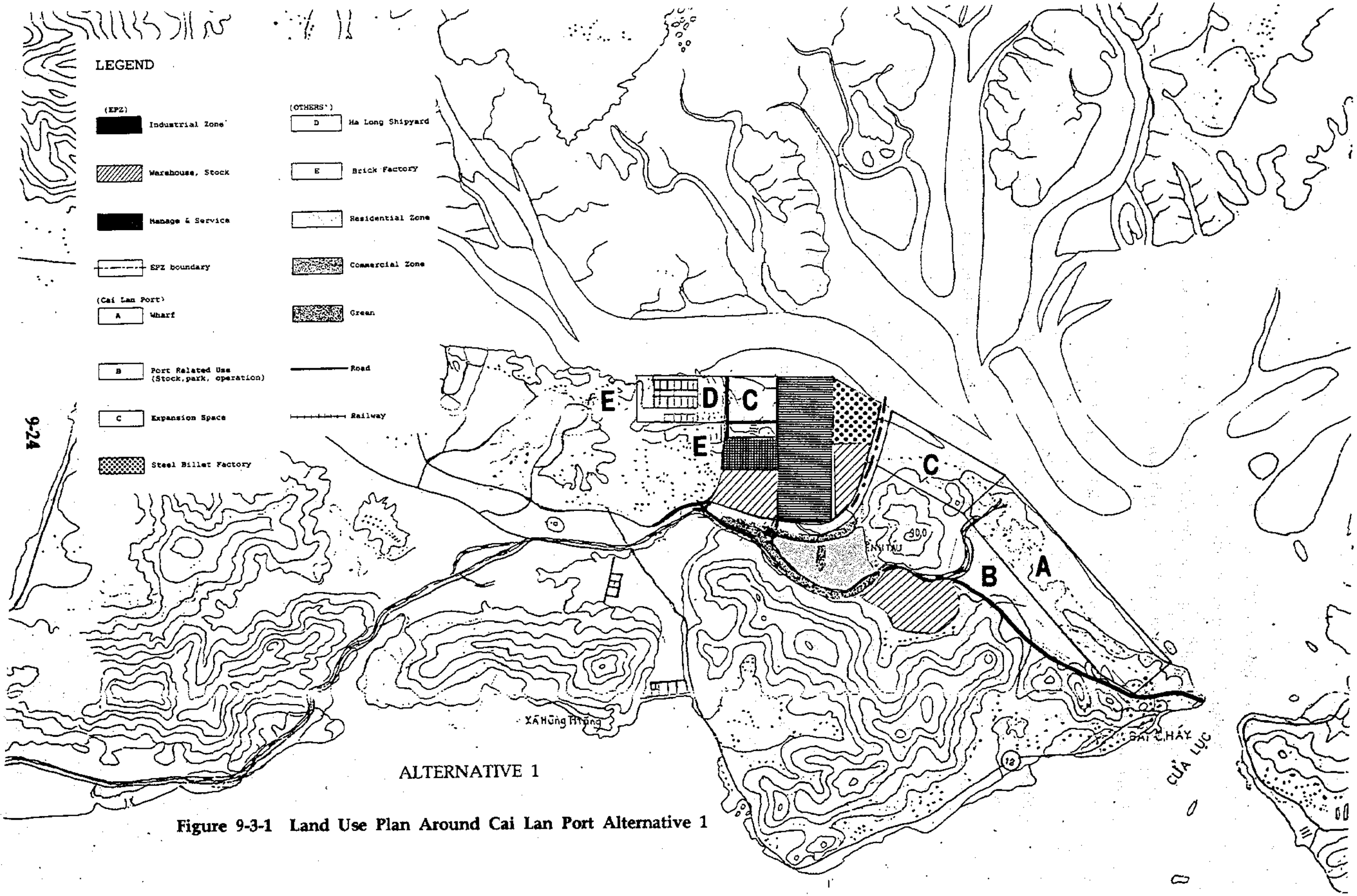


Figure 9-3-1 Land Use Plan Around Cai Lan Port Alternative 1

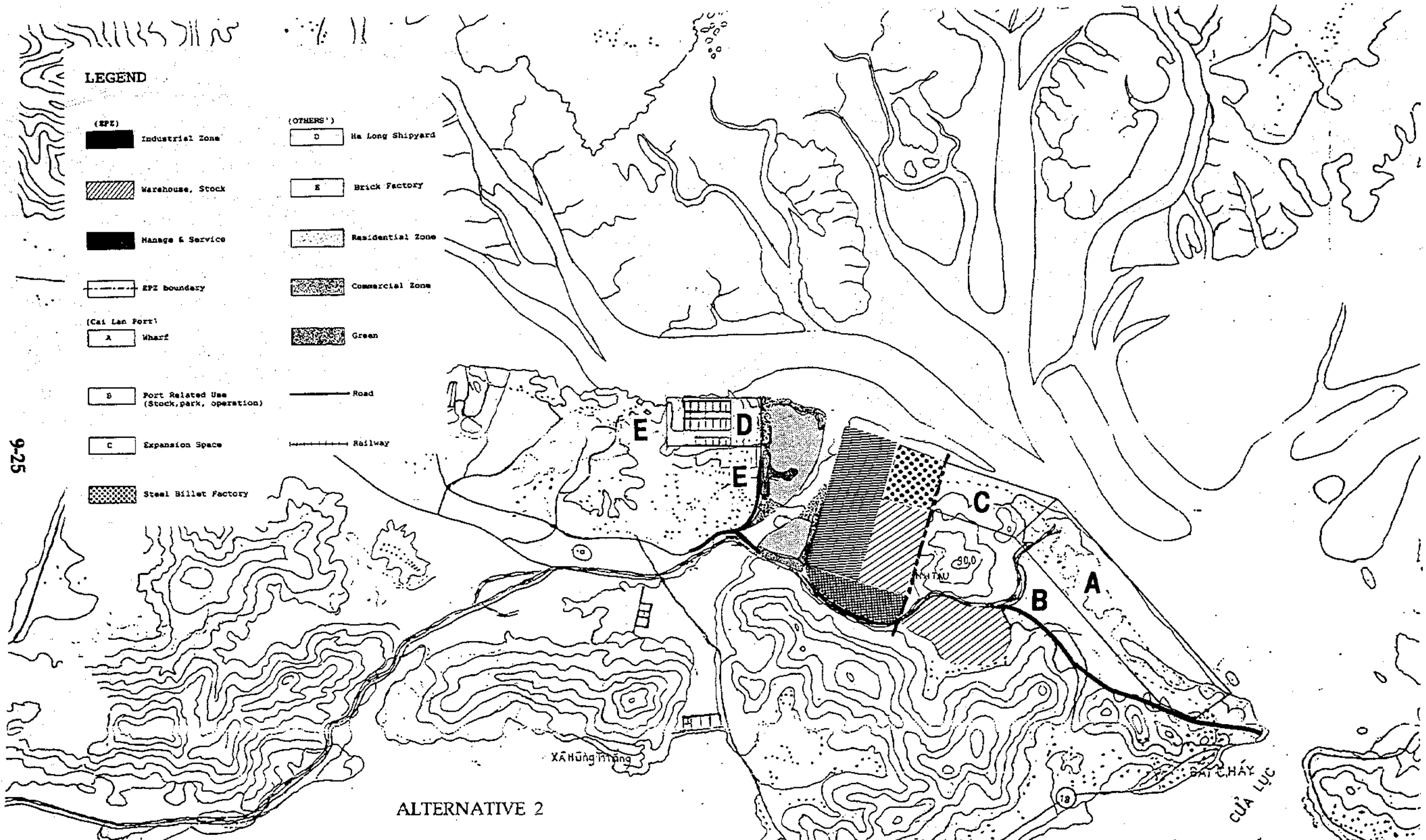


Figure 9-3-2 Land Use Plan Around Cai Lan Port Alternative 2

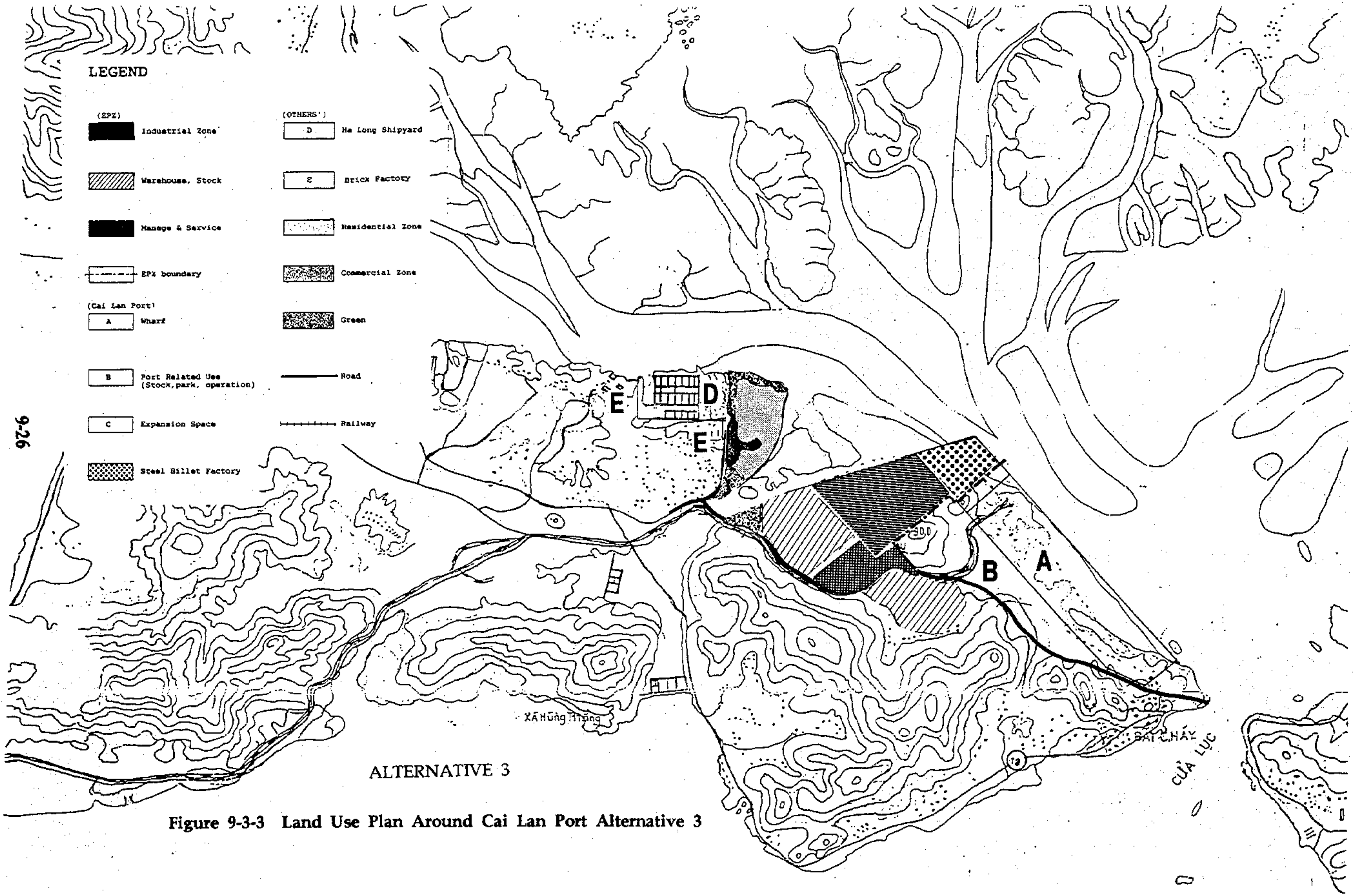


Figure 9-3-3 Land Use Plan Around Cai Lan Port Alternative 3

Table 9-3-4 Scale of Each Industry

Type of Industry	Alternative 1	Alternative 2	Alternative 3
Port	305 ha	295	232
excluding mountain	(245)	(235)	(202)
wharf	100	100	100
port related	63	63	63
warehouse	32	32	32
expansion	50	40	7
Genh Tau Mt.	60	60	30
EPZ	126	122	123
industry	60	60	60
stockyard	28	28	42
manage,service	16	16	16
expansion	22	0	0
green	0	6	5
residential	0	8	0
commercial	0	4	0
Steel Billet	20	20	20
Shipyard	32	32	32
Residential	30	28	28
Commercial	6	6	6
Green	10	6	6

9.3.3 Development Direction by Industry

(1) Cement Industry

Three large cement factories are assumed to be constructed in north Bai Chay Bay area near limestone mines. One factory will start production by the year 2000.

Table 9-3-5 Major Cement Factory

Projects	Ha Long	Lang Bang	Hoanh Bo
Capacity	1.2 mil.	1.4 mil.	1.4 mil.
JV	MARUBENI LAFARGE	SSANGYONG	not decided
Location	Da Trang	Lang Bang	Da Trang
Construction Period	1998-2002	1996-2000	2006-2010
Scale	50ha	50ha	50ha
Materials	limestone clay, silica plaster iron ore	limestone clay, silica plaster iron ore	limestone clay, silica plaster iron ore
Port related Cargo	1.5 mil.	1.5 mil.	1.5 mil.
Situation	finish F/S	finish F/S	pre F/S
Water-discharge	0.3-0.5m^3/ton	0.3-0.5m^3/ton	0.3-0.5m^3/ton
Wastes to air	50mg/m^3-dust	50mg/m^3-dust	50mg/m^3-dust
Employee	500	500	500

(Vietnam Cement Corporation)

(2) Steel Industry

Vietnam Steel Corporation and NKK (major Japanese steel company) are planning to build a Steel Mill factory near Cai Lan port. The detailed information is as follows :

1. Location : Next to the port. Near the berth that accommodates 30,000 DWT ship.
2. Scale : 20 ha, facilities (Electric Arc Furnace, ladle furnace, continuous casting machine, oxygen plant, rolling mill.
3. Completion : by 2000
   1st stage : Setting up a steel making plant
   2nd stage : Rolling facility
4. Present Situation : Preparing Pre-Feasibility Study
5. Materials : scrap (imported) 600,000 tons/year
   coke & coke fine, lime stone/burnt lime
   ferroalloys, other additives and fluxes,
   refractory, electrode, etc
6. Industrial Wastes : EAF slag (200,000 tons/year)
   waste water (160 m^3/days)
7. Number of labors : 500

There will be two other metal plants. One is Steel Plate & Sheet factory, capacity 1 million tons/year, scale is nearly 100 ha. The other is Aluminum Smelting factory, capacity 150 thousand tons/year, scale is over 50 ha. Though it is possible that the steel plant will be located near Cai Lan port, the space near the port is very limited and environmental impact would be significant.

The aluminum plant should be built near the electric power station because it requires high electric power compared to other metal plants. So the location is also very limited. In conclusion, we decided not to include these 2 projects.

(3) Chemical Industry

Northern Vietnam has abundant mineral resources. The Fertilizers and Basis Chemicals Corporation (FERCHEMCO) plans to construct fertilizer factory. The materials (apatite) are loaded from Lao Cai by railway. Other information of the project is as follows.

1. Capacity : 148,500 tons/year
2. Location : DAI YEN (western Ha Long City, along Route 18A)

3. Market : 100% local
4. Capital : 89.562 mil.US$ (16 mil. foreign side)
5. Construction : 30 months
6. Scale : 10ha
7. Materials : apatite:200,000tons/year, diamonum phosphate:56,000
ammonia:33,000, electricity:13.2 mil.kwh

Port related cargo : 99,000 tons(DAP)
33,000 tons(ammonia)
56,000 tons(diamonum phosphate)

FERCHEMCO plans to start production by the year 2000.

(4) Shipbuilding and Machinery Industry

A major shipbuilding and repairing factory is located along Bai Chay Bay. Ha Long Shipyard has building/repairing facilities available for up to 5000 DWT ship. The total scale is 20 ha. Ha Long Shipyard also operates a small ship-repairing yard on the coast of Ha Long Bay.

When Cai Lan port is completed, the shipyard will be required to repair or build ship up to 30 - 50 thousand DWT. The model factory, capacity of 50,000 DWT and 16 vessels/year needs 20 ha of scale and 2500 labors. Water demand is 3000m^3 per day.

Other port oriented industries, such as handling machine repairing, container making require 3 ha near the port. Labor demand is nearly 500.

(5) Agricultural Industry

One food processing factory (wheat mill factory) is planned to be built close to Cai Lan port. And another foodstuff processing factory is planned to be built in CLEPZ.

1. Wheat Mill Factory (VINAFOOD1)

According to the increasing demand for wheat flour of north Vietnam, Ministry of Agriculture and Vietnam Food Corporation (VINAFOOD1) planned to construct a wheat mill joint venture in the early 70s' and Soviet experts made a feasibility study. However, the project was never implemented.

The demand for flour is still increasing in line with the recent growth of the Vietnamese economy and VINAFOOD1 is eager to construct a wheat mill factory in the Cai Lan area.

The outline of the wheat mill is as follows.

1. Company : JV with VINAFOOD & foreign(Singapore,Japan)
2. Capacity (Products): wheat powder 270,000 tons/year
   rice 200,000 maize 300,000
3. Market : all products are for export,
4. Location : behind Cai Lan port
5. Construction period : 36 months, by 1996
6. Scale : 7 ha
7. Plan by stage :
   1st stage: capacity 300 tons/day
   2nd stage: capacity 600 tons/day and instant noodle, bread, cake
   3rd stage: capacity 900 tons/day and instant noodle, bread, cake
8. Port related cargo : 770,000 tons
9. Situation : waiting for approval by SCCI
10. Materials : wheat (360,000) imported (America, Australia, Canada, France)
    Rice (260,000) domestic
    Maize (400,000) domestic

11. Water demand : 40m^3/day
12. Employees : 400
13. Water supply : 40m^3/day

At the request of the Ministry of Agriculture, the Transport Engineering Design Institute (TEDI) determined the location and layout of the factory. Based on TEDI's study, the location of the mill is at the back of berth No1 perpendicular to the berth alignment. The advantages of this location are that the conveyer belts for sacked wheat , rice and maize will be short and the access roads to the mill will be near the existing road network of the port.

In this study the wheat factory is recommended to be located in the EPZ. Even if CLEPZ is not approved, the wheat mill factory will be built near the port.

2. Foodstuff Products (VINAFOOD1)

Since many workers and their families will come to Bai Chay bay area, VINAFOOD1 plans to supply fast foods for these families. VINAFOOD is now preparing pre-F/S and also looking for a joint venture partner. The location of the factory should be in CLEPZ. Production starts after 2000.

3. Other related projects

Other major agricultural projects are as follows. venture partner.

a. Hai Chau Seaproduct Farm

- Products : Shrimp 2 times per year 1 ton/ha/time
  Crab 2 times per year 3 ton/ha/time
- Scale : 30 ha
- Capital : 0.4 mil.$
- Location : Tuan Chau island

b. Development of swamp land in Ha An, Yen Hung

- Capacity : 300 tons/year (shrimp, fish)
- Location : swamp land, east of Yen Hung district
- Scale: 820 ha
- Capital : 0.6 mil. $

c. Pearl Culture in Cam Pha District

- Location : Cai Lim Island

Islands around Cam Pha are suitable for pearl culture. A Japanese company has already begun successful operations in Van Hoa, Cai Bau island.

d. Fish Port Project

- Location : Co-to - Thanh Lan islands area
- Facility : Bridge (200 m)
  Ships for off-shore fishing
  Service Station (benzine, water, ice, food, foodstuff, alcohol, beer, transportation service)
- Present situation : Preparing F/S

e. Aquaculture Project

- Location : Hoang Tan, Yen Hung district
- Scale : 600 - 700 ha
- Capital : 0.7 mil.US$ (Domestic)

- Facilities : Dam, dike, drains, irrigation canals

Quang Ninh Province is seeking joint venture partners for all of the above projects.

(6) Coal Industry

Quang Ninh province has the largest natural coal exploitation area in the country, located between Uong Bi and Cam Pha. Total volume of coal was 6.4 million tons in 1987 and 5 million tons in 1993. Based on the estimation by the Ministry of Energy the volume will reach 10 million tons in year 2000. However it will be difficult to achieve this target due to the lack of coal screening equipment and the ill-equipped coal handling ports. Hon Gai Port can only accept ships under 10000 DWT. Berth size at Cam Pha port is also insufficient to accommodate larger ships.

Coal handling berths at Cam Pha port can accommodate 30,000 DWT ships, but there is a plan to expand capacity up to 50,000 DWT.

Hon Gai Port has been asked to expand by the Hon Gai Coal Company. However, after Cai Lan Port is completed, both ship number and ship size will increase and water transportation will become congested especially near Cua Luc Strait. In addition, as the tourist industry grows and expands along Ha Long coastal area, Hon Gai Port will be required to accept passengers and tourists. Therefore, in the future the center of the coal industry will be shifted to the Cam Pha district.

Table 9-3-6 Forecast of Coal Production

year	capacity (1 million tons)		
	Hon Gai coal	Uong Bi	Cam Pha
1997	1.4	1.2	3.0
2000	1.4	1.2	4.5
2005	1.8	1.2	4.5

(Ha Long City Master Plan)

(7) Tourism Industry

1. Development Direction

Demand for tourism is increasing year by year. Many foreigners will visit Viet Nam under the "Doi Moi" policies. Many Vietnamese will also start visiting resorts as their standard of living becomes higher. The improvement of transportation (roads upgrade, construction of new bridges, international airport and new ports) will also increase the number of tourists visiting Ha Long city and Ha Long Bay.

Ha Long Bay is the famous resort of Northern Viet Nam. It consists of more than 3000 different shaped islands providing tourists with magnificent and unique scenery. The seashore along the coast is beautiful and unspoiled.

However, compared with other Asian and Oceanic countries, the average period of one trip is short and average expenditure is small. In the future, as the income per capita increases, the expenditure will also increase.

Table 9-3-7 Number of Days Spent by Tourists and Their Daily Expenditure

(source : World Tourism Organization)

Countries	Number of days spent by tourist	Daily Expenditure
Australia	32.0	54 US$
New Zealand	21.0	52
Japan	13.2	144
Philippines	12.1	121
Indonesia	11.8	82
Thailand	7.1	116
S. Korea	5.5	219
Hong Kong	3.3	255
Singapore	3.3	273
Vietnam	3.0	30

According to the " Report on Major Direction of Tourism Development of Vietnam " the direction of tourism industry is

- To develop as a major economic sector of the region
- To coordinate tightly the exploitation of (natural and human) resources with creation of good quality original tourism products in order to attract domestic and foreign tourists.
- To upgrade and preserve tourism resources in special and tourism environments in general through gradual improvement of infrastructure and technical service facilities.
- To focus on development of appropriate tourism types in accordance with typical characteristics of geographical locations as sightseeing, swimming, short-term (weekend) resting in city's vicinity, tourism involving one subject, conference, sport, medical

treatment.

- To emphasize the planning of tourism sites, national and international tourism areas, especially Hai Phong, Quang Ninh area.
- To invest in infrastructure facilities (hotel)

Based on tourism demand and estimated number of foreign tourists arriving in Vietnam till 2005, the master plan of tourism development determined numbers of rooms in hotels of the first tourism region (Hanoi and its vicinity) in 2005 at 10,110 international standard rooms.

2. Projects

Since tourism is a prosperous industry, many projects have already been proposed and are waiting for approval. Joint Venture partners for the projects listed in Table 9-3-8 have already been found and applications to begin construction have been submitted to the Vietnamese government.

