CHAPTER 3 OUTLINE OF QUANG NINH PROVINCE

3.1 Geographic and Natural Condition

Quang Ninh (Figure 3-1-1) is a frontier province, located in the north east of Vietnam between latitude 20° to 21° 14′ north and from longitude 106° to 108° east. It borders China in the east (along a frontier of 122 km in length), the East China Sea in the south, Hai Hung province and Hai Phong city in the west, and Ha Bac and Lang Son provinces in the north.

The province is connected with Hanoi by roads and railroads, with Hai Phong city by roads and river-ways (40 km), with Ha Bac, Hai Hung and Lang Son provinces by roads, railroads and the sea, and to Quangtay and Quangdong (Chinese provinces) and Hong Kong by sea.

The land area is 5,939 km^2, with hilly and mountainous areas and midlands accounting for 80% of the whole area of the province.

In the south lies the coastal area with plains, ranges and areas flooded by salt water (covering an area of 30,000 ha). The province's sea areas, which are part of the East China Sea, cover 6,000 km^2, including thousands of islands (over an area of 653 km^2). The sea area also includes Ha Long bay, famous for its beauty.

The average summer temperature (from June to September) is 29 degrees Celsius, while the average winter temperature (from December to March) is 15 degrees Celsius. The annual average rainfall is 2,008 mm. The dry season runs from October to April and the rainy season from May to September.

3.2 Socio-economic Activities

The province comprises 9 districts and 3 provincial towns. The provincial capital is Hong Gai town, located in the center of the province. Hong Gai is 90 km away from Dong Trieu district in the west and 180 km away from Hai Ninh district in the east, 180 km away from Hanoi and 62 km away from Hai Phong.

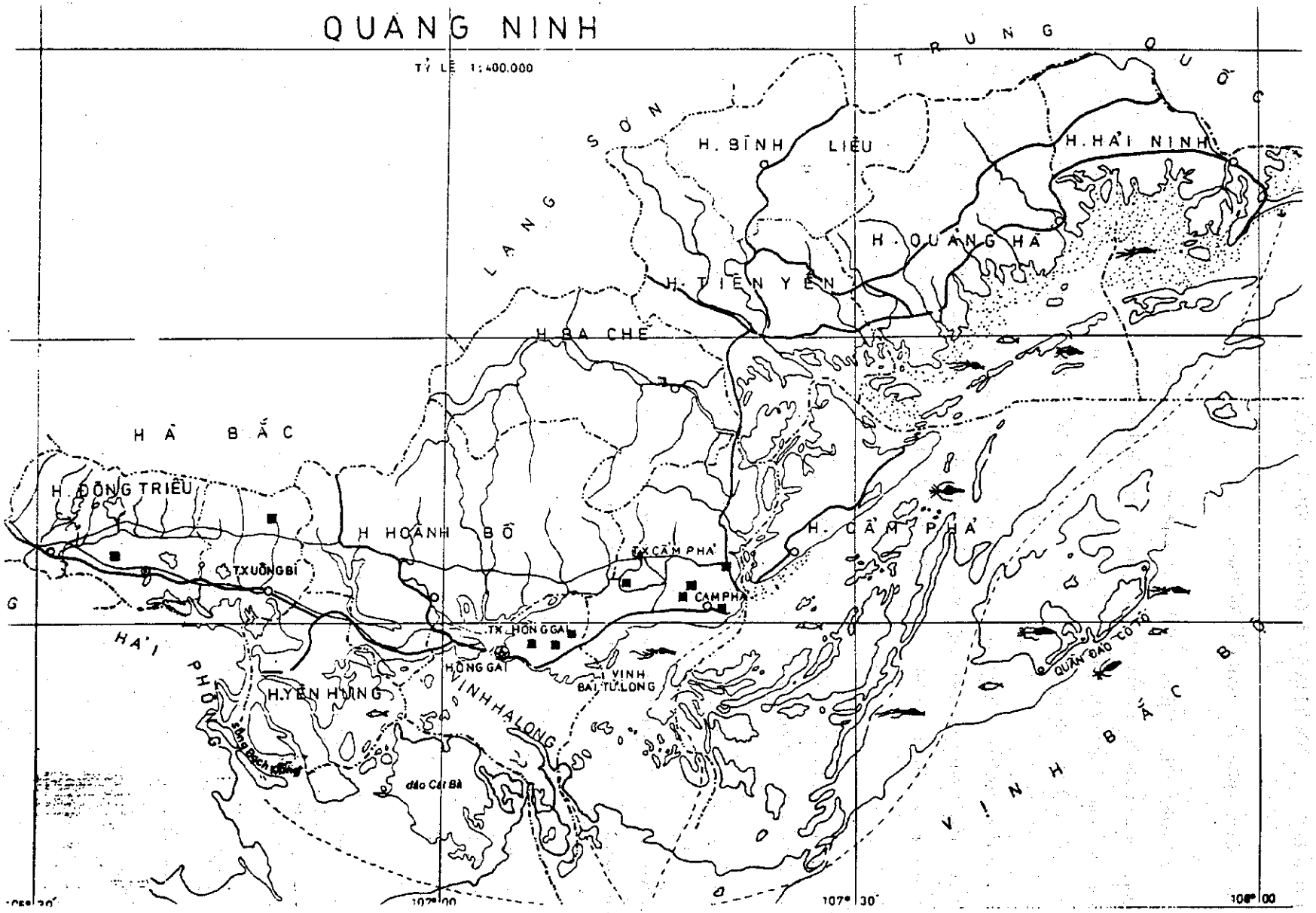


Figure 3-1-1 Quang Ninh Province

The population of Quang Ninh, according to 1990 statistics, is approximately 834,000. The urban population is 357,000, accounting for 42.8% of the total, while the rural population represents 61% of the whole population of the province.

3.2.1 Natural Resources

(1) Lands:

The total area of agricultural land is 60,000 ha. The area of cultivated land presently in use is 33,000 ha. It would be possible to enlarge the area of agricultural lands. The total area of land available for this purpose is 20,000 ha situated in coastal areas which could be enclosed with dikes. These areas, which could be transformed into agricultural land include a 2,700 ha stretch east of Yen Hung district, a 1,500 ha expanse north of Cua Luc, 700 ha in Tien Yen district, 1,000 ha in Quang Ha district and 2,000 ha in Hai Ninh district.

Forestry lands cover nearly 400,000 ha (accounting for 67% of the whole area of the province) of which 163,000 ha is classified as natural forest area. However, forests now only account for 14,000 ha.

The timber production capacity is approximately 2.6 - 2.8 million m^3. Moreover, there are medicinal plants and commercial trees and plants such as pine-trees, cinnamon trees and many others. There is still a wide area left for commercial forestry.

(2) Sea

Quang Ninh's sea area includes several State-owned fishing grounds with various sea resources which enable a yearly exploitation of 15 - 20 tons of fish and other sea products (shrimps, lobsters, pearl-oysters, squids, crabs and other species). In addition, the coastal area of the province could be adapted to salt production and sea-product raising.

The provincial sea area is a well-surrounded, deep-sea bay with a low amount of sediment. This is advantageous for construction of sea-ports such as Hong Gai, Cai Lan and Cua Ong. Some large areas of land, good for the construction of export-

processing zones, are available behind these ports.

Ha Long Bay, renowned for its beauty and blessed with lovely scenery, fine weather and many cultural relics, is also within this sea area.

(3) Mineral resources

Quang Ninh has many resources which could be exploited for industry. It is the largest coal production area in Vietnam. Coal mines concentrate on a stretch from Cam Pha to Dong Trieu which runs for 430 km, with a capacity of 3.6 billion tons. This allows an annual production rate of 18 - 20 million tons at present.

Clay, which is necessary for brick and tile production, is concentrated on Gieng Day, Kich Tho and Lang Bang (belonging to Hoang Bo district). There is a clay production potential of hundreds of million m^3.

Lime-stone is present in large quantities from Dong Trieu to Hoanh Bo and Ha Long Bay. Sand and grits are present in many localities. Van Hai sand-field in Cam Pha district, with a capacity of 5.6 million m^3, is now being used for glass making.

Kaolin is found in Dong Trieu and Hai Ninh. The Tan Mai kaolin mine in Quang Ha district, with a capacity of 56 million m^3, is being exploited for ceramics, cement and heat-resistant brick production.

There are two types of mineral water in Quang Ninh:

- Hot mineral water in Quang Hanh, Cam Pha and Tien Yen with a capacity of 1,000 - 1,010 m^3/day, at a temperature of 40 - 50 degrees Celsius and a mineral level of 2.2 - 2.5 mg/litre. This water is good for treating various ailments.

- Potable mineral water is found in Quang Hoanh district with a capacity of 1,000 - 1,500 m^3/day, at a mineral level of 2.5 - 11 mg/litre. It is now being exploited.

3.2.2 Quang Ninh's Economy - Industries, Agriculture, Forestry and Fishery

Industrial production plays an important role in Quang Ninh's economy, accounting for 65% of general industrial and agricultural production(Figure 3-2-1).

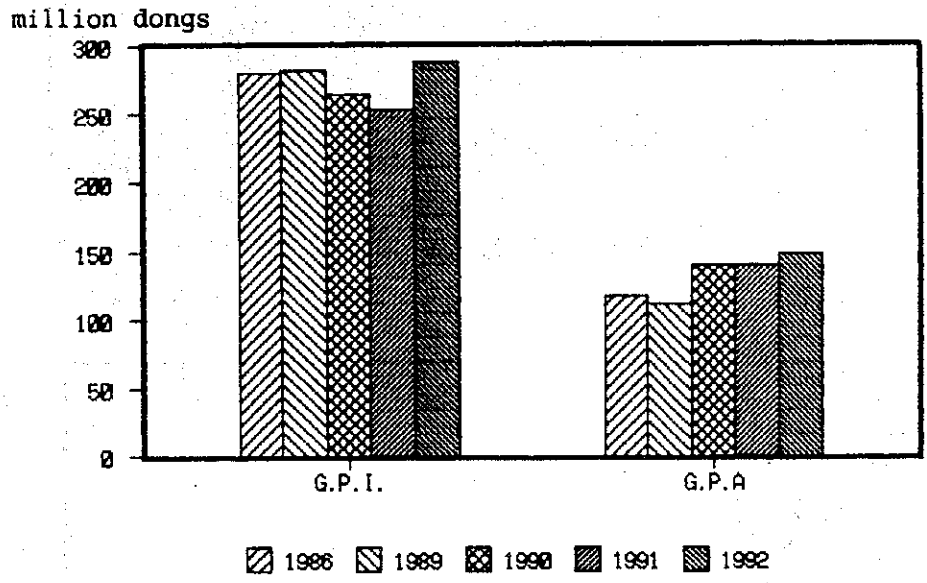


Figure 3-2-1 Gross Production of Industry and Agriculture in Quang Ninh Province

For the year 1991 (Figure 3-2-2), the production was as follows*:

coal : 3.9 million tons

bricks : 57 million pieces

tiles : 6.4 million pieces

mineral water : 1.8 million litres

sea-products : 8,000 tons of which 1,100 tons were for export.

Agricultural, forestry and fishery production have a smaller part in the economic structure(Figure 3-2-3, Figure 3-2-4).

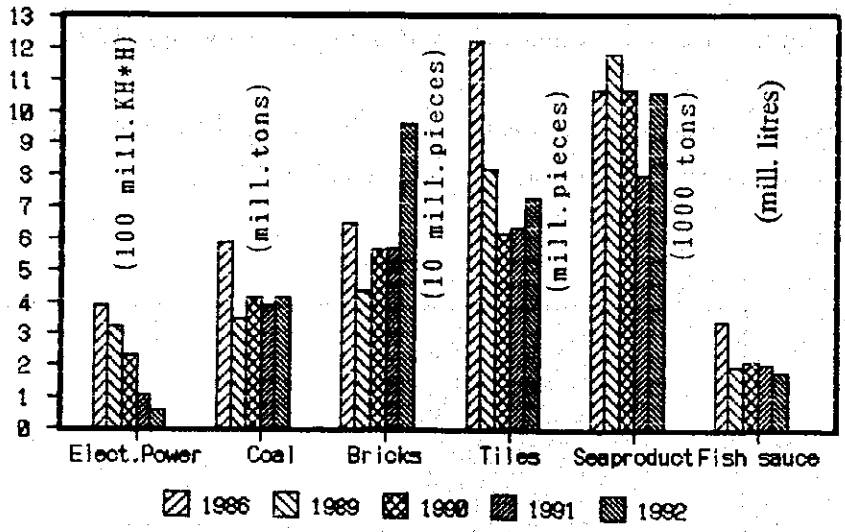


Figure 3-2-2 Main Industrial Products in Quang Ninh Province

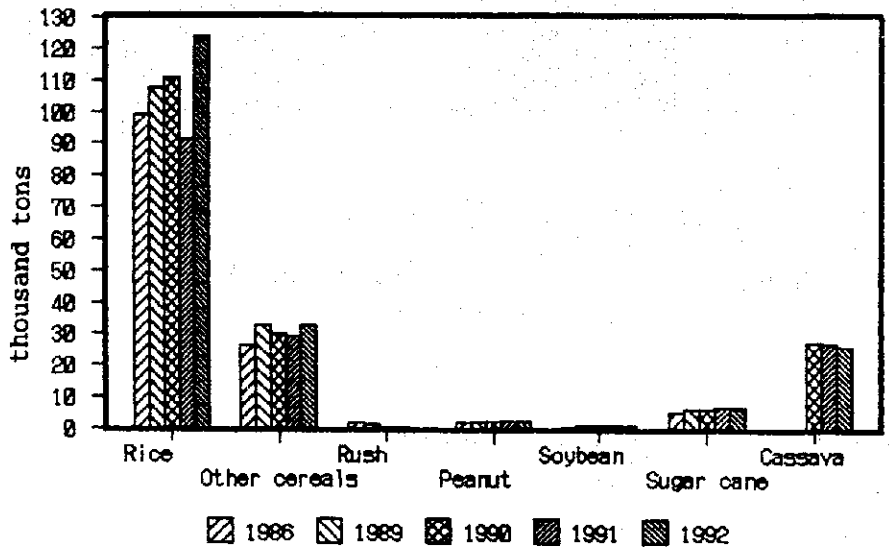


Figure 3-2-3 Production of Major Crops in Quang Ninh Province

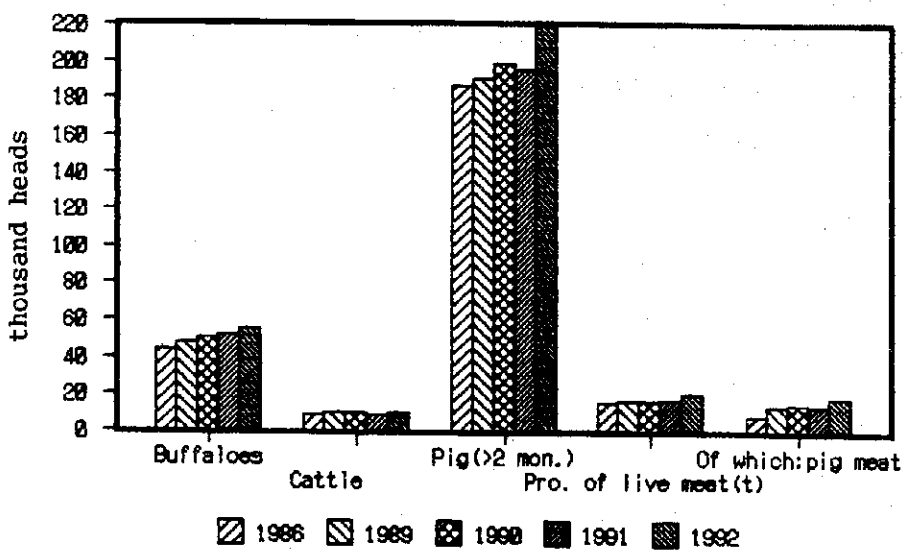


Figure 3-2-4 Livestock Industry in Quang Ninh Province

In 1991 the following was produced or raised:

food :	190,000 tons
pigs :	195,000 heads
buffalos:	53,900 heads
cows and bulls :	3,000 heads

Other economic factors presently of concern are transport, tourism, and foreign trade. Transport includes sea-transport, road-transport and river-transport (passenger and freight). Tourism is being promoted in Bai Chay and at Tuan Chau Island. At present there are 2,500 beds of which 500 meet international standards.

