2-3 Port Facilities

2-3-1 General

Hai Phong Port complex consists of four port zones - Main Port, Chua Ve Port, Vat Cach Port and old Chua Ve Port. The Main Port of Hai Phong Port is made up of 11 berths, and stretches 1,722m along the quayside. Main Port is located about 7km downstream of Vat Cach Port. Chua Ve Port is located a further 4km downstream of Main Port, consisting of two berths with a total length of 330m.

The major port facilities in each port zone are briefly summarized in the table below while a detailed description of each port facility is given in the following sections. The general plan of each port is shown in Figure 2-3-1, 2-3-2, 2-3-3 and 2-3-4.

Table 2-3-1 Main Facilities of Hai Phong Port

Description	Main Port	Vat Cach	Chua Ve	Old Chua Ve
1. Berth Facilities				
- Nos. of Berth	11	3	2	1
- Length of Berth	1,722m	314m	330m	200m
- Design depth	- 8.4m	- 3.0m	- 8.4m	
2. Equipment				--
- Jib Crane	25 sets (5-14ton)		Container crane 2 set	
- Folklift	39 set	3 sets	3 sets	
- Mobile Crane	6 sets	5 sets	5 sets	
3. Warehouse	30 building (74,300m²)	-	-	
4. Marshalling Yard	(53,000m²)	-	(24,000m²)	

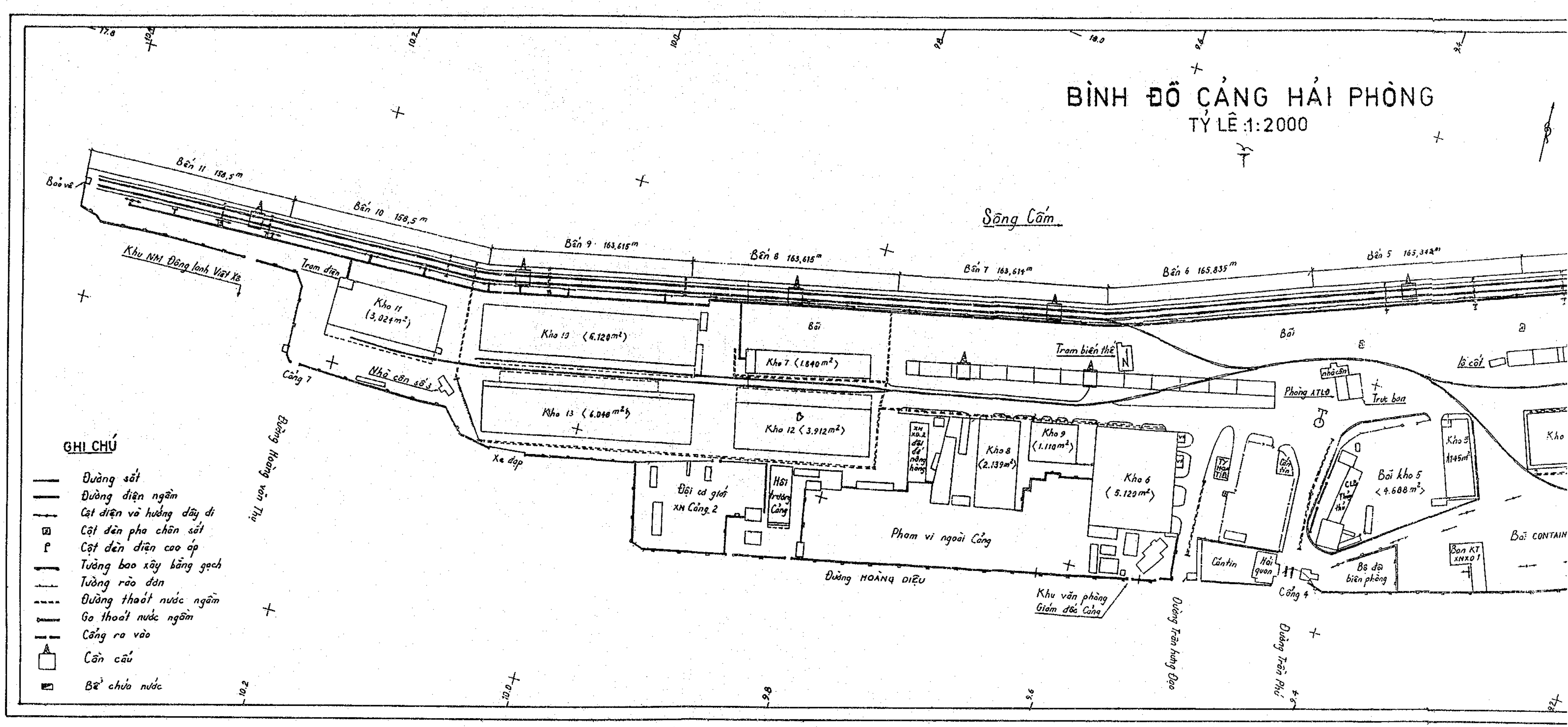
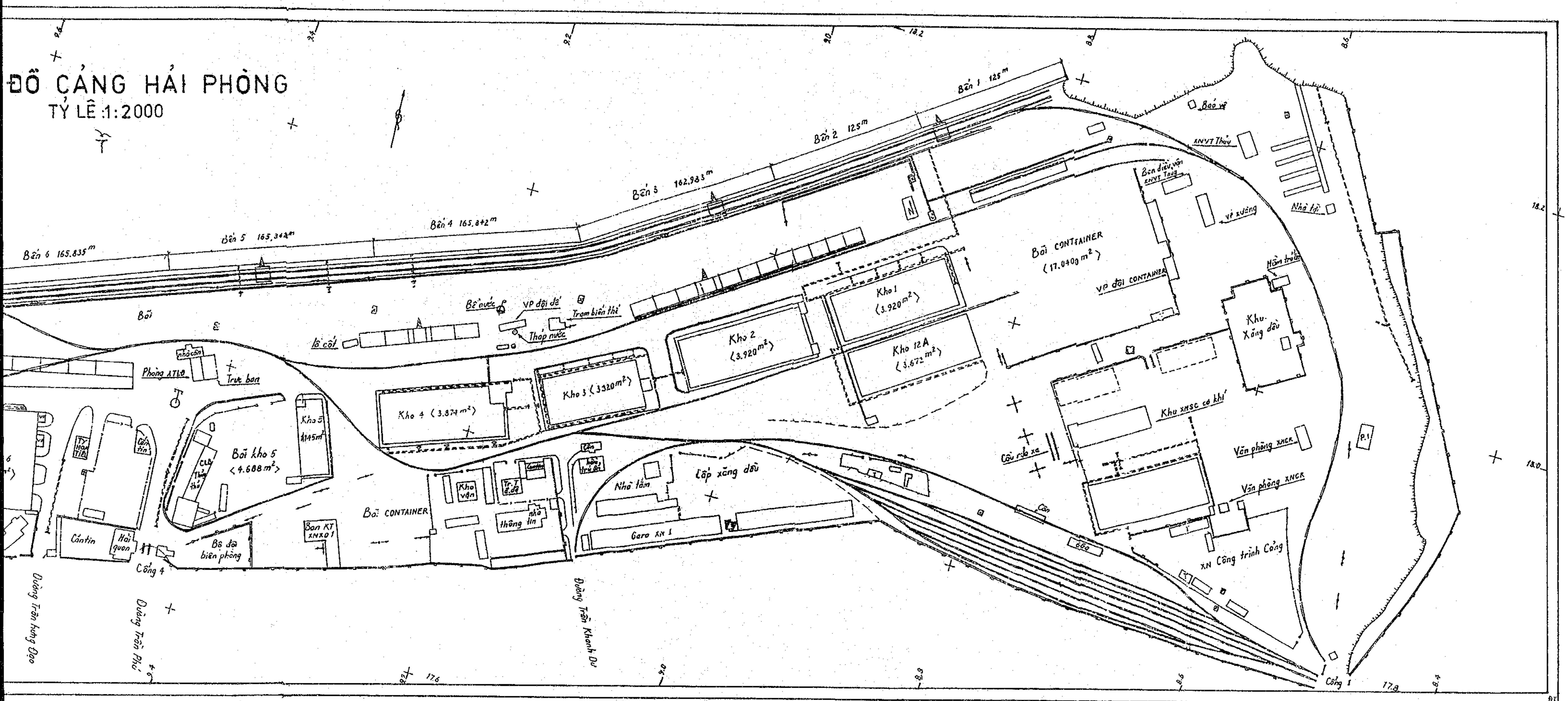