Table 9-3-8 Major Tourist Projects

Name	Hon Hai Hotel	Investa H.	Water plane
Capacity	3 floors 48 rooms	5 floors 200 rooms	airplanes
JV partner	Chinese	Taiwanese	French
Duration	20 years	25 years	10 years
Approval	obtained	pending	obtained
Capital	$ 0.6 mil.	$ 39 mil.	$ 0.13mil.

There are also many projects in which pre-feasibility or feasibility studies are on-going; the Vietnamese side is currently searching for joint venture partners.

a. Children and Youth Summer Camp, and provincial Youth League Office:
US$ 30 mil.
4 floors, 250 bed hotel
80-800 bed hotel and recreational and camping compound

b. Upgrading Bach Dang Hotel at Bai Chay Beach

US$ 2 mil.

7 floor, 110 bed hotel

c. Sailors Club and Hotel

US$ 3 mil

3 floor 70 bed hotel

d. Ha Long Hotel (near Hwy 18A between Bach Dang and Van Hai Hotels)

US$ 20 mil.

10 floor, 140 room hotel

e. Tourist Village at Ha Long Bay

2 mini-villages of 100 wooden houses

f. Ben Doan Hotel (near Hwy 18A right behind Ha Long bay)

US$ 30 mil.

4 floor hotel & entertainment and recreational facilities

g. Floating Hotel

US$ 20 mil.

h. Hotel and Mini-supermarket at Bai Chay Beach

US$ 7 mil.

i. Son Thuy Hotel

hotel and tourist villas

j. Tuan Chau island tourist center (JV with French company)

450 mil.$

5 floor hotel and a road connecting Tuan Chau with inland

(8) Other industries

Based on our survey on related organizations, there are other industrial projects around Bai Chay Bay Area. Though these industries are not often related to Cai Lan Port, they are worth analyzing to grasp the comprehensive impact on the Bai Chay Bay Area.

1. Construction Material Industry

Brick and tile industry is concentrated in Gieng Day, west of Cai Lan port. By the year 2000 production volume of brick and tile will reach nearly 200 million pieces per year because of large projects that are planned. New clay mine will be exploited along Route 18A.

2. Hi-tech Industry

As for high-tech industry, its location and rough scale have been proposed, but a pre-feasibility study has not yet been conducted. The scale and products of the model factories are as follows.

Table 9-3-9 Model Factories of Hi-tech industry.

Industry	Capacity	Scale	Employee	Water
Air-condition	500,000/y	9ha	1000	2000m^3/d
VTR	300,000/y	8.8	850	300
Color-TV	720,000/y	13	2000	600
Calculator	5 mil./y	0.5	210	120
Corrugated Cardboard	4 mil.m^2/y	3.3	110	180
Watch	4.8mil/y	4.8	1320	850
Condenser	400 mil./y	2	400	1000
Pollution Prevention Equipment	100/y	0.5	250	100
Camera	600,000/y	10	1140	600
Photocopy	60,000/y	2	200	100
Stereo	120,000/y	4	600	5800

(based on statistics of Japanese factories)

3. Electric Power Plant

Since future electric power demand in Bai Chay Bay area will increase due to the growth of industry location, electricity supply should be increased. Ministry of Energy plans to expand capacity of existing power station in Pha Lai from 400 MW to 800 MW. Simultaneously a new thermal power station will be constructed in Quang Ninh province. The capacity is 600 MW in the 1st stage, and 1200 MW in the 2nd stage. The location of the new power plant has not been decided, but it should be located near the coal mine. The most suitable location both for supply of fuel and for protection of water environment is around Cam Pha area.

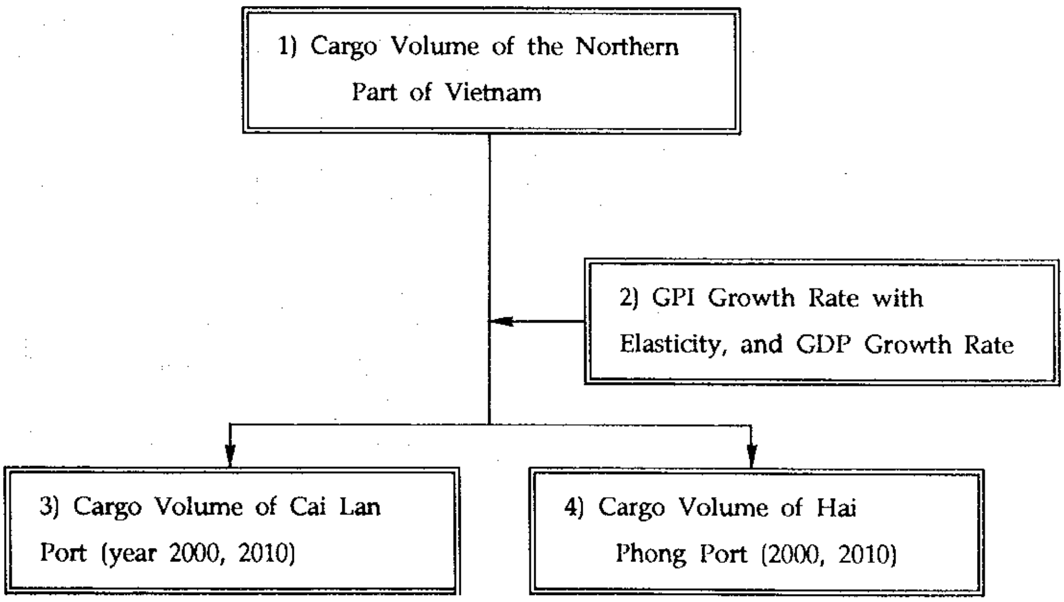
CHAPTER 10 DEMAND FORECAST UP TO THE YEARS 2000 AND 2010

10.1 Methodology for Demand Forecast

There are two methods commonly used to forecast the future cargo volume. The first one is a macro forecast and the other is a micro forecast. The macro forecast is based on the assumption that the cargo volume handled by the port reflects the economic activity in the port's hinterland. The total cargo volume is estimated using the historical relation between cargo volume and macroeconomic indices. The other is a micro forecast which estimates the cargo volume of each commodity individually based on related indices, the forecast demand and supply situation, and the government development plans.

In this chapter, according to the assumptions in the following flow-charts, macro and micro forecasts are conducted.

(1) Macro Forecast



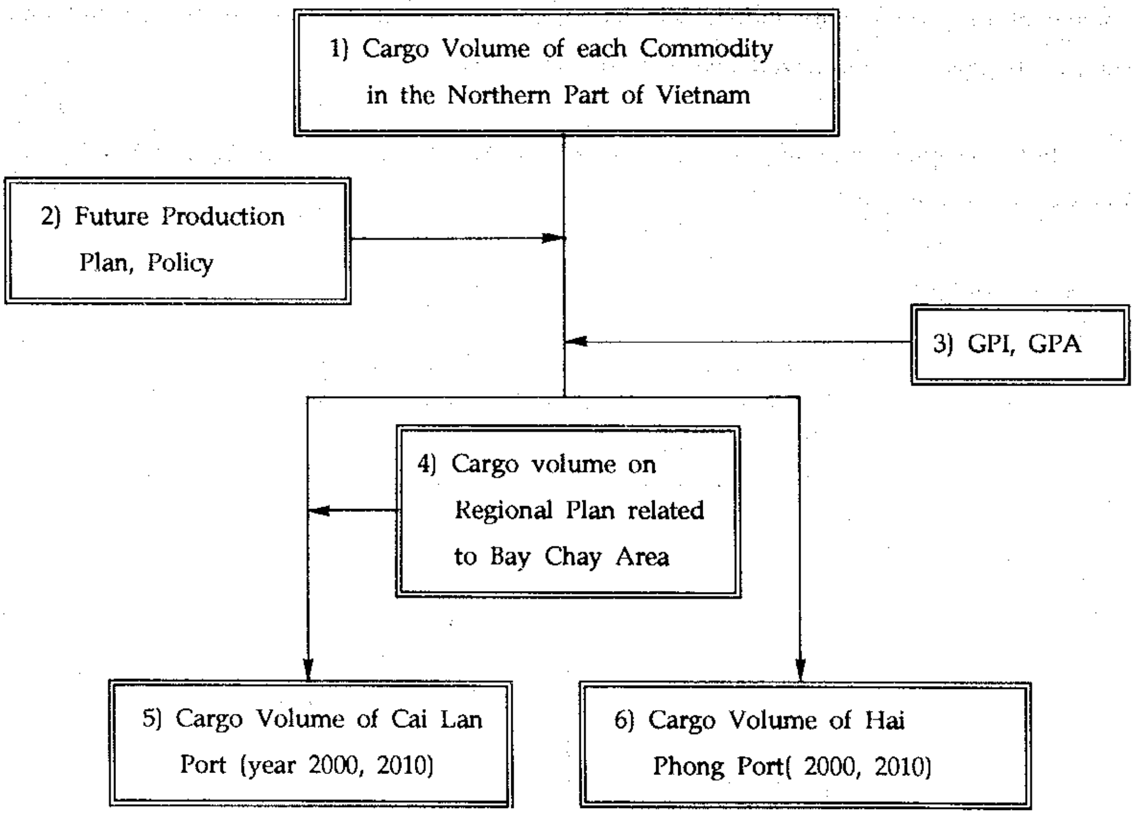
Note :

1) Cargo volume of the northern part of Vietnam is estimated using Hai Phong Port data because almost 100% of general-cargo handling is carried out by Hai Phong Port. Coal and petroleum cargo are excluded because they are handled by special-use ports.

2) Growth rate of GPI(Gross Product of Industry) in case 1 and case 2 is estimated at 12.5% and 14% with elasticity in the years 1994 - 2000, and GDP growth rate is estimated at 10% for the years 2001 - 2010. Growth rate of GPI in case 3 is estimated at 12% - 17%(elasticity 0.96) in the years 1994 - 2010.

3),4) Assuming the cargo handling capacity is reached in Hai Phong Port in each target year, surplus cargo volumes are estimated to divert to Cai Lan port.

(2) Micro Forecast



Note :

1) Cargo volumes of each commodity in the northern part of Vietnam are estimated using the commodity volume of Hai Phong port. Coal and petroleum are excluded because they are handled by special-use ports (excluding domestic coal).

2) If there are production development plans and projects in the government policy for any commodity, the cargo volume is adapted to those conditions.

3) Growth rate of GPI (Gross Product of Industry) and GPA (Gross Product of Agriculture) are estimated at 12% - 17%(elasticity 0.96) and 4 - 5%(elasticity 0.96), respectively, in the years 1994 - 2010.

4) Based on Ha Long City Master Plan, cargo volume generated from industry zone or construction projects is added by rough estimation.

5),6) Assuming the cargo handling capacity is reached in Hai Phong Port in each target year, the surplus cargo volumes are estimated to divert to cargo volume estimates of Cai Lan port.

10.2 Macro Forecast

(1) Macro method

Generally speaking, the cargo handling volume of ports has a close relation with the socio-economic indices. Based on the total cargo volume of 1992 in Hai Phong Port, the percentage of industrial cargo is 76%. Thus, GPI (Gross Product of Industry) is correlated with total cargo volume with elasticity (coefficient 0.96) between 1982 and 1989 as shown in Table 10-2-1.

Table 10-2-1 Cargo Volume of Hai Phong Port and GPI

Year	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Volume	2,183	2,255	2,449	2,511	2,605	2,575	2,982	2,725	2,516	2,433	2,378	2,706
Rate		3.3%	8.6%	2.5%	3.7%	-1.2%	15.8%	-8.6%	-7.7%	-3.3%	-2.3%	13.8%
GPI	73.5	83	94	103.3	109.6	120.6	137.8	133.3	137.5	151.8	175.8	197.1
Rate		12.9%	13.3%	9.9%	6.1%	10.0%	14.3%	-3.3%	3.2%	10.4%	15.8%	12.1%

Source: Hai Phong Port, General Statiscal Office
Note: Volume (Unit: 1,000 Tones), GPI (Unit: Billion Dongs, Const.1982)

Based on the planned growth rate of secondary sector of GDP with elasticity in Chapter 8, the results summarized in Table 10-2-1 and Figure 10-2-1 show cargo volume growth by year.

Table 10-2-2 Total Cargo Volume Forecast

Unit : Million Tones

	Year 2000	Year 2010
Cai Lan Port and Hai Phong Port	5.8	24.5

Note: GDP growth rate(Secondary Sector): 1993-2000:12%, 2001-2005:17%, 2006-2010:15%

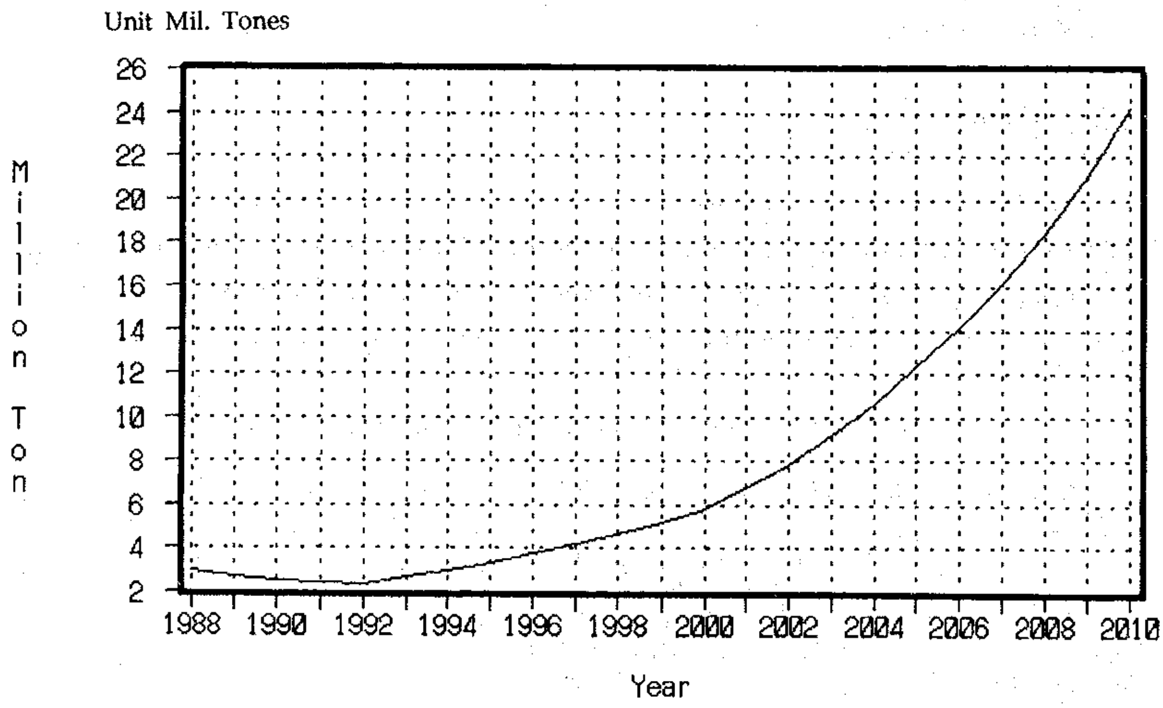


Figure 10-2-1 Total Cargo Volume Forecast

10.3 Micro Forecast

Considering the present cargo commodities handled at Hai Phong Port and the development plans of several government agencies, the major commodities which Cai Lan Port can be expected to handle are classified into the following groups (see Table 10-3-1).

- Agricultural Products :
  * Export : Rice, Vegetables, Foodstuff, Rattan Wares Jute and Tapis
  * Import : Wheat and Wheat flour
  * Domestic Cargo : Rice and Food

- Mining Products :
  * Export : Ore, Metal, Clinker and Cement
  * Import : Ore and Asphalt
  * Domestic Cargo : Coal, Ore, Apatite, Cement, Clinker and Gypsum

- Forestry Products :
  * Export : Timber and Logs

- Industrial Products :
  * Import : Metal and Fertilizer
  * Domestic Cargo : Metal and Fertilizer

- Containerizable Cargo :
  * Export : Machinery, Equipment and Container Cargo
  * Import : Foodstuff, Machinery, Equipment, Construction materials, Container Cargo and Others
  * Domestic Cargo : Machinery and equipment, Foodstuff, Construction Materials and Others

In the micro forecast for cargo volume in the year 2000, the cargo volume generated from four factories is added. A cement factory, a fertilizer factory, a steel factory and a wheat meal factory are assumed to be in operation until the year 2000 (see chapter 9 for additional data on these factories).

Table 10-3-1 Cargo Volume of Hai Phong Port by Main Commodity Categories

Unit: Tones

Commodity	1989	1990	1991	1992	1993
Export					
Ore	2,252	2,919	18,491	40,765	80,127
Machinery, equipment	863	1,615	710	454	777
Metal	497,182	227,375	119,116	74,818	10,458
Logs, timber	7,092	58,765	158,453	97,668	4,370
Rice	32,837	14,540	1,997	25,055	79,785
Vegetable	42,790	26,161	5,522	2,367	2,405
Foodstuff	25,293	17,270	11,602	8,410	7,499
Rattan wares, jute tapis	4,915	2,285	7,002	3,462	5,290
Apatite	0	7,346	0	0	0
General Cargo	137,786	153,457	34,559	12,622	4,612
Container	0	12,640	51,455	115,910	220,243
Total loaded	751,010	524,373	408,907	381,531	415,566
Import					
Coal	204	0	0	0	0
Ore	75,201	81,605	39,441	58,519	29,951
Machinery, equipment	117,511	81,123	33,699	23,457	39,588
Metal	283,064	202,104	28,238	99,171	241,766
Fertilizer	270,718	281,497	313,244	374,264	371,455
Chemicals	15,828	13,622	11,018	18,352	22,622
Cement	951	1,120	0	2,737	201
Rice	56,541	0	0	0	0
Wheat flour	21,247	40,578	23,888	33,291	10,481
Foodstuff	13,924	4,660	6,562	6,946	367
Cotton, yarn, textile	16,292	29,609	12,642	845	979
Asphalt	28,427	27,722	11,544	31,510	23,454
Container	0	40,377	100,024	117,390	280,290
Others	168,363	172,426	40,918	82,366	154,924
Total loaded	1,068,271	976,443	621,218	848,848	1,176,078
Domestic					
Coal	31,675	19,634	12,771	19,856	21,411
Ore	598	486	3,950	30,640	47,694
Apatite	12,872	0	4,034	2,624	0
Gypsum	11,319	24,355	12,521	22,342	29,151
Clinker	268,609	257,879	169,490	31,849	42,246
Food	202,985	147,517	457,480	285,378	135,777
Cement	92,693	185,130	328,265	493,245	445,759
Machinery, equipment	7,468	3,950	3,497	3,681	23,950
Metal	58,044	32,482	15,774	26,046	60,045
Fertilizer	31,335	65,161	60,994	64,021	49,061
Foodstuff	5,871	7,940	34,994	4,905	8,301
Costruction materials	134,522	217,628	224,788	99,185	152,045
Others	47,336	52,998	74,722	63,942	99,227
Total loaded	905,327	1,015,160	1,403,280	1,147,714	1,114,667
Total	2,724,608	2,515,976	2,433,405	2,378,093	2,706,311

Source : Hai Phong Port

10.3.1 Agricultural Products

The quantities of rice, vegetables, foodstuff, rattan wares, jute and tapis are forecast in relation to the balance of agricultural production volume and consumption. Figure 10-3-1 shows the yearly export cargo volume of agricultural products. Table 10-3-2 and Table 10-3-3 show the balance of agriculture products, and agricultural data of cultivation and products in the northern part of Vietnam, respectively. According to the information in Figure 10-3-1, the export volume of vegetable, foodstuffs and rattan jute fell marginally, however, rice volume recovered after 1991. Presently Viet Nam is the world's third biggest rice exporter. One type of export rice is the perfume rice in the red river delta. Table 10-3-3 shows in production volume per hectare in 1992 increased by 100% over production of past years.

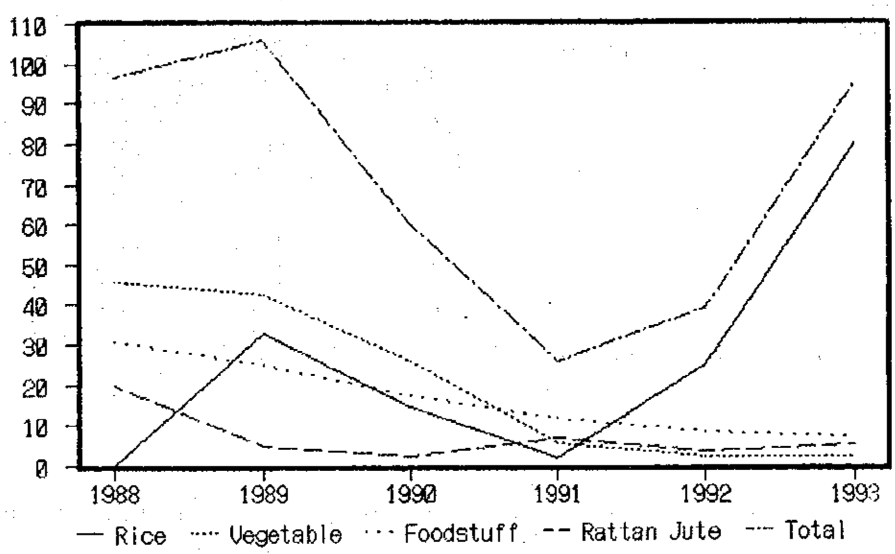


Figure 10-3-1 Cargo Volume of Agriculture by Year

Table 10-3-2 Balance of Agricultural Products in the Northern Part of Viet Nam

Unit: 1,000 Tones

Province	Surplus	Shortage	Province	Surplus	Shortage
Ha Giang, Tuyen Quang		33.5	Vinh Phu		51.1
Cao Bang		22.5	Ha Bac	23.4	
Lang Son		76.5	Ha Noi		244.0
Bac Thai		64.2	Hai Phong		6.9
Lai Chau	7.3		Hoa Binh, Ha Tai	92.1	
Son La		52.6	Hai Hung	373.3	
Lao Cai, Yen Bai		47.9	Thai Binh	429.5	
Quang Ninh		58.4	Nam Ha, Ninh Binh	385.3	
			Total	1310.9	657.6

Source: Transport Economic & Science Institute(TESI), MOTC

Table 10-3-3 Agricultural Cultivation and Products of the Northern Part of Viet Nam

	1986	1989	1990	1991	1992
Cultivation					
Area of land used for agriculture(ha)	2,280,400	2,095,300	2,069,300	2,037,600	2,045,800
Of which:cultivated	1,637,300	1,643,900	1,625,200	1,594,100	1,596,400
Area of sown land (ha)	2,670,500	2,837,000	2,779,900	2,746,000	2,799,700
Gross production of agri.(at constant price of 1989) million dongs	4,492,597	5,065,077	4,917,182	4,578,541	5,405,069
Cultivation	3,132,708	3,594,032	3,396,895	3,121,888	3,733,766
Breed	1,359,889	1,471,045	1,520,287	1,456,653	1,671,303
Sown area of major crops (ha)					
Food	2,248,370	2,435,674	2,365,774	2,323,475	2,392,669
Rice	1,774,335	1,840,137	1,837,137	1,783,736	1,804,730
Maize	62,429	129,532	116,832	131,233	135,733
Soybean	32,108	34,807	45,807	40,907	40,806
Tea	11,100	11,500	11,000	11,100	12,000
Jute	14,400	9,900	9,200	8,200	7,800
Production of major crops (tons)					
Food	5,876,800	7,371,100	6,769,200	5,823,900	7,526,000
Rice	4,801,000	5,991,300	5,550,900	4,627,500	6,115,000
Maize	113,200	234,400	199,300	222,000	227,600
Soybean	23,700	29,900	36,000	33,000	33,900
Tea	22,500	23,400	25,600	23,300	24,800
Jute	41,100	24,400	21,300	22,000	18,700
Yield of the major crops (quintal/ha)					
Rice	26.5	31.0	29.9	25.9	62.1
Maize	2.5	3.8	3.5	3.4	10.3
Soybean	4.9	5.5	6.1	5.9	13.2
Tea	0.7	0.7	1.0	0.9	2.5
Jute	6.6	6.2	5.8	6.9	10.2

Source : General Statiscal Office

Thus, with the development of agricultural technology, the volume of agricultural products is expected to continue increasing in correlation with the planned GPA (Gross Product of Agriculture). Rice export volumes through Hai Phong port are estimated using GPA growth rate of 4-5% (elasticity 0.96), however, other vegetables, foodstuffs, rattan wares and jute are estimated based on the present levels averaged over the past 5 years in the target year 2000 and are adapted to the GPA growth rate (elasticity 0.96)in the years 2001-2010.