With regard to import and export(Figure 3-2-5), the main products for export are coal, frozen sea-products (680 tons), cinnamon (220 tons), rubber and handicraft items. Excluding state-run coal export, the local export turnover of 1991 was US$ 12 million. Imported goods include petroleum, steel, asphalt, fertilizer and insecticides.

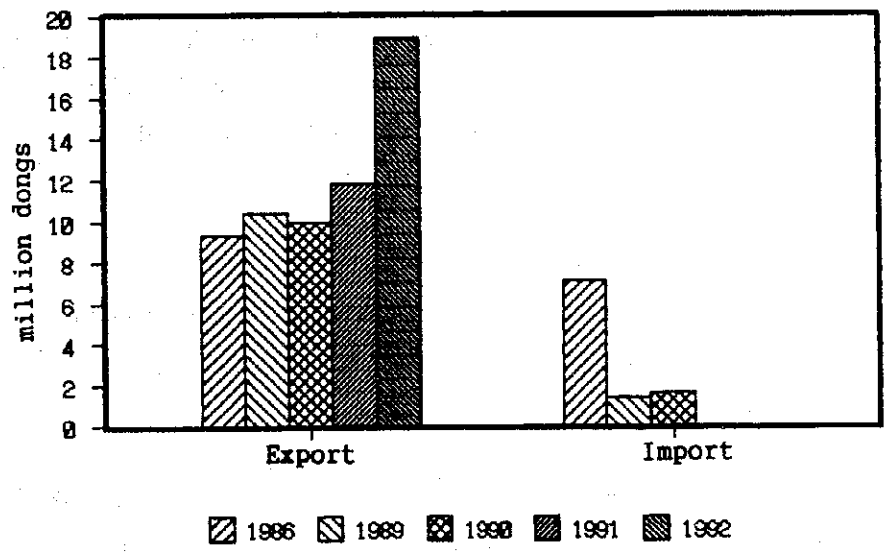


Figure 3-2-5 Foreign Trade of Quang Ninh Province

3.3 Traffic Access to the Bai Chay Bay Area (See Figure 3-3-1)

Transport between Cai Lan Port and its hinterland will be via roads linked to national trunk road No. 18, by railways connected to Ha Long Station and by domestic shipping.

Road No. 18 passes Hong Gai. It is not only an inter-provincial road but also a provincial internal one which leads to the center of the town of Hong Gai and to Hanoi and Hai Phong as well. Asphalt-paved roads measure 6 - 9 m wide and are all of standard H30 construction. Daily traffic is 1,000 - 1,500 vehicles/day.

There is a rail-road from Bai Chay to Kep which is part of the national rail-road network. Through domestic waterway transport, Cai Lan port can be easily accessed from any port in Vietnam.

3.3.1 Road Transportation Network

Cai Lan Port is located in the Bai Chay District,and is linked to Hanoi, the capital of Vietnam, through national roads No. 5, No. 10 and No. 18. The total road length is about 160 km. Road No. 5 runs from Hanoi to Hai Phong, road No. 10 from Hai Phong to Uong Bi and road No. 18 from Uong Bi to Bai Chay. To the east of Bai Chay, road No.18 extends up to Cam Pha and Tien Yen.

Out of Hanoi, there are two other alternative routes to Bai Chay. One route is via road No. 1A up to Bac Ninh and then road No. 18 which passes through Chi Linh to Bai Chay. The second route follows road No. 5 up to Hai Duong, then branches off to road No.183, finally joining road No. 18 at Chi Linh.

Along the roads from Hanoi to Bai Chay, there are four ferry crossings, two ferries along road No. 10 (Binh ferry and Rung ferry), one ferry along road No. 183 (Binh ferry) and another one along road No. 18 (Pha Lai ferry). All of them operate on an around-the-clock service basis and function as one of the sections of each national road.

Generally, the roads mentioned above are in poor condition. The worst one is road No. 18, particularly in the section between Bac Ninh and Chi Linh. The width of the road is about 8-10 m with some narrow sections of 6-6.5 m. Most of the road section is paved with gravel. On the western side of Pha Lai ferry, the road condition becomes slightly better, being asphalt

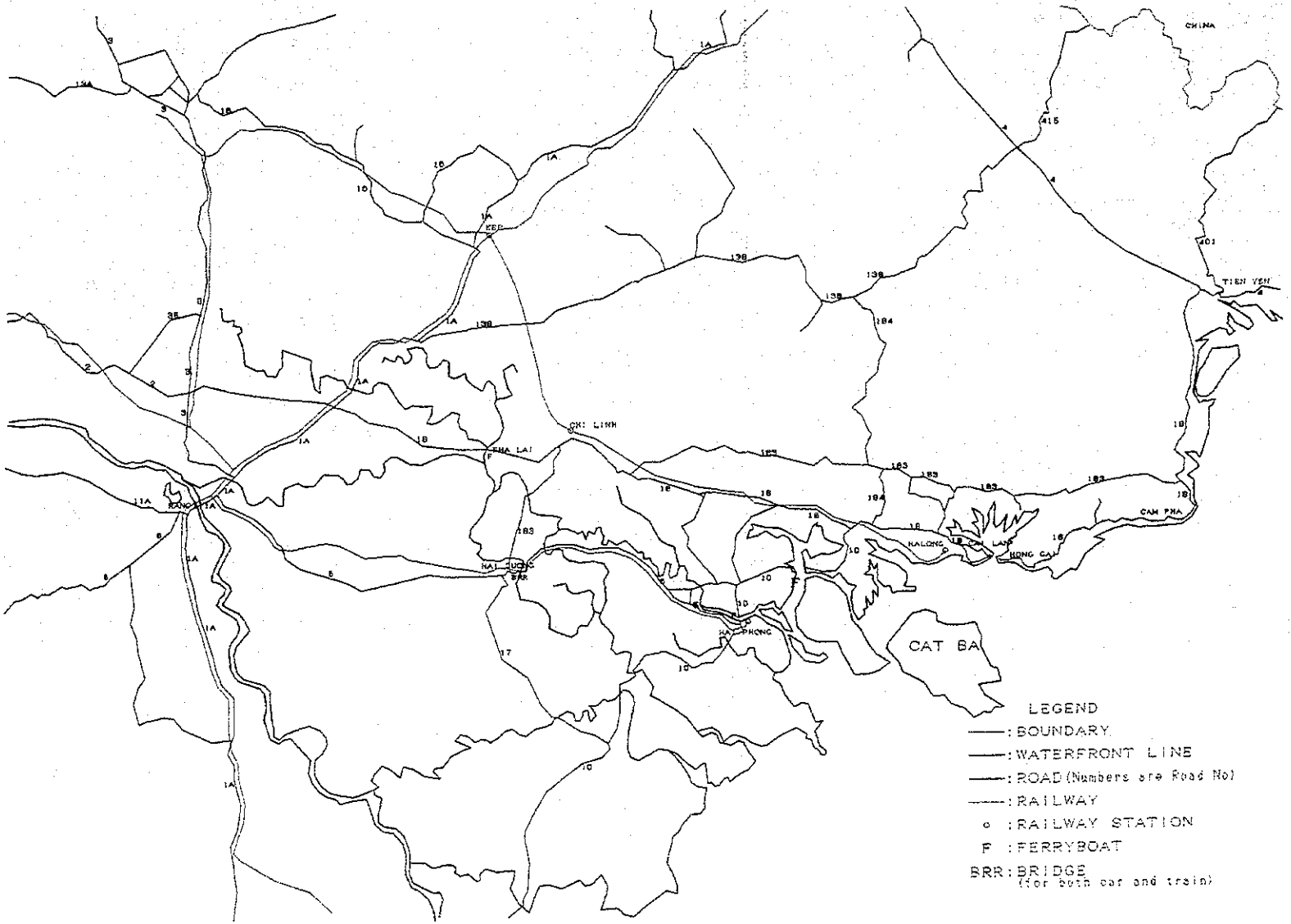


Figure 3-3-1 Transport Network around Bai Chai Bay

macadam pavement, but it is still of poor quality in terms of pavement and alignments.

On the road No. 5, the section closest to Hanoi is 23 m wide, gradually narrowing to 18 m wide and finally to 8 - 10 m wide. Most of the road is of asphalt macadam pavement which has been poorly maintained. Road sections requiring urgent rehabilitation accounts for as much as 40-50% of the total.

Road No. 10 has two lanes and is paved by asphalt macadam. The surfacing is damaged in many places. Periodic maintenance is performed section by section, mainly by overlay works using rock-fill and asphalt spreading on top.

3.3.2 Railway Network

The railway line does not reach as far as Cai Lan Port. The station nearest the Port is Ha Long Station, located about 3 km south west of the Port. The railway connection between Ha Long Station and Cai Lan Port is expected to open in the near future. The right-of-way for installing the railway line is already present, ready for placing ballast foundation.

The railway line will extend from Cai Lan via Ha Long and Chi Linh up to Kep where lines branch off to the north and south. The southern line stretches to Hanoi through Yen Vien and Gialam, while the northern line travels via Dong Dang through Dong Mo and Lang Son. The major railway lines in northern Vietnam are shown in Figure 2-4-2.

3.3.3 Inland Waterway Transport Network

In northern Vietnam, there are many rivers across the large expanse of the Red River delta, and a river transport system is operating there efficiently. Among these rivers, the Red River, Thai Binh River and Cua Cam River play the most important transport role. Many river ports are operating along the river banks, contributing to the shipment of local cargo, including general cargo and various kinds of break-bulk cargo. Bulk cargo to and from Cai Lan port will be transported by domestic shipping in a similarly economical manner.

CHAPTER 4 OUTLINE OF MAJOR SEA PORTS IN THE NORTHERN PART OF VIETNAM

4.1 General

In Vietnam there are seven major public ports, all of them run under the overall control of Vietnam National Maritime Bureau (VINAMARINE). In the south, Sai Gon is the central port. It handled about 4.6 million tons of cargo in 1993, equal to about 53 % of the national total of seaborne cargo shipment. To the north of Sai Gon Port are Nha Trang Port and Quy Nhon Port which operate mainly for the shipment of import/export cargo, but also partly for handling domestic cargo.

In the central part of Vietnam, the major port is Da Nang, which handled about 2.6 thousand tons of cargo in 1993. To the north of Da Nang Port, Nghe Tinh is a key port, mainly serving the domestic trade and recently functioning as a trans-shipment port for Laos, a land-locked country that has no sea port for the shipment of import/export cargo.

In northern Vietnam, Hai Phong Port is the leading port, serving as a coastal gateway to the area. With its cargo shipment somewhat stagnant, Hai Phong Port's throughput in 1993 logged in at about 2.7 million tons, about 40% of the national total. The demand for container cargo in Hai Phong Port is very high, showing an annual growth rate of 80% for the past three years.

Another major port in north Vietnam is Quang Ninh Port, which is located about 60 km east of Hai Phong Port. Quang Ninh Port has no quayside facilities and all cargo shipment is executed in the offshore anchorage area of Ha Long Bay.

In addition to the seven ports mentioned above, the new deep sea port, Cai Lan, is now under construction. Cai Lan Port is located near Quang Ninh Port on the opposite side of Cua Luc Strait and some 2 km within Bai Chay Bay. In the vicinity of Cai Lan Port, three other dedicated ports are also in operation. Details about individual ports in north Vietnam, including Hai Phong Port, Quang Ninh Port, Cam Pha Port, Hong Gai Port, B-12 Port and Cai Lan Port are presented below.

4.2 Description of Each Port

4.2.1 Hai Phong Port

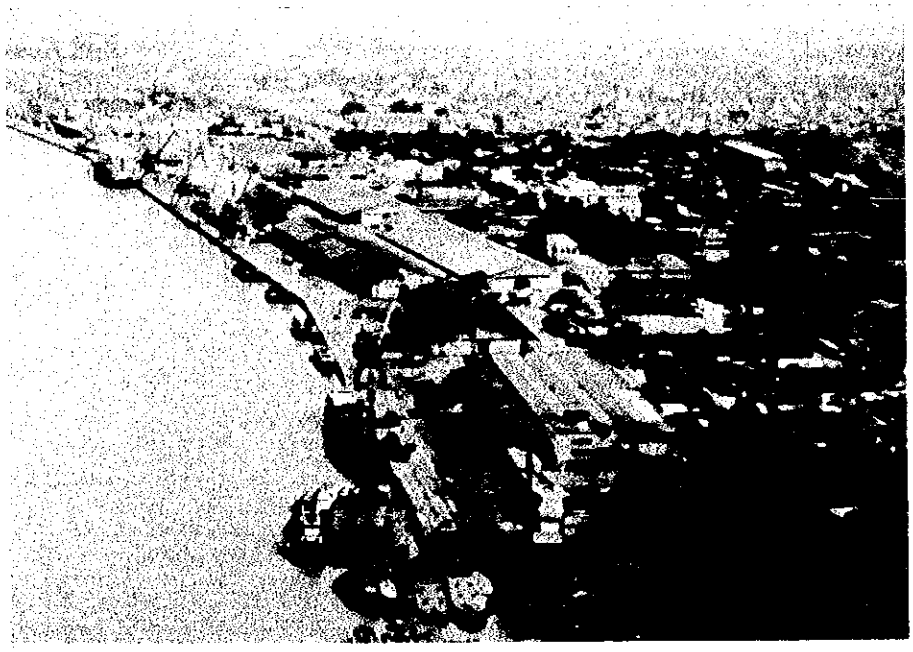
Hai Phong Port is located about 105 km east of Hanoi by road and about 30 km inland of the South China sea. Located on the right bank of Cam River, Hai Phong Port consists of three port divisions, Main Port, Chua Ve Port and Vat Cach Port. Main Port has a berth length of 1,722 m, consisting of 11 berths provided with 14 transit sheds (74.300 m^2) and wide open storage yards (53.000 m^2). Chua Ve Port has a total berth length of 330 m, made up of 2 berths with open storage yards of about 30,000 m^2. This port mainly serves the marshalling of container cargo. Vat Cach Port has a total berth length of 314 m, handling domestic cargo. The major facilities in each of these port divisions are summarized in Table 4-2-1.

Table 4-2-1 Major Facilities in Hai Phong Port

	Main Port	Vat Cach Port	Chua Ve Port
1. Berth Facilities			
- Number of berth	11	3	2
- Berth length	1,722 m	314 m	330 m
- Water depth (Design)	-8.4 m	-3.0 m	-8.4 m
2. Cargo Handling Facilities			
- Quayside crane	25 (5-14 ton)	Floating crane	Container crane 2 set
- Folk-lift truck	39 sets	3 sets	3 sets
- Mobile crane	6 sets	5 sets	5 sets
3. Transit Shed and Warehouse	30 buildings (74,300 m^2)	-	-
4. Open storage yard	(53,000 m^2)	-	(30,000 m^2)

Hai Phong Port, historically, has suffered from siltation problems in its access channel where depth is maintained at approximately -4.0 m. This limits the size of ships calling at the port to less than 6,000 DWT, under a tidal operation.