Fig.2-3-1 Plan of Main Port Area



1 Plan of Main Port Area

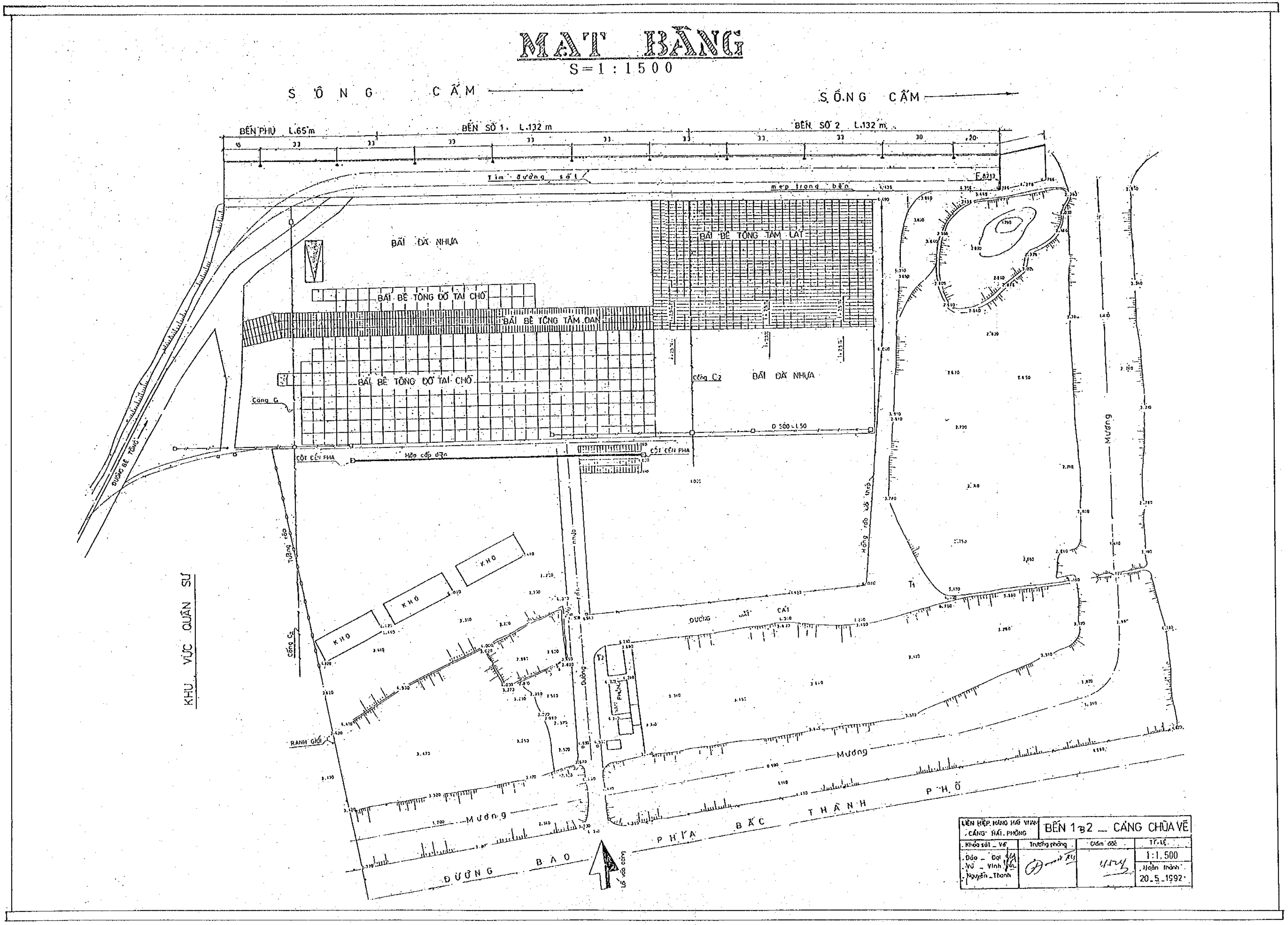


Fig. 2 – 3 – 2 **CHUA VE–DOAN XA PORT**

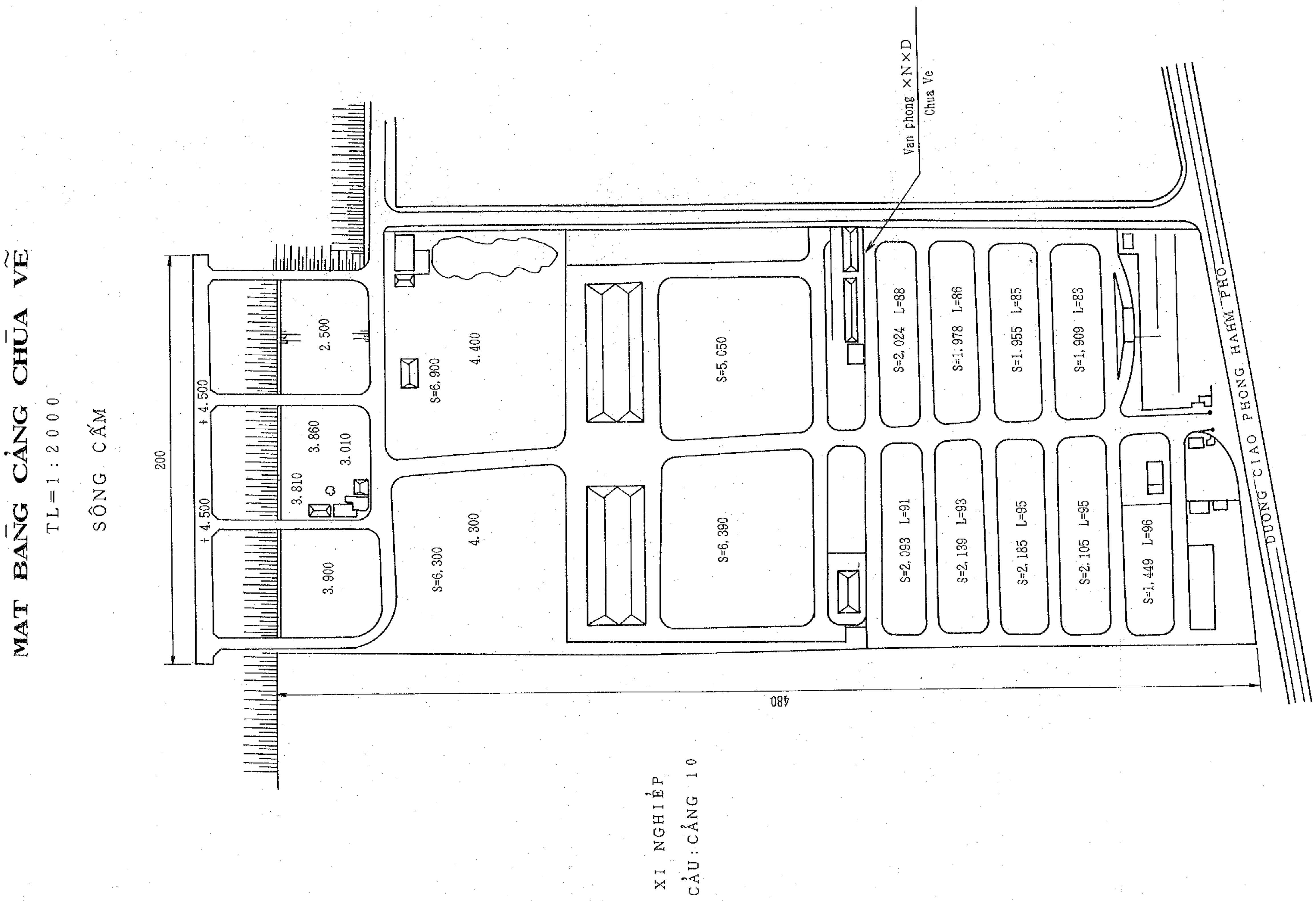


Fig. 2 – 3 – 2' **OLD CHUA VE PORT**

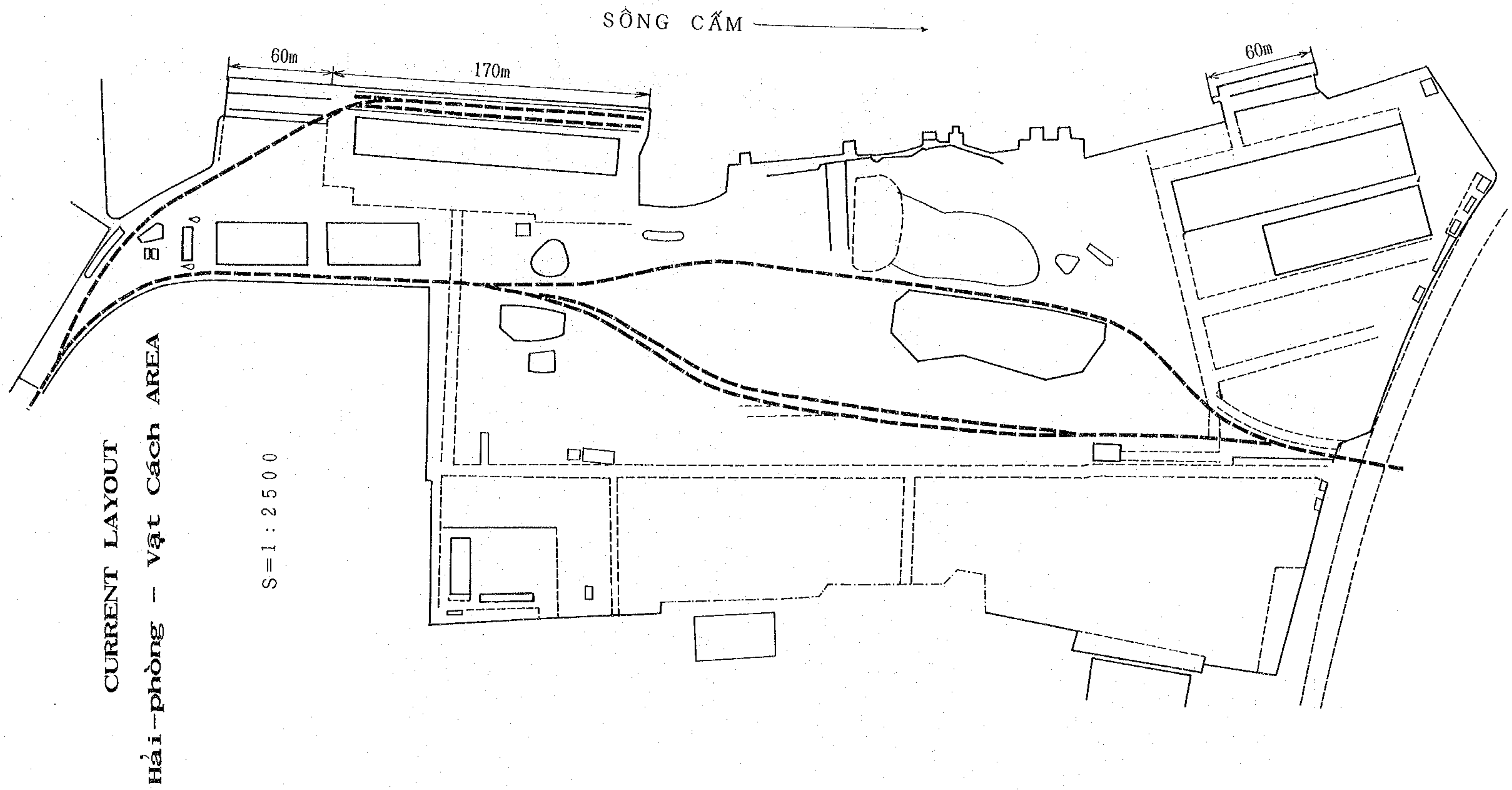


Fig. 2 – 3 – 3 **VAT CACH PORT**

2-3-2 Main port

(1) Berth Facilities

The Main Port of Hai Phong consists of 11 berths. Among them, Berth No.1 and No.7 handle container cargo shipment, and the annual container throughput in 1992 was recorded at 13,815 TEU in total. The remaining nine(9) berths cater to conventional general cargo and break-bulk cargo with an annual throughput of about 2.1 million tons.

The existing quaywall was constructed with steel-sheet-piled structure in 1970's. The sheet pile quaywall has since remained in good condition, causing no operational problem. An outline of each berth is provided below.