Viet Nam Central Food Corporation 1 (VINAFOOD 1) under the Ministry of Agriculture and Foodstuff is planning a wheat mill factory close to Cai Lan Port. The volume of commodities from this factory to be exported and imported through Cai Lan Port is estimated as follows.

* Import :	Wheat in bulk - - - - - - - - - - -	240,000 tons/year
* Export :	Wheat Mash(sacked)- - - - - - - -	30,000 tons/year
	Rice(sacked)- - - - - - - - - - - - -	200,000 tons/year
	Corn in bulk - - - - - - - - - - - - -	300,000 tons/year
	Total	770,000 tones/year

In addition, it is estimated that at least four provinces(Cao Bang, Bac Thai, Lang Song, Quang Ninh) of Cai Lan port's main hinterland will require agricultural products from southern Viet Nam because of the shortage of agricultural products. Perfume rice in the red river delta of the northern part of Viet Num is applied mainly for export rice, and the agricultual production of the north mountain region is still low, thus, these four provinces will presumably be provided with rice from the southern part of Viet Nam through Cai Lan port. Table 10-3-4 shows rice consumption and production by provinces in the target years 2000 and 2010.

Table 10-3-4 Forecast on Agriculture Production & Consumption

(In Terms of Polished Rice)

Unit: 1,000 Tones

Province	Production	Consumption	Balance	
			Surplus	Shortage
Year 2000				
Cao Bang	220	235	-	15
Lang Son	200	235	-	35
Bac Thai	280	381	-	101
Quang Ninh	280	296	-	116
Year 2010				
Cao Bang	260	275	-	15
Lang Son	236	282	-	46
Bac Tai	340	424	-	84
Quang Ninh	220	352	-	132

Source: Transport Science and Economic Institute (TESI)

Note : Conversion rate: rice : polished rice = 1 : 0.65

Total converted rice shortage volumes in the target years based on above table are 411,000 tons in 2000, 426,000 tons in 2010. According to the rice forecast by TESI, considering each transport mode and production around provinces, domestic cargo volume of agricultural products through Cai Lan port is estimated at 158,000 tones in 2000 and 148,000 tons in 2010. A summary of cargo volume of agricultural products is shown in Table 10-3-5.

Table 10-3-5 Cargo Volume of Agricultural Products

Unit : 1,000 tones

		Year 2000	Year 2010
Hai Phong Port	Export	143	500
	Import	26	26
	Domestic	177	205
Cai Lan Port	Export	530	954
	Import	266	1,001
	Domestic	158	148
Total	Export	673	1,454
	Import	292	1,027
	Domestic	335	353

10.3.2 Mining products

(1) Ore

The main mining export products in the northern part of Vietnam are tin and manganese ore. The cargo volume of ore is estimated using a GPI growth rate of 12-17%(elasticity 0.96). Table 10-3-6 shows a summary of ore cargo volume in the target years 2000 and 2010.

Table 10-3-6 Cargo Volume of Ore

Unit: 1,000 Tones

		Year 2000	Year 2010
Hai Phong Port	Export	172	172
	Import	64	64
	Domestic	102	353
Cai Lan Port	Export	0	545
	Import	0	204
	Domestic	0	74
Total	Export	172	717
	Import	64	268
	Domestic	102	427

(2) Apatite

Apatite reserves, located in Lao Cai in the northern part of Viet Num, are estimated at 831 million tons of which 80 millon tons are of high quality. Apatite production could be developed as a commodity for export, if mining volumes increase and a screening factory with foreign investment is established at the Lao Cai site in the future. Table 10-3-7 shows a summary of domestic apatite cargo volume in the target years 2000 and 2010.

Table 10-3-7 Forecast of Domestic Apatite Cargo Volume

Unit : 1,000 tones

	Year 2000	Year 2010
Hai Phong Port	70 ton	140 ton
Cai Lan Port	0 ton	0 ton
Total	70 ton	140 ton

(3) Clinker, Cement and Gypsum

According to the Viet Nam Cement Corporation, under the Ministry of Construction, the total national output in 1993 was around 4.7-4.8 million tons, and thus Viet Nam will have to import between 1 million and 1.5 million tons of cement in 1994 to meet the domestic demand of 6-6.5 million tons. The consumption volume is forecast to reach 20 million in 2000, and 35 million tons in 2010.

In the future strategy of the Vietnam Cement Corporation, some large-scale cement producing plants would be constructed simultaneously in the northern part of Vietnam. (see Table 10-3-8 and 10-3-9)

Table 10-3-8 Cement Production Development Plan (1994-2000)

	Cement Plant		Province	Capacity (Mil.Ton)	Ex. & Domes. of Cai Lan P (Mil.Ton)	Construction Term	Remarks
Northern Part of Viet Nam	Ching Fong	(JV)	Hai Phong	1.4	0	1994-1997	Private Port
	Butson	(Local)	Nam Ha	1.4	0	1994-1997	Private Port
	Fuc Son	(JV)	Hai Hung	0.8	0		Private Port
	Expansion of Hoang Thach 2	(Local)	Hai Hung	1.2	0	1994-1995	Private Port
	Rehabilitation of 4 Furnaces in Hai Phong	(Local)	Hai Phong	0.2	0	1995-1996	Hai Phong Port
	Lang Bang	(JV)	Quang Ninh	1.2	0.26	1996-2000	Private Port
	Sub-Total			6.2	0.26		
Central Part of Viet Nam	Van Xa		Hue	0.5		1994-1996	
	Nghi Son		Thang Hoa	2.2		1995-1998	
	Bim Son Rehabilitation		Thang Hoa	0.6		1995-1996	
	Bim Son (2nd Stage)		Thang Hoa	0.1			
	Dien Tri		Binh Dinh	0.1		1994-1996	
	Da Nang 1		Da Nang	0.1		1994-1996	
	Da Nang 2		Da Nang	0.5			
	Dong Hoi		Quang Tri	0.1			
	Quy Nhon		Binh Dinh	0.3		1995-1996	
	Ba Hon		Khanh Hoa	0.3		1995-1996	
	Sub-Total			4.7			
Southern Part of Viet Nam	Sao Mai		Kien Giang	1.8		1994-1997	
	Rehabilitation of 2 Furnaces in Ha Tien 2		Kien Giang	0.5		1995-1997	
	Ha Tien 1 (Expansion)		Ha Tien	1.2			
	Binh Dien		HCMC	0.2			
	Vinh Long		Vinh Long				
	Phouc Thang		Vung Tau	1.0			
	Can Tho		Can Tho	0.3			
	Sub-Total			5.0			
Others	59 Vertical Furnaces			3.0		1994-1998	
	Total			18.9			

Table 10-3-9 Cement Production Development Plan (2000-2010)

	Cement Plant		Province	Capacity (Mil.Ton)	Ex. & Domes. of Cai Lan P (Mil.Ton)	Construction Term	Remarks
Northern Part of Viet Nam	Tam diep	(JV)	Ninh binh	1.2	0.36	2001-2005	Ninh Phuc Port
	Phuc Son 2	(JV)	Hai Hung	0.8	0.24	2001-2005	Cua Lo Port
	Hoang Mai	(JV)	Nghe an	1.2	0.36	2001-2005	Private Port
	But Son Expansion	(Local)	Nam Ha	1.4	0	2001-2005	Consumption
	Luong Son	(Local)	Ha Tay	1.2	0	2006-2010	Consumption
	Lang Son	(Local)	Lang son	1.4	0	2006-2010	Private Port
	Trang Kenh	(JV)	Hai phong	1.2	0	2006-2010	Private Port
	Ha Long	(JV)	Quang Ninh	1.4	0.42	1998-2002	Private Port
	Ha Long Expansion	(JV)	Quang ninh	1.4	0.42	2006-2010	Private Port
	Sub-Total			11.2	1.80		
Central Part of Viet Nam	Nghi Son Expansion		Thanh hoa	1.4		2006-2010	
	Thach My		QN-Da nang	1.4		2001-2005	
	Thach Ha		Quang binh	1.4		2001-2005	
	Dong Ha		Quang tri	1.4		2001-2005	
	Thanh Ha Expansion		Quang binh	1.4		2006-2010	
	Thach My Expansion		QN-Da nang	1.4		2006-2010	
	Sub-Total			8.4			
Southern Part of Viet Nam	Ta Thiet		Tay ninh	1.8		2001-2005	
	Sub-Total			1.8			
	Total			21.4			

Joint venture factories with foreign partners are necessary to export at least 30% of the cement production at each factory. Thus, in the forecast 30% of cement volume is adopted for export cement volume from each joint venture factory Cai Lan port (see Table 10-3-8 and Table 10-3-9). The domestic cement volume handled through Hai Phong port is estimated from the amount of production of local furnace cement factories in Hai Phong province, taking into account the cement production planned up to the target years 2000 and 2010.

However, there is another cement factories plan not included in Table 10-3-9. Thus cement cargo volume in Cai Lan port is calculated from GPI growth rate, 12-17%(elasticity 0.96) in 2010.

Volumes of gypsum needed as material is 3% of total cement products in cement factory. Thus, gypsum domestic cargo volume in Cai Lan port in the year 2010 is estimated to be 3% of production capacity of two cement factories. And gypsum domestic cargo volume in Hai Phong port is estimated by using GPI growth rate, 12 - 17% (elasticity 0.96) in 1994 - 2010.

A summary of cement and gypsum cargo volumes in the target years is shown in Table 10-3-10 and Table 10-3-11, respectively.

Table 10-3-10 Export and Domestic Cement Volume Forecast

Unit : 1,000 Tones

		Year 2000	Year 2010
Hai Phong Port	Export	240	240
	Domestic	700	850
Cai Lan Port	Export	240	2,060
	Domestic	0	380
Total	Export	480	2,300
	Domestic	700	1,230

Table 10-3-11 Domestic Gypsum Volume Forecast

Unit: 1,000 tones

	Year 2000	Year 2010
Hai Phong Port	63	215
Cai Lan Port	0	84
Total	63	299

(4) Asphalt

According to the Master Plan Study on the Transport Development in the Northern Part in Viet Nam (JICA), total length of the national, provincial and district roads will reach 5,545km in the target year 2010. Thus, the import asphalt volume through Cai Lan port is estimated from the asphalt volume in the road development plan in 2000. And asphalt volume handled in 2010 is obtained by adopting planned GPI growth rate 12-17%. Asphalt cargo volume through Hai Phong is also calculated adopting GPI growth rate. A summary of the import asphalt cargo volume is shown in Table 10-3-12.

Table 10-3-12 Forecast of Import Asphalt Volume

Unit: 1,000 tones

	Year 2000	Year 2010
Hai Phong Port	50	50
Cai Lan Port	0	120
Total	50	170

10.3.3 Forestry Products

(1) Logs and timber

According to a UNDP report, much forest vegetation has disappeared in past years. In the northern mountain areas, the growth rate of forestry products is over 3% and these materials are mostly used for support in coal mine tunnels in the Quang Ninh area. Logs and timber cargo are expected to maintain their present levels in the year 2000. And to compensate for the ban on the export of any raw timber, wood industrial factories in EPZ are expected to begin operations after year 2000, thus, the cargo volume of forestry products is calculated from GPI growth rate, 12-17% (elasticity 0.96) in the years 2001-2010. A summary of export forestry products volume is shown in Table 10-3-13.

Table 10-3-13 Forecast of Export Forestry products Volume

Unit: 1,000 tones

	Year 2000	Year 2010
Hai Phong Port	52	242
Cai Lan Port	0	165
Total	52	407

10.3.4 Industrial Products

(1) Fertilizer and Chemicals

The main factory for production of phosphate (SSP) is located at Lam Thao (Vinh Phu Province). The capacity of SSP plant is 100,000 tons per year. The urea fertilizer plant is located in Ha Bac Province and has a capacity of 100,000 tons per year. However production of fertilizer is not sufficient to meet domestic demand and the bulk of fertilizers and potash has to be imported. Two million tons was imported in 1988 and 1.5 million tones in 1989.

The Fertilizer and Basic Chemicals Corporation under the Ministry of Heavy Industry has planned a fertilizer factory for DAP (Diamond Ammonia Plant), with the first stage to be completed in year 2,000 and the second stage in 2010. Material volume and production volume will be as follows:

First Stage (year 2000)

Import material	
* Diamonum Phosphate (Liquid)- - - - - - - -	56,000 ton/year
* Ammonia(Liquid) - - - - - - - - - - - - - - -	33,000 ton/year
Total	89,000 ton/year
Domestic material	
* Apatite -	220,000 ton/year

It is necessary to import 89,000 tones/year of the chemical liquid material to produce 148,500 tones/year of fertilizer products. Those material will be handled as import cargo from USA. About 74,000 tones/year (50% of production volume) will be handled as domestic cargo through Cai Lan port. In the year 2010, DAP plant will be expanded to double scale production as part of the second stage.

Import fertilizer in the target years for the five provinces (Cao Bang, Lang Song, Bac Thai, Quang Ninh, Ha Bac) which comprise Cai Lan port's main hinterland is in the forecast. The following Table 10-3-14 shows the forecast of fertilizer consumption, distribution of the domestic fertilizer production and balance (import cargo volume through Cai Lan port).

Table 10-3-14 Estimation of Fertilizer Consumption, Distribution of Production and Balance

Unit: 1,000 Tones

Province	Year 2000			Year 2010		
	Consumption	Distribution of Domestic Production	Balance (through Cai Lan Port)	Consumption	Distribution of Domestic Production	Balance (through Cai Lan Port)
Cao Bang	20	8	12	10	5	5
Lan Son	15	8	7	9	4	5
Bac Thai	34	20	14	24	12	12
Quang Ninh	20	0	20	12	0	12
Ha Bac	70	30	40	35	35	0
Total	159	66	93	90	56	34

Source: Transport Economic and Science Institute (TESI), MOTC

Fertilizer is distributed to provinces shown in the above table from the urea fertilizer factory in Ha Bac province. Domestic fertilizer cargo volume is estimated using the growth rate of GPA, 4-5% (elasticity 0.96) in Hai Phong port. Chemical cargo volume in Hai Phong port is estimated using the growth rate of GPI, 12-17% (elasticity 0.96) in the years 2001-2010. A forecast of cargo volume of fertilizer and chemical products is shown in Table 10-3-15.

Table 10-3-15 Cargo Volume of Fertilizer and Chemical Products

Unit: 1,000 Tones

		Year 2000	Year 2010
Hai Phong Port	Import (Chemical)	49	49
	Import (Fertilizer)	484	484
	Domestic (Fertilizer)	64	74
Cai Lan Port	Import (Chemical)	89	525
	Import (Fertilizer)	103	124
	Domestic (Fertilizer)	74	153
Total	Import (Chemical)	138	574
	Import (Fertilizer)	587	608
	Domestic (Fertilizer)	138	227

(2) Metal

Viet Nam Steel Corporation belonging to Ministry of Heavy Industry is located in Thai Nguyen (Bac Thai Province) in northern Vietnam. This plant uses local iron ore, and production in 1993 was 109,675 tons of steel.

This enterprise has a future development plan for the northern part of Vietnam. Each component is described below.

(a) Upgrading of existing factory (year 1994 - year 2000)

i) Thai Nguyen Steel Plant Iron Complex

In 1993, Thai Nguyen Steel Plant Iron Complex produced 109,675 tons using local ore. According to a joint-venture contract between Thai Nguyen Steel Plant and NATSTEEL Co., the capacity will expand to 220,000 tones/year in 1994, 290,000 tones/year in 1995 and 300,000 tones/year in 2000.

- Import material: Scrap 144,000 tones/year

ii) Hai Phong steel plant

The Ministry of Heavy Industry and the People's Committee of Hai Phong have a steel mill project near the port. A steel rolling plant is expected to produce an annual steel output of 200,000 tons/year.

- The first stage (1995): 200,000 tones/year
- Import material (scrap): 230,000-250,000 tones/year

(b) Future Development Project (under F/S) target year 2000

i) Hai Phong steel plant

The second stage (1998): 500,000 tons/year

Import material (scrap): 570,000-620,000 tons/year (estimated)

ii) Quang Ninh steel plant

- Capacity : 500,000 tons/year(Domestic Sea transport :350,000 tones/year)
- Material(scrap) and additives 600,000 tones/year
- Import material : coke coal(5,100 tones/year), sand coke coal(5,100 tones/year), scrap(275,000 tones/year) electrode(750 tones/year)

(c) Future conceptual development plan

Vietnam Steel Corporation has the following conceptual project plans for Hai Phong or Quang Ninh in the northern part of Vietnam.

i) Steel plant (local ore)

Capacity : 1 million tones/year

ii) Steel Smelting plant

Capacity : 750,000 tones/year

iii) Qui Xa Steel Mine plant (Yen Bai province)

Joint-Venture with China, Capacity : 2.5 million tones

Customers : Thai Nguyen Steel & Iron Complex, Local Customers

(Hai Pong port and Cai Lan port) for export to Lang Son Province (export to China) and Van Nam (China)

In the target year 2000, the steel production from "Stage 1" and "Stage 2" of the project is adopted. In the years 2001-2010, the cargo volumes of each port are estimated using GPI growth rate 12-17%(elasticity 0.96). The import and domestic steel volume is estimated in Table 10-3-16.

Table 10-3-16 Import and Domestic Metal Volume Forecast

Unit : 1,000 Tones

		Year 2000	Year 2010
Hai Phong Port	Import	764	764
	Domestic	447	522
Cai Lan Port	Import(Scrap)	287	854
	Domestic(Steel)	350	1,050
Total	Import	1,051	1,618
	Domestic	797	1,572

10.3.6 Containerizable Cargo and General Cargo

The export and import volumes of containerizable cargo such as machinery, equipment, foodstuffs, construction materials and others are forecast in relation with GPI. However, domestic general cargo, the same as commodity of export and import, is not included in containerizable cargo. The containerizable volumes and domestic general cargo in the years 2000 and 2010 are estimated using GPI growth rate 12-17% (elasticity 0.96).

The summary of containerizable cargo and domestic general cargo is shown in Table 10-3-17.

Table 10-3-17 Cargo Volume of Containerizable Cargo and General Cargo

Unit: 1,000 Tones

		Year 2000	Year 2010
Hai Phong Port	Export	1,057	1,256
	Import	817	1,695
	Domestic	487	1,048
Cai Lan Port	Export	131	1,550
	Import	312	3,509
	Domestic	122	863
Total	Export	1,188	2,367
	Import	1,129	4,566
	Domestic	609	2,540

Depending on the distribution of population, Hai Phong Port and Cai Lan Port will share approximately 80% and 20% of the total general export cargo in the year 2000, respectively.

Based on the cargo handling capacity, total cargo volume is forecast at approx. 8.4 million tons due to the expansion of berth and the improvement of cargo handling operation in the target year 2010. Following table shows the distribution of cargo volume to the Hai Phong port zones in 2010.

Table 10-3-18 Capacity of the Hai Phong Port Cargo Volume in 2010

	berth	1,000 ton/ berth.year	1,000 ton/year
(1) General Cargo			
Vat Cach	5	100	500
Main Port Bulk	3	700	2,100
Conventional	5	300	1,500
Total	13		4,100
(2) Container Cargo			
Main Port	3	650	1,950
Chuave Existing	2	650	1,300
New	2	650	1,300
Total (Including Emp. Con.	7		4,550
Container Volume (70%)			3,185
(3) River Traffic			1,065
(4) Grand Total	21		8,350

Assuming the cargo volume handled at Hai Phong port will exceed port is capacity (about 8 million tons) in the target year 2010, surplus general cargo volumes diverted to Cai Lan port are considered to be export and import cargo volume of Cai Lan port. However, the cargo volume generated from Hai Phong EPZ is roughly estimated and also included. The summary of diverted cargo volume from Hai Phong port in the target year 2010 is shown in Table 10-3-19.

Table 10-3-19 Diverted cargo volume from Hai Phong port

Unit :1,000 Ton

Commodity	1993	%	5 Years	2000	%	Diverted Cargo Year 2010	2010	%
Export								
Ore	80		29	172		545	172	
Machinery, equipment	1		1	1		4	1	
Metal	10		186	22		71	22	
Logs, timber	4		65	52		165	242	
Rice	80		31	104		55	104	
Vegetable	2		16	21		11	21	
Foodstuff	7		14	13		41	370	
Rattan wares, jute tapis	5		5	5		1	5	
Cement				240		-	240	
General Cargo	5		69	8		25	108	
Container	220		80	378		1,199	378	
Total loaded	416	15%	496	1,016	19%	2,117	1,663	20%
Import								
Ore	30		57	64		204	64	
Machinery, equipment	40		59	68		216	68	
Metal	242		171	764		-	764	
Fertilizer	371		322	484		100	484	
Chemicals	23		16	49		154	49	
Wheat flour	10		26	26		15	26	
Foodstuff	0		6	1		2	241	
Cotton, yarn, textile	1		12	2		5	2	
Asphalt	23		25	50		160	50	
Container	280		108	481		1,526	481	
Others	155		124	266		844	266	
Total loaded	1,176	43%	938	2,254	42%	3,225	2,494	30%
Domestic								
Coal	21		21	46		-	158	
Ore	48		17	102		74	353	
Apatite	0		4	70		-	140	
Gypsum	29		20	63		45	215	
Clinker	42		154	Dev.Plan		-	-	
Food	136		246	177		-	205	
Cement	446		309	700		-	850	
Machinery, equipment	24		9	41		30	142	
Metal	60		38	447		-	522	
Fertilizer	49		54	64		3	74	
Foodstuff	8		12	14		10	49	
Costruction materials	152		166	261		190	899	
Others	99		68	170		124	587	
Total loaded	1,115	41%	1,117	2,155	40%	476	4,193	50%
Total	2,706	100%	2,552	5,424	100%	5,818	8,350	100%

10.3.7 Transhipment Cargo Volume to/from China

Based on the following assumptions, cargo volume to/from China is estimated. It should be noted that the dispute over the border is neglected here.

a. In this forecast, only railway transport is taken into consideration because of the present and presumed road conditions.

b. On the basis of the distance by railway, the hinterlands of Hai Phong Port and Cai Lan Port in China are assumed to be Yunnan, Guangxi, Sichuan and Guizhou provinces.

c. The data source of cargo volume in the four provinces is China Foreign Economic Trade Year Book (1993/1994).

d. Based on the railway distance, the percentage of cargo handling volume to/from Viet Num from/to four Chinese provinces is assumed as follows ; Yunnan (60%), Guangxi (10%), Sichuan (30%) and Guizhou (10%) in each total cargo volume.

e. Cargo volume is estimated based on the economic growth rate of (maximum) 8% (1992-1995) and 10% (1996-2000) under the five-years plan in China, while a 10% growth rate is adopted from 2001 to 2010.