Hai Phong Port was the largest port in Vietnam before the war but has now relinquished this position to Sai Gon Port in terms of cargo shipment. The cargo throughput at Hai Phong Port in 1993 was recorded at 2.7 million tons, which is 1.9 million tons less than at Sai Gon Port. The staple cargoes are logs and timber in export, metal and fertilizer in import, and cement and machinery in domestic trade. The breakdown of cargo handled in Hai Phong port is summarized in Table 4-2-2.



- Hai Phong Port -

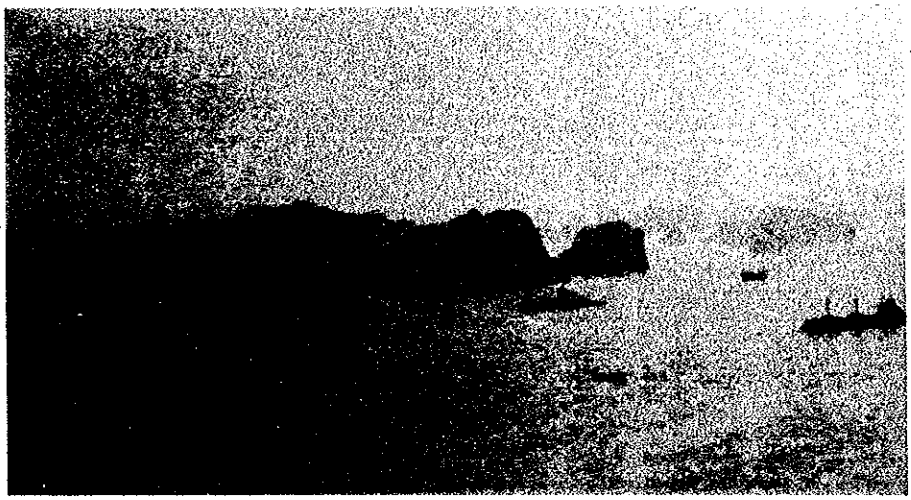
Table 4-2-2 Cargo Statistics of Hai Phong Port in 1993.

(unit: tons)

(Export)	
Ore	80,127
Machinery, equipment	777
Metal	10,458
Logs, timber	4,370
Rice	79,785
Vegetable	2,405
Foodstuff	7,499
Rattan ware, jute tapes	5,290
General cargo	4,612
Container	220,243
Sub-total	415,566
(Import)	
Ore	29,951
Machinery, equipment	39,588
Metal	241,766
Fertilizer	391,455
Chemicals	22,622
Cement	201
Wheat flow	10,481
Foodstuff	367
Cotton, yarn, textile	979
Asphalt	23,454
Container	280,290
Others	154,924
Sub-total	1,176,078
(Domestic)	
Coal	21,411
Ore	47,694
Gypsum	29,151
Clinker	42,246
Food	135,777
Cement	445,759
Machinery, equipment	23,950
Metal	60,045
Fertilizer	49,061
Foodstuff	8,301
Construction materials	152,045
Others	99,227
Sub-total	1,114,667
Total	2,706,311

4.2.2 Quang Ninh Port

Quang Ninh Port is situated in Ha Long Bay and is known as the "floating port", because there are no quay facilities in the port. All cargo is carried to the offshore anchorages for transfer to or from ships. This is a very inefficient manner in which to operate a port and some measures to improve this situation are needed. The major cargo is coal and the annual throughput in 1992 was approximately 700,000 tons.



4.2.3 Cam Pha Port

Cam Pha Port is located about 35 km east north east of Hong Gai Port and has two dedicated berths for loading coal. The berth is 300 m long and provided with two ship loaders, each with a nominal loading capacity of 1,000 tons/hour. The berth capacity is 15,000 DWT at the maximum. The export coal in 1993 logged about 1.5 million tons. To meet the growing coal demand, the berth capacity needs to be upgraded at least to 50,000 DWT class.

4.2.4 B - 12 Port

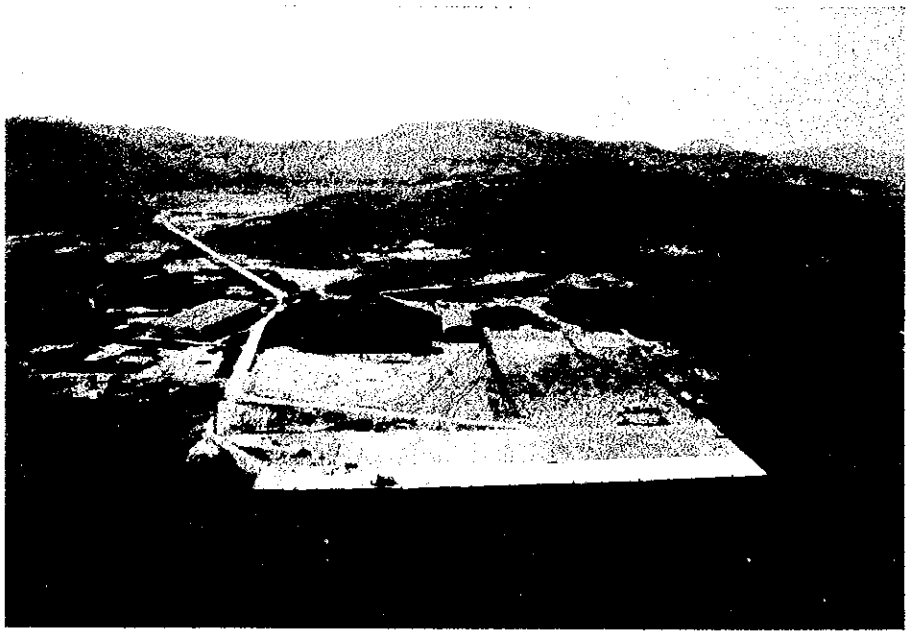
The oil port, B-12, is under the control of Petrolimex and is located at the entrance of Bai Chay Bay. Four mooring buoys are present offshore to allow tankers up to approximately 30,000 DWT to moor and unload cargo. This is directly in the path of the channel along which ships would need to pass to access Cai Lan Port. Thus, if the Port development goes ahead, it may be necessary to relocate the B-12 port, or at the least, the mooring buoys. Oil is piped to shore from these buoys, stocked in a tank farm, and redistributed to local oil users by small barges. The annual throughput is reported to be 700,000 to 800,000 tons.

4.2.5 Hong Gai Port

Hong Gai Port is under the control of the Ministry of Energy and is located at the tip of the Hong Gai peninsula, opposite the B-12 offshore mooring buoys across the Cua Luc Strait. The port has a very old coal loading berth of 140 m long in length. This is provided with two cranes. The current coal loading operation causes significant dust pollution to the nearby area. The access channel depth is reported at -7.5 m which allows ore carriers of a maximum 10,000 DWT to call at the port under a tidal operation. Recent statistics show that the annual throughput is 1.5 million tons, of which about half a million tons are exported.

4.2.6 Cai Lan Port

Cai Lan Port is the subject of this study and is located about 2 km west of B-12 oil port in Bai Chay Bay. Port construction is now under way and one 160 m long berth has been completed together with some back-up yard pavement. Inshore of the berth area, the reclamation and leveling works have been almost completed, waiting for the construction of onshore facilities, including transit sheds, railway sidings, etc.



4.3 Present Cargo Handling System in Major Sea Ports of Northern Part of Vietnam

4.3.1 General

At almost all ports in the northern part of Vietnam, cargo handling equipment is generally old and efficient methods of cargo operation have been slow to develop. Cargo handling productivity is therefore at a low level compared with advanced countries. One reason for this may be that there is a large labor pool living in the vicinity of many ports and it is therefore easy to continue operating using physical laborers. Mechanization and computerization has therefore been slow to develop.

Little consideration is currently given to noise prevention and the development of safe work practices at these ports. As is well known, cargo handling work is one of the most dangerous types of physical labor and there are many regulations to ensure safe work practices in advanced countries. In the near future this is likely to become an important issue in Vietnam.

In Vietnam there are many well-trained experts with high technological potential. It is anticipated that these experts will be able to undertake maintenance and repair of industrial equipment in future. In port areas this should make it easy to advance into maintenance work on cargo handling equipment and repair work on damaged containers.

(1) Container cargo handling

Almost all container cargoes in the northern part of Vietnam are handled at Hai Phong Port. In recent years, container cargoes have increased remarkably and total throughput for the year 1993 was reported at 54,314 TEU from Hai Phong Port.

However, this total throughput is only about half the volume an ordinary international container terminal would normally handle. It would be possible to expand this as there is enough land space for container handling in the Hai Phong Port area. But the problem of shallow water depth at this port remains. Also, in the main container terminal there are still not enough gantry cranes for exclusive container handling use, although Chua Ve Port area is equipped with two large jib cranes (KONDOR CRANE). Judging from the remarkable increase of container cargoes in recent years, it would be advisable to equip the port with ordinary gantry cranes for exclusive container use.

In the container yard, almost all equipment is very old and does not handle container cargo efficiently. Mobile cranes and jib cranes are widely used for container handling in the yard, however these are not really appropriate for container handling, and it is considered that top-lifters would be more efficient in these container yards.

As to the container yard operation, container cargo handling is very different from conventional general cargo handling. Various kinds of data are required for such an operation to run smoothly, such as ship condition, yard condition, land transport, working schedule in the yard and container freight storage (CFS) area, etc. In order to carry out a quick and smooth container operation, the terminal operator usually prepares the ship stowage plan, yard location plan, gate slip plan, CFS working plan and prepares various kinds of related documents using computers. These fundamental processes of container operation are still not undertaken at Hai Phong Port.

(2) Handling of coal, oil and other cargo

Coal cargoes in the northern part of Vietnam are almost all handled at the ports of Quang Ninh, Hong Gai and Cam Pha. In 1992 the total handling volume of these ports recorded about 2.9 million tons.

At Quang Ninh port, the so-called floating port, all of the coal cargoes are handled by a barge operation in port offshore area. At Hong Gai port, coal is delivered by rail, in 4-ton buckets, directly from the coal producing area. The coal is loaded by lifting each bucket and emptying it just over the open hold hatch. The productivity of this method is about 2000 tons/day. Because the water depth at the quayside is not so deep, it is only possible to cater to ships under about 10,000 DWT. Ships over that weight must be loaded offshore by barge.

At Cam Pha Port the water depth at the quayside is kept at -9.0 m and it is possible to load ships up to about 15,000 DWT. The berth is equipped with two large loading machines, and productivity is about 10,000 tons/day per machine. Deep draft ship must be loaded by barge offshore of Cam Pha Port.

As to oil cargoes, almost all are handled at B-12 port, located near Hong Gai port. About 700,000 tons per year pass through this port. Large size ships usually unload

via submarine pipe lines while moored offshore. Turnaround time using this method is about four days for the largest ships (27,000 DWT) which can enter this port.

General cargoes and other bulk cargoes are handled mainly at Hai Phong Port, using quayside jib cranes and ship gears. Productivity approaches a reasonable level.

4.3.2 Condition of Cargo Handling System in Major Ports

(1) Hai Phong Port

Container cargoes are mainly handled at Main Port berths No. 1 and No.2, and also at Chua Ve Port in Hai Phong Port. General cargo and bulky cargo handling is carried out at Main Port and the handling methods are described below.

1) Container cargo handling at Main Port

At Main Port No. 1 and No. 2 berths, the containers on shipside are handled by quayside jib cranes with a rated load of 16 tons, and by ships gear. Heavy containers weighing more than 14 tons must be handled by ships gear because the maximum lifting capacity of quayside jib cranes is 14 tons.

The productivity of container handling using quayside jib crane is about 8 TEU/gang/hour, and the productivity using ship gear is about 10 TEU/gang/hour.

The above productivity is not too bad but there are cases where containers of different weights (less than 14 tons and over 14 tons) are stowed in the same ship's hold so that loading and unloading requires both quayside jib cranes and ships gear. This causes a delay in cargo handling.

Where handling is done by quayside jib crane, the container is placed firstly on the apron or yard and then another jib crane picks up the container and transports it to the yard. With ships gear, a container is placed on a chassis and then the yard jib crane or top-lifter picks it up and places it in the yard.

Jib cranes are widely used in the yard for lifting and moving containers, however containers can only be stacked in the area covered by the reach of the jib crane. Also, the lifting capacity of jib cranes is limited to 10 - 14 tons. It should be said that quayside jib cranes and yardside jib cranes are not appropriate for handling heavy containers.
Moreover, container handling in the yard is also conducted by top-lifters, fork-lift trucks and chassis, and all available yard equipment is assigned to containers coming from shipside when shipside works are conducted.
Therefore there is almost no yard equipment to deliver and undeliver containers to and from land side, which cuts down efficiency. More equipment is needed so that both these functions can be carried out at once.

Another problem that arises from the lack of sufficient yard equipment is the use of fork-lift trucks to shift containers. Fork insertion into the large containers (40') causes damage to both container and fork-lift truck.

Stuffing and unstuffing containers is carried out on open space in the yard. This creates a very dangerous situation for the workers because heavy machinery is also operating in the open yard space. Manual work-space should be separated from this machinery. An additional point is that this unstuffing and stuffing work would be better carried out by small fork-lift trucks of 2-3 ton capacity, than by hand.

There are two gates in this Main Port container area. One is at the south end of No. 1 berth and the other is at the south west end of No. 2 berth. At these two gates when a container goes through on a chassis, only security matters are checked by gate clerks. Gate clerks should be performing other functions as well (refer Section 4.3).

As to the CFS operation, one warehouse is scheduled for use as a CFS in future and this will be very effective, especially in the rainy season.

There is a repair shop in the middle section of No. 1 berth container yard. Many technical experts are working there, repairing various kinds of machinery. They are well-skilled technically, however the facilities of the repair shop are very old and it would be advisable to improve and modify the facilities. The demand for repair work, especially of containers is going

to increase.

2) Container handling at Chua Ve Port

At Chua Ve port area, containers on shipside are handled by two quayside jib cranes (Kondor Crane - described in Table 4-2-3) with a rated load of 40 tons. The productivity of quayside jib cranes is about 17 TEU/ gang / hour. The above productivity of container handling by quay side jib crane is considered to be generally reasonable.

At the container yard behind the apron, quayside jib cranes (Kondor cranes) are used efficiently. By using the long reach of these cranes (a maximum of 32 m) it is possible to place 2 rows of stuffed 40' containers stacked in 3 tiers.

In the middle of the container yard, the containers are handled by using mobile cranes and top-lifter. Also trucks are used to transport containers from apron to yard. When using the mobile cranes, the stacking height is a maximum of 2 tiers because the length of the mobile crane boom is very limited.

In the back (southern) part of the container yard jib cranes are scheduled to be brought in the main port area. But they are not designed for container handling and therefore, the total quantity of yard equipment will still be insufficient.

This area is expected to become the main container terminal in future, and a significant number of containers will be handled here sooner. The present mobile crane system for yard equipment is not the most appropriate system for handling a large number of containers. New specialized yard equipment such as transfer cranes should be introduced.

As with the Main Port, container delivery work cannot be conducted during ship side working because all yard equipment has to be assigned to receiving containers from ship side. This is not an efficient practice.

As to refrigerated containers, there are 20 refrigeration plug units at the

western end of the yard. The demand for this facility is likely to increase sooner or later.

The main gate is at the south end of the Chua Ve area. As with the Main Port, this container gate is not yet used properly because only security matters are checked by gate clerks.