Berth No.1

No.1 Berth (125m long), which is located in the downstream end of Main Port, now only serves container shipment for the shipping line of GEMATRAN. The No.1 Berth is provided with two(2) 10 ton rail-mounted quayside cranes, both of them 16-20 years old, working in very poor condition. For lack of their hoisting capacity, the container handling is being done by ship's gear.

The container marshalling yard is 17,000m^2 in area and severely congested, so that Hai Phong Port has a plan to expand the marshalling yard inshore, behind shed No.12A and close to the maintenance shop zone. To the east of Berth No.1 is the fishing port and dry dock facilities, leaving no more space for expansion of marshalling yard.

The railway from port entrance No.1 curves along the eastern port boundary, traveling into the apron of No.1 Berth and further extending up to No.11 Berth.

Berth No.2

Berth No.2 (125m long) is provided with one 10 ton (made in 1977) and one 5 ton (made in 1980) quay crane and contributes to bulk cargo shipment (clinker, apatite and ore). Sometimes, unloading and loading is carried out directly to and from the railway wagons running under the quay crane. Berth No.2 has two transit sheds behind the open bulk-storage yard, Shed No.1 (3,920m^2) and Shed No.12 (3,672m^2). Shed No.1 is being used for storing dangerous goods, while Shed No.12 is being renovated to serve as CFS. Between these transit sheds and the open storage yard is located one set of traveling crane whose rails extend up to Berth No.3, taking care of bulk cargo handling in the open yard of Berth No.2. The railway line runs between Transit Shed No.1 and No.12A and extends up to the rear of Berth No.3. These lines are not used now due to shortage of stowed cargo. A lot of containers, which overflow from the neighboring Berth No.1 are stacked mostly in two-tiers in front of the Shed No.1.

Berth No.3

Like Berth No.1, Berth No.3 handles bulk cargo shipment. Berth No.3 (162.98m) has two 10 ton cranes, both of which (made in 1979) are too old to function efficiently. At the rear of the open yard, a yard crane travels in and out of Berth No.2, serving cargo marshalling in the yard. Transit shed No.2 (3,920m^2)is located behind the yard, next to transit shed No.1.

Berth No.4

Berth No.4, generally, handles heavy break-bulk cargo such as steel products, coils and sometimes bulk cargo. Berth No.4 (165.84m) has two 5 ton quayside cranes, installed in 1978 and 1979 respectively. One more 12.5 ton crane runs behind the open storage yard, contributing to rehandling of heavy cargo in the yard. At the center of the berth is located an old elevated water tank which is not used now. Water supply is executed by water tankers. Transit shed No.3 (3,320m^2) and No.4 (3,874m^2), which mainly stock general cargo, fertilizer and bagged cargo, are located behind the open yard across the spur lines of railway that run along the rear of transit shed No.1 through transit shed No.3 to transit shed No.4. This railway line is not well used now.

Berth No.5

Berth No.5 also serves the shipment of break-down cargo. Berth No.5 (165.84m) has two quayside cranes, one 10 ton crane (installed in 1972) and one 5 ton crane (installed in 1978), both of them too old. Behind the open storage yard across the spur line of railway lies one transit shed No.5 (1,145m^2) as well as one open storage yard (4,688m^2). Port Gate No.4 (the main gate) is situated inshore of this open storage. The canteen and city-owned seamen's club are also sitting near Port Gate No.4.

Berth No.6

Berth No.6 (165.84m) has two 10 ton quayside cranes, installed in 1974 and 1977 respectively. Behind the berth apron runs marshalling yard crane that serves the marshalling of container overflowing from Berth No.7, and the transit shed No.6 (5,120m^2) is located further behind. The Hai Phong Port Administration Office is located just behind transit shed No.6 with the entrance gate open to the city road that runs along the southern boundary of the port. Other minor facilities are also situated near the operation building, including a restaurant and customs office.

Berth NO.7

Berth NO.7 (163.61m) handles container cargo of H-A line (Korea) using two quayside cranes (16 tons) and two marshalling yard cranes (16 tons and 10 tons) that travel on the rail, covering the open storage yard of Berth No.7 and No.6 as well. H-A line ships occasionally use their own derrick cranes for container handling, so that container shipment at Berth No.7 is a mixture of quay and ship cranes.

A lot of containers are stacked between these two rows of crane rails, and some of the containers are stacked between the marshalling yard and the transit shed No.9 (1,110m^2).

Berth No.8

Berth No.8 (163.62m^2) has two 10 ton quayside cranes, made in 1972 and 1968. These cranes, so obsolete, can hardly display the said nominal capacity, so ship's gear plays a major role in loading and unloading cargoes.

Unlike the berths before mentioned, transit sheds occupy a considerable part of the back up area. Two transit sheds are located behind the open storage yard. These are transit shed No.7 (1,840m^2) and transit shed No.12 (3,912m^2) and spur line of railway runs in between. Some empty containers overflow from Berth No.7

Berth No.9

Berth No.9 (163.62m) has one ton quayside crane (made in 1968), which is too old and not functioning well. Like Berth No.8, the open space behind the apron is so small, mostly occupied by large transit sheds. One is transit shed No.10 (6,120m^2) and another is transit shed No.13 (6,048m^2), which are mostly used for storing agricultural products, such as cereals.

Berth No.10

Berth No.10 (158.5m) is not provided with a quayside crane. Transit shed No.11 (3,024m^2) is located close to the apron area. Transit shed No.11 stocks mainly cereals.

Berth No.11

Berth No.11 (158.5m) handles mainly frozen and fresh cargo such as fish, meat, vegetable, etc., and has two quayside cranes: one 10 ton crane (made in 1968) and one 5 ton crane (made in 1969). Berth No.11 has no transit shed, but a large cold storage stands just behind Berth No.11, outside the port area. This cold storage will effectively function in future with the growing demand of frozen goods.

(2) Cargo Handling Equipment

There is an abundance of port equipment in the main port of Hai Phong Port. Most of this equipment, however, is very old and somewhat obsolete, requiring urgent replacement. The key inventory of quayside cranes and yard equipment is summarized in Table 2-3-2.