Based on the above, cargo volume is forecast in the target years.(see Table 10-3-20 and Table 10-3-21)

Table 10-3-20 Import & Export Cargo Volume by Province

Unit: Mil. Tones

Year	Yunnan	Guangxi	Schuan	Guihou	Total
1992	0.5	3.0	0.5	0.8	4.8
2000	1.1	6.0	1.0	1.6	9.7
2010	2.8	15.6	2.7	4.2	25.3

Table 10-3-21 Estimated Transhipment Cargo from/in Northern Viet Nam

Unit: Mil. Tones

Year	Yunnan 60%	Guangxi 10%	Sichuan 30%	Guizhou 10%	Total
2000	0.6	0.6	0.2	0.1	1.5
2010	1.7	1.6	0.8	0.4	4.5

Total cargo volume on Table 10-3-21 represents forecast cargo volume handled at Hai Phong port and Cai Lan port in the target years, however, Chinese transhipment volume is not added to the above cargo volumes for facility planning because too much uncertainty exists.

10.3.8 Summary of Micro Demand Forecast

(1) Cargo volume of Cai Lan port

The cargo volume at Cai Lan Port from four factories by micro forecast is estimated at 1.8 million tons in the target year 2000, which represents about 70% of the total cargo volume.(See Figure 10-3-2)

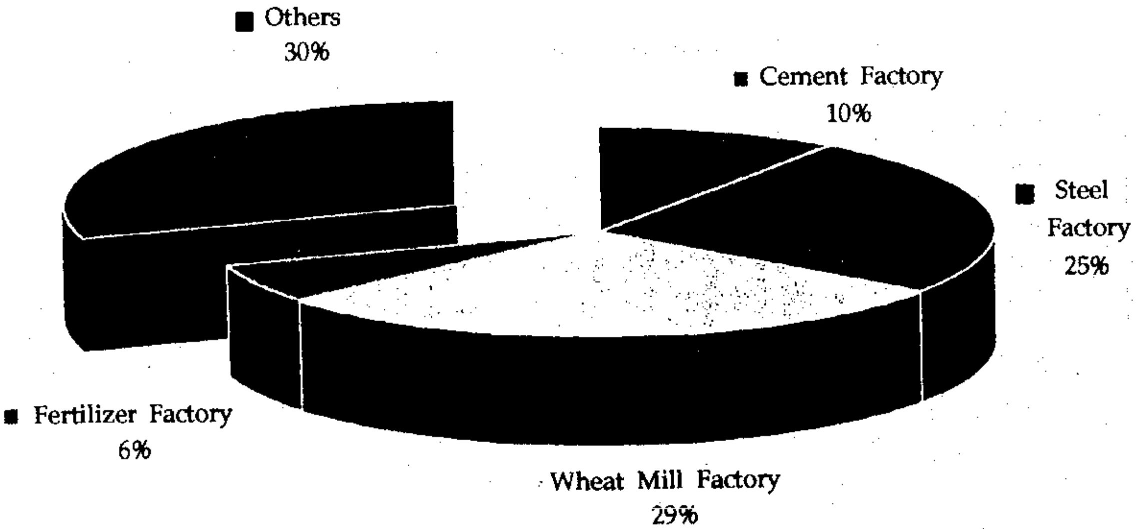


Figure 10-3-2 Cargo Volume of Four Factories through Cai Lan port

(2) Summary of Micro forecast

Table 10-3-22 shows a summary of the micro forecast.

Table 10-3-22 Summary of Micro Forecast

Unit : 1,000 Tonnes

Commodity	2000		2010		Remerks
		%		%	
Export					
Ore(tin, manganese, cupper)	-		545	3.8%	
Metal	-		71	0.5%	
Rice	200	7.5%	513	3.6%	VINAFOOD 1
Maize	300	11.2%	316	2.2%	VINAFOOD 1
Grained Wheat	30	1.1%	125	0.9%	VINAFOOD 1
Cement	240	9.0%	2,060	14.4%	Cement Factory
Containerizable Cargo	131	4.9%	1,550	10.8%	Resin, Quanimex
Total loaded	901	33.7%	5,180	36.2%	
Import					
Coal	10	0.4%	31	0.2%	Steel Factory
Other Ore	-		204	1.4%	
Scrap	287	10.7%	854	6.0%	Steel Factory
Fertilizer	103	3.8%	124	0.9%	5 Provinces
Chemicals	89	3.3%	525	3.7%	DAP Fertilizer
Asphalt	30	1.1%	120	0.8%	Road Development Plan
Wheat	240	9.0%	1,001	7.0%	VINAFOOD 1
Containerizable Cargo	312	11.6%	3,509	24.5%	Construction Materials
Total loaded	1,071	40.0%	6,368	44.5%	
Domestic					
Ore	-		74	0.5%	
Gypsum	-		84	0.6%	Cement Factory
Rice	158	5.9%	148	1.0%	4 Provinces
Cement & Clinker	-		380	2.7%	Cement Factory
Steel	350	13.1%	1,050	7.3%	Steel Factory
Fertilizer	74	2.8%	153	1.1%	DAP Factory
General Cargo	122	4.6%	863	6.0%	
Total loaded	704	26.3%	2,752	19.2%	
Total	2,676	100.0%	14,300	100.0%	

10.3.9 Cross check with the Results of Macro Forecast

Figure 10-3-3 shows a comparison of cargo volumes obtained by the macro and micro forecast methods described in Section 10.2 and 10.3.

The result of the micro forecast almost corresponds with that of the macro forecast in the year 2010. However, there is a discrepancy between the macro and micro forecast in the target year 2000. This discrepancy is mainly related to the products and materials of factories and the construction materials and equipment of projects on regional planning in the Bay Chay area. Herein, the cargo volumes handled at the ports of Hai Phong Port and Cai Lan port for the target years will be forecasted as those obtained by the micro forecast method.

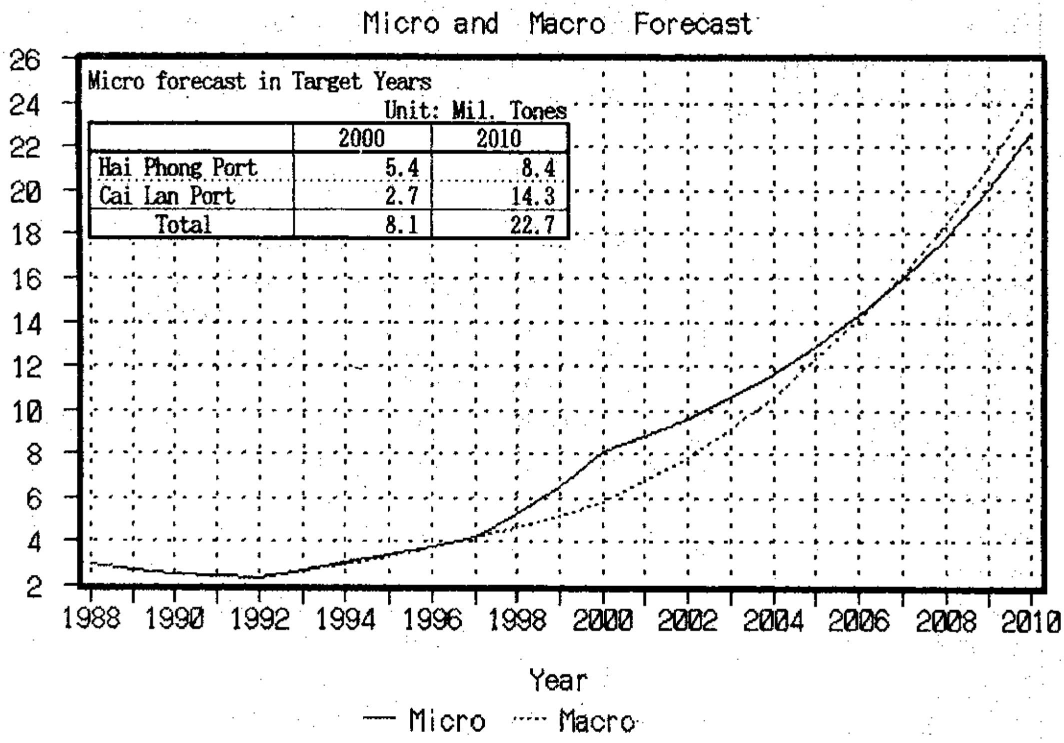


Figure 10-3-3 Forecast of Total Cargo Volume in Target Years

10.4 Forecast of Container Cargo

10.4.1 Trend of Containerization at Hai Phong Port and Cai Lan port

The percentage of containerization is the ratio of the volume of container cargoes to the volume of containerizable cargoes. The volume of containerizable cargo was estimated by their suitability for containerization from the statistical data in Hai Phong port. The greater part of categories of goods are suitable for containerization, but most of steel and metal and fertilizer have been pronounced unsuitable for containerization.

10.4.2 Estimation of Volume of Container Cargoes in the Target Years

The percentage of containerization in the target years is estimated by using the containerization ratio of Saigon port in Figure 10-4-1. Then, the volume of containerizable cargoes in the target years can be obtained by multiplying the percentage of containerization. Cai Lan port is assumed to have the same level of containerization as Hai Phong port because both ports are in the northern part of Viet Nam an both ports have common hinterland and same type of cargo is diverted from Hai Phong port. In addition, 20% of domestic general cargo is estimated to be replaced by container cargo in the year 2010 with the advance of increasing domestic feeder services. Table 10-1-1 shows the estimated volume of container cargoes at Cai Lan port.

Table 10-4-1 Forecast Volume of Container Cargo at the Cai Lan Port

Unit: 1,000 Tones

Target Year	Type of Cargo	Containerizable Cargo	Percentage of Containerization	Container Volume
Year 2000	Export	131	72%	94
	Import	312	72%	225
	Total			319
Year 2010	Export	1550	80%	1,240
	Import	3509	80%	2,807
	Domestic	863	20%	173
	Total			4,220

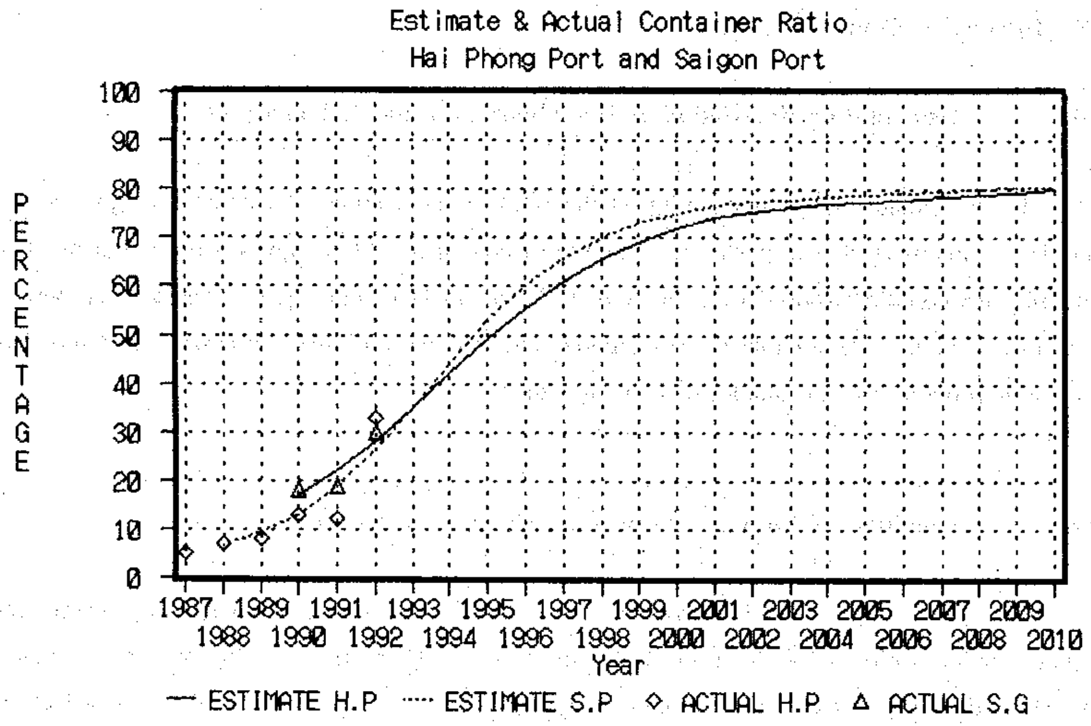


Figure 10-4-1 Estimation of future percentage of containerization

Source : Hai Phong port Rehabilitation Project by JICA Study team in 1993

10.5 Forecast Volume of Conventional Cargoes at Cai Lan port

The forecast volume of conventional cargo at Cai Lan port in the target years is obtained by deducting container cargo volume from the total cargo volume. The results are shown in Table 10-5-1.

Table 10-5-1 The Volume of Conventional Cargo through Cai Lan port

Unit: 1,000 Tones

	Year 2000	Year 2010
Export	807	3,940
Import	847	3,561
Domestic	704	2,752
Total	2,358	10,253

10.6 Forecast of Vessel Size

Size of calling vessels is calculated by average loading volume of both domestic and foreign cargo (cf. Table 12-3-12, Chapter 12). The results of vessel size distribution are shown in the following bar-chart.

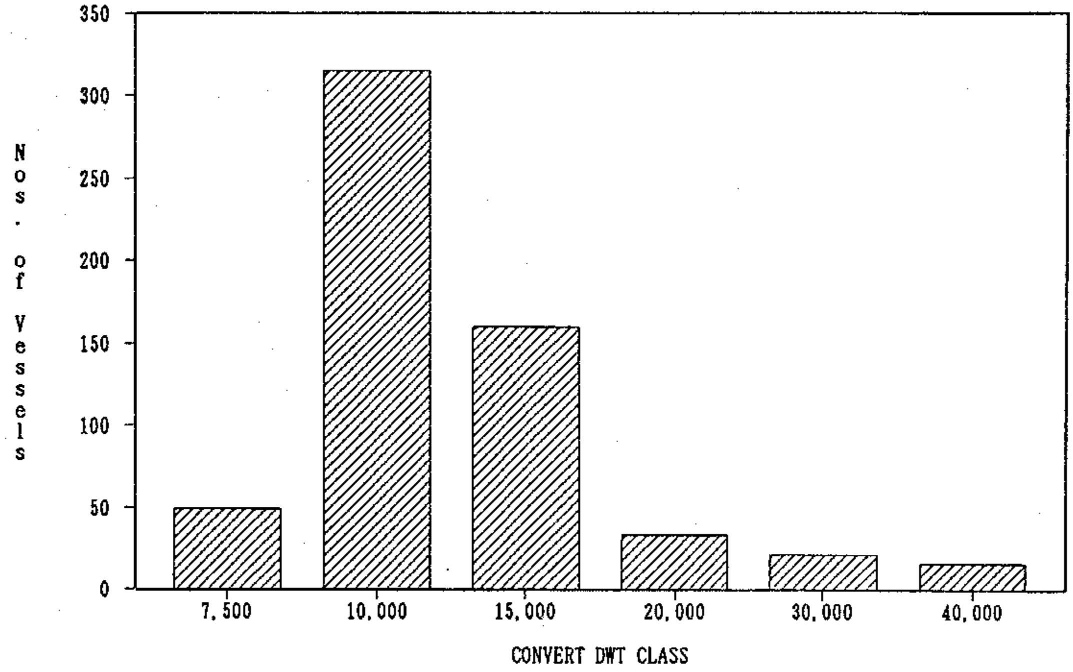


Figure 10-6-1 Vessels Size Forecast (Year 2000)

CHAPTER 11 LONG TERM PORT DEVELOPMENT CONCEPT UP TO THE YEAR 2010

11.1 Principle for Formulating Long Term Development Concept

11.1.1 Characteristics and Function of Port

(1) Background

The economic prospects in Vietnam are now improving, which is evident from the stable price levels, the strong domestic demand both for productive and consumer goods and privatization of State-owned enterprises. In addition, Joint ventures with foreign investment have helped push economic growth to higher levels.

In 1993 the economic growth rate was recorded at 7.5% and the inflation rate remained at 4 - 5%. The National Assembly has set targets for 1994 in which GDP growth rate is 8%, industry output 11%, agriculture 4% while inflation will be below 10%.

However,because of the undeveloped nature of its industries,Vietnam has a long way to go, especially if it wants to change its economic structure and to raise the standard of living.

In Table 11-1-1 no change in orientation is seen.

Table 11-1-1 Economic Structure (GDP %) in Vietnam

	1990	1991	1992	1993
Industry	23.7%	23.6%	27.5%	25.4%
Agriculture	38.6	40.8	34.5	36.4
Service	37.7	35.6	38.0	38.2

Source: General Statistics Department.

As long as industry occupies the lowest percentage in the national economic structure, there will be no economic take-off for Vietnam.

In Vietnam many goods are consumed, but the products of heavy industry, and even the products of light industry depend on imports from China,Thailand, Hong Kong, Singapore, Taiwan, Japan, and other foreign countries.

It is no exaggeration to say that without developing industry in Vietnam, the standard of living is not likely to increase.

In order to help spur indusrial development, encourage exports and create jobs, the Vietnamese government has set up four export processing zones (EPZs) since the promulgation of the regulation on export processing zones on October 18, 1991.

These four EPZs are shown in Table 11-1-2.

In comparison with those in other countries Vietnam's EPZs are of a large size and companies which will be located in EPZs are allowed to invest in such infrastructure as power and water, roads and harbors, etc. At present, (January in 1994) 100 companies from 25 countries have registered for land and several companies are now operating. Most of these companies are engaged in garment making, textiles, processing of agricultural products and food, manufacturing of sports equipment, and electronics and video games.

Table 11-1-2 Vietnam's Licensed EPZs

Name of EPZ	Land area (ha)	Investment capital for infrastructure construction (US$ million)
Tan Thuan (Ho Chi Minh City)	300	89
Ling Trang (Ho Chi Minh City)	60	14
Da Nang	120	24
Hai Phong	300	150

Source: Vietnam News 16 January in 1994.

Many local governments, including Quang Ninh Province, intend to set up EPZs of their own so as to attract investment capital. As mentioned in Chapter 10, central and local governments are eagerly trying to encourage the development of industries and EPZs which will be located around the Bai Chay Bay area. Under these circumstances, during the planning of

Cai Lan port development it is important to consider industrial development that will be deeply concerned with port function.

(2) Development Scenarios

To meet the above mentioned demand it can be said that there are three scenarios for the development of the port.

1) Case 1:

The first case is to develop such heavy industry as iron and steel industries, oil refineries and the petro-chemical industry which will comprise the heavy industrial complex. There is likely to be a big electricity demand so that electric power stations will need to be constructed in the adjacent area. In this case, the port would be classified as an industrial port. The port facility itself would function as one of the industrial factories' equipment and a large proportion of the berths would belong to industrial factories. Thus the port would be comprised mostly of private berths.

The port area, including factories, would cover at least 1,000 - 3,000 ha. Usually raw materials for such factories are transported by ships over 100,000 DWT in size and this means the channel and berth will necessarily be over -16 ~ -17 m deep. Container berths will be necessary for general cargo originating in the factories and hinterland.

2) Case 2:

The second case is to develop the industries which have the advantage of regional resources. As already mentioned, Bai Chay Bay area is endowed with plenty of coal, limestone, clay, kaolin and silica sand as well as agriculture, forestry and fishery products. By fully using such resources, the development of cement factories, brick and tile and ceramic factories, the glass industry, agriculture, forestry, fishery processing industries, etc., can take place.

With the advantage of apatite which will be transported from Lao Cai province, fertilizer factories also will be able to be developed.

As far as cement and limestone are concerned, construction materials for industry such as gravel, sand and ready-mixed concrete will be developed. Associated with these industries, timber milling factories, steel bar or mill factories and steel structure fabrication industries can be developed.

In this case the port would be constructed to accommodate less than 50,000 DWT class vessels which need -13 ~ -14m deep channel and berth.

For case 2 it can be said that the port would have a comprehensive function both for regional industrial development and for the transportation of various kinds of commodities from and to EPZs and hinterland.

3) Case 3:

This case is similar to the port of Hai Phong in the master plan study report on transport development in the northern part of Vietnam (Masterplan Study) conducted by JICA in 1993.

This type of port is usually designed as a commercial port specializing in the transportation function (it is referred to as a transportation base port). In this case trans-shipment cargo originating from and going to EPZs is very important. This cargo will be mainly transported as container cargo.

At present, all Vietnamese sea ports are limited to accepting container feeder service vessels from and to Hong Kong, Taiwan and Singapore. With regard to container feeder service vessels, it will be soon necessary to upgrade to ship sizes which can carry more than 500 TEU. Container ships with 30,000 DWT and 11 m draft are likely. Thus the berth and channel will need to be deepened to at least -12.0 m.

Regarding container transhipment, there is an idea to develop the port in a similar fashion to Singapore. Da Nang, Cam Ranh, Vung Tau, Thi Vai, Con Dao including Cai Lan have been all discussed this topic.

Container terminals in Singapore consists of Tanjungpagar, Kepel and Brani covering 183 ha with 12 berths and 54 wharf-cranes. Brani District is currentry being rebuilt as a comprehensive container terminal and will be completed by 1994. When completed, berths will increase from two to nine, from 36 ha to 80 ha and the depth will be -15.0 m, easily berthing next-generation container vessels and handling 10,000,000 TEUs annually.

There are, in total, 92 shippers and 420 ships now are operating. The largest ship is over 58,000 GWT with the capacity of 4,400 TEU. Furthermore, the Government of Singapore is adopting the policy of a free port system, and there are six areas designated for free trade zone.

Considering the geographical advantage of Singapore and its scale and function it can be concluded that the system used in Singapore is too advanced to introduce to Cai Lan Port.

Table 11-1-3 shows the summary of the development scenarios including the examples.

4) Recommended Scenario

Out of these three cases, Case 2 is most preferable considering all constraints such as physical, social, economic and environmental condition.

Table 11-1-3 Development Scenarios

Constraint and Factors	Case - 1	Case - 2	Case - 3
Character-istics	Idustrial Port To transport raw materials and products for heavy industries.	Regional Development Port To transport various kinds of goods for regional economic activities	Commercial Port (transportation Base Port) To be the window for the mass foreign trade transportation.
Role	Port operation mainly consists of the heavy industrial productive activities and port facilities itself function as a part of factories.	To support and promote the economic and industrial activities in the vicinity area of the port.	To accelerate economic ativities in the hinterland
Example	Kashima Port (Japan)	Shekow(Shinzhen, PRC), Dokai(Japan)	Kobe Port (Japan) Particular one, Singapore
Cargo	Raw materials and products of heavy industries Steel ore Chemical goods oil, etc... bulk cargo	Cagoes for local industries and others	General cargo container Free zone, EPZ.
Land use for hinte-rland	Heavy industries compose industrial complex.	Regional industries, brick timber, steel bars, light industries, EPZ.	Warehouses,inland depository
Ship size depth	More than 100.000 DWT over -17.0m	Less than 50,000 DWT -13 ~ -14.0m	Over 30,000 DWT over -12.0m

Beside the function mentioned above the port may also function for use of tourism, for instance, to accommodate passenger ships, both domestic and foreign and to meet the increasing demand for sea leisure.

An evaluation of the three cases is shown below.

Table 11-1-4 Evaluation of Three Scenarios

Constraint and Factors	Case - 1	Case - 2	Case -3
Physical condition	×	○	○
Socio-economic	△	○	×
Environment	×	△	○
Total	×	○	△

○ : Good
△ : Average
× : Poor

11.1.2 Allotment of Roles and Functions between Hai Phong Port and Cai Lan Port

In the study on transport development in the northern part of Vietnam (Master Plan), a fundamental concept for port development in the Northern part of Vietnam was recently discussed and is described as follows.