A lot of empty containers are currently stacked in this Chua Ve area. Also, in the old Chua Ve area many empty containers, mostly 20' containers, are stacked in two tiers using top-lifter at the southern part of this area.

3) General cargo and bulk cargo handling

At Hai Phong Port, general cargoes and bulk cargoes are handled at the Main Port area from berth No. 3 to berth No. 11. General cargoes are handled both by quayside jib cranes and ships gear, while bulk cargoes are handled by quayside jib cranes. The productivity of quay side jib cranes and ship gears , as reported in the feasibility study on Hai Phong Port rehabilitation, is as follows:

Cargo	Quay side jib crane	Ship gear
General cargo	11 ton/gang/h	8 ton/gang/h
Baggage cargo	21 ton/gang/h	16 ton/gang/h
Steel Product	45 ton/gang/h	26 ton/gang/h
Bulk cargo	52 ton/gang/h	-

The productivity of general cargo and baggage cargo handling by quayside jib crane and ships gear is almost the same, but for steel products quayside jib cranes have a higher productivity than ships gear.

All bulk cargoes are handled by quayside jib cranes and their productivity is of a reasonable value. From the above, it can be deduced that jib cranes should be used for handling heavy cargoes (mainly steel products) while ships gear is better for general cargo and baggage cargo. However quayside jib cranes must still be used for handling cargo transported by ships without ship gear.

In the yard area, mobile cranes are used for handling and shifting the steel cargoes, but it is said the use rates of the mobile cranes are less than 30%. The movement of steel products from apron to yard or warehouse could be done by tractors more effectively.

Forklifts are very useful for handling cargoes on the apron or yard and in the warehouse but some units of fork-lift truck are being transferred for stuffing and unstuffing of container cargo. This is causing a considerable shortage of handling equipment in the yard.

A summary of equipment is shown in Table 4-2-1. The purchase years of the quay side jib cranes are shown in Table 4-2-2. All jib cranes were made in the USSR.

The numbers of jib cranes by age is as follows:

Age	0-10	11-15	16-20	21+
Number	3	8	6	8

The procurement of spare parts is very difficult because the cranes are no longer produced. The capacity of jib cranes ranges from 5 to 16 tons, but there are only three of 16 ton capacity. Usage of cranes is therefore limited to comparatively light cargoes.

(2) Hong Gai Port

In this port ships of the maximum size(about 15,000 DWT) can only enter the port at present with the advantage of a sea tide of about 3 m. At the quayside, there is a berth 140 m long and -7.0 m deep. Due to this water depth, it is only possible to handle ships of about 10,000 DWT and anything over that is handled offshore by a barge operation.

At the berth, main handling system is by 4-ton capacity buckets, which are transported directly from the coal producing center by rail. Coal cargoes are stowed in the ship hold by lifting the buckets with a quayside jib crane and emptying them just above the hold. The productivity of this method is as follows:

4 tons bucket x 24 times x 24 h x 0.9 = 2073.6 tons

(24 times .... about 2.5 min/one round)

(0.9 ..... working efficiency)

From the above, working efficiency is calculated at about 2,000 tons/day.

As a back-up system, very old loading machines are used. In this case buckets are emptied at the quayside and the coal cargoes are carried on conveyer and loaded into the ship's hold by hopper. Besides this, in the offshore area, coal cargoes are loaded directly from barge to ship using ship's gear. It is said that maximum productivity is about 3,000 tons/day when four gangs are working.

(3) Cam Pha Port

At this port ships of the maximum size (about 15,000 DWT) can only enter the port at present by using the advantage of a sea tide of about 3 m. At the quayside, there is a berth 300 m long with a water depth of -9.0 m. Two large scale loading machines, made by HITACHI.JAPAN and installed in 1980, are set up on the berth. The productivity of these loading machines is :

1,000 tons/hour per machine (designed capacity)

800 tons/hour per machine (maximum capacity)

and considering the operation ratio, normal productivity is estimated at about 10,000 tons/day per machine.

Because the water depth is only -7.0 m at the shallowest spot of the channel, deep draft ships are sometimes loaded directly from barge to ship using ship's gears, offshore of Cam Pha Port.

(4) B-12 Port

Almost all oil cargoes in northern part of Vietnam are handled at B-12 Port, which handles about 700,000 tons per year. Ships up to a maximum size of about 30,000 DWT can unload here by mooring to four large mooring buoys and unloading the oil cargo through four submarine pipe lines of a diameter of 273 mm. A four day turnaround can be achieved for a 20,000 ton oil cargo.

However, considering that the flow rate of light oils such as gasoline or diesel oil is 4 - 5 m / second, productivity can be calculated as follows:

$(273/1000 \times 1/2)^2 \times 3.14 \times (4 - 5) \times 3600 = 842 - 1053$

This indicates that the rate should be about 1000 tons per one hour. From this it can be estimated that, if facilities such as the pumping system and others were improved, an unloading time of one day could be achieved for a 20,000 ton cargo.

At present about 20 ships are calling this port each month but the 27,000 DWT tankers only arrive at infrequent intervals.

4.3.3 Typical Scope of Cargo Handling

(1) Scope of cargo handling in foreign ports

In Japan and some other countries in the world, docks and facilities in the port are sometimes managed by private licensed companies depending on the kind of field and work. For instance, in cargo handling operations for importing cargo, there may be several independent businesses, such as onboard stevedoring, longshoring, warehousing or yard storing and picking up cargo for delivery. In the above case, respective companies are responsible for providing their own workers, equipment and other materials, and the job description of workers is separate.

(2) Scope of cargo handling in Hai Phong Port

In the port of Hai Phong, the manning system for cargo handling is a little bit different from other countries. Each enterprise under the direct supervision of the director of Hai Phong Port manages and provides general workers who are engaged in onboard stevedoring, longshoring and warehousing work. This excludes tallying and operating shore machineries. In the Main Port of Hai Phong, there are 11 teams for the above job. One team consists of one chief foreman, four foremen and four gangs each with about 30 men, who also include operators of ship's gears. The number of workers in the Port of Hai Phong is about 2,200 - 2,500.

Operators of shore cranes, drivers of forklifts, in-dock trucks and trailers and other machinery operators belong to Hai Phong Port.

They work 24 hours a day by 4 shifts as follows;

0600-1200, 1200-1800, 1800-2400, 2400-0600

The chief foreman draws up plans for the cargo handling operation, not only for assigned vessels but also for the day's longshoring, warehousing and delivering. He also coordinates with other departments for machinery operators and tally men.

(2) Present scope of cargo handling in the port of Quang Ninh

This port is called the "Floating Port" and the difference from Hai Phong Port is that all workers are directly managed by Quang Ninh Port. And there is a water team to transport workers and also to tow barges between the shore and vessels in anchorage. Activities of this are restricted to the sea water area. Operations at Quang Ninh Port do not include loading coal at the pier which belongs to the Coal Mining Co.

There are 18 groups of laborers for cargo handling, mainly loading coal, under the supervision of the Operation Department. One group consists of 3 foremen and about 15 laborers. The total number of laborers is about 273. There are 60 ship's gear operators.

Quang Ninh Port owns 7 barges of 250 kilo tons capacity with 4 crew for each, 8 tugs with one crew for each, one launch for laborers' transportation with 6 crew, 4 trucks, 12 forklifts and two mobile cranes as supporting equipment on land.

Table 4-3-1 Summary of Equipment in Hai Phong Main Port area and Chua Ve Port area

No.	Equipment	Main Port Area		Chua Ve Port Area	Note
		Enterprise I	Enterprise II		
	(TRUCK)				
1	IFA-W50	10	13		Load 5 Ton
2	Zul-130	1	2	4	Load 5 Ton
3	KAMAZ BEN	3	2	2	Load 8 Ton
4	UWAT	1	1	1	
5	TA369				
6	BO MAZ		1	3	Load 5 ton
7	KAMAZ short				Load 8 Ton
8	BO MAZ short		34	9	Load 8 Ton
9	BO MAZ long				Load 12 Ton
10	CHAINA				Load 5 Ton
11	KPAZ			1	Load 6 Ton
	(TRACTOR)				
1	Tractor 6711	1	1		
2	Tractor 6911		9		
3	Tracror 7011	11	1	6	
4	Tractor IRQ	5	34	3	
5	Tractor ZETC 25K	1			
6	Remorque Tractor	3	2	1	
7	Tractor MTZ				
	(FOLKLIFT)				
1	Forklift 4045	8	3		Lift 5 ton
2	Forklift 4014M	4		2	Lift 5 ton
3	Forklift Oil	4	3	1	Lift 3 ton
4	Forklift Power		11		Lift <1 ton
5	Forklft USSR-CT	1			Lift 10 ton
6	Forklift HYSTER-50	2			Lift 2.5 ton
7	Forklift HYSTER-250	1			
8	Forklift KAIMAR	1			Lift 5 ton
9	Forklift HYSTER-620	1			Lift 32 ton
	(MOBILECRANE RUBBER)				
1	KC 5363	1	2	1	Crane 25 ton
2	kPA 3			2	
3	RDK			1	Crane 28 ton
4	Hoist	2			
5	Bulldozer	1		1	
6	Steam Roller				
7	Bus	6		5	
	(CLEVIS)				
1	20'	6			
2	40'	3			
3	Rumai 4T	9			
4	Russan 60T	1			
5	Russan 20T	1			

(Report from feasibility study on Hai Phong port rehabilitation plan)

Table 4-3-2 Summary of Jib Cranes in Hai Phong Main Port Area

No	Jib Crane	Capa.	Year of Install	Country Manuf.d	Consumption Power	Location
	Hoang Dieu					
1	Crane No.11	10 T	1972	USSR	320 KW	Berth to Chua Ve
2	Crane No.17	10 T	1974	USSR	320 KW	Berth No.4
3	Crane No.23	10 T	1977	USSR	320 KW	Berth No.4
4	Crane No.26	5 T	1978	USSR	155 KW	Berth No.11
5	Crane No.27	5 T	1978	USSR	155 KW	Berth No.10
6	Crane No.28	5 T	1979	USSR	155 KW	Berth No.10
7	Crane No.30	10 T	1979	USSR	320 KW	Berth No.5
8	Crane No.31	10 T	1979	USSR	320 KW	Berth No.5
9	Crane No.34	5 T	1980	USSR	155 KW	Berth to Vat Cach
10	Crane No.36	12.5 T	1990	USSR	320 KW	Berth No.1
11	Crane No.02	10 T	1968	USSR	320 KW	Berth No.7
12	Crane No.03	10 T	1968	USSR	320 KW	Berth No.7
13	Crane No.04	10 T	1968	USSR	320 KW	Berth No.8
14	Crane No.09	5 T	1969	USSR	155 KW	Berth No.11
15	Crane No.10	16 T	1972	USSR	360 KW	Berth No.7
16	Crane No.18	10 T	1974	USSR	320 KW	Berth to Chua Ve
17	Crane No.25	10 T	1977	USSR	320 KW	Berth No.6
18	Crane No.37	10 T	1990	USSR	320 KW	Berth No.7
	Container Enterprise					
1	Crane No.13	10 T	1972	USSR	320 KW	Berth No.8
2	Crane No.16	16 T	1974	USSR	360 KW	Berth No.7
3	Crane No.35	16 T	1985	USSR	360 KW	Berth No.1
4	Crane no.12	10 T	1972	USSR	320 KW	Berth No.3
5	Crane No.24	10 T	1977	USSR	320 KW	Berth No.3
6	Crane No.32	5 T	1979	USSR	155 KW	Berth No.1, 2
7	Crane No.29	5 T	1979	USSR	155 KW	Berth No.3

(Report from feasibility study on Hai Phong port rehabilitation plan)

Table 4-3-3 Kondor crane's particulars (Two Units) in Chua Ve Port Area

(1)	Lifting Capacity	Hook	32 Ton (out reach 8m-32m)		40 Ton (out reach 8m-25m)	
		Grab	16 Ton (out reach 8m-32m)			
		Container	32 Ton (out reach 8m-32m)			
(2)	Lifting Height above Quey Rail	Hook	28.5m			
		Grab	15.5m			
		Container	(20') 19.0m		(40') 17.0m	
(3)	Lifting Level under Quey Rail	Hook	13.0m			
		Grab	10.0m			
		Container	(20') 13.0m		(40') 15.0m	
(4)	Speed of Crane	Lifting 40m/min	Unlifting 47m/min			
		Changing of Out Reach 40m/min			Shifting on Rail 20m/min	
(5)	Others	Gross Weight	430 Ton			
		Installed	1988 TAKRAF GERMANY			

(Data source from Hai Phong port)

CHAPTER 5 OUTLINE OF BAI CHAY BAY AREA

5.1 Site Condition

Cai Lan Port is located in Bai Chay Bay, which lies to the north of Ha Long Bay, one of the most beautiful spots in Vietnam and dotted with a number of small, scenic islands. Many tourist hotels cluster along the coast of Ha Long Bay, most of them located near Cua Luc Strait. During the summer season, many vacationers visit Ha Long Bay and enjoy sightseeing by boat cruising in the bay area.

Geographically, Bai Chay Bay is separated from Ha Long Bay by Cua Luc strait where the Bai Chay - Hong Gai Ferry provides a link between Bai Chay District and Hong Gai District. This ferry service functions as a section of national road No.18, which originates from Thai Nguyen, passing through Bai Chay/ Hong Gai and extending up to Cam Pha, one of the largest coal exporting ports in the north of Vietnam.

All the ships calling at Cai Lan Port in the future will sail through Ha Long Bay, crossing the ferry service area and entering the Bai Chay Bay. The ships, after passing the narrow Cua Luc Strait, will make sharp portside turns to approach Cai Lan Port.

Into Bai Chay Bay flow many rivers whose estuaries are densely covered by mangroves. This mangrove forest abounds in the coastal zone of Bai Chay Bay, particularly in the north and the west.

Cai Lan Port is under construction on the southern coast of Bai Chay Bay, where the mangrove vegetation is relatively thin. The southern coast is sparsely inhabited by local villagers and partly occupied by various shore facilities such as the B-12 oil berth, Ha Long ship yard, brick factory, etc.

Cai Lan Port is located between the ship yard and the oil berth. The existing access to Cai Lan Port is by national road No. 18, which before reaching the Bai Chay Ferry terminal passes via an earth-paved hill road. The port road branches off this section of route No. 18 and runs into the port area. The port access road crosses a causeway that traverses the swampy outlet of an irrigation reservoir located inshore of the port area. The swampy area is sparsely vegetated by mangroves. The port road, after passing this causeway, goes onto the flat terrain of the port, which is surrounded by small hills.

The recently completed Berth No.1 is located on the shoreline of this flat terrain. To the east of the berth lies a small estuary area covered by low-growing mangroves. A small hill is situated inshore of Berth No.1. To the west, a chain of hills extends close to the coast line up to the vicinity of the shipyard.

In the port area stand three large transit sheds that were constructed in the era of the civil war. Small buildings are also dotted in the port area, most of them lying to the south east of the currently developed port area.

5.2 Natural Condition

5.2.1 Meteorology

Meteorological data representing the climate in the Project Port site has been recorded at Bai Chay Weather Station, which is located at 20° 58' N and 107° 04' E at an elevation of 37.6 m above sea level. A report by TEDI (1988) summarizes the meteorological data from 1974 to 1982, including temperature, precipitation, fog, winds and typhoons.

(1) Temperature

Temperatures recorded in the Bai Chay Station are tabulated below. The highest and the lowest temperature ever recorded was 35.9 °C on June 2, 1982 and 5.4 °C on December 14, 1975 respectively. The summer season, June to August has an average temperature of about 28 °C, while the winter season consists of December, January and February with an average temperature of 16-17 °C.