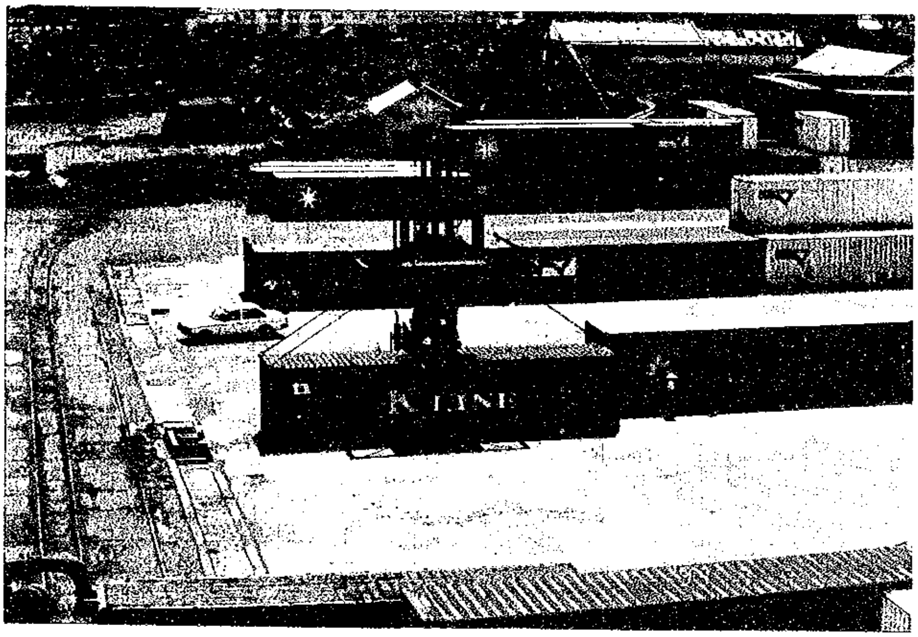
Table 2-3-2 Summary on Jib Cranes of Main Port Area

No.	Crane ID	Capa.	Year of Install.	Country Manuf.d	Consumption Power	Location
I.	Enterprise No.1					
1	Crane No.11	10T	1972	USSR	320kW	Berth No.5
2	Crane No.12	10T	1972	USSR	320kW	Berth No.1
3	Crane No.17	10T	1974	USSR	320kW	Berth No.3
4	Crane No.23	10T	1977	USSR	320kW	Berth No.2
5	Crane No.24	10T	1977	USSR	320kW	Berth No.1
6	Crane No.26	5T	1978	USSR	155kW	Berth No.5
7	Crane No.27	5T	1978	USSR	155kW	Berth No.4
8	Crane No.28	5T	1979	USSR	155kW	Berth No.4
9	Crane No.30	10T	1979	USSR	320kW	Berth No.3
10	Crane No.31	10T	1979	USSR	320kW	Berth No.3
11	Crane No.32	5T	1979	USSR	155kW	Pavement of Berth No.12
12	Crane No.29	5T	1979	USSR	155kW	Pavement of Berth No.3
13	Crane No.34	5T	1980	USSR	155kW	Berth No.12
14	Crane No.36	12.5T	1990	USSR	320kW	Pavement of Berth No.4
II.	Enterprise No.2					
1	Crane No.02	10T	1968	USSR	320kW	Berth No.8
2	Crane No.03	10T	1968	USSR	320kW	Berth No.9
3	Crane No.04	10T	1968	USSR	320kW	Berth No.11
4	Crane No.09	5T	1969	USSR	155kW	Berth No.11
5	Crane No.10	16T	1972	USSR	360kW	Berth No.7
6	Crane No.13	10T	1972	USSR	320kW	Berth No.8
7	Crane No.16	16T	1974	USSR	360kW	Berth No.7
8	Crane No.18	10T	1974	USSR	320kW	Berth No.6
9	Crane No.25	10T	1977	USSR	320kW	Berth No.6
10	Crane No.35	16T	1985	USSR	360kW	Pavement of Berth No.7
11	Crane No.37	10T	1990	USSR	320kW	Pavement of Berth No.7

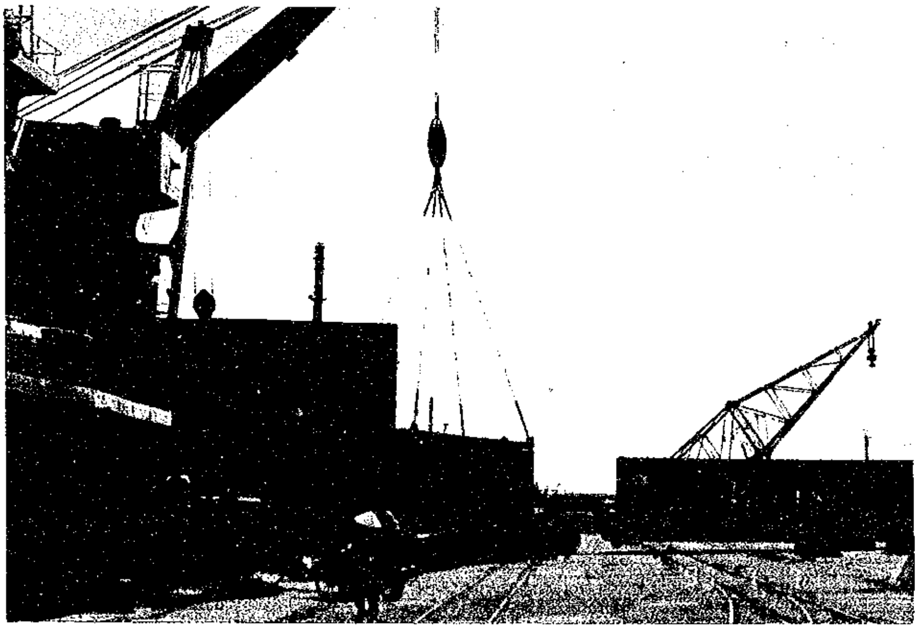
Table 2-3-3 Summary on Equipment at Yard in Main Port and Chua Vc

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	China				Load 5 ton
11	KPAZ			1	LOad 6 ton
	TRUCK				
1	Tractor 6711	1	1		
2	Tractor 6911		9		
3	Tractor 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	Forklift USSR-CT	1			Lift 10 ton
6	Forklift HYSTER-50	2			forklift 2.5T
7	Forklift HYSTER-250	1			
8	Forklift KAIMAR	1			forklift 5T
9	Forklift HYSTER-620	1			forklift 32T
	MOBILECRANE RUBBER				
1	-KC 5363	1	2	1	crane 25T
2	-KPA3			2	
3	_RDK			1	crane 28T
4	Hoist	2			
5	Bulldozer	1		1	
6	Sream roller				
7	Bus	6		5	
	CLEVIS				
1	20'	6			
2	40'	3			
3	Rumani 4T	9			
4	Russan 60T	1			
5	Russan 20T	1			

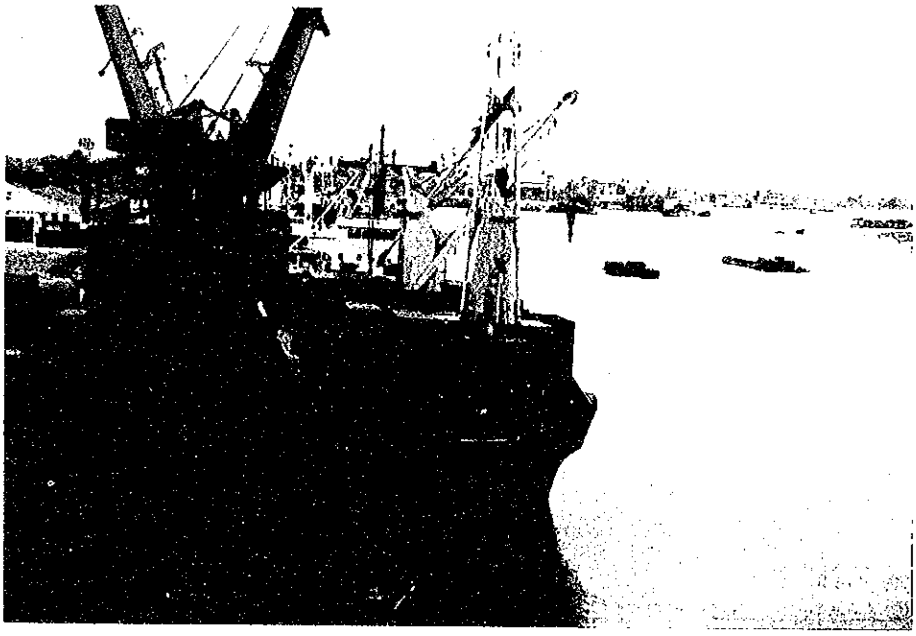
Main Port Area
Berth No.1
CFS not provided.
Stuffing and unstuffing carried out at the container yard.