- Development of a large scale sea port, which functions efficiently and is integrated with other ports, is essential for socio-economic development in the Northern part of Vietnam.

- In searching the site of a new deep sea port in the Northern part of Vietnam, Cai Lan was selected as the best alternative,under the situation no completely ideal site was found.
In expanding Cai Lan Port, it is necessary to commence civil works at the possible early stage to absorb the excessive demand at Hai Phong Port prior to the expected time of saturation.

- Hai Phong Port and Cai Lan Port should be functioned to supplement each other under the integrated management and operation framework as well as provision of sufficient transport and communication facilities between the two ports.(excerpt from the Master Plan Study)

Considering these development concepts, the present situation of the two ports and the future demand expected, the roles and functions of the two ports are set out below.

Hai Phong Port	Cai Lan Port
International General Commercial Port	Regional Development and Transportation Port
- To handle various kinds of commodities and a variety of types of general and container cargo for hinterland	- To handle limited kinds of high volume cargo in unit commodity such as bulk cargo for the surrounding local industries
- Foreign trade + domestic trade	- Mainly foreign trade
- Middle size ship (less than 10,000 DWT)	- Large size ship (10-40,000DWT)

As mentioned in the previous section,industrial development is vitally important and Cai Lan port should have the function not only to accelerate the new industrial development but also to be deeply concerned about where developing industries would be located in the Bai Chay Bay area and to handle mainly industrial cargo originating from those developing industries. Therefore, Cai Lan Port should be characterized as the regional development port rather than a transportation base port.

It has been predicted that Hai Phong Port has a physical constraint in expanding its handling capacity, then it is necessary for Cai Lan Port to absorb the excessive demand at Hai Phong Port.

As far as container cargo is concerned, even if, container ships are upgraded to 1000 TEU type in the near future, Hai Phong Port, due to the heavy siltation, can not accommodate over 300-400TEU type container ships both technically and economically. Therefore Cai Lan Port will play an important role for container transportation after the year of 2000.

Regarding tourism development, a port generally has the function to accept passenger ships for tourism and can prepare the quays and basin for tourism boats. Ha Long Bay and Bai Chay are potentially good areas for developing tourism. It would thus be natural for Cai Lan Port to contribute to the development of tourism industry through facilities for tourism.

There are several areas where such facilities for tourism boats or tourist transportation could be developed in Bai Chai Bay Area. For instance there is an idea to convert Hon Gai Port to passenger wharves.

Thus, the role and function allocated to Cai Lan port is summarized below.

- To encourage,promote and support the development of various kinds of local industries.
- To handle bulky cargo for the factories located in the vicinity of the port
- To transport cargo exceeding the existing port capacity in the northern part of Vietnam.(under the maximum utilization of Hai Phong Port)
- To meet containerization and accept large container ships.
- To promote tourism development.

Cargo volume allocated between Hai Phong Port and Cai Lan Port is as follows.

Table 11-1-5 Cargo Volume allocated between Hai Phong Port and Cai Lan Port

Unit:1000 tons

		Year 2000		Year 2010	
		Master Plan	This Study	Master Plan	This Study
Hai Phong Port	Total	4,600	5,424	8,200	8,350
	Container	1,500	1,200	4,500	3,200
Cai Lan Port	Total	1,000	2,676	6,300	14,300
	Container	0	335	600	4,000

Handling capacity of Hai Phong Port is carefully examined using productivity and future expansion in Hai Phong Port.(cf.Chapter 10.3.6)

11.1.3 Environmental Aspects

(1) Background

Environmental concerns grew during the 1980s as a consequence of socio-economic development in Vietnam. The 1980 Constitution of Vietnam comprises Article 36 on the protection of natural resources and the environment.

Resolution No 246 of the council of Ministers in 1985 reviewed the investigation/inventory, exploitation, management and conservation / protection of natural resources and gave directives for further actions, including the establishment of a national agency responsible for natural resources and environment management and control.

The Law of Land (1987), the Ordinance of Protection and Development of Aquatic Resources (1989), the Law of People Health Care (1989), the Law of Mineral Resources (1989) etc, also address environmental concerns.

In December 1990 the International Conference on "Environment and Sustainable Development" was held in Hanoi where drafts of the Environment Protection Law, the National Environment strategy and National Action Plan were presented.

A little before this conference, in March 1990, the State Committee for Science established a group to prepare the project of the Law for Environment Protection, including the managers and researchers of the program on Natural Resources and Environment.

The Bill of Environment Protection has been continuously supplemented, and was passed through the 9th Legislature National Assembly, dated 27 December 1993.

On 10 January 1994, the Environment Protection Law was promulgated with the aims of appropriately using natural resources, preventing the impacts causing pollution and destroying environment, restoring losses, and continuously improving the potential of natural resources and environmental protection.

Consequently, temporary guidelines on environment impact assessment for investment projects were issued as the instructions by the Prime Minister (No 73-Ttg) dated 25 February, 1993. Provisional environmental criteria were published in 1993 by the Ministry of Science, Technology and Environment are being reviewed and revised with a deadline of April, 1994.

(2) Environmental Consideration

Some environmental aspects that should be considered in the Cai Lan Port Development include the following:

1) Pure environment preservation

From the global environment point of view, several issues should be considered initially, such as whether the development affects the global balance of ecology, atmospheric or oceanic quality, or the status of rare species.

In the current study these are not considered to be key issues. It is not necessary to include them in the discussion because the scale of development is so small that there is unlikely to be an effect on global environmental balance. No rare species have been found in the vicinity of the site by field survey so far.

2) Environment preservation from the viewpoint of living circumstances and recreation

It is inevitable that appreciation of the environment depends somewhat on living standards. When the standard of living is low, more stress tends to be laid on development than on preservation of the environment. Therefore it is important to ensure that in this project the environmental issues are put into perspective so that any differences of approach between the Vietnamese authorities and the Study Team can be fully discussed. Experiences of development in Japan and other countries have shown that the environment must be taken into consideration otherwise the developments may be regretted at a later date. The importance of the environmental perspective must be stressed.

However, preservation of the environment is not going to achieve a rise in the Vietnamese standard of living. As far as our final purpose is to raise the standard of living, some development must be necessary. There are two points to consider. The first is that, during site selection, if the economic effects of developing two sites are equal, the site where the impact to environment by development will be least should be selected. For example, it should be stressed that Hai Phong Port must be utilized to the maximum extent as far as is economically feasible, considering the additional investment and the maintenance costs of the facilities.

A new port is essential for the development of the northern part of Vietnam centering on Hanoi. If we cannot specify any other alternative than Cai Lan for the new deep sea port development, a new port will have to be constructed there.

The second point is that, if some development is inevitable at the site, the area where development will take place should be restricted to minimize the effect on the environment. In the worst case, the port development could signal the beginning of an unregulated sprawl of industry and housing. A long term master plan for the development is essential. This should be formulated in such a manner that developments around water area, shore-line and land area are arranged as effectively as possible with the minimum environmental effect.

At the same time it is important to establish a planning scheme which will prevent developments which do not comply with the master plan. For example, in the Cai Lan Port site some unplanned reclamation with waste soils has been observed next to the port area. This indicates that the environment is already being affected offsite by unnecessary and unplanned development.

3) Mangrove forest in Bai Chay Bay.

According to the preliminary field survey, there are 9 principal species of mangrove found in Bai Chay Bay. The names and particulars of these mangroves are as follows.

- Aegiceras corniculatum (A.c.)- **Very Common**
Extensive distribution, small trees with many stems per trunk, very productive with seedlings; local people cut for firewood.

- Avicennia marina leave (A.m) **Common**
Stands of squat on sandy flats, less common on soft mud, Small leaves; few seedlings; local people cut for firewood and fodder for buffalo.

- Hibiscus tiliaceus (H.t.)- **Common**
Toward landward fringes of mangrove
Local people use to make mats from bark.

- Excoecaria agallocha (E.a.)- **Common**

On higher and drier ground above A.m. flats.
Terrestrial fringes of mangrove.
Milky leaves used as fish poison by local people.

- Kandelia Candel (K.c.)- **Frequent**

Standing out above A.c. on muddy wet soil.
Mud flat species up to 3 ~ 4 m.
Flowers used as a source of mangrove honey.
Local people cut for firewood.

- Lumnitzera racemosa (L.r.)- **Frequent**

A back zone species on dry flats above A.m.
Small thick leaves.

- Rhizophora stylosa (R.s) **Frequent**

Associated with K.c on softer wet mud.
Suffered less than A.m and A.c. from firewood collection.

- Clerodendron inerme (C.i.)- **Infrequent**

Back mangrove above mean high water
Leaf has herbal medicinal properties
Good as protector of sea dike, slow erosion.

- Bruguiera gymnorrhiza (B.g.)- **Uncommon**

Associated with R.s.

Some estuarine, mangrove dominated areas of Bai Chay Bay are more important than others in both ecological and economic terms. Generally speaking to some extent the degradation of mangrove is prevailing across the whole Bai Chay Area. Mangroves in south-central Bai Chay Bay appear to be of lower eco-economic value than those on the northern side of Bai Chay Bay. And the loss of a small mangrove-dominated inlet near the Cai Lan Port site would have very limited ecological and economic effects.

In these terms, it can be concluded that some limited mangrove loss/removal associated with development of Cai Lan Port may be possible, if suitable mitigation measures are taken.

11.1.4 Port Development Related to Tourism Development

(1) Background

There are three or four major tourism center regions in Vietnam, the Ho Chi Minh City region including Vung Tau, Da Lat and Nha Trang, Da Nang and Hue, and Hanoi - Hai Phong - Quang Ninh.

These regions attract many tourists especially in recent years. In 1993 700,000 tourists visited, compared to 440,000 tourists in 1992, and it is estimated that the number of tourists will reach 1.0 million in 1995.

Regarding foreigners, visitors from Taiwan account for the greatest number. Many visitors also come from France, Japan, US, Great Britain, Hong Kong and Thailand. In order to accommodate more foreign tourists, who contribute to the state budget and activate the economy, the master plan study on National Development of Tourism is now being carried out by Vietnam Administration of Tourism.

In 1993, 250,000 tourists visited Quang Ninh province, mostly Bai Chay and Ha Long Bay. Ha Long Bay, with its 3000 islands rising from the clear, emerald waters of the Gulf of Token, attracts many visitors. These tiny islands are dotted with innumerable beaches and caves. The main routes for tourists are shown in Chapter 7 Figure 7-1-2. Also Bai Chay is the main transport hub and accommodation center. It has a dirt and pebble beach and a few climbable hills in the vicinity. As already mentioned in Chapter 6, several tourism development plans are now underway.

(2) Cai Lan Port Development and Tourism Development.

Both developments are a matter of economic policy of the Vietnamese government, and tourism development itself is not the matter we study. However, tourism development can be integrated with the port function, particularly in sea transportation of passengers or marina activities. Furthermore, tourist facilities are attractive and used for other purposes such as meetings and conference, and other industries could be expected to make use of these facilities. This will allow a higher grade infrastructure to be developed because of the higher efficiency in utilization.

Now in Japan the prevailing port development concept is the following: The port should not only have the function of transportation, but also the function to attract, gather many people and provide good atmosphere. Convention facilities located there can fully utilize the benefit of the water-front atmosphere.

So such facilities as marinas, convention facilities, parks and plazas and even commercial facilities are being constructed and operated adjacent to or at the center of ports.

In front of Bai Chay Bay, there stretches the magnificent vista of Ha Long Bay. Many small boats for tourists are mixing with fishing boats or anchoring along the coast line of Bai Chay. This means it will probably be necessary to construct a small harbor or a marina in the vicinity of Bai Chay.

As a conclusion, we could confirm that Bai Chay Bay is most suitable for port development while Ha Long Bay should be utilized for tourism. It is unlikely that there will be no interaction between them, on the contrary, it might soon be appropriate to make plans for constructing a tourist wharf with facilities for cruisers and large passenger ships.

11.1.5 Study Area

Considering the topographic condition, the development of such sectors as agriculture, fishery, industry, tourism, and existing development concepts of urban planning and infrastructure, it is preferable to adopt the whole area around Bai Chay Bay,(see Figure 11-1-1) as the Study Area.

Cai Lan Port development project will influence the other categories of development so that the long term development concept should deal, not only with port development, but also with broad socio-economic and environmental matters.

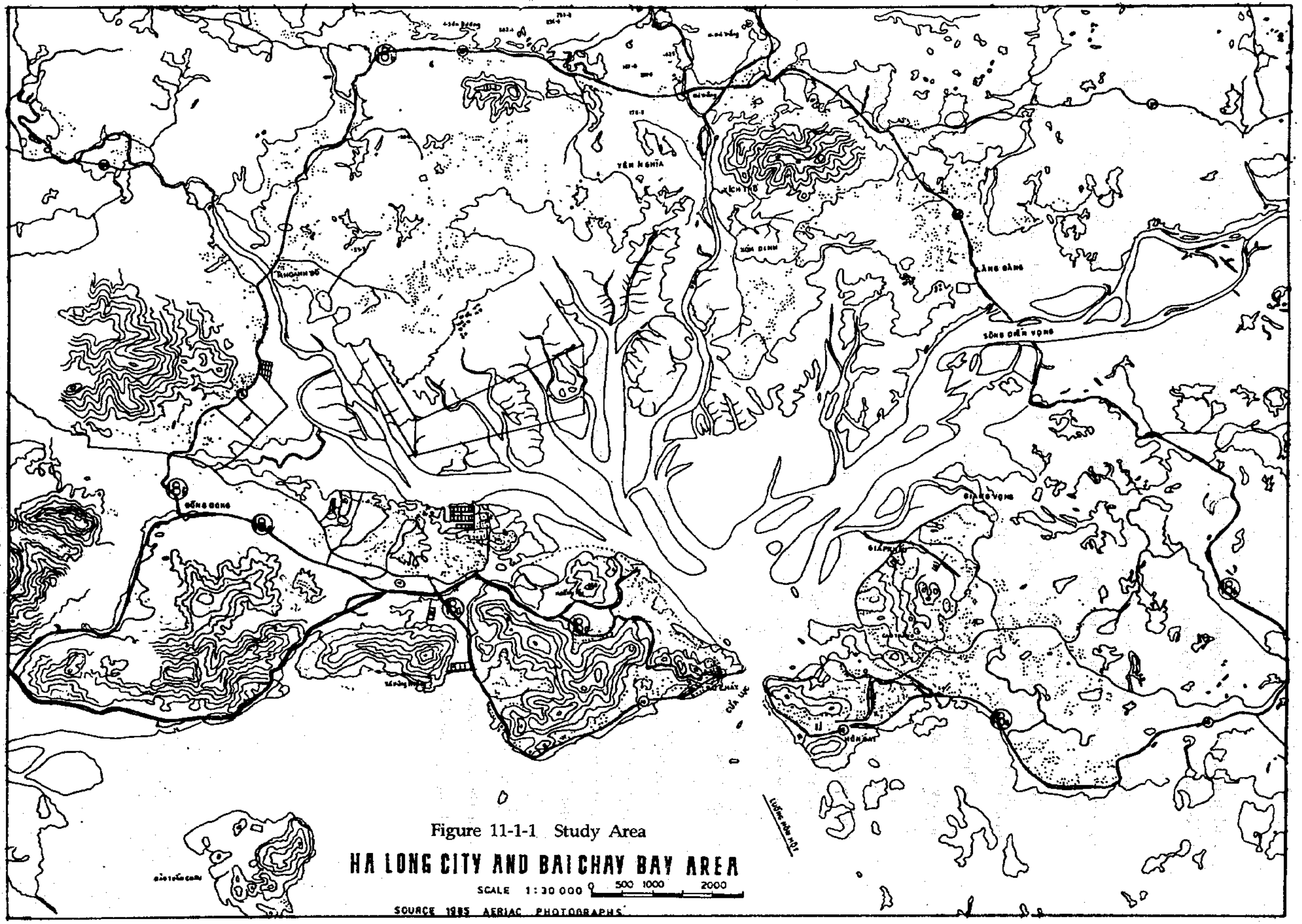


Figure 11-1-1 Study Area

HA LONG CITY AND BAI CHAY BAY AREA

SCALE 1:30 000 0 500 1000 2000

SOURCE 1985 AERIAC PHOTOGRAPHS

11.2 Conceptual Zoning Plan for Development of Bai Chai Bay Area

11.2.1 Principle of Zoning

(1) The Aim of Zoning

The aim of conceptual zoning is to make clear what functions can be considered in future and to determine what layout of each function would be most desirable from the point of view of integrated development of the area. Once the zoning plan is formulated, it will be easier to plan port development. If the location of each zone is set up with due consideration, there will be no interference between each function.

(2) Assumptions of Zoning

The study area is referred to as greater Bai Chai Bay, that is, the north limit is national road no. 18B and the southern limit is the latitude line along the south side of Tuan Chau Island. The eastern limit is the edge of Quang Ninh town and the western limit is almost at Dong Dang settlement.

In previous Chapter 9, JICA Study Team examined the master plan of Ha Long city, then made some modifications.

However, in order to grasp the development direction of the Port in the long term (including after 2010) apart from such detail planning as the master plan, the assuming of the development of greater Bai Chay Bay is done freely, based on the modified plan discussed in Chapter 9.

The function of each zone introduced in the plan is classified as follows.

- Port area including marina and an area for tourism purposes
- Residential and commercial areas including a business area
- Heavy and light industrial area
- Agricultural and aquacultural area
- Reserve or natural areas including mangrove.

The total planning population of the area is approximately 500,000. The types of industries to be located in the area are:

- Cement factory
- Brick, tile and ceramic factory

- Steel industry including smelting bar manufacturing, fabrication
- Chemical factory including fertilizers, coal and petro-chemical industry
- Construction material
- Agroindustry such as wheat mill, beer, sugar, starch and food processing
- Light industry such as textile,sewing,furniture

The location of EPZs is the same as the above said modified plan.

The principal transportation network is as follows. South of national road No. 18B a new trunk road connecting both the east and west with national road No. 18 will be planned. This will form a circular network. Over Cua Luc Strait, a new high bridge or a tunnel will be constructed under which large ships can pass. Also, over Dien Vong River a new bridge will be constructed on the basement of the existing jetties.

Almost all existing roads will be improved to meet the future traffic demand. The existing railway will be extended to the port area.

The port zoning principles are as follows:

- Water area and mangrove forest will be reserved as much as possible in order to maintain the present hydrological condition, and to prevent water pollution.
- Hong Gai coal handling port and B-12 oil handling port will be relocated.

(3) Selection of Port Development Location

From the view point of only the space and area where port facilities can be constructed, there are four possible locations to select from as shown in Figure 11-2-1.

Alternatives 1 and 2 are in Bai Chay Bay and Alternatives 3 and 4 arein Ha Long Bay. Each alternative has its own demerits and merits. Particulars of these alternatives are as follows.

Alternative 1 has a relatively long berth alignment and is well protected from wind and waves. Alternative 2 also has a long berth alignment, however the land area behind berth is a small and also it is not in a good position to connect to the Hanoi region because there is as yet no bridge over Cua Luc strait.

Alternative 3 will destroy the Bai Chay coastline which is an important tourism feature. Furthermore an enormous volume of dredging would be required because of its shallow depth. Alternative 4 has a space constraint as there is no room to construct a large port and the area in front of the berth line is too deep to reclaim land cost-effectively.

The alternatives are evaluated in Table 11-2-1. The result of the evaluation shows that Alternative 1 is the most suitable plan.

Table 11-2-1 Evaluation of Alternative Locations

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Environmental Impact	○	△	×	×
Berth length	○	○	△	×
Port Area	○	○	△	×
Channel	△	△	×	○
Future expansion	○	○	△	×
Cost	○	△	×	○
Access to Hanoi	○	×	○	×
---------------	----------	----------	----------	--------
Total evaluation	○	△	×	×

○ : Good

△ : Normal

× : Poor

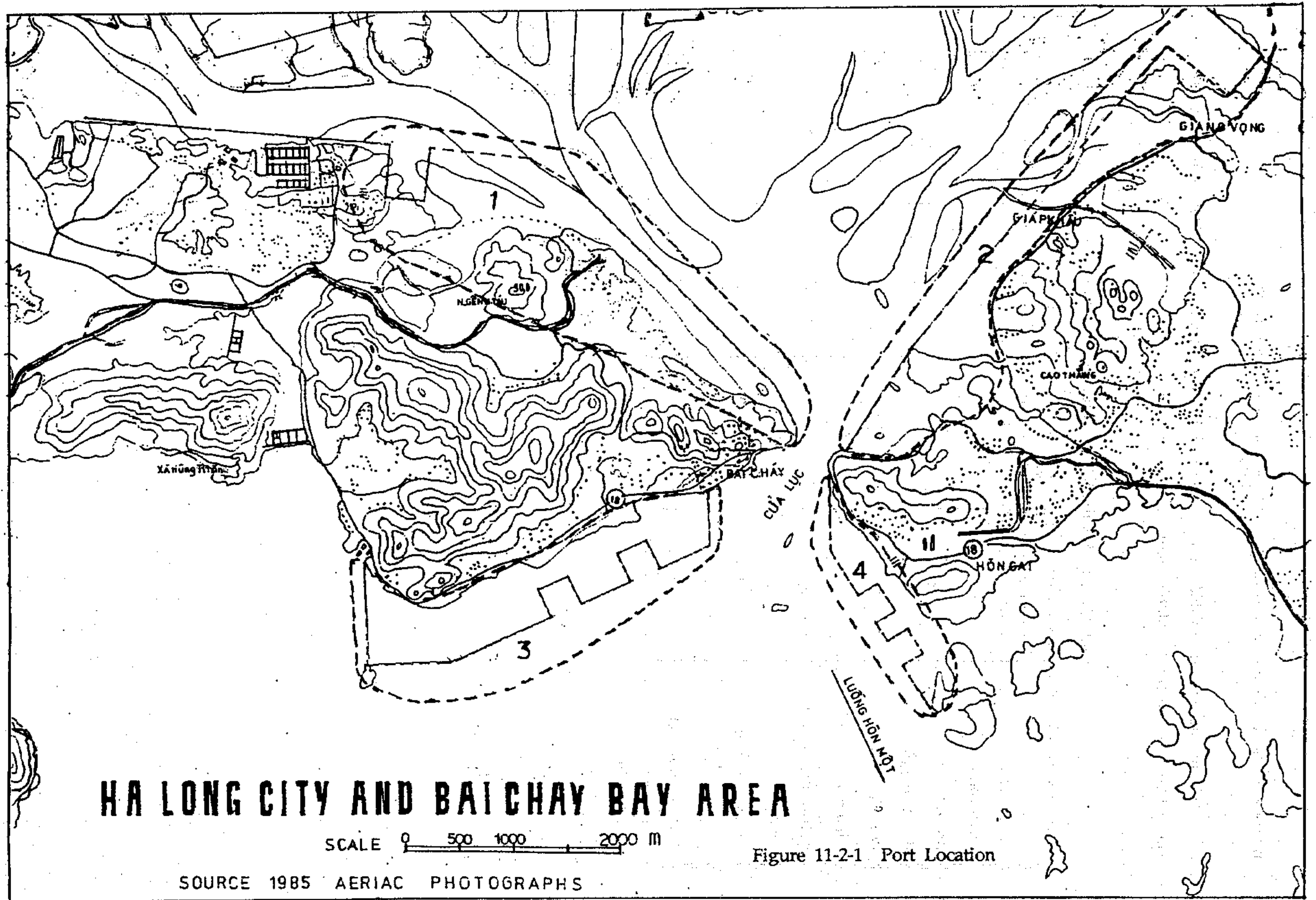


Figure 11-2-1 Port Location

11.2.2 Alternative Plans

(1) Mangrove in Relation to Zoning Plan

It is possible and useful in planning terms to classify the mangrove stands in Bai Chay Bay into several zones. These are shown in Figure 11-2-2. The status of the zones reflects estimated ecological-economic importance on the basis of preliminary field work.