Table 5-2-1 Temperatures in Bai Chay (1974 - 1982)

(Unit : °C)

	Jan.	Feb.	Mar.	Apr	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov	Dec.
Average	16.4	16.5	19.7	23.2	26.7	28.2	28.6	27.9	26.9	24.8	20.9	17.6
Maximum	27.9	28.9	32.3	30.3	34.8	35.9	34.5	35.0	33.6	31.5	30.3	27.5
Minimum	6.0	7.0	10.7	13.7	19.0	21.9	22.2	21.8	19.4	14.2	9.0	5.4

(2) Precipitation

The annual precipitation significantly fluctuates year by year, ranging from 1,419 mm in 1976 to 2,892 mm in 1980. The daily maximum rainfall was recorded at 350,4 mm on July 21,1978. Rainy days are comparatively frequent, averaging 194 days per year.

Table 5-2-2 Precipitation in Bai Chay (1974 - 1982)

(Unit: mm)

	1974	1975	1976	1977	1978	1979	1980	1981	1982
Annual Rainfall	1,885	1,598	1,417	1,429	2,327	2,270	2,892	1,923	2,275

Table 5-2-3 Rainfall and Rainy Days in Bai Chay (1974 - 1982)

	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Monthly Rainfall (mm)	22.5	25.5	23.8	112.7	266.8	269.8	346.2	463.4	262.7	145.7	48.9	14.0
Rainy Days	14	16	22	19	15	19	19	21	17	15	9	8

(3) Fogs

The Bai Chay area experiences fogs and mists during the winter and early spring months, averaging 58 days a year.

Table 5-2-4 Foggy Days in Bai Chay (1974 - 1982)

	Jan.	Feb	Mar	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Dense	0	0.5	0.8	0	0	0	0	0	0	0	0	0	1.3
Medium	0	2	4	0.5	0	0	0	0	0	0	0	0.5	7.0
Thin	9.1	10.2	17	8.0	0.5	0	0	0	0.3	0.3	2	2	49.4

(4) Winds

Generally, the winds in Bai Chay area are gentle. Winds of 1 - 3 m/sec account for 69.9 % and 14 m/sec plus for 0.18 %. The winds predominantly blow from NE (20.8 %), followed by E (13.4 %) and N(10.4%).

(5) Typhoons

The Bai Chay area and its vicinity, including Hai Phong and Mong Cai are occasionally subjected to typhoons. The strongest winds induced by typhoons reached 51 m/sec on August 21,1977, when the typhoon "Sanah" struck the Hai Phong Port area. The historical records of typhoons are tabulated below.

Table 5-2-5 Records of Typhoons in North Vietnam

Date	Name of Typhoon	Typhoon Attacked Area Area Affected by Typhoon	Maximum Wind speeds
June 19,1975	-	Hai Phong	NE-24/sec
Aug. 10,1975	-	Quang Ninh	S-24 m/sec
Aug. 21,1977	Sanah	Hai Phong	NE-51 m/sec
Aug, 28.1977	Etaine	Mong Cai	WNW-19 m/sec
Oct. 2,1978	Lda	Quang Ninh	NNE-32 m/sec
Aug. 3,1979	Hope	Bien gioi Viet Trung	NE-25 m/sec
Jun. 28,1980	Hrebent	Quang Ninh	WSW-24 m/sec
Jul. 23,1980	Joe	Quan Ninh/Hai Phong	S-35 m/sec
Aug. 10,1981	Roy	Hai Phong	-
Aug. 20,1981	Warren	Hai Phong	ESE-26 m/sec
Sep. 16,1982	Iwong	Quang Ninh	NE -28 m/sec
Jul. 18,1983	Vere	Hai Phong/Quang Ninh	- 40 m/sec
Apr. 26,1984	Wynne	Hai Phong/Quang Ninh	- 25 m/sec

5.3 Socio-economic Condition

5.3.1 Population of Bai Chay Peninsula

The main centres of population around Bai Chay Bay are focussed on the newly created Ha Long City. This includes the settlement of Bai Chay and the town of Hong Gai, which lie on either side of Cua Luc Strait.

The town of Hon Gai, on the eastern edge of Cua Luc Strait, extends north along the Bai Chay Bay shoreline and east along the Ha Long Bay coast. Hong Gai is a busy coastal port, dedicated to the shipping of coal under the direction of the Ministry of Energy. This town is the centre of government for Quang Ninh Province. Other economic activities here include fishing and tourism. Large coal mines are located in the hill country east of Hong Gai, in the vicinity of Cam Pha and elsewhere along the coastal range of hills.

Bai Chay extends westward around the shoreline of Ha Long Bay until it meets the settlement of Cai Dam. Together, Bai Chay and Cai Dam currently have a population of 9,200 people. Bai Chay, on the western side of Cua Luc Strait, is a small coastal settlement. It is one of the main population centres of the Bai Chay "peninsula", which stretches along the southern edge of Bai Chay Bay, separating the estuarine waters of the Bay from the coastal waters of Ha Long Bay.

Approximately 5 km west of Cua Luc Strait are Gieng Day (population 3,300) and Ha Khau (population 7,000). Hung Thang, on the Halong Bay coast, has a population of 3,100. Further west still is the settlement of Dong Dang, 11 km west of Cua Luc Strait and in the western-most corner of Bai Chay Bay. Just 4 km north of Dong Dang, also on the edge of Bai Chay Bay is Hoanh Bo.

From Hoanh Bo around the northern edge of Bai Chay Bay the population is scattered in small hamlets or single dwellings. Most of this rural population is located on the low-lying agricultural land close to the coast, and on the lower slopes of the surrounding hill-sides. This scattered population structure remains similar around the northern and eastern shores of Bai Chay Bay.

About 1 km from Cai Lan Port itself is the Cai Lan settlement, some 2 km west of Bai Chay. Approximately 80 people live in Cai Lan. The houses here line Route 18 which leads to the Port. A few other residences are present along this road between Cai Lan and Gieng Day. In the Port area itself, there are no permanent dwellings and the few occupants are Port workers. Some house-

boats moor along the shoreline near the Port. Cai Lan will be most directly affected economically and socially by the port development.

5.3.2 Employment Structure

Most people in the area are employees of the government and thus their main income is from salary. A smaller number of people are employed in the tourist industry, while a very few are employed in the fisheries and agricultural sectors. Considering the limited area of agricultural land in the area (estimated at approximately 200 hectares by Quang Ninh Province) this is not surprising.

5.3.3 Bai Chay Bay - Northern Shoreline

While the northern shoreline of Bai Chay Bay is separated from the Cai Lan area by several kilometers of estuary, the potential effects of the port development on water quality and hence on the mangrove ecosystem make this an area of importance to this study. Economic activities in this area revolve mainly around agriculture and the harvesting of sea food of various types. Large areas of mangrove are present around the northern estuary and these are heavily exploited for firewood. Shell fish are collected from the mud flats (up to 2 kg per person per hour) in some places. Mangrove worms are also harvested from the area. Although much of this natural produce is utilized directly by the local population, some is marketed as well.

Large areas of mangrove have been developed for aquaculture, particularly shrimp. Quang Ninh Province estimates that approximately 12 hectares of the Bay is used for this purpose. Aquaculture, as in other parts of Vietnam, is expected to be of increasing importance to the local and national economy.

The existing infrastructure is as follows.

(1) Roads

Route 18 connects Ha Long City with Hanoi, and via Routes 5 and 10, with Hai Phong and the western hinterland. This road is 6-9 m wide and mostly paved. From a junction at Gieng Day there are two alterative routes to Bai Chay. One of these follows the northern edge of the Bai Chay peninsula, passing Cai Lan Port and winding through hills down to the ferry terminal. This road is unpaved from the Cai

Lan Port turnoff to Bai Chay. This is the route along which Cai Lan Port traffic would pass. Very little housing is present along this road.

The southern route is a paved road following the shoreline of Ha Long Bay and passing through Cai Dam and the main tourist and residential areas. This route is most commonly used by all traffic travelling to the tourist areas and to Bai Chay ferry.

The road which traverses the northern Bai Chay Bay area is Route 18B. This branches off Route 18 at Dong Dang, passes through Hoanh Bo and then through the agricultural area to the north of the estuary. Route 18B and Route 18 re-join each other near Cam Pha, well to the east of the project area.

(2) Railway

The Bai Chay peninsula is linked to the western cities by rail, but the railway line ends at Ha Long Station, some 3 km west of Cai Lan Port. An itinerant market has grown up around the railway station. Although the rail bed extends to near Cai Lan Port the railway line from Ha Long to Cai Lan was removed approximately 10 years ago. There is no railway near the northern Bai Chay Bay coast line.

(3) Heliport

The only air access to Bai Chay at present is a heliport situated close to the town.

(4) Water Sources

In the populated areas of Bai Chay and Hong Gai some water resources are supplied from ground water bores. However, much of the population is served by piped water from the Dong ho water plant, located several kilometers northwest of Bai Chay. This has a capacity of 20,000 m^3 per day, less than half of which is currently being used. This pipeline supplies Cai Lan.

(5) Electricity Supply

Electricity is supplied to the Bai Chay area via the national grid, which provides both 35 KV and 110 KV power. The main sources of electricity are the Uong Bi and Pha Lai thermoelectric plants.

(6) Communication

The area is supplied with numbered shortwave systems and telecommunication systems through the Ha Long Post office. This provides national and international links.

(7) Culturally Significant Places

Buddhism is the main religion of the Bai Chay people. While there are no large pagodas on the peninsula, two small pagodas are present on the shoreline close to Cai Lan Port. The closest is less than 100 m east of the existing berth. The second pagoda is another 200 m further along the same shoreline, beside a small estuary. Access to both is along a dike which follows the edge of the estuary on the perimeter of the port area. Many people visit these pagodas on festival occasions.

5.4 Environmental Condition

As described in the preceding section, land use around Bai Chay Bay varies from intensive agriculture to aquaculture, forestry, shipping and other industries such as brick and tile manufacturing. In addition there are a number of small settlements around the southern edge of Bai Chay Bay, and a large rural population along the northern shoreline. A number of observations can be made about the likely environmental quality resulting from these land uses. More detailed information is provided in the environmental impact assessment.

5.4.1 Terrestrial Land Use and Effects on Water Quality

The hilly areas north of Bai Chay Bay, originally forested, have been cleared of much of their forest cover. Some re-afforestation has been carried out using plantation species such as *Pinus, Eucalyptus* and *Casuarina*. As has occurred in many other areas of Vietnam, removal of

forest cover has lead to considerable erosion of the hill soils. This is likely to have increased the sediment loads being carried into Bai Chay Bay over the past few decades.

Aerial photographs of the northern Bai Chay area (1:30,000, 1985) show intensive agriculture across the coastal plans and low foot-hills behind the large mangrove estuary. The flat or gently sloping land available for agriculture in this area is quite limited and agriculture is intensive right to the edges of the estuary. In many places, the local people have reclaimed land along the coastal margin for agriculture.

The intensity of agriculture means that there is no longer any natural terrestrial vegetation bordering much of the estuary and thus the natural

filtering effects of this vegetation have been lost. Thus small-scale coastal erosion is also adding to the increased sediment loads entering Bai Chay Bay.

In the northeastern hinterland of Bai Chay, some large coal mines are located. It is likely that mine water from this area enters Bai Chay Bay and also affects its water quality. Coal stock piles are present in several locations along the eastern shoreline of Bai Chay Bay. Coal is deposited in these places to await transportation by barge to Hong Gai. Examples of such sites are Dao Sa To, just north of Hong Gai and in the upper reaches of Dien Vong channel. Coal is piled directly adjacent to the shoreline in these areas and there appears to be no sediment or water control. The same can be said for the brick works which are located at various places around the estuary, for example, at Gieng Day, a few kilometers west of Cai Lan. Here the clay materials and factory are located beside the water's edge and sediment is freely entrained during rainfall. These coal and brick operations have been present for many years and are probably having a continued effect on estuarine water quality.

Other land use factors which may be having an adverse effect on water quality within the Bai Chay Bay estuary, as well as in the coastal waters of Ha Long Bay, are the discharge of sewage and stormwater from the populated areas of Hong Gai, Bai Chay, Gieng Day, Dong Dang and Hoanh Bo. There is no area-wide sewage or stormwater treatment in these areas, and as in most parts of Vietnam, sewage is discharged directly to the nearest river or to the sea. In Bai Chay, individual hotels have treatment facilities which are said to be of the septic tank type. Effluent is discharged from these hotels into the channel beyond the mudflats offshore from the tourist area.

Seawater quality parameters such as suspended solid load, turbidity, presence of human-borne bacteria, oil and grease and heavy metals such as lead may be adversely affected by effluent from these various sources.

5.4.2 Coastal and Marine Environment

Within Bai Chay Bay there are many hectares of mangrove vegetation. Several species of mangrove are present, including *Aegiceras corniculatum, Avicennia marina, Bruguiera gymnorrhiza, Clerodendron inerme, Excoecaria agallocha* and *Kandelia candel*. These species are used to a greater or lesser extent as a source of firewood by the local inhabitants and also as grazing for cattle. For these reasons most of the mangrove vegetation in the estuary is low and stunted. While these species are capable of reaching a height of several meters in this area, according to local scientists, frequent grazing and cutting means that they rarely reach a height of 2 m and most are much smaller.

Fisheries in the estuary include fin-fish, shrimp and shellfish. As with many of the estuarine and inshore coastal areas of Vietnam there is heavy pressure on these fisheries. Fish and shellfish provide a food source for the local populace as well as being marketed elsewhere. No quantitative data about fisheries stocks in these areas has yet been supplied.

Aquaculture in Bai Chay Bay has also had a large effect on the mangrove vegetation. Development of dikes and ponds to trap water for shrimp farming has had a detrimental effect on the mangroves. As a healthy mangrove ecosystem is a crucial factor in maintaining good fish stocks, the development of aquaculture may have a detrimental impact on other fisheries in the long term.

5.4.3 Air Quality

Air quality in the Bai Chay Bay area is most noticeably affected by dust generated by traffic on the many unpaved dirt roads. Heavy loads of particulate material can be observed on vegetation, houses and sidewalks along such roads.

5.4.4 Environmental Laws and Standards

The Vietnamese government has recently enacted the Environment Protection Law (January 1994). This sets out general requirements for environmental protection and for environmental impact assessment. No specific mechanisms by which the law will be implemented have been provided as yet.

Provisional environmental standards have been developed and published and these are currently being debated by the Vietnamese government. The guidelines include several categories

of relevance to the Cai Lan Port project, including coastal water quality, industrial waste water quality, air quality, noise and vibration.

With some exceptions, the standards provided are generally within the range of standards promulgated elsewhere, for example, in Japan, Australia, New Zealand, Indonesia and the U.S.A.

CHAPTER 6 NATURAL CONDITION OF CAI LAN PORT

6.1 General

In this chapter the geographical and hydrographical conditions are discussed. The general meteorological natural conditions are summarized in Section 5.2.

Besides the investigation on the environmental study, the field surveys listed below were conducted on the site shown in Figure 6-1-1 in January and March 1994.

- Topographic Survey
- Bathymetric Survey
- Seismic Survey
- Hydrologic Suevey

The results of surveys are described in the following sections considering the data mainly from the existing suvey reports carried out by TEDI.