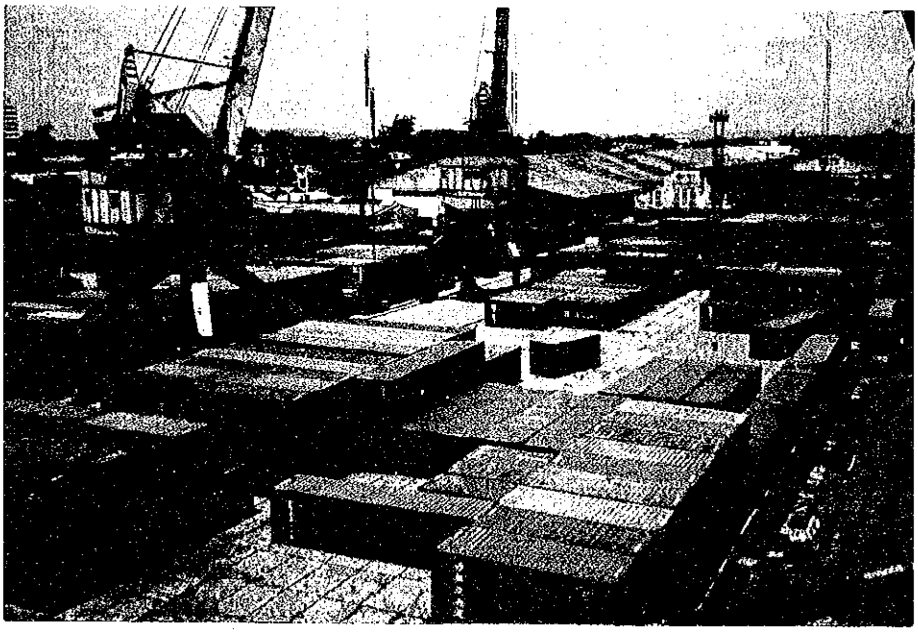
40' container shifted by using 20' spreader with wires.



Container handling by using ship gear.



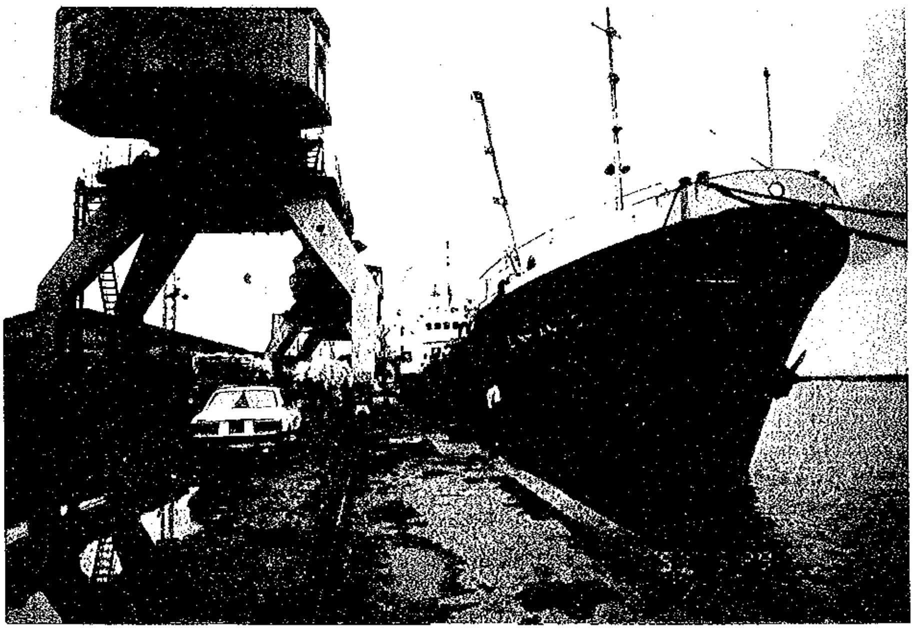
Main Port Area
Berth No.7
Container handling by using jib crane.



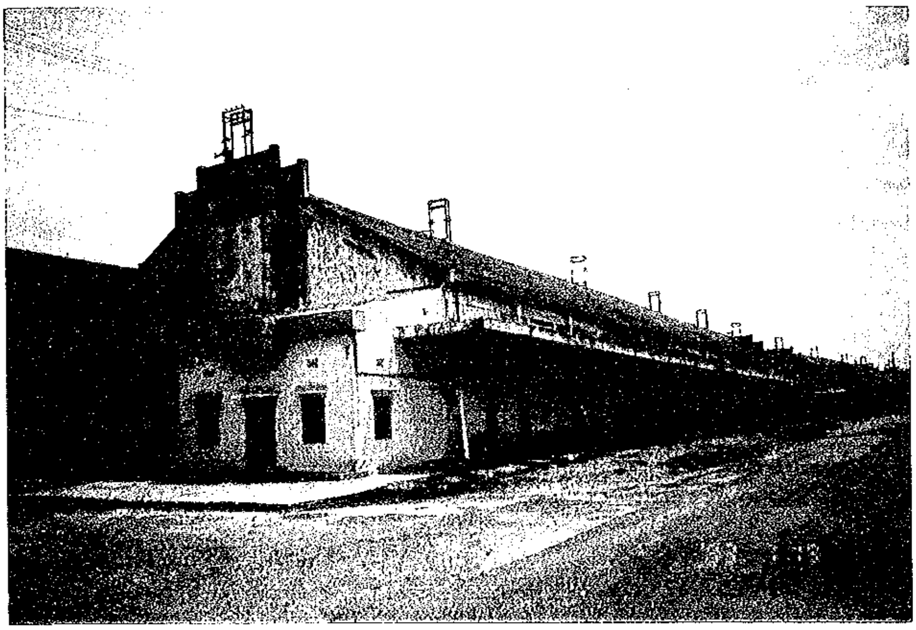
Container marshalling by using jib crane at yard.

Main Port Area

Chip Loading



Wheat unloading
dirctly to trucks



Warehouse NO.2

2-3-3 Chua Ve Port

(1) Berth Facilities

The Chua Ve Port, located about 4km downstream of the main port of Hai Phong, has a 329m long quaywall, consisting of two 132m long berths plus 65m end portion. The former section can accommodate 40 ton container jib cranes and the latter only five(5) ton jib crane. Four cranes are installed on the relieving-platform-type pier. Two 40 ton cranes hold middle position in the pier and the 5 ton crane is located on each pier end. Container handling is carried out by two 40 ton cranes, while two 5 ton crane in the downstream side is out of order now. All of the unloaded sand is used in the construction of the road that will run behind the Chua Ve Port area.