Table 11-2-2 Mangrove Zones and their Status

Zone	Status	
A	Medium plus	(M+)
B	Medium plus	(M+)
C	High minus	(H-)
D	High minus	(H-)
E	Medium minus	(M-)
F	Medium minus	(M-)
G	Low	

According to the classification there are three basic alternatives. In the first case, all mangrove zones except zone G will be reserved. The second case is to reserve zones C and D. The third case is to reserve zones A and B.

(2) Alternative Plans

Based on the classifications and the alternatives for protection, four alternative zoning plans can be set forth. These zoning plans are shown in Figures 11-2-3 to 11-2-6. These alternative plans conserve the mangrove area to varying degrees.

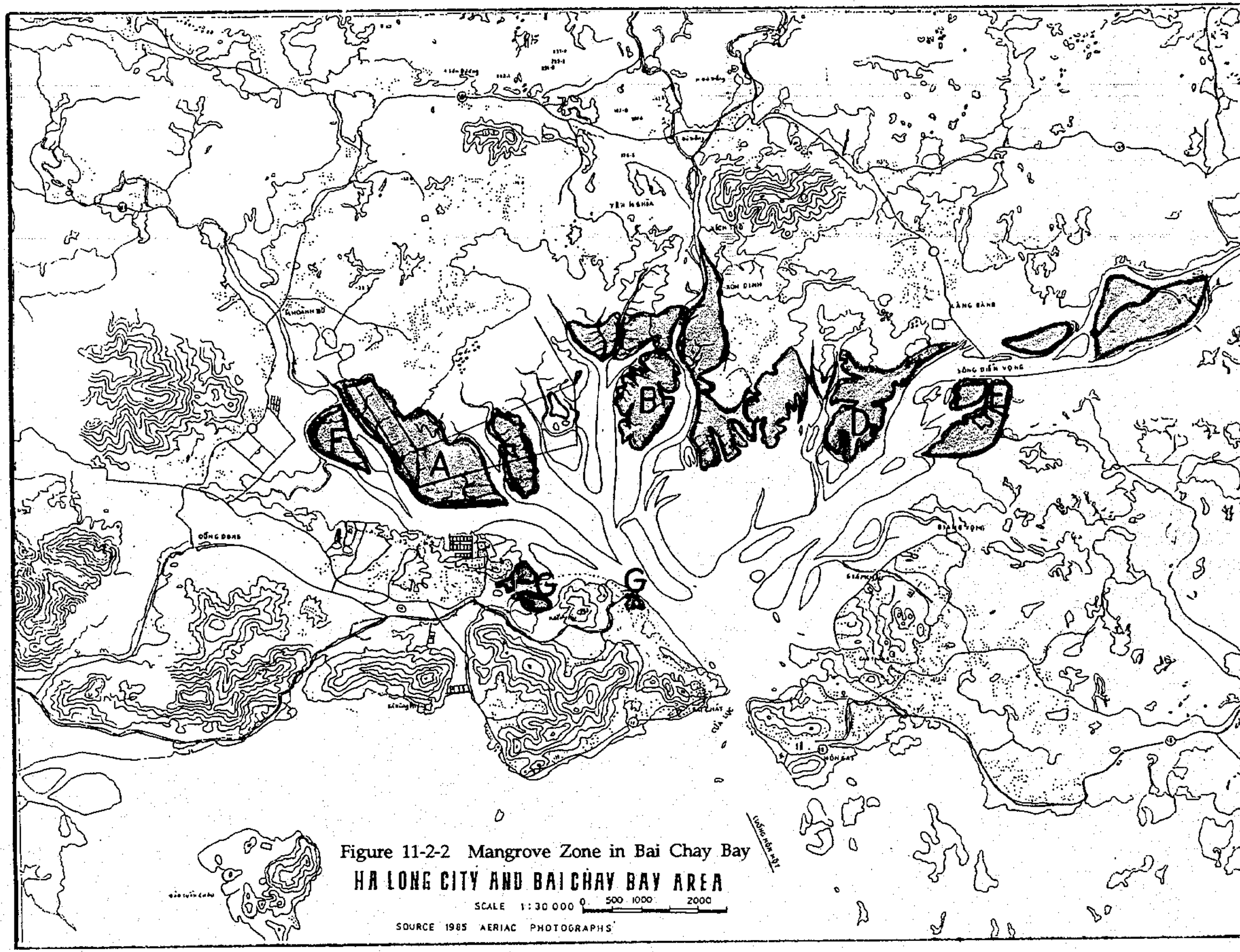


Figure 11-2-2 Mangrove Zone in Bai Chay Bay

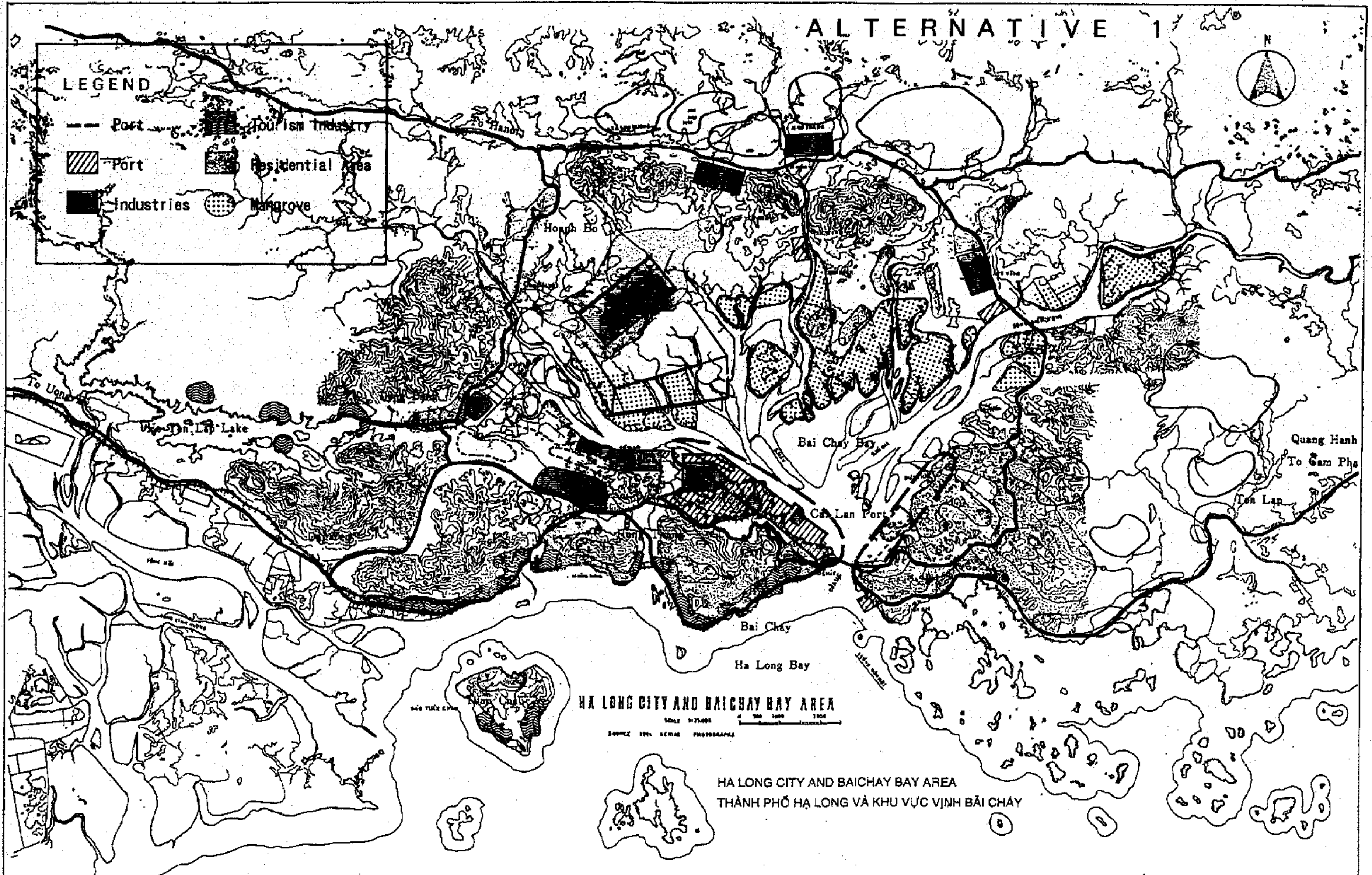


Figure 11-2-3 Zoning Plan Alternative 1

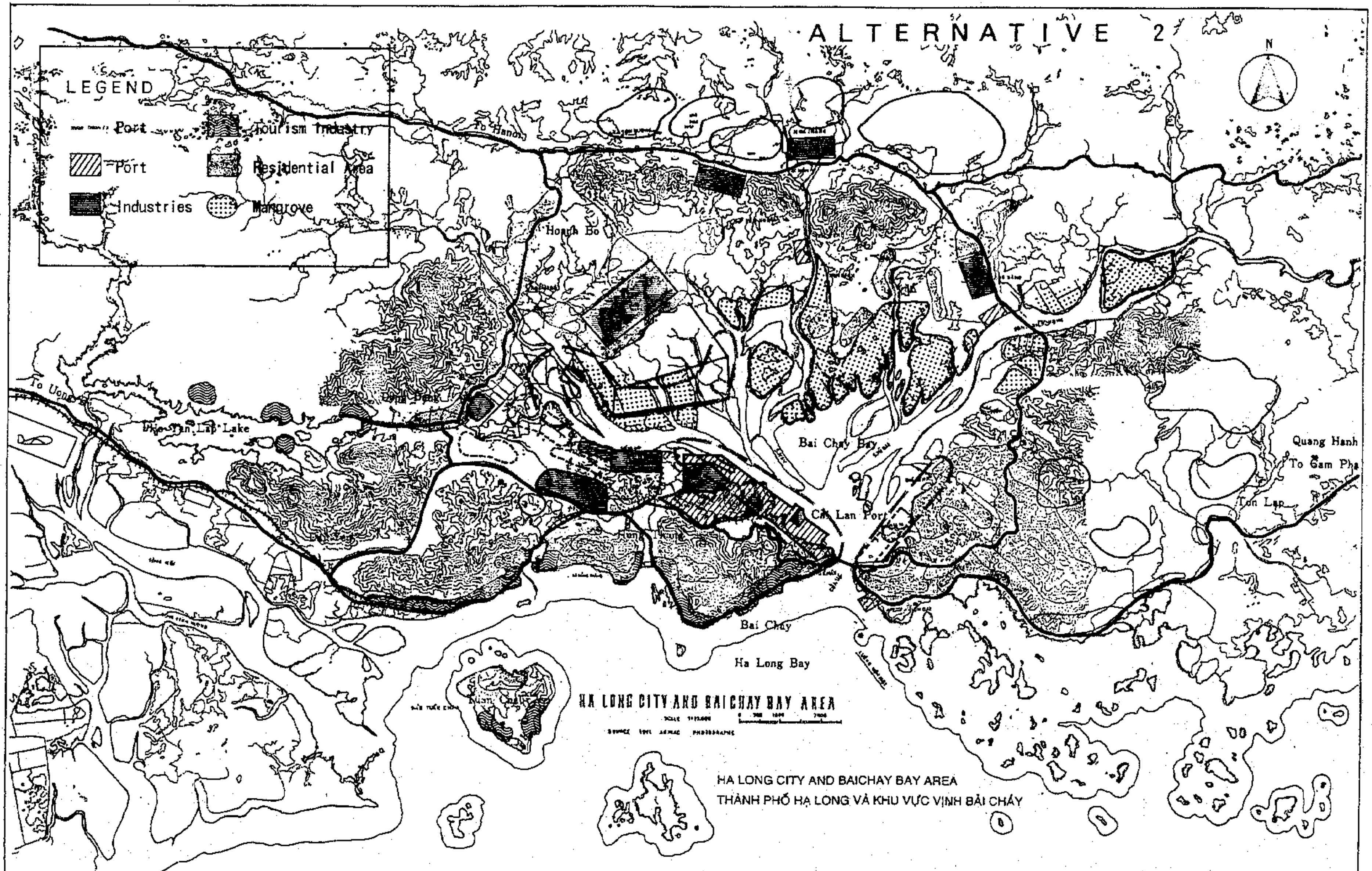


Figure 11-2-4 Zoning Plan Alternative 2

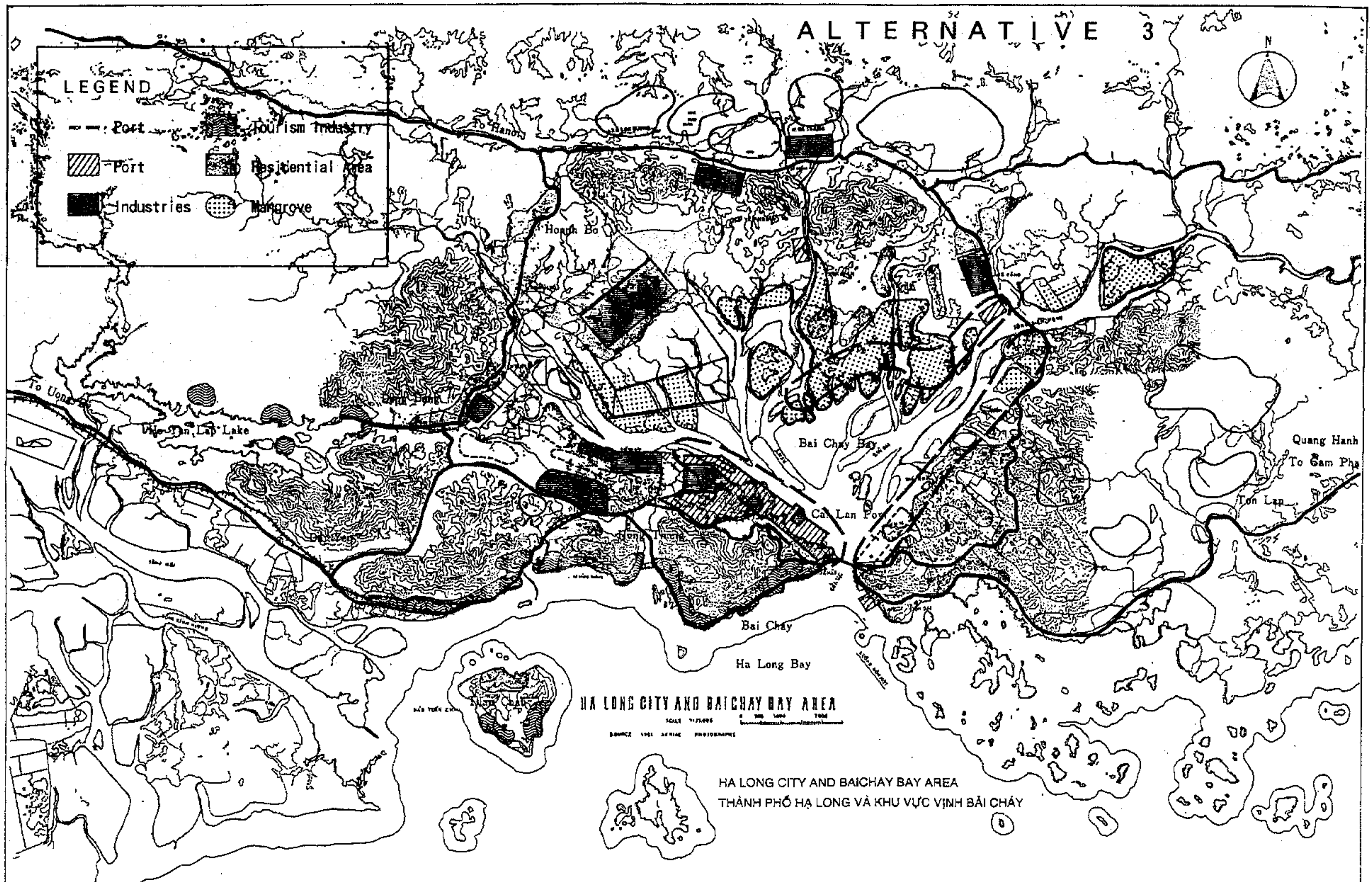


Figure 11-2-5 Zoning Plan Alternative 3

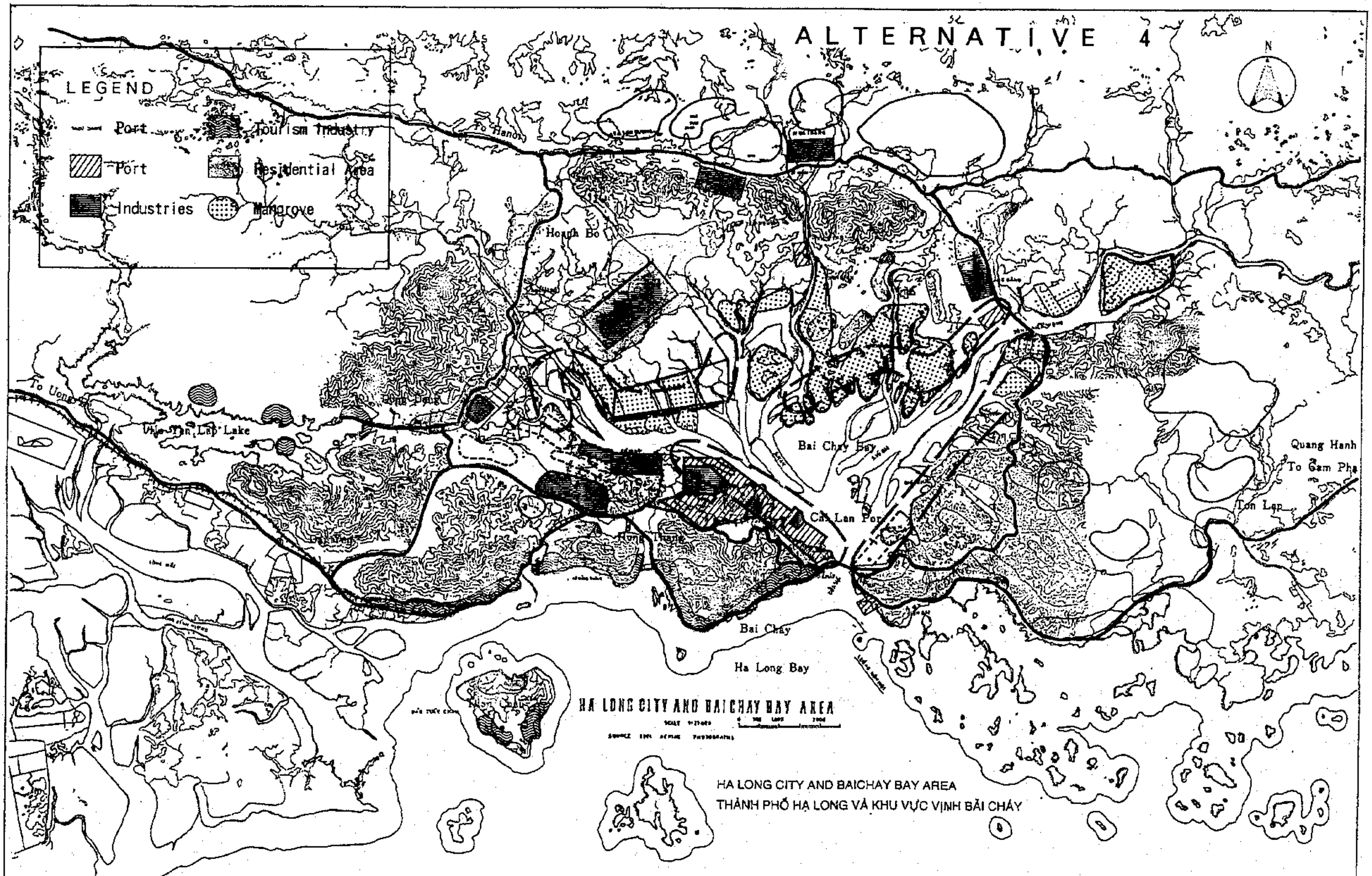


Figure 11-2-6 Zoning Plan Alternative 4

Alternative 1 protects mangrove to the highest degree, only removing zone G. Alternative 4 is the most fully industrial development with the smallest amount of mangrove reserved (zones A and B). Alternative 2 is between 1 and 4 and would reserve zones C and D. Alternative 3, similar to alternative 4 would reserve zones A and B. The alternatives are evaluated in Table 11-2-3.

Table 11-2-3 Evaluation of Alternative Zoning Plans

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Environmental Impact	○	△	△	×
Industrial Development	×	○	○	○
Cost	○	△	△	×
Economic Performance	×	○	○	○
Future Expansion	○	○	○	×
Comprehensive Evaluation	△	○	○	×

○ : Good

△ : Normal

× : Poor

The result of evaluation indicates that Alternatives 2 and 3 can be recommended. Comparing Alternatives 2 and 3, if the intention is to emphasize industrial development then Alternative 3 would be most appropriate.

11.3 Planning Criteria

11.3.1 General

Technical standards for constructing ports are divided into 3 aspects, that is, planning standards, design standards and implementation standards including technical regulations on environment protection and safety.

These standards are derived from the natural and socio-economic conditions of the country based on theoretical background. Therefore they may be slightly different from country to country, even if the same theory is adopted.

Vietnam, similar to other countries, has set forth the technical standard for construction of ports as a Ministerial Regulation on August 3rd in 1992. This has been promulgated as "the Engineering Design Standards of Sea-berths" (hereinafter Vietnamese standards), with the registration number of 22 TNC 207-92 by Ministry of Transport and Communications.

This study will be carried out based on these Vietnamese standards as much as possible.

Nevertheless, as stated in General Principles Section 1.1 of Vietnamese standards, where there is no corresponding Vietnamese or Ministerial standard, foreign standards shall be referred to, and in this case the Japanese Technical Standards for port and habour facilities will be used.

11.3.2 Ship Size and Berth

The Vietnamese standards state in General Principles Section 1.4 that "The preliminary data for the berth construction design, given in the technical analyses of the design shall include:

- The length of the berth
- The bottom level of the berth
- Crown height of the berth
- Designed capacity of berth
- Design ship - type
- Peculiar requirements of the berth".

Usually, information about the ship size entering the planning port is not enough to allow analysis so a general standard of ship size will be adopted. In Vietnam the Russian standard of ship size prevails. Ship size determines berth length and depth. The Russian standard of ship size is different from the Japanese one. A comparison of ship dimensions under the two standards is shown in Table 11-3-1, and berth lengths and depths are shown in Table 11-3-2.