6.2 Geographical and Topographical Conditions

The coastline of Vietnam is a drowned coastline consequent on the rise in mean sea level over the last 10000 years of some 80m. Older (alluvial) sediments containing weathered rock fragments were overlain during this period by recent deposits which are likely to comprise soft silty clays or clayey silts offshore; inshore, these recent deposits may comprise loose silty fine/medium sands. The most visible rock type in the area is the karstic limestone which is responsible for the dramatic island topography offshore. However, intrusive/extrusive rocks are likely to be present but it is not known which rock type is the older formation. These general considerations lead to a possible geological succession which is diagrammatically illustrated in Figure 6-2-1.

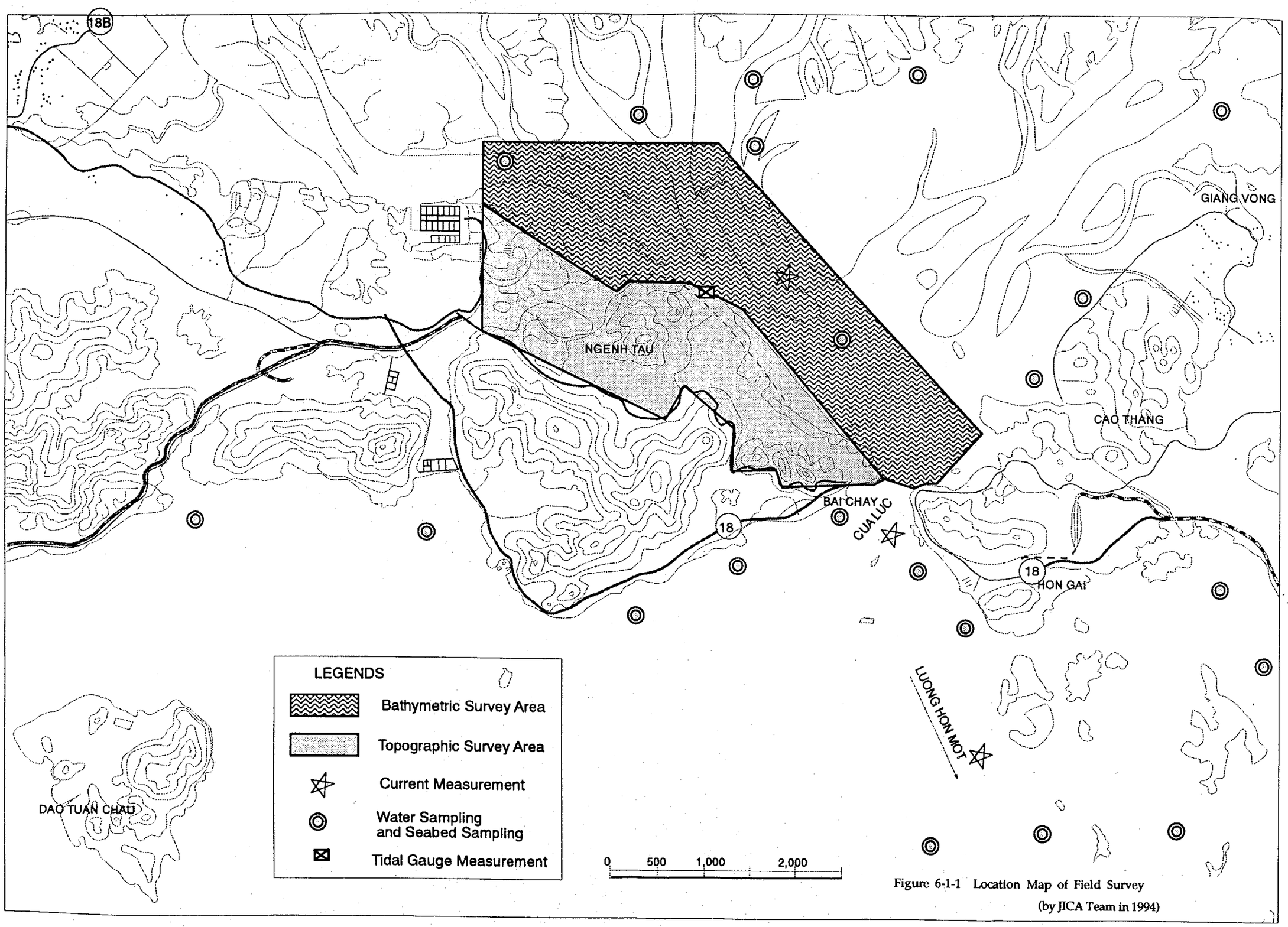


Figure 6-1-1 Location Map of Field Survey
(by JICA Team in 1994)

6.2.1 Geological Conditions

(1) Seismic Survey

Based on the geology investigation report "GEOLOGY INVESTIGATION FOR CAI LAN 1975", in the port area carried out by TEDI, the existence of a rocky layer in a rather shallow position under the sea bed was revealed. In order to obtain more detailed profiles of the rock formations covering the offshore area and the existing navigation channel, JICA Team has decided to perform a sonic-prospecting survey instead of the conventional test boring due to the existence of sea traffic and occasional high waves.

The sono-prober can reveal the outline profiles of subsoil conditions in a more efficient manner. Calibrating with the existing soil data revealed by the TEDI's investigation done in the port area, the sonic-prospecting survey can disclose the profiles of rock formation well enough to perform the feasibility study of the port development in Cai Lan.

The seismic survey was completed at the end of March 1994 and the results are reported in the "GEOPHYSICAL SURVEY, CAI LAN PORT CONSTRUCTION PROJECT, VIETNAM". The survey coverred two survey zones - port area with about 1.5 km x 5.0 km in size and the approach channel area with 0.3 km x 30 km. Interpretation of the seismic sounding data is made referring to the said existing geology investigation report.

(2) Soil Characteristics and Borehole Correlation

A soil boring investigation conducted by TEDI in the Cai Lan Port area reveals the following information. The topsoil consists of sandy silt at a consistency of running plasticity. The bed rocks appear below this sandy silt at -6.0 m to -12.0 m elevation, fluctuating across the area. The rock is composed of limestone and the top layer of this rock is weathered about 3-5 m thick. The physical and mechanical properties of the soils in the port area are summarized in Table 6-2-1 and shown in Figures 6-2-2 and 6-2-3. There are no available borehole logs elsewhere in the Port area or anywhere along the approach channel.

The logs of these boreholes were made available for correlating the geophysical data. The positions of all of the holes are shown in Figure 6-2-2.

The boreholes and analysis of seismic records have revealed the following general succession.

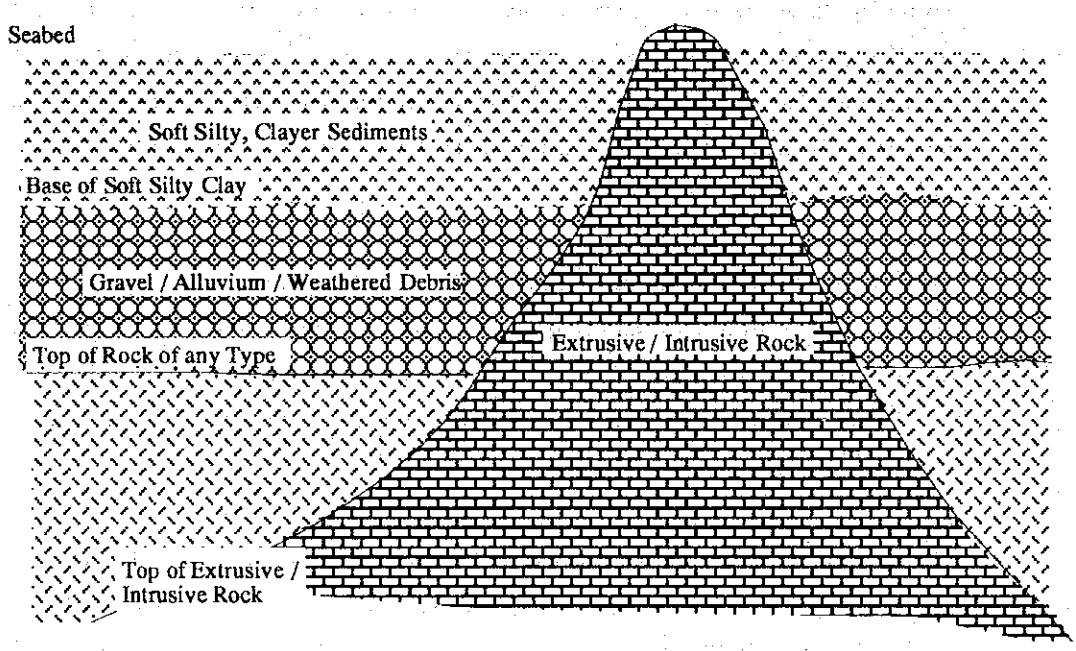
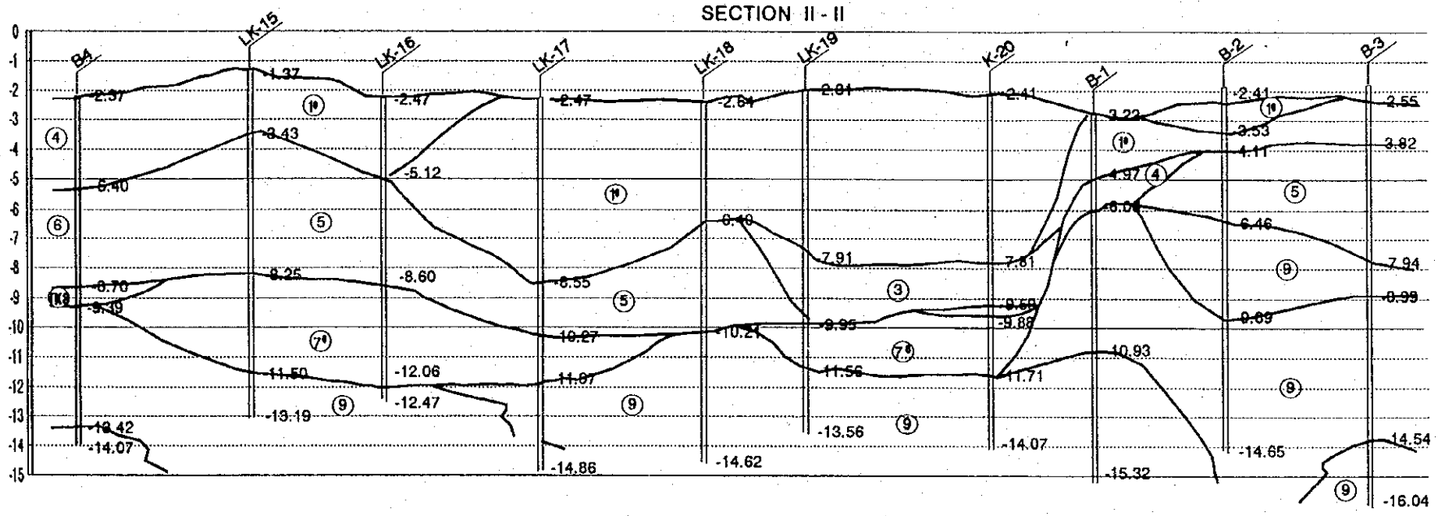
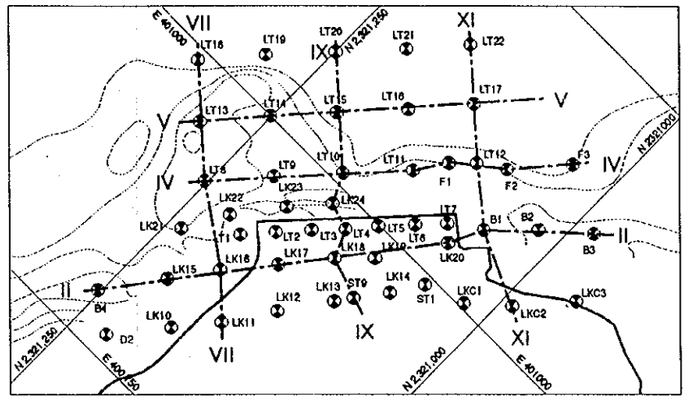