Behind the concrete-deck pier lies a container marshalling yard where 20 and 40 foot containers are stacked in 2 tiers. The ground slot plan in the marshalling yard seems very densely arranged, forcing full use of mobil crane's reach and the existing yard space (25,000m^2). As a result, stowing capacity is considerably high. Immediately behind the quaywall, 4 tier-stacking takes place, mainly for 40 foot containers. Two tier-stacking yard is marshalled by mobil-cranes/truck-cranes, while 40 foot container handling is conducted 40 ton quayside cranes.

The pavement of the marshalling yard is of asphalt-macadam structure or concrete blocks, each having a share of approximately 50%. The pavement near the quaywall is mainly of asphalt-macadam. The existing marshalling yard is surrounded by a non-developed area, that is frequently flooded during rainy seasons, due to its slight elevation. This surrounding area is a potential future port zone that could be developed into a marshalling yard. The existing port area used for the container marshalling totals 25,500 m^2 and the future land inside the port boundary is about 59,400 m^2.

(2) Cargo Handling Equipment

At present, Chua Ve Port holds the following yard equipment:

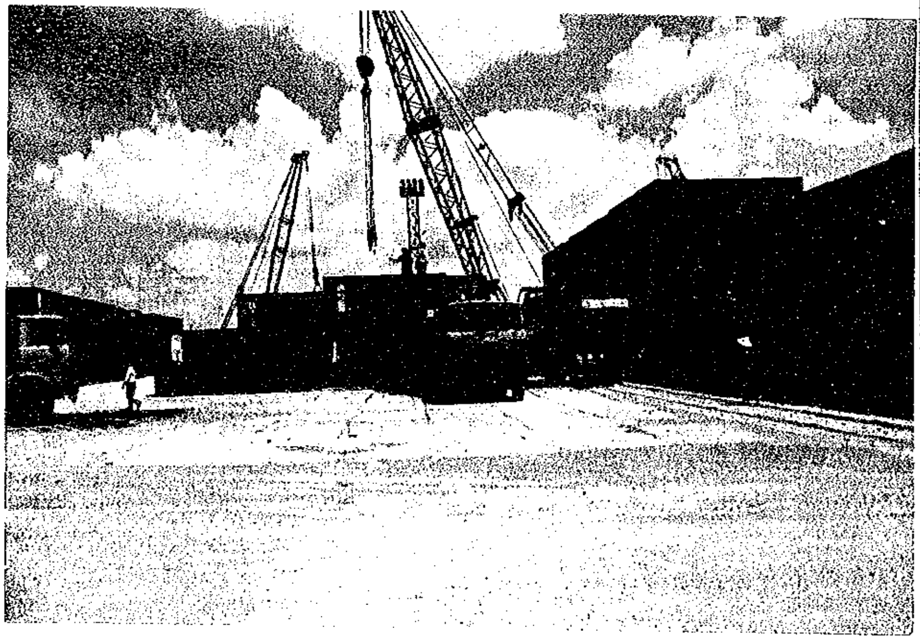
Rubber mobile cranes (4)
- 2 of 16 ton capacity
- 1 of 25 ton capacity
- 1 of 28 ton capacity (less power than specified now)

Tracks(5)
- All of 12 ton capacity

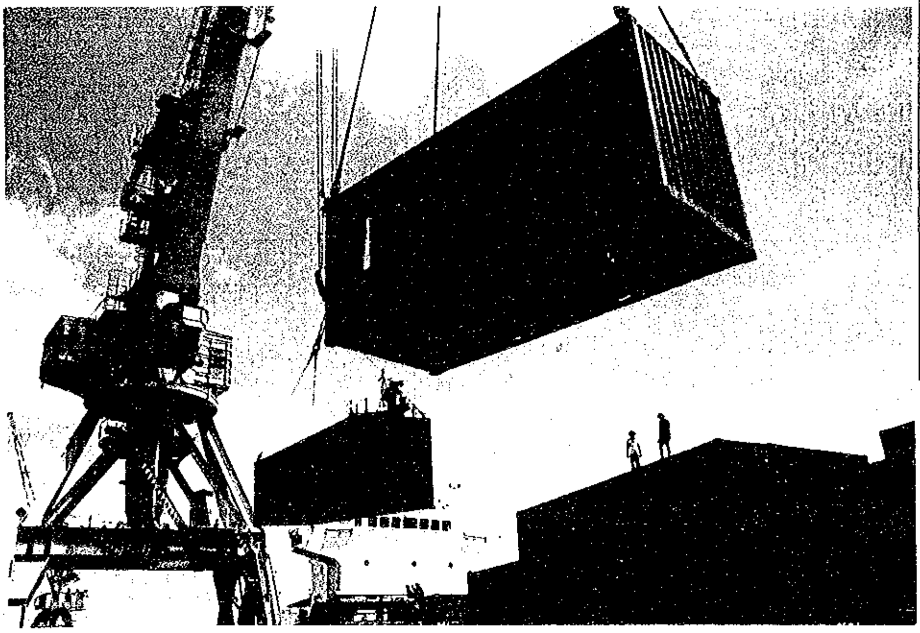
Forklift(3)
- 1 of 2.5 ton capacity
- 2 of 5 ton capacity (too old)

Chua Ve Port Area

Container handling by using a couple of 40ton jib crane.



Container handling at yard by using truck cranes



Container handling by using 40 ton jib crane with wire slings.

2-3-4 Channel and Basin

Hai Phong Port is located 20 miles upstream of the estuary of the river. The existing navigation channel is 80-100m wide and -4.0m deep at the shallowest section, allowing only one way traffic except in two sections. One such section is between Point 15 and Point 22 where the natural water depth is greater than -10m and the width is more than 500m and the other is between Point 29 and Point 31 which provides a 300m wide channel with a depth greater than -10m. These deep and wide sections of the navigation channel allow the ships to pass each other.

Generally, most large vessels navigate through the channel during high tide that occurs once a day. According to the Hai Phong Port, most large ships sail in and out the port using +2.5m tides, which reportedly occur once a day for 75% of the year (Study Team's estimate is 66%). Most of the vessels calling the Hai Phong Port use this high tide zone that continues for an average of 4.0 hours. The vessels approach this Port at a cruising speed of 8 knots and take about 2.5 hours to pass through the channel. According to the Port Authority, the time intervals between each sailing ship should not be less than 30 minutes, so that the maximum channel transit capacity during this high-tide band can be estimated at 8 ships in total.