Table 11-3-1-(1) Ships Dimensions

DWT	Cargo ship					
	Russian standard			Japanese standard		
	Overall length	Moulded breadth	Full load draft	Overall length	Molded breadth	Full load draft
700	55 m	8.6 m	3.5 m	58 m	9.7 m	3.7 m
1,000	64	9.8	3.9	64	10.4	4.2
2,000	86	12.2	4.7	81	12.7	4.9
3,000	98	13.6	5.4	92	14.2	5.7
5,000	116	15.6	6.5	109	16.4	6.8
8,000	134	13.8	7.8	126	18.7	8.0
10,000	143	19.2	8.2	137	19.9	8.5
15,000	165	21.8	9.2	153	22.3	9.3
30,000	195	25.5	11.0	186	27.1	10.9
40,000	212	27.5	12.0	201	29.4	11.7
50,000	-	-	-	216	31.5	12.4
70,000	-	-	-	205	33.8	13.4

Table 11-3-1-(2) Ships Dimensions

DWT	Container ship					
	Russian			Japanese		
	Overall length	Moulded breadth	Full load draft	Overall length	Moulded breadth	Full load draft
20,000	-	-	-	201 m	27.1 m	10.6 m
21,800	228 m	29.0 m	10.5 m	-	-	-
30,000	-	-	-	237	30.7	11.6
34,000	267 m	32.2	11.7	-	-	-
40,000	263	33.5	12.4	-	-	-
50,000	280	35.8	13.0	-	-	-

Table 11-3-2-(1) Berth Length and Depth

DWT	Cargo ship					
	Russian			Japanese		
	Berth length	Water depth of berth	Water depth of basin	Berth length	Water depth of berth	Water depth of basin
700	65 m	4.0 m	4.0 m	70 m	4.5 m	4.5 m
1,000	75	4.2	4.2	80	5.0	5.0
2,000	100	5.4	5.4	100	5.5	5.5
3,000	110	6.1	6.1	110	6.5	6.5
5,000	130	7.3	7.3	130	7.5	7.5
8,000	150	8.4	8.4	160	9.0	9.0
10,000	160	9.1	9.1	170	10.0	10.0
15,000	185	10.2	10.2	190	11.0	11.0
20,000	-	-	-	(210)	(11.0)	(11.0)
30,000	220	12.2	12.2	240	12.0	12.0
40,000	240	13.3	13.3	260	13.0	13.0
50,000	-	-	-	260	14.0	14.0
70,000	-	-	-	300	15.0	15.0

Note:( ) the former Japanese Standard

Table 11-3-2-(2) Berth Length and Depth

DWT	Container ship					
	Russian			Japanese		
	Berth length	Water depth of berth	Water depth of basin	Berth length	Water depth of berth	Water depth of basin
20,000	-	-	-	250 m	12.0 m	12.0 m
21,800	250 m	11.6 m	11.6 m	-	-	-
30,000	-	-	-	300	13.0	13.0
34,000	290	13.0	13.0	-	-	-
40,000	-	-	-	330	14.0	14.0
50,000	-	-	-	350	15.0	15.0

Berth length and water depth of the berth will be determined by comparing the above figures.

11.3.3 Channel

As far as channel depth and width are concerned, the Japanese Standards are simpler than the Vietnamese. The Japanese Standards stipulate the following:

(1) Width of waterways

Except for special waterways such as waterways with a remarkably large traffic volume, waterways crossed by sailing ships or waterways for very large ships,the width shall be decided as per Table 11-3-3.

Table 11-3-3 Width of Waterways

Length of Waterways	Condition of Navigation	Width
Relatively long waterways	Waterways where ships pass each other frequently	2L
	Waterways where ships pass each other infrequently	1.5L
Waterways other than the above	Waterways where ships pass each other frequently	1.5L
	Waterways where ships pass each other infrequently	L

Note: L is overall length of the ship

This means that the channel must be at least as wide as the overall length of the ship. In most countries, particularly where the channel is suffering from siltation problems, channel width is less than one ship length of the planned ship size. Mud conditions must then be considered in estimating keel clearance.

(2) Depth of the Channel

According to the Japanese standard, the depth of waterway should be a value no less than the full load draft of the ship, in consideration of the extent of oscillatory motion of the ship due to natural conditions such as waves, winds and tidal currents and the trim. In this case "a proper depth" means a depth obtained by an allowance added to the depth of a basin as specified in Table 11-3-2. There is no more detailed method written in the Japanese standards.

(3) Adoption of Planning Criteria for Channel

Considering the condition of the channel at Cai Lan Port, and the Vietnamese Standard which is stipulated in more detail than the Japanese Standard, we prefer to adopt the Vietnamese Standard, "Designed water level - water depth of water areas and access channels of port and ship repair yard" in this Study.

11.4 Planning Ship Size

11.4.1 Bulk Carrier

Most of the cargo transported through Cai Lan Port is break bulk or bulk cargo. Therefore, it is important to examine the dimension of the bulk cargo ship.

Figure 11-4-1 shows the tonnage tendency of bulk carrier in the world. It can be said that recently the tonnage between 10,000 DWT and 40,000 DWT is decreasing, on the other hand over 40,000 DWT ships are increasing and becoming the dominant ship size.

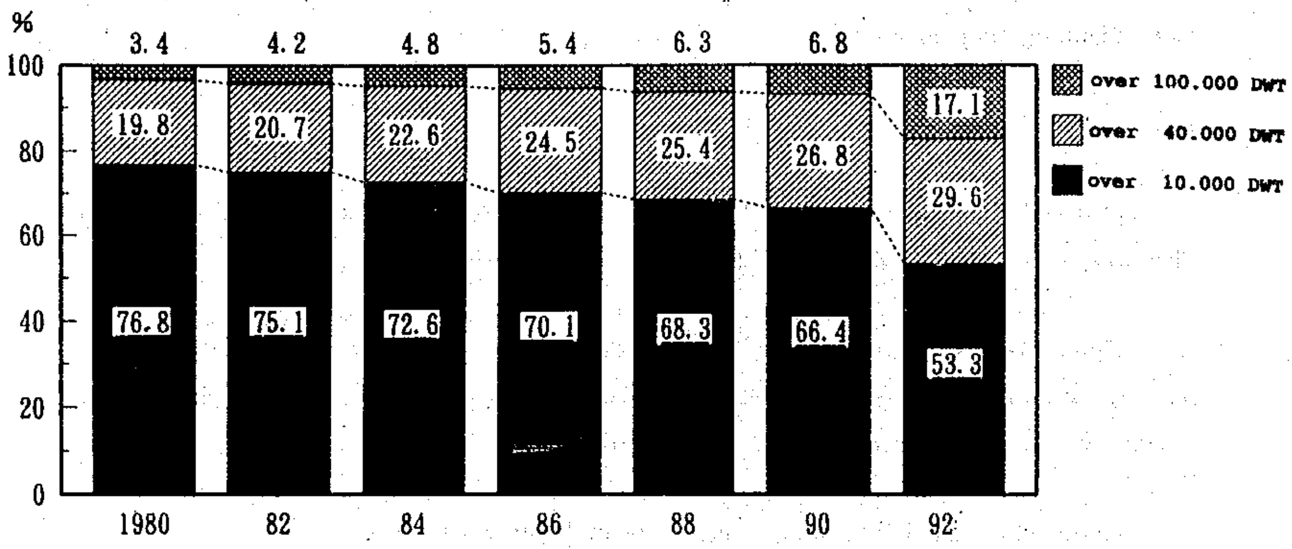
Figure 11-4-2 shows the draft tendency of bulk carriers in Japan.
One - fourth of bulk carries have a draft over 15 m and more than 50% of them are over 12m.

Table 11-4-1, Figure 11-4-3 ~ 5 are made by summing up the data from Lloyd's Register of ships (1988) and Japanese ship Details (1987).

It also shows that 15,000 DWT to 50,000 DWT ship size is the dominant class throughout the world for bulk carriers.

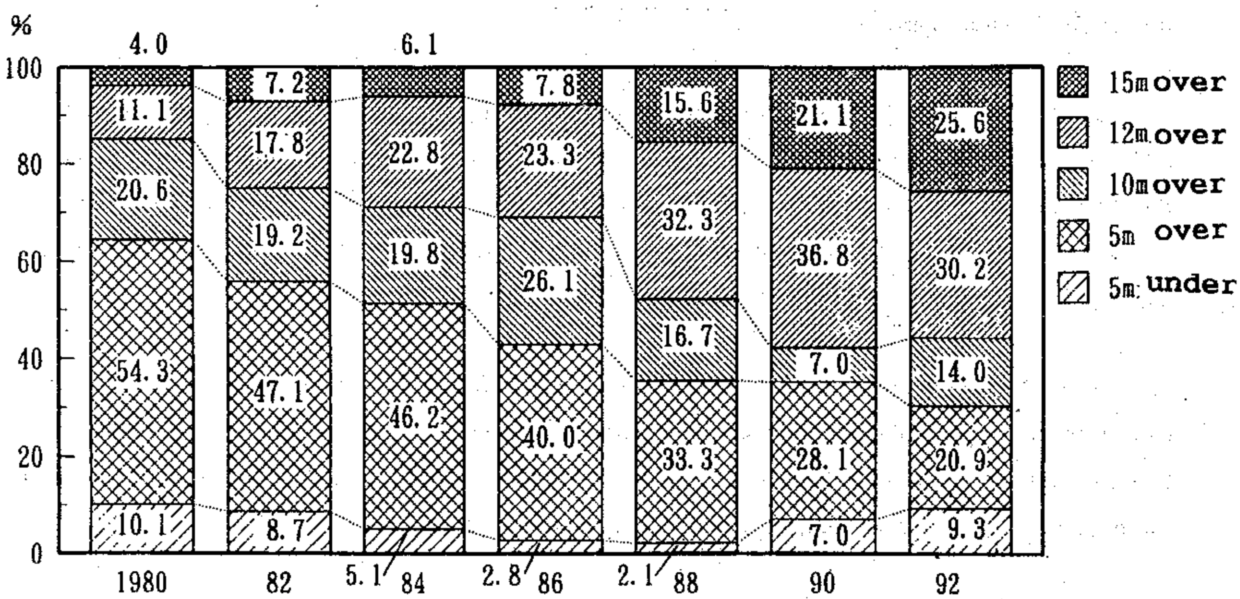
Table 11-4-2 shows ship building number and tonnage by year. It is apparent that 30,000 DWT ~ 50,000 DWT bulk carrier is the dominant class both in number and tonnage in 1991 and the average ship size of 30,000 DWT ~ 50,000 DWT class was 41,400 DWT. In 1992 it was 41,250 DWT; and total average was also 37,700 DWT. Over 50,000 DWT class was less than 30,000 DWT ~ 50,000 class both in number and tonnage.

From the point view of ship size prevailing in the future we can chose 40,000 DWT bulk carrier as the representative ship size for planning. However, taking into consideration the tendency for ship size to increase, it might be possible to adopt 50,000 DWT class bulk carrier for maximum ship size in long term planning, if economic circumstances allow.



Note : Excluding under 10,000 DWT vessels
Source : World Bulk Fleet

Figure 11-4-1 The Tonnage Tendency of Bulk Carrier in the World
(each year in January 1st)



Note : Excluding under 100 GWT
Source : Statistics of Commercial Fleet in Japan
Ship owner's Association

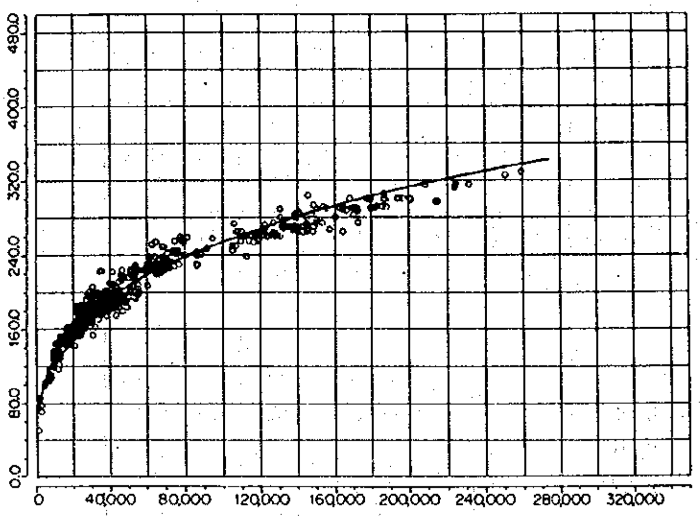
Figure 11-4-2 The Draft Tendency of Bulk carrier in Japan
(each year in July 1st)

Table 11-4-1 Distribution of Ships by type and DWT

Unit: Ship Number

DWT \ Type	Container		Bulk Carrier		General Cargo ship	
	Number of Data	Composition	Number of Data	Composition	Number of Data	Composition
0- 499	0	0	0	0	271	0.0401
500- 999	1	0.0012	4	0.0012	609	0.09
1.000- 1.999	10	0.0121	4	0.0012	1258	0.1859
2,000- 2,999	18	0.0217	7	0.0021	626	0.0925
3.000- 4,999	37	0.0446	4	0.0012	1009	0.1491
5,000- 9,999	181	0.2181	36	0.0109	1434	0.2119
10,000- 14,999	82	0.0988	117	0.0353	622	0.0919
15,000- 29,999	241	0.2904	1271	0.3834	931	0.1376
30,000- 49,999	230	0.2771	1067	0.3219	6	0.0009
50,000- 99,999	30	0.0361	599	0.1807	-	-
100,000-199,999	-	-	194	0.0585	-	-
200,000-	-	-	12	0.0036	-	-
Total	830	1.0000	3,315	1.0000	6766	1.0000

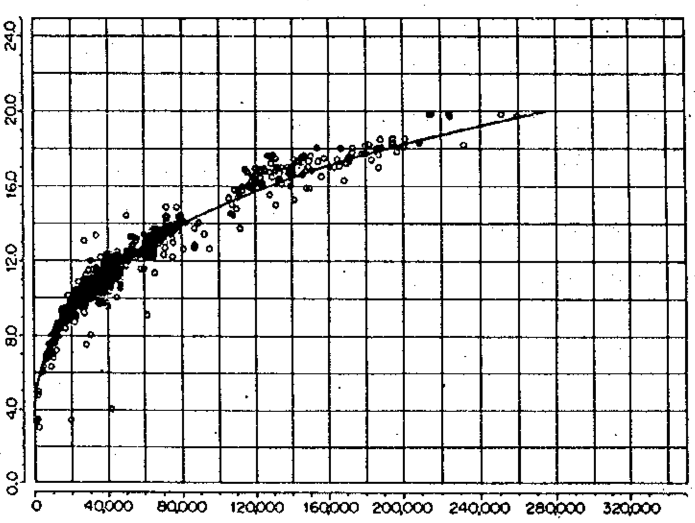
Source: Technical Note of the Port and harbour Research Institute
Ministry of Transport, Japan No.652



Number of Data	3295
Deadweight Ton	(T)
Maximum	259588
Minimum	825
Length of Overall	
Maximum	328.58
Minimu	49.97
Correlation Formula	
Log Loa= 0.926 + 0.296 log DW	
Standard Deviation	0.021
Correlation Coefficient	0.968

Source: Technical Note of the Port and harbour Research Institute
Ministry of Transport, Japan No.652

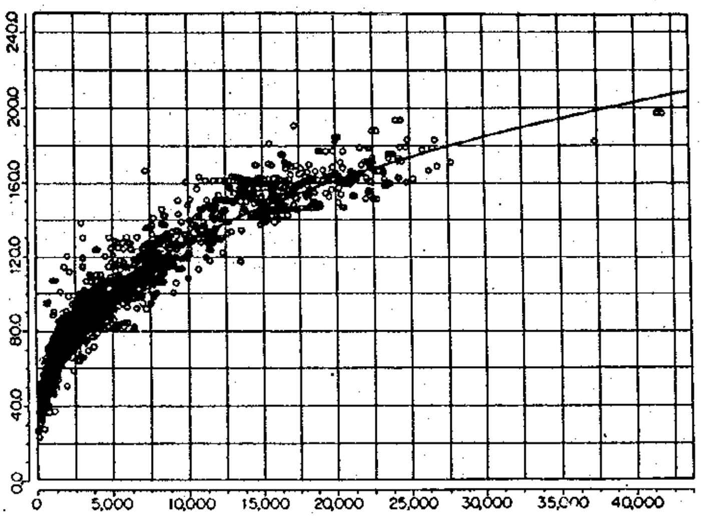
Figure 11-4-3-(1) Bulk Carrier, Relation between DWT and Ship Length Overall



Number of Data	3312
Deadweight Ton	(T)
Maximum	259588
Minimum	825
Full Draft	(m)
Maximum	19.84
Minimum	3.00
Correlation Formula	
Log MW =-0.267 + 0.288 log DW	
Standard Deviation	0.022
Correlation Coefficient	0.963

Source: Technical Note of the Port and harbour Research Institute
Ministry of Transport, Japan No.652

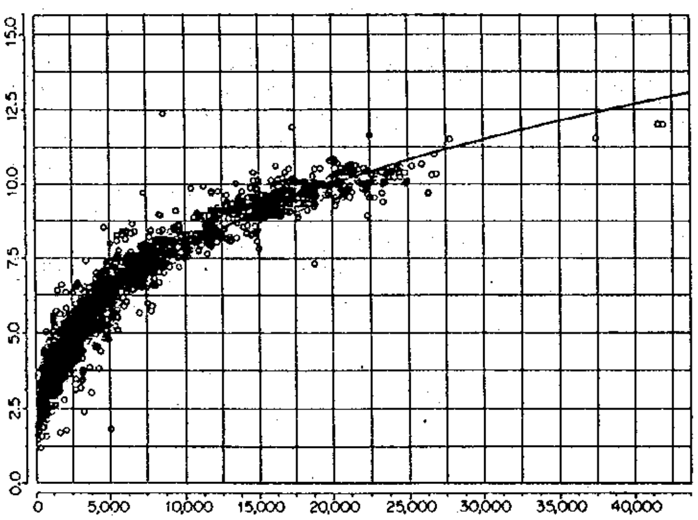
Figure 11-4-3-(2) Bulk Carrier, Relation between DWT and Full Draft



Number of Data 6187
Deadweight Ton (T)
Maximum 41949
Minimum 39
Length of Overall (m)
Maximum 197.72
Miniau 22.61
Correlation Formula
Log Loa= 0.799 + 0.328 log DW
Standard Deviation 0.042
Correlation Coefficient 0.965

Source: Technical Note of the Port and harbour Research Institute
Ministry of Transport, Japan No.652

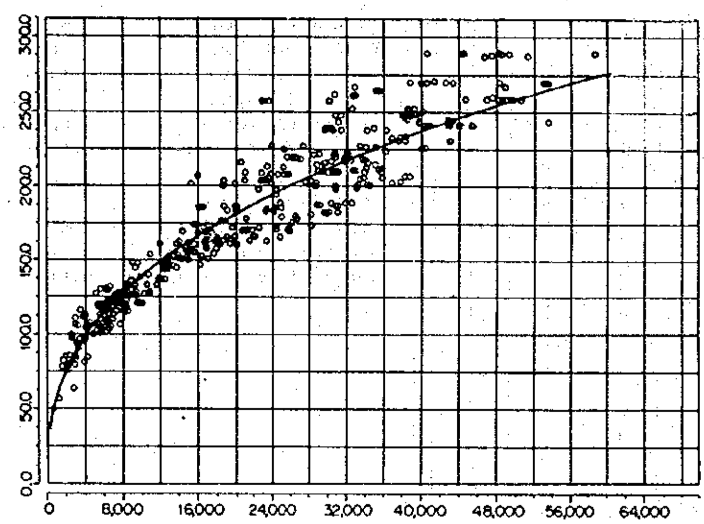
Figure 11-4-4-(1) General Cargo Ship, Relation between DWT and Ship Length Overall



Number of Data 6409
Deadweight Ton (T)
Maximum 41949
Minimum 39
Full Draft (m)
Maximum 15.03
Minimum 1.19
Correlation Formula
Log MW =-0.464 + 0.341 log DW
Standard Deviation 0.047
Correlation Coefficient 0.961

Source: Technical Note of the Port and harbour Research Institute
Ministry of Transport, Japan No.652

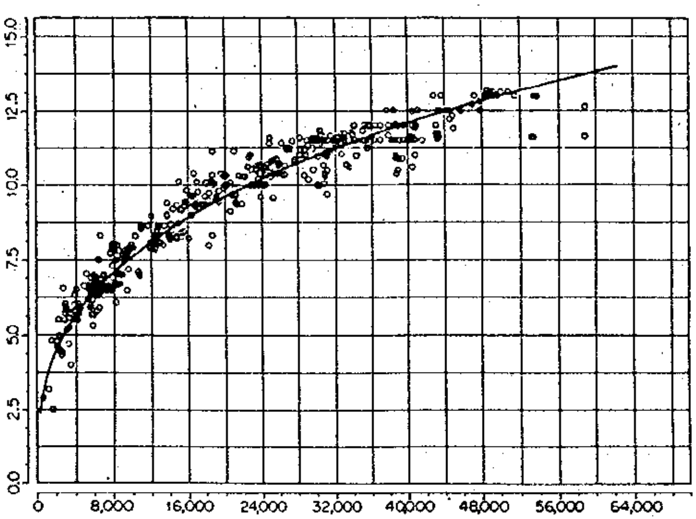
Figure 11-4-4-(2) General Cargo Ship, Relation between DWT and Full Draft



Number of Data 825
Deadweight Ton (T)
Maximum 58943
Minimum 659
Length of Overall
Maximum 289.57
Minimu 49.66
Correlation Formula
Log Loa= 0.612 + 0.383 log DW
Standard Deviation 0.038
Correlation Coefficient 0.963

Source: Technical Note of the Port and harbour Research Institute
Ministry of Transport, Japan No.652

Figure 11-4-5-(1) Container Ship, Relation between DWT and Ship Length Overall



Number of Data 829
Deadweight Ton (T)
Maximum 58943
Minimum 659
Full Draft (m)
Maximum 13.20
Minimum 2.50
Correlation Formula
Log MW =-0.450 + 0.333 log DW
Standard Deviation 0.034
Correlation Coefficient 0.962

Source: Technical Note of the Port and harbour Research Institute
Ministry of Transport, Japan No.652

Figure 11-4-5-(2) Container Ship, Relation between DWT and Draft

Table 11-4-2 Ship building number and tonnage by year

Bulk carrier																	
Size	10,000- 29,999		30,000 - 49,999		50,000 - 69,999		70,000 - 149,999		150,000 - 199,999		200,000- 259,999		260,000-		Total		%
Year	No	1000 DWT	No	1000 DWT	No	1000 DWT	No	1000 DWT	No	1000 DWT	No	1000 DWT	No	1000 DWT	No	1000DWT	
70 before	176	5,865	91	3,406	37	2,094	19	1,650	1	160	0	0	0	0	324	13,175	6.6
71	93	2,129	32	1,115	14	830	12	1,307	2	319	0	0	0	0	153	5,700	2.86
72	119	2,753	44	1,509	22	1,302	15	1,543	2	314	0	0	0	0	202	7,421	3.72
73	99	2,381	42	1,469	30	1,772	24	3,766	1	165	0	0	0	0	196	9,553	4.79
74	98	2,199	44	1,630	33	1,903	18	1,720	1	156	0	0	0	0	194	7,608	3.81
75	90	1,882	45	1,583	29	1,669	19	1,823	2	322	0	0	0	0	185	7,279	3.65
76	145	3,155	60	2,182	39	2,268	32	3,188	0	0	0	0	0	0	276	10,811	5.42
77	217	4,871	93	3,436	31	1,880	4	2,206	2	319	0	0	0	0	367	12,712	6.37
78	135	2,989	62	2,337	22	1,293	15	1,490	0	0	0	0	0	0	234	8,109	4.06
79	70	1,509	28	1,030	10	590	7	690	0	0	0	0	0	0	115	3,819	1.91
80	66	1,401	30	1,069	20	1,175	4	392	1	191	0	0	0	0	121	4,228	2.12
81	93	2,102	41	1,480	51	3,192	30	3,695	2	383	0	0	0	0	217	10,852	5.44
82	76	1,684	84	3,215	63	3,918	32	3,557	3	544	2	411	1	264	261	13,593	6.81
83	60	1,311	94	3,531	42	2,628	18	1,678	3	524	2	442	0	0	219	10,114	5.07
84	118	2,883	166	6,341	55	3,499	14	1,489	7	1,209	0	0	0	0	360	15,421	7.73
85	100	2,453	169	6,608	18	1,123	7	799	13	2,317	2	466	0	0	309	13,766	6.9
86	63	1,469	73	2,870	26	1,634	10	1,396	15	2,670	2	475	1	359	190	10,873	5.45
87	20	466	31	1,238	27	1,731	6	801	9	1,624	2	424	0	0	95	6,284	3.15
88	4	61	8	291	15	980	3	281	4	742	3	690	0	0	37	3,045	1.53
89	15	360	22	871	34	2,250	7	948	5	851	5	1,046	0	0	88	6,326	3.17
90	22	496	23	957	30	1,975	32	4,272	4	716	5	1,074	0	0	116	9,490	4.76
91	13	292	23	952	9	581	18	1,974	3	519	2	513	0	0	68	4,831	2.42
92	24	524	16	660	4	245	16	2,193	2	333	1	204	1	318	64	4,477	2.24
Total	1,916	45,235	1,321	49,780	661	40,550	382	42,858	82	14,378	26	5,745	3	941	4,391	199,487	100

Source: Lloyd's Maritime Data Net

11.4.2 Container ship

As regarding container ships in Vietnam, at the moment there is no direct shipping route to North America nor to Europe.