Figure 6-2-1 Assumed Typical Geological Succession

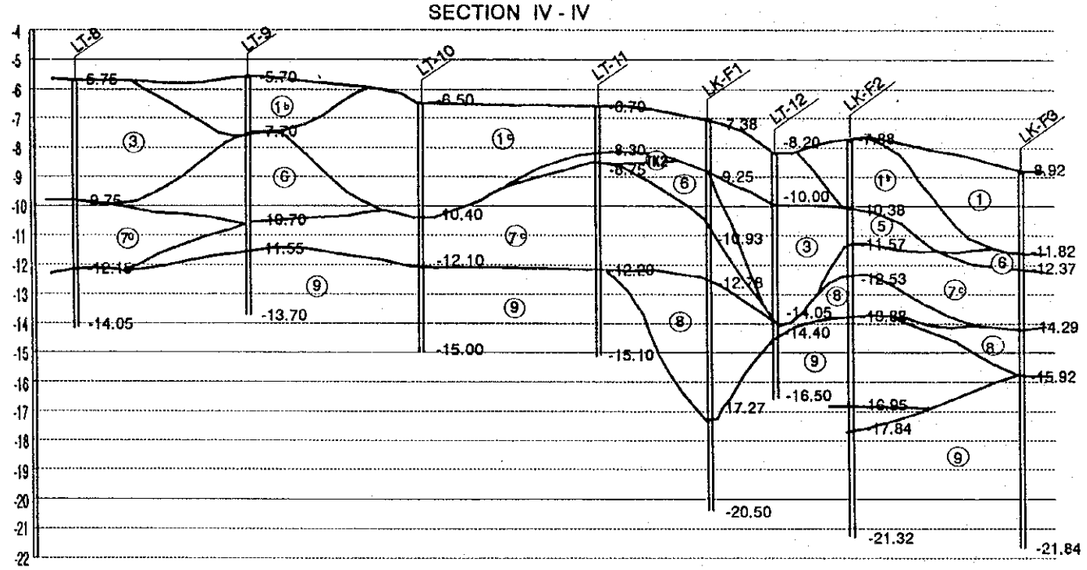
SECTION II - II



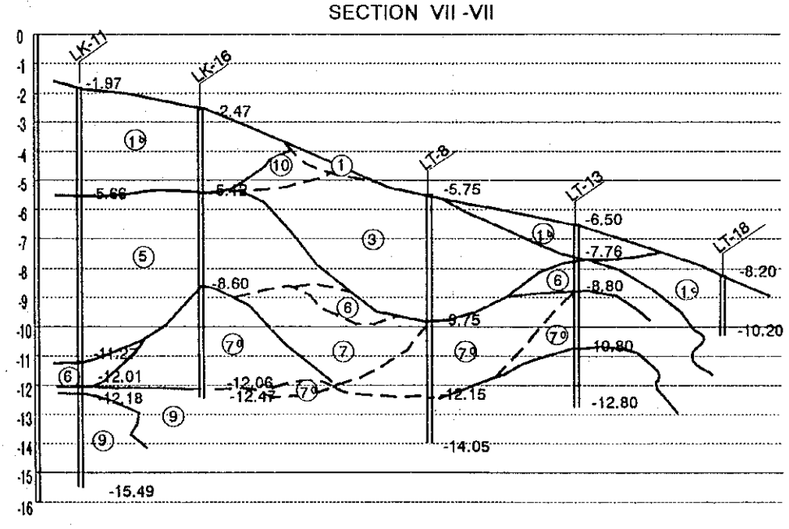
LOCATION MAP OF BORE HOLES



SECTION IV - IV



SECTION VII -VII



SECTION V - V

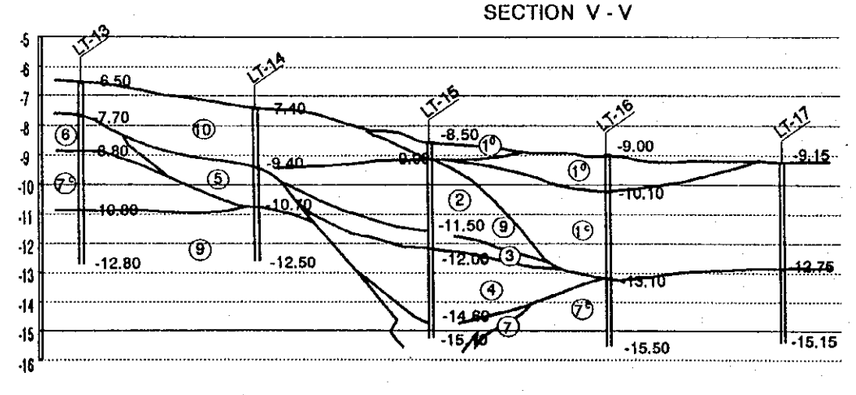


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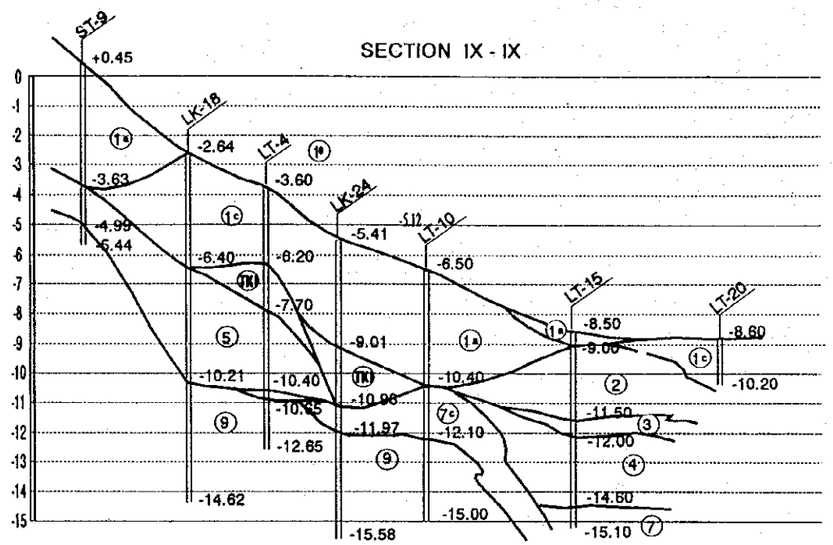
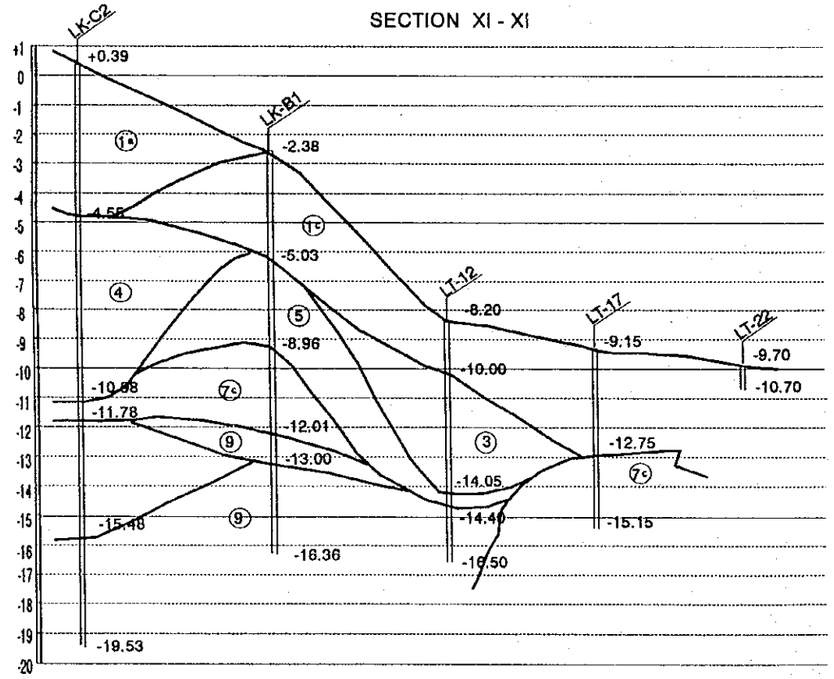
Figure 6-2-2(a) GEOLOGICAL CROSS SECTION
at existing Berth No.1 of CAI LAN PORT

SECTION IX - IX



SECTION XI - XI



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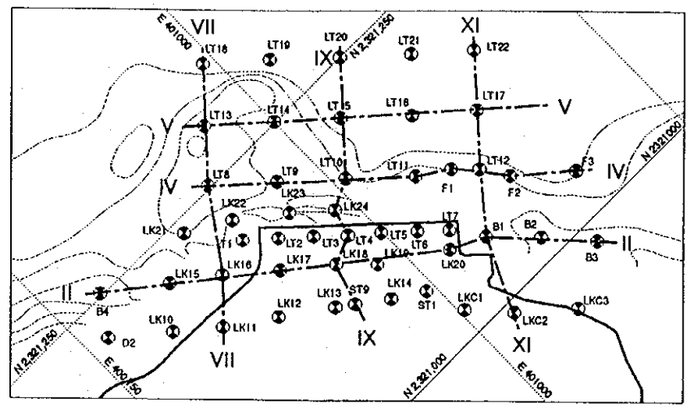
LOCATION MAP OF BORE HOLES



LGENDS OF SOIL CLASSIFICATION

1a	Slit sand clay black gray mixed with clam shells, organic matters.	7	Gravel, quartz, yellowish white.
1b	Silt/clay, sand/clay, plastic and wet black-gray mixed with clam shells.	8	Clay, white-gray, pink-gray, light brown mixed with gravels. Half plastic.
1c	Silt clay, clay wet, black-gray mixed with few gravels, clam shells & organic matters.	8a	Clay/sand, gray, light brown, mixed with gravels and quartz, half plastic.
2	Clay, black gray. Plastic and wet to wet.	TK1	Silt/clay/sand, clay/ sand, wet, grayish mixed with organic matters .
3	Clay/sand, black gray mixed with clam shells, plastic soft to wet.	TK2	Clay/sand grayish mixed with organic matters, plastic, wet.
4	Clay, brightly colored (red, yellow, brown, etc.), plastic hard.	TK3	Clay/sand red, yellow mixed
5	Clay/send, brightly colored, mixed plastic hard to hard.	9	Weathered rock, pink and white.
6	Sand/clay, brightly colored, mixed with a few gravels, wet		

Figure 6-2-2(b) GEOLOGICAL CROSS SECTION
at existing Berth No.1 of CAI LAN PORT

The results of the correlation for those boreholes which fell within or close to the tracks of the survey are given in Table 6-2-2, below. All figures are in metres below Chart Datum (CD).

Table 6-2-2 Borehole Correlation

Bh No	Sea bed		Base of Clayey	Soft Sediments	Top of Any	Rock of Type
	B h		B h	Seismic Survey	B h	Seismic Survey
B2	2.4	2.3	6.5	8.0	6.5	11.5
B3	2.6	2.0	7.9	8.0	7.9	11.0
B4	2.4	3.0	8.7	8.1	9.4	9.6
F1	7.4	9.6	10.9	11.3	17.3	14.0
F2	7.9	9.6	11.6	11.0	13.9	14.2
F3	8.9	9.0	11.8	12.0	15.9	16.0
LX15	1.4	2.9	8.3	7.0	11.6	11.0
LK21	3.8	4.2	8.3	9.0	12.5	12.0
LK23	5.1	10.1	7.0	11.9	12.0	16.0
LK24	5.4	10.0	11.0	12.0	12.0	12.0
LT8	5.8	6.2	9.8	10.5	12.2	11.6
LT9	5.7	9.2	10.7	10.5	11.6	12.2
LT10	6.5	9.2	10.4	10.3	12.1	14.0
LT11	6.7	9.6	8.3	11.0	12.2	13.5
LT12	8.2	9.6	14.0	10.8	14.4	14.5
LT13	6.5	6.6	8.8	9.8	10.8	10.7
LT14	7.4	7.7	10.8	11.0	10.8	13.0
LT15	8.5	8.3	9.0	10.7	15.1	16.4
LT16	9.0	9.4	13.1	12.3	15.5	17.0
LT17	9.2	9.9	12.8	12.5	15.2	16.8
LT18	8.2	8.1	10.2	13.1	-	16.3
LT19	8.3	8.7	10.3	14.0	-	17.7

(3) Contoured Rock Surface

1) Top Elevation of Any Type of Rock

Port Area (Figure 6-2-4):

The difference between the levels of these drawings and the base of soft silty clayey sediments represents the isopachs of gravel/alluvium/weathered debris. Generally, this thickness varies between 2m - 6m. In addition to the two small areas around the light houses, outcrops also appear close to the small island near the entrance of the port and to the north between the two lighthouses.

Approach Channel :

The level of this horizon is generally deeper than -18m CD. However, the material between the base of the soft silty clayey sediments is gravel, alluvium and weathered debris.

2) Top of Presumed Extrusive/Intrusive Rock

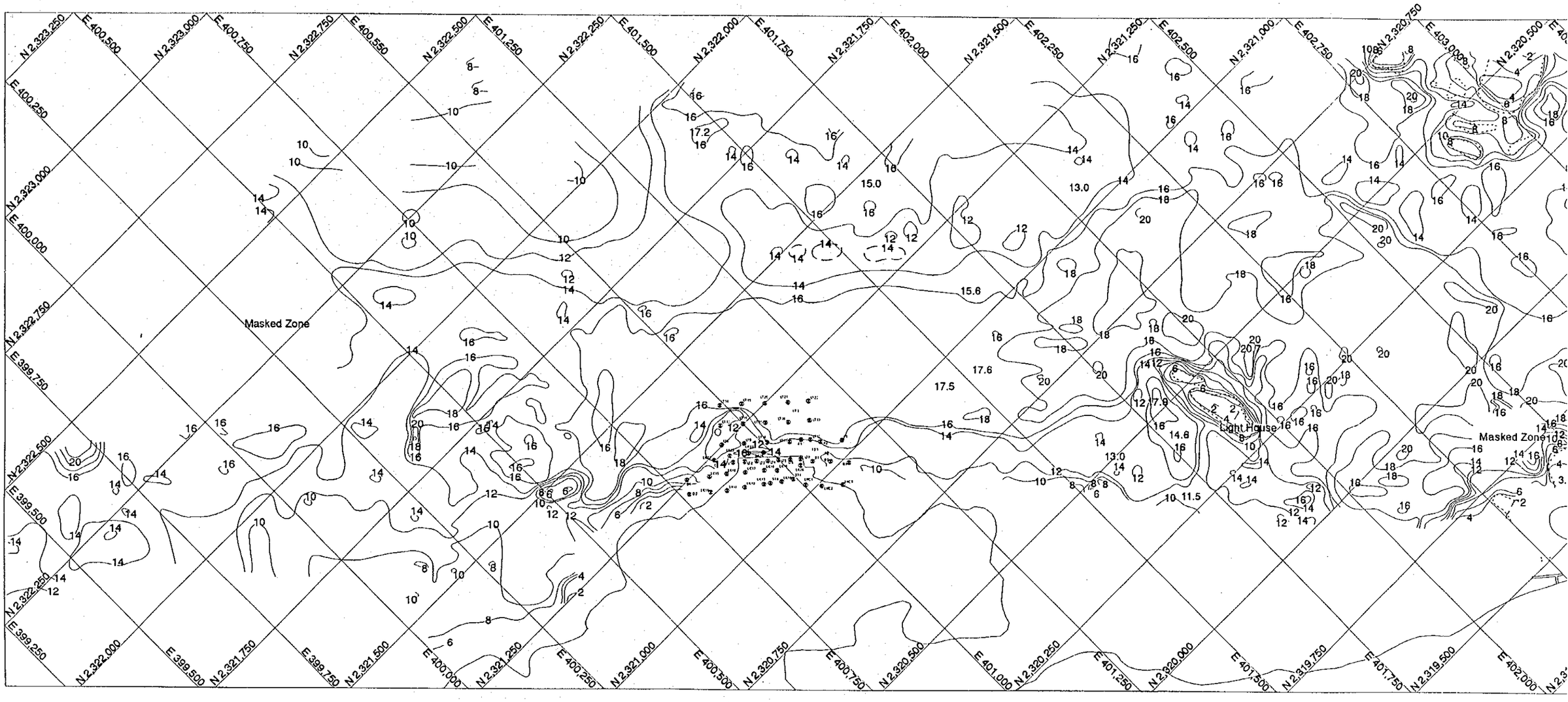
Port Area only :

Because this horizon is uncorrelated the interpretation of it from the seismic records is extremely tentative. Except at outcrop, these rocks lie within the sedimentary rocks but the relationship between the two rock types is not clear.

Because most of the seismic energy has already been reflected by overlying sediments and sedimentary rocks, these intrusive/ extrusive rocks were only identifiable on the records at relatively shallow depth although such rocks seem certain to be present at greater depth.

6.2.2 Topographical Conditions

The topographic survey was carried out on site in January and February 1994, covering the potential development area of Cai Lan port and its vicinity. The topographic survey zone extends over the southern coast of Bai Chay Bay, including the brick factory site in the west boundary, the Bai Chay ferry terminal in the east boundary and the hilly road of route No.18 in the south boundary. The topographic survey area is shown is Figure 6-2-5, which covers about 5.0 km^2 in order to cover the coast west


Masked Zone
Light House
Masked Zone
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E 400,500
N 2,323,000
E 400,750
N 2,322,750
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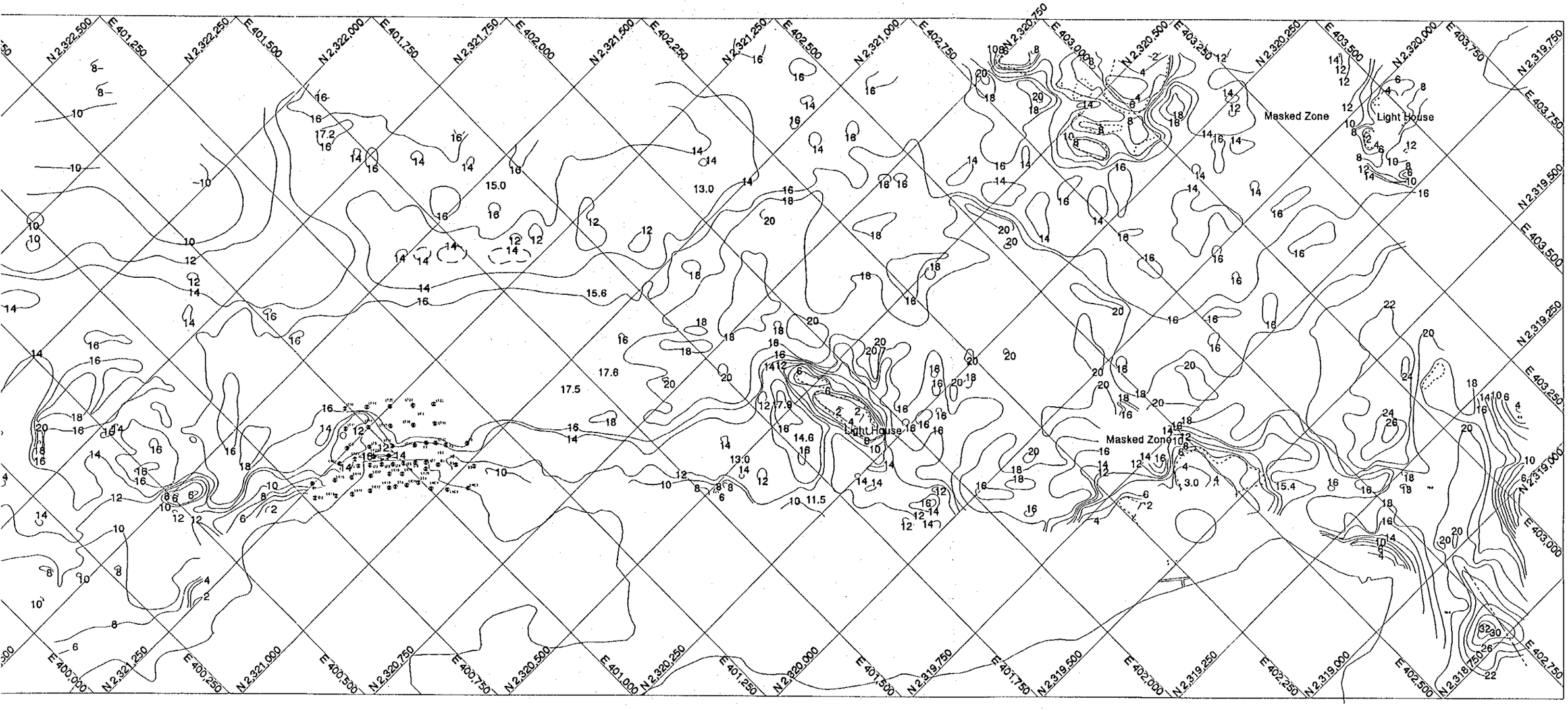
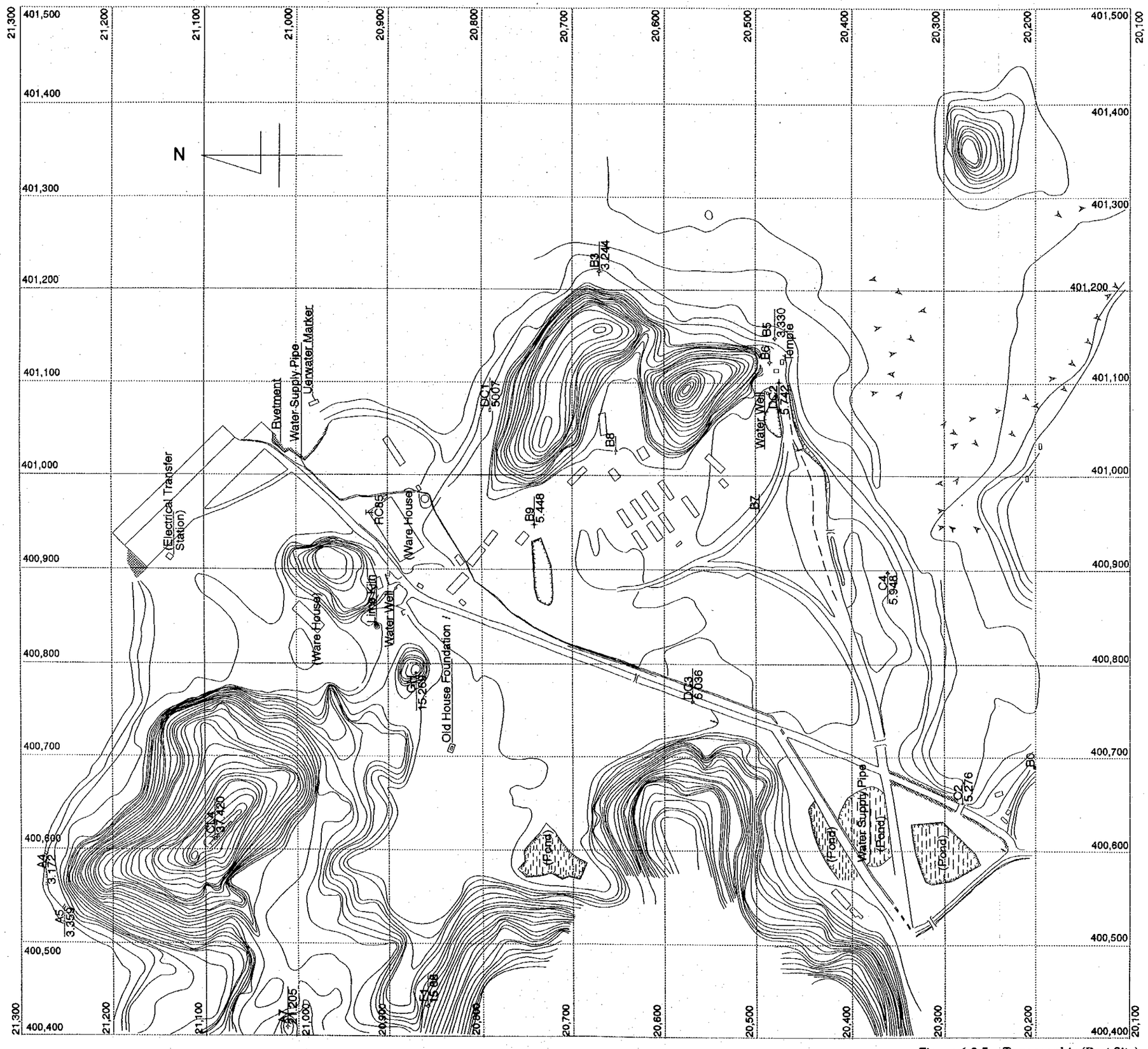


Scale : 1/ 10,000

Figure 6-2-4 Rock Port Area



Scale : 1 : 4,000

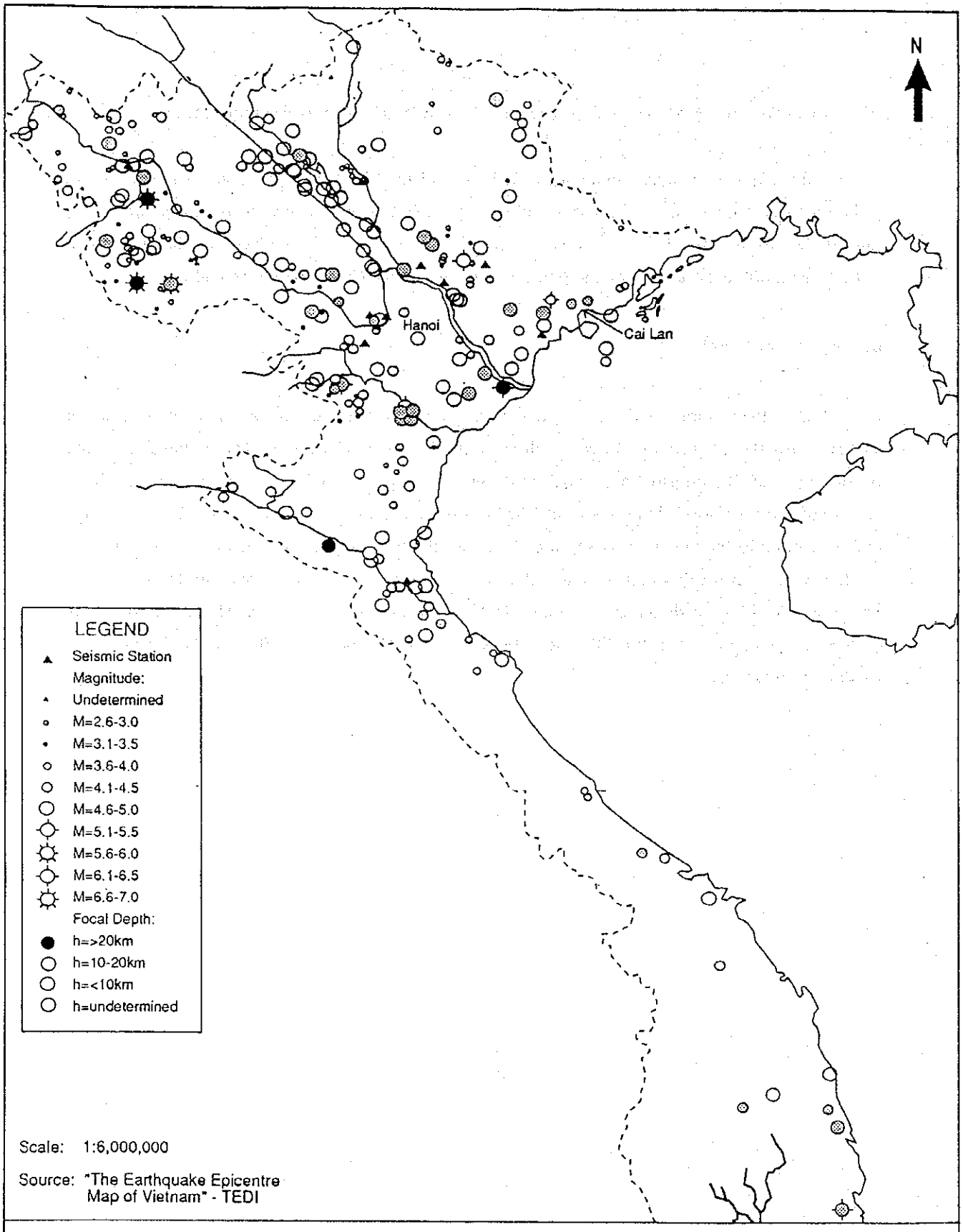
Figure 6-2-5 Topographic (Port Site)

of Cai Lan Port, where Ha Long ship yard and large-scale brick factory are in operation.

The maps are available in a scale of 1/1,000 and 1/2,500. The topographic map shows that inshore part of survey area belongs to the hilly zone, while the mangrove vegetation is predominant immediately to the east of the port area currently being developed. In the port area lie three small hills. The mountain road skirting the port area runs to the Bai Chay Ferry Terminal area.

6.2.4 Earthquake

In Vietnam, more earthquakes occur in the northern part than the southern part. In north Vietnam near the project area, there are three seismic stations; Hai Phong, Hanoi and Bac Giang. According to TEDI's information, a large fault line lies along the Red River and earthquakes have been frequently recorded along this zone. The local seismic map indicates that this belt area belongs to a seismographic zone with a magnitude of 6.1 - 6.5 on the Richter scale. The project site at Cailan is slightly away from this high seismic intensity zone, having a potential magnitude of 5.6 - 6.0. The past records of earthquakes are shown in Figure 6-2-6. The design criteria of earthquake is discussed in Chapter 13 "PRELIMINARY DESIGN CONDITION FOR THE SHORT TERM PORT DEVELOPMENT PALN".



LOCATION OF EARTHQUAKE EPICENTRES IN NORTHERN VIETNAM

Figure 6-2-6 Past Records of Earthquake

6.3 Hydrographical Conditions

6.3.1 Tides

In Bai Chay and Hong Gai, high water tide occurs once a day for most of the days, but occasionally twice per day, about one to three days in a month. The TEDI report, "Hydrologoial Data of VBAI CHAY area 1982" indicates that there is some difference between the high tide levels at Hong Gai and Cai Lan. The high water level in Cai Lan is 2-3 cm higher than that in Hong Gai. The low water level however, is similar at the two sites. The tidal elevations in Cai Lan are reported as follows.

High Water Level	:	+ 3.60 m
Medium Water Level	:	+ 2.06 m
Low Water Level	:	+ 0.60 m

The highest high water level was recorded at + 4.46 m on December 23, 1968 and the lowest water level at -0.11 m on December 22, 1968.

According to the records from the Bai Chay Weather Station, the sea level at Hong Gai Port tends to rise due to decreases in atmospheric pressure as well as winds blowing into the bay area. The highest rise ever recorded was 50-60 cm on July 18, 1963 and 70-80 cm on October 10, 1942. Furthermore, the local people say that high water level reached between +6.00 m and +6.60 m when a typhoon approached Hong Gai in 1985. It seems difficult to justify this local information, as even adding 1.0 m to the normal H.W.L (+3.6 m) is well short of the 6.0 m reported. Nevertheless, it should be noted that Cai Lan Port is located in an area substantially influenced by water surges caused by typhoons.

Based on the tidal measurement for one month in the period from 16 January to February 1994, by hourly manual reading from a tidal guage placed at the existing Pier No.1, the tidal harmonic analysis was carried out by TEDI's computer and the major tidal constituents are tabulated below.

The maximum and minimum water levels measured during this period are as follows:

Hmax = 3.71 m at 4 a.m 26 January 1994
Hmin = 0.52 m at 5 p.m 26 Jan 1994.

6.3.2 Tidal Currents

In the area from Cai Lan Port to the Hong Gai - Bai Chay Ferry area, tidal currents were measured by TEDI. It is reported that the maximum current speeds were 85 cm/sec (= 1.7 knots) on the flood tides and 134 cm/sec (= 2.7 knots) on the ebb tides. The TEDI report indicates that very fast currents occur in the port area particularly during the period of the ebb tides.

To confirm this information, the current survey was carried out, including the current measurement and tidal measurement. Three (3) current meters were installed in the port area, one in front of the Berth No.1, another two in the North and South of the Cua Luc strait respectively. Tide measuring poles were installed near the inshore edge of the Berth No.1 and the tidal measurement took place for one month.

The current measurement was carried out over one month from 16 January 1994 to February 16 1994. Some noteworthy survey results have been summarized below. The maximum current speeds observed at each survey point are tabulated as follows.

Table 6-3-1 Tidal Currents

Position	Ebb tides	Flood tides
Survey Point No.1	0.62 m/see	0.52 m/see
Survey Point No.2	0.40 m/see	0.20 m/see
Survey Point No.3	0.68 m/see	0.40 m/see

Generally, the currents in ebb tides were recorded faster than in flood tides. The fastest current was recorded at 0.62 m/see (= 1.2 knots) four hours after High Water, Jan.26,1994 at survey point No.1, which is in front of the existing pier of Cai Lan Port (see Figure 6-1-1).

6.3.3 Waves

The wave regime off Cai Lan Port was observed during the period of 1965-1968. For more than 90 % of the time, the waves are categorized as "calm", which means that the wave climate was mild, posing no major obstacle in terms of port planning. High waves rarely exceed 1.0 m. The predominant wave direction is NE. The relationships recorded between the winds and the waves are summarized in Table 6-3-6.

Table 6-3-6 Relationship Between Wind and Waves at Bai Chay

Date	Wave Direction-Wave Height	Wind Direction-Wind Speed
1962	W - 1.5 m	W - 12 m/sec
1963	SW - 2.5 m	SW - 24 m/sec
1964	W - 2.5m	SW - 28 m/sec
1965	SE - 0.75m	SW - 12m/sec
1966	SE - 0.75m	S - 7m/sec
1967	NE - 1.0m	N - 14m/sec
1968	SW - 0.75m	-
1969	SSE - 0.75m	WNW - 12 m/sec
1970	NE - 0.75m	NNE - 8m/sec
1971	SE - 0.75m	SE - 8m/sec

6.3.4 Hydrographic Conditions

The bathymetric survey was been conducted in front of the newly developed port area in Bai Chay Bay and in the area of navigation channel that is aligned in the Ha Long Bay, about 30 km long from the Hong Gai Port to the most offshore navigation marker. The results indicates the presence of many shoals in the bathymetric survey area, including many rocky shoals between the Cua Luc Strait and the port area. The existing Hong Gai Channel has shallow spots of -7 m or so.

In addition, the existing sea chart indicates some possibility of shoals in an elevation of less than -12 m in the section of offshore channel close to Goeland. The bathymetric area covered by the JICA Study is about 7.9 km^2. The bathymetric survey area is shown in Figure 6-1-1.