Both in Sai Gon and Hai Phong Port there are feeder service routes to Sai Gon - Hai Phong - Hong Kong - Taiwan - Korea - Japan and Hai Phong - Sai Gon - Singapore.
The list of container service routes and shipping companies now operating in Vietnam is as follows.

Table 11-4-3 Container Service Shippers in Vietnam

Shipper's name	Ship's name	Year built	Ship Capa-city	Calling Ports	Service days
Gemar-trans	TRICOLOR STAR OCEAN SKY	1984 1975	160 TEU 154 TEU	SP-HCM-SP HCM-HP-HK-KL-HCM	9 15
EAC-Saigon Shipping	ALICE RIIS MARINE RIIS SAIGON GATE MIMOSA	1987 1987 ? 1967	62 TEU 61 TEU 122 TEU 38 TEU	HCM-HK-KL-HCM HCM-HK-KL-HCM SP-HCM-SP SP-HCM-SP	7 7 5 5
Heung-A Shipping	CARGO BOY	1980 1988	200 TEU 280 TEU	PU-KL-HCM-PU PU-KL-HCM-PU	10 10
PPS Internatinal	STRAITS PRIDE	1971	160 TEU	SP-HCM-SP	10
Regional Container Line	BUNGA BINDANG	1976	150 TEU	SP-HCM-SP	7
Spore Soviet	IZYESTIA A.GONCHAROV I.YAMBURENKO K.JESPERSON	? ? ? ?	320 TEU 270 TEU 270 TEU 320 TEU	SP-HP-SP SP-HP-SP SP-HCM-BKK-SP SP-HCM-BKK-SP	10 10 10 10
Foong Sun Shipping	SEJATI PRATAMA	?	Conven.	SP-HCM-SP	10

Note: SP:Singapore HK:Hong Kong HCM:Ho Chi Minh HP:Hai Phong
KA:Kaohsiung KL:Keelung PU:Pusan BKK:Bangkok

Source: Data in the Study on transport development in the northern part of Viet Nam (JICA in 1994)

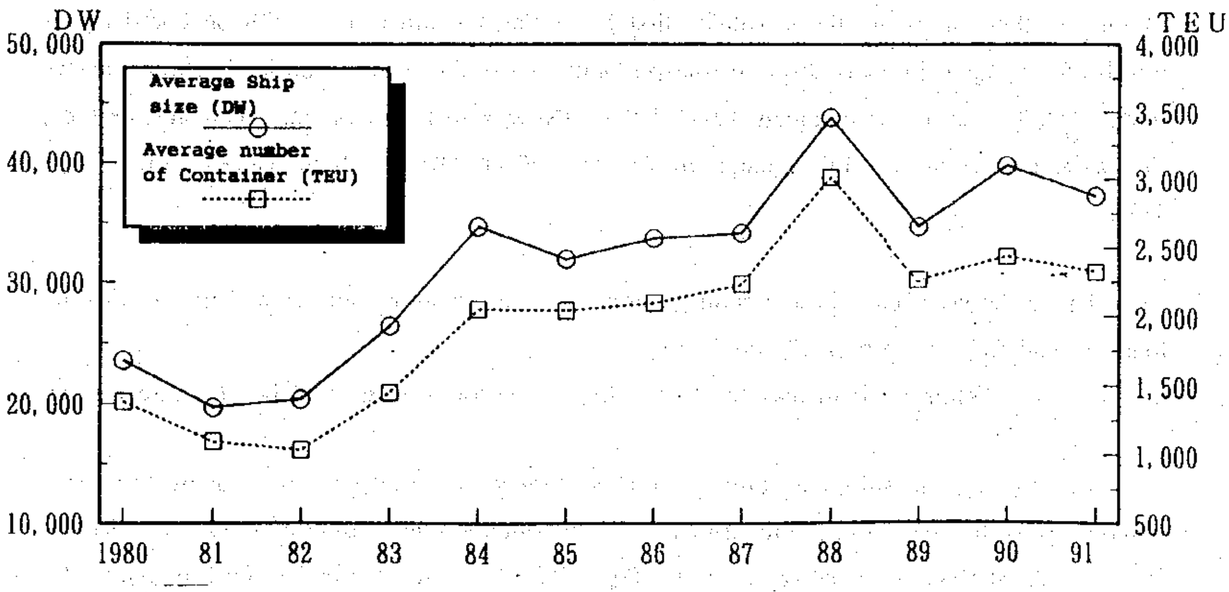
Representative Container Ships that enter and leave Hai Phong Port are shown in Table 11-4-4 and these ships are the so-called first generation container ships with on board cranes which are engaging in short distance transportation across the ocean, capacity is almost always under 500 TEU and approximately 10,000 DWT. (Now, fourth generation, over panamax type) The second generation container ships are 15,000 ~ 20,000 DWT with the capacity up to 1000 TEU.

Up to the year 2000, these second generation container ships (built from 1980 to 1983) are likely to call Cai Lan Port(cf. Figure 11-4-6),
because cargo volume will increase and accordingly one lot of cargo will be of a larger scale.

Considering the shipping routes and characteristics of transportation system and cargo volume up to the year 2010, the third generation of container ships (built after 1982) which are 25,000 ~ 30,000 DWT with the capacity of 1500 - 2000 TEU will call Cai Lan Port. (cf.Figure 11-4-6)

Table 11-4-4 Dimension of Container Ship Calling in Hai Phong Port

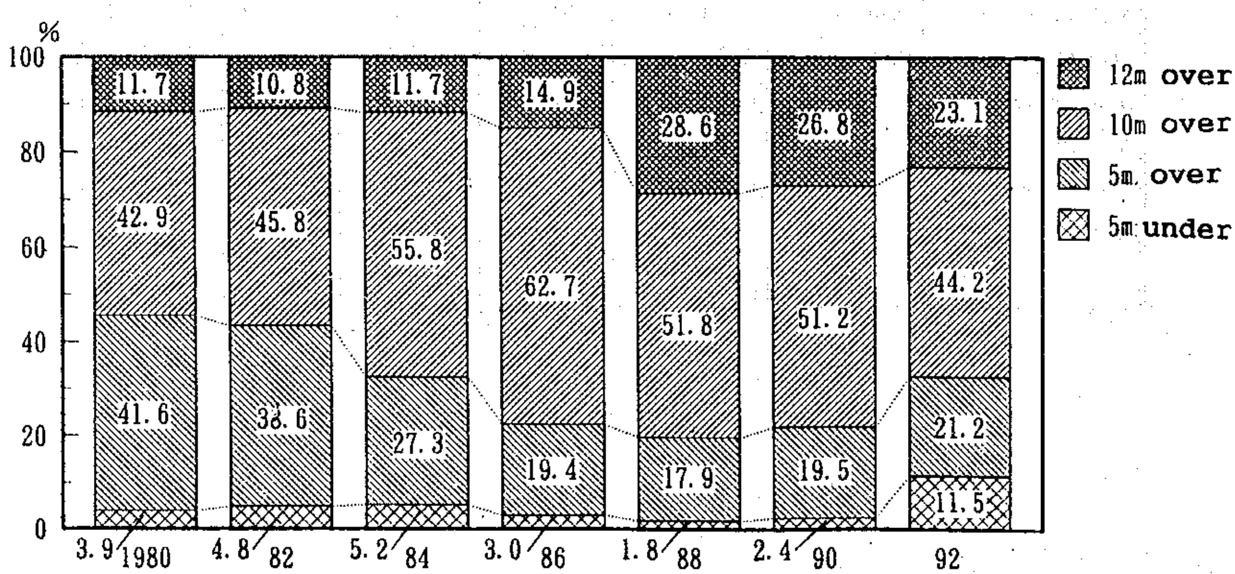
Name of Ship	Flag	Ship Type	DWT	LAO (m)	Draft	Capacity
Mekong Vitesse	Denmark	Sem-Con.	5,230	115.5	5.36	414 TEU
Hau Giang	Viet Nam	Ro-Ro	12,800	122.3		354 TEU
Viet Nam		Full-Con		92	6.6	260 TEU
Maritime		Full-Con		102	7.4	320 TEU
Development		Full-Con		114	8.5	450 TEU
Co.		Full-Con		120	8.8	520 TEU
		Full-Con		140	9.2	650 TEU



Note : Each Whole Year

Source : NYK Research Department

Figure 11-4-6 Average Full Container Ship Size Newly Built in the World



Note: Over 100 GWT steel ship

Source: Statistics of Commercial Fleet in Japan

Ship owner's Association

Figure 11-4-7 The Draft Tendency of Full Container Ship in Japan
(each year in July 1st)

11.4.3 General Cargo Ship

As far as general cargo ship size is concerned, it is said that 10,000 - 20,000 DWT class is wildly used throughout the world. As can be seen in Table 11-4-1 there are two peaks on the number of ships (the same as number of ship's data).

One is 1000 - 2000 DWT class ships, second is 5,000 ~ 10,000 DWT ship. It can be estimated that the former are engaged in domestic transport and the latter in overseas transport. Ships in the 5,000 ~ 30,000 DWT class account for 44% of all general cargo ships.

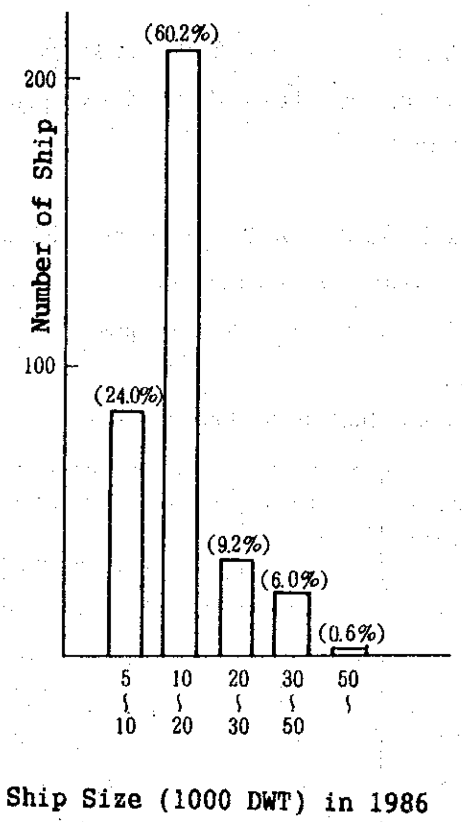
Table 11-4-5 Representative General Cargo Ship in Hai Phong Port

Name of Ship	Flag	Ship Type	DWT	LAO (m)	Draft	Capacity
Song Sai Gon	Viet Nam	General	10,785	151.4	9.0	15,180 TON
Long An	Viet Nam	General	9,639	118.6	7.7	10,329 TON
Long Thanh	Viet Nam	General	11,832	125.3	8.5	14,580 TON
Long Hai	Viet Nam	General	8,610	118	7.4	9,869 TON
Leninskaja	CIS		7,390	135.2	6.5	6,280 TON
Nikolaj	CIS		7,700	136.8	7.5	6,667 TON

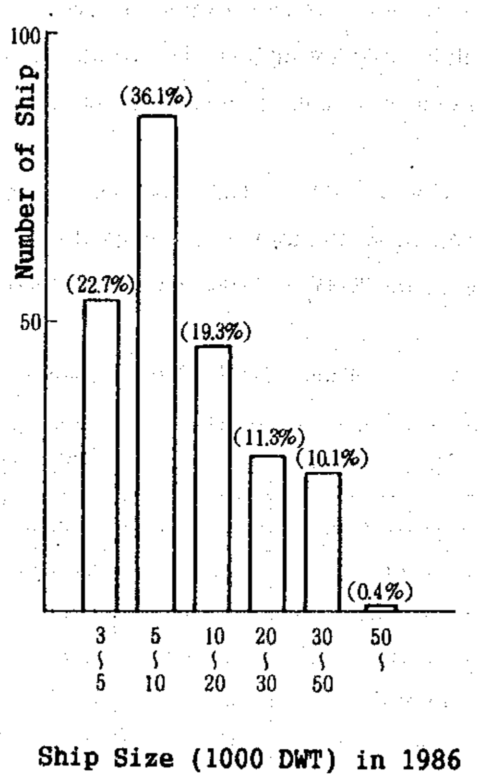
Table 11-4-5 shows the representative general cargo ship's dimensions.

Figure 11-4-8 shows an actual example of ships size distribution in the People's Republic of China Port. It is likely that the 10,000 to 20,000 DWT class general cargo ships to transport steel and iron scrap will become the dominant trend.

Considering these facts, maximum general cargo ship for planning both in short term and long term can be decided at 20,000 DWT (particularly in the case of steel and scrap transportation).



General Cargo Ship



General Cargo Ship (Steel and Scrap)

Source: The Report from Da Lien Port F/S Study JICA 1988

Figure 11-4-8 General Cargo Ship Size Distribution

11.4.4 Optimum Ship Size and Water depth.

As a reference for determining ship size and water depth, minimum total costs for dredging and freight are roughly examined.

For the sake of convenience the following conditions and premises were set.

(1) One ship size was chosen for each channel depth and it was assumed that all cargoes were carried by this ship.

(2) Conditions for entering the port were: full load (including ballast); tidal operation; +2.0m, bottom allowance of draft x 0.1 (cm). The ship's size for each channel depth were: 20,000 DWT for -9.0m; 30,000 DWT for -10.0m; 40,000 DWT for -11.0m; 50,000 DWT for -11.5m based on the design ship size. For average net freight volumes, 60% of the dead weight tonnage was assumed to be freight for transport.

(3) The duration of each voyage was assumed to be 15 days.

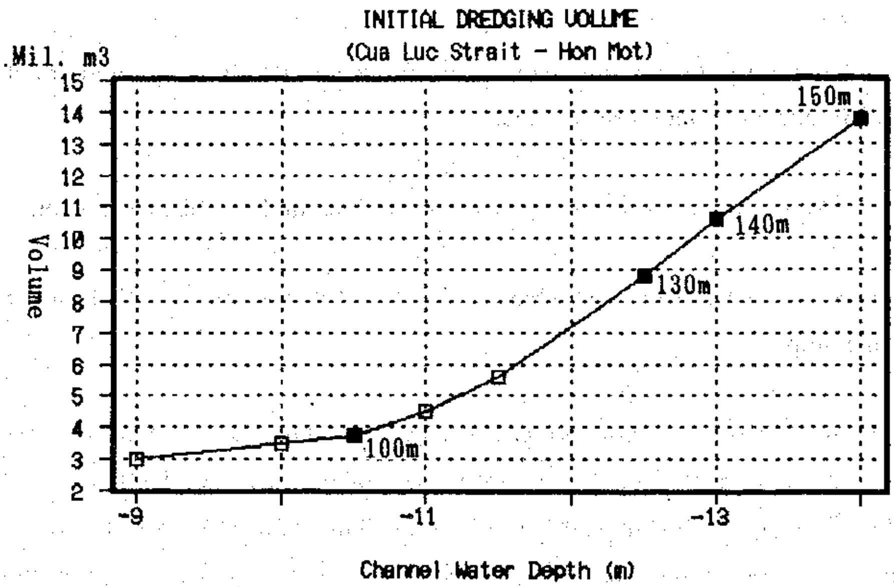
(4) The cargo volume transported was 3.0 million tons of bulky cargo per year.

(5) Dredging cost excludes the cost of maintenance dredging and initial dredging volume is estimated using the curve in the Figure 11-4-9

The results are shown in Table 11-4-6 and Figure 11-4-10. It can be seen that the total cost tends to rise when the depth deviates from -11.0m.

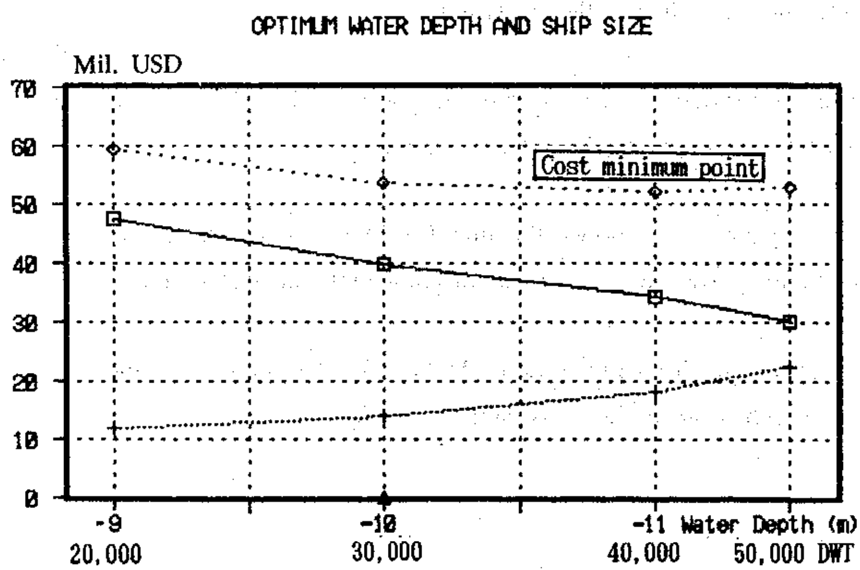
It can be explained as follows; the unit freight cost decreases as the ship size increases. Nevertheless, dredging cost increases in accordance with the water depth.

It can be said that the depth around -11.0m, 40,000 DWT case, is the most optimum ship size and water depth, even if these are simple calculations.



Note: 100m, 130m, 10m, 150m is channel width
■ — Calculation Value
□ — Estimation Value

Figure 11-4-9 Initial Dredging Volume



Note: □ Total freight cost, + Dredging cost, ◇ Total cost

Figure 11-4-10 Optimum Water Depth

Table 11-4-6 Demurrage Rates and Total Cost

Vessel Size (DWT) (Bulk Carrier)	20,000	30,000	40,000	50,000
Freight Cost (USD/day/ship)	12,640	15,900	18,300	20,350
Total Freight cost (1000 USD)	47,400	39,830	34,310	30,530
Channel Depth (m) (Draft x 1.1 - 2.0m)	- 9.0	- 10.0	-11.0	- 11.5
Dredging Volume (initial mil.m3)	3.0	3.5	4.5	5.6
Dredging cost (million USD)	12.0	14.0	18.0	22.4
Total (million USD)	59.4	53.8	52.3	53.0

11.4.5 Planning and Design Ship Dimension

As already mentioned in Chapter 11.3 Planning Criteria, Ship dimensions for planning and design are slightly different between Vietnamese Standards and Japanese standards.

Generally speaking Russian ships are slightly heavier and longer than Japanese ships.

Considering the future tendency of the ships, dimensions and prevailing ships in the future and for the sake of the convenience, average ship sizes will be adopted.

The following ship dimensions, berth length and water depth of berth and basin are used for planning.(cf. the figure in the column of Planning and Design Standard)

(1) 10,000 DWT general cargo ship

	Vietnamese Standard	Japanese Standard	Planning and Design Standard
Overall Length (m)	143	137	140
Moulded Breadth (m) (Beam)	19.2	19.9	19.6
Full Load Draft (m)	8.2	8.5	8.4
Berth Length(m)	160	170	160
Water Depth of Berth& Basin	9.1	10.0	9.0

(2) 15,000 DWT general cargo ship

	Vietnamese Standard	Japanese Standard	Planning and Design Standard
Overall Length (m)	165	153	160
Moulded Breadth (m) (Beam)	21.8	22.3	22.0
Full load Draft (m)	9.2	9.3	9.3
Berth Length (m)	185	190	185
Water Depth of Berth & Basin	10.2	11.0	10.0

(3) 20,000 DWT Container Ship

	Vietnamese Standard	Japanese Standard	Planning and Design Standard
Overall Length (m)	228	201	215
Moulded Breadth (m) (Beam)	29	27.1	28
Full Load Draft (m)	10.5	10.6	10.5
TEU	(1000)	(1000)	(1000)
Berth Length (m) Water Depth of	-	250	250
Berth& Basin	-	12.0	12.0

Note: ( ) Shows Number of TEU estimated from other data

(4) 30,000 DWT Container Ship

	Vietnamese Standard	Japanese Standard	Planning and Design Standard
Overall Length (m)	(212)	237	225
Moulded Breadth (m) (Beam)	(29.3)	30.7	30
Full load Draft (m)	(11.0)	11.6	11.3
TEU	(2200)	(2200)	(2200)
Berth Length (m)	290	300	300
Water Depth of Berth& Basin	13.0	13.0	13.0

Note: ( ) is estimation from Figure 11-4-5-(1) ~ (2)

(5) 20,000 DWT Bulk Carrier

	Vietnamese Standard	Japanese Standard	Planning and Design Standard
Overall Length (m)	-	(162)	165
Moulded Breadth (m) (Beam)	-	(24.0)	25
Full load Draft (m)	-	(9.8)	10.0
Berth Length (m)	-	210	210
Water Depth of Berth & Basin	-	11.0	11.0

Note: ( ) is estimation from Figure 11-4-3-(1) ~ (2)

(6) 30,000 DWT Bulk Carrier

	Vietnamese Standard	Japanese Standard	Planning and Design Standard
Overall Length (m)	195	186	191
Moulded Breadth (m) (Beam)	25.5	27.1	26.3
Full load Draft (m)	11.0	10.9	11.0
Berth Length (m)	220	240	240
Water Depth of Berth & Basin	12.2	12.0	12.0

(7) 40,000 DWT Bulk Carrier

	Vietnamese Standard	Japanese Standard	Planning and Design Standard
Overall Length (m)	212	201	207
Moulded Breadth (Beam)	27.5	26.5	27
Full load Draft (m)	12.0	11.7	11.9
Berth Length (m)	240	260	260
Water Depth of Berth & Basin	13.3	13.0	13.0

(8) 50,000 DWT Bulk Carrier

	Vietnamese Standard	Japanese Standard	Planning and Design Standard
Overall Length (m)	(207)	216	212
Moulded Breadth (m) (Beam)	(30.4)	31.5	31
Full load Draft (m)	(12.1)	12.4	12.3
Berth Length (m)	-	260	260
Water Depth of Berth & Basin	-	14.0	14.0

Note : ( ) is estimation from Figure 11-4-3-(1) ~ (2)