The current water depth guaranteed in the channel is -4.0m. Including an additional 2.5m during high tide, -6.5m is the commonly used water depth of the channel. It means that most ships calling at the Port can make use of the water depth of 6.5m at present. The vessels less than 3,000 DWT can call at the Port without substantial tidal restriction, but the vessels more than 6,000 DWT - 7,000 DWT are forced to reduce their drafts before entering the Port. Most heavily loaded ships before going into the channel, drop their anchors offshore, thus unloading their cargo into barges, in most cases in Ha Long Bay. After adjusting their drafts, they sail into the channel.

This tidal operation causes a lot of time loss particularly to large-size bulk carriers and general cargo vessels. No significant constraints have so far been observed on the predominant container fleet of less than 200 TEU in capacity, while container vessels greater than 400 TEU frequently run into trouble. No special restriction seems to be imposed on night navigation. It is said that most of the navigation aids function well, posing no fatal obstacle to the ship handling in the channel even at night time. The pilotage is compulsory from "0" buoy off the Do Son Beach to the berthing position in the port. The pilotage service is mandatory for all foreign ships and local ships greater than 2,000 DWT class. The anchorage area is designated east of Hon Dan Island off the Do Son Beach. The pilot should be on board at this anchorage area. The turning basin is provided in front of Berth 4 - Berth 6, with a diameter of 245m. The present navigational rule at Hai Phong Port limits the maximum ship length (L.O.A) to less than 155m.

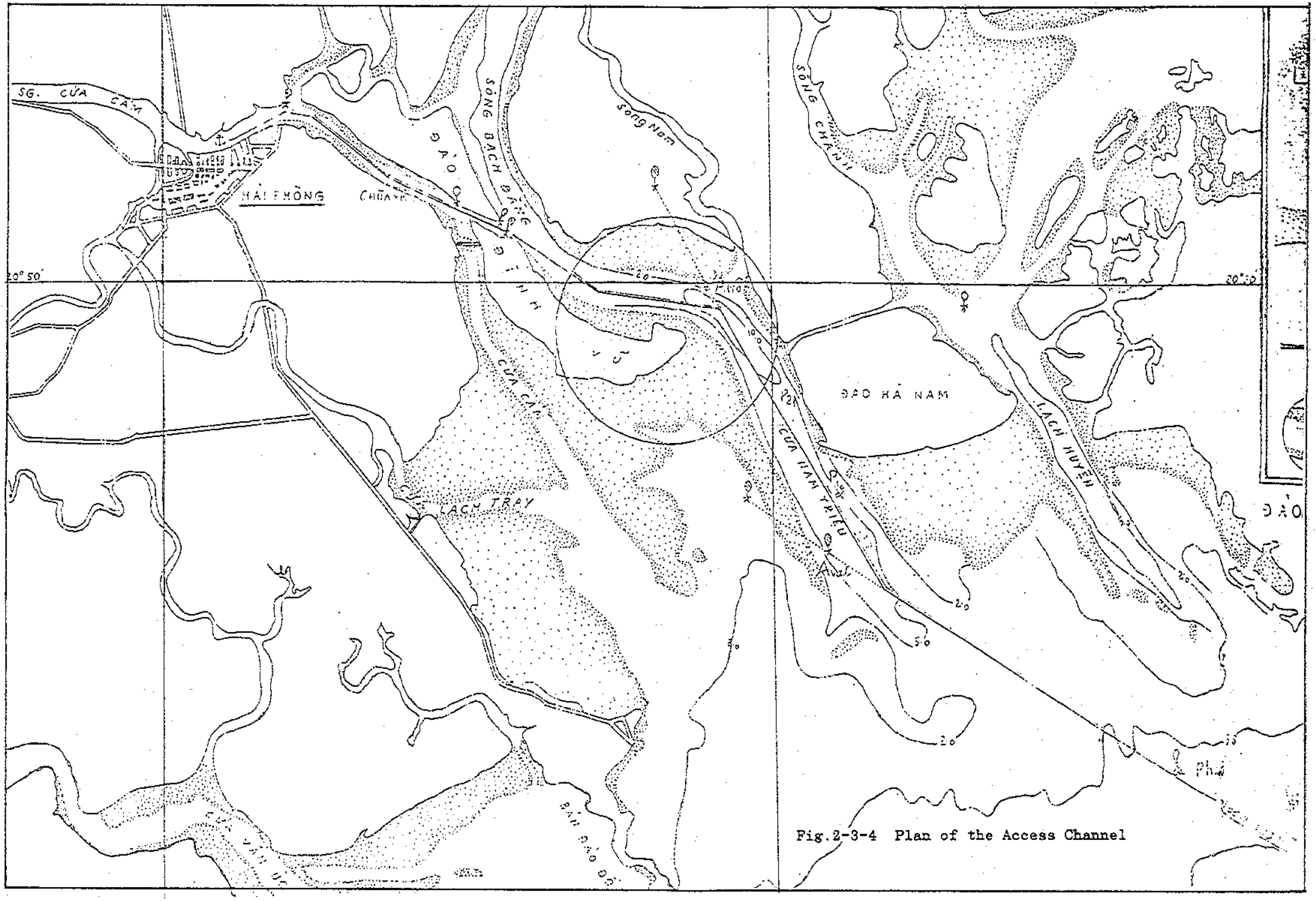
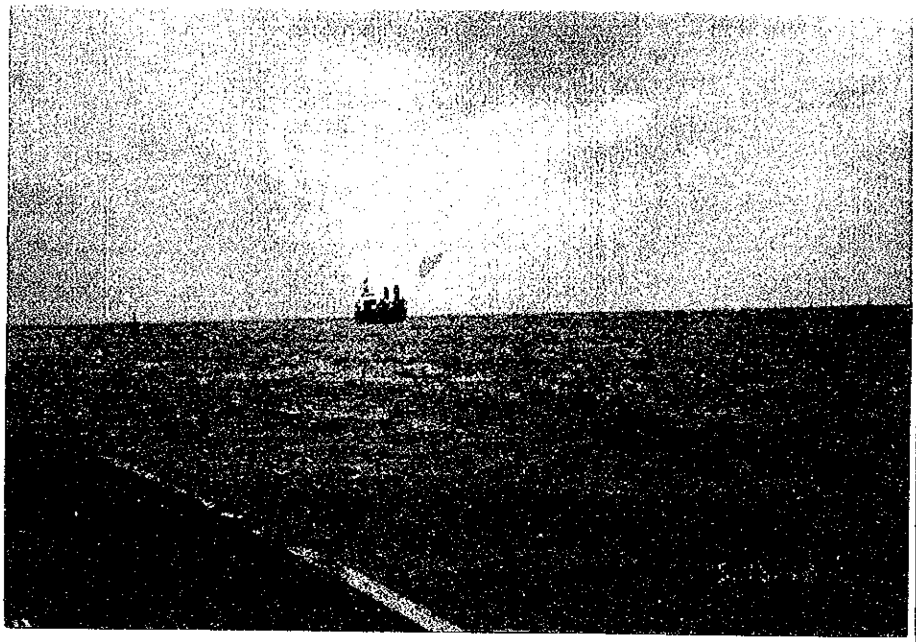


Fig.2-3-4 Plan of the Access Channel



Access Channel and Basin

Container ship in Nam Trieu Channel

Entrance of Dinh Vu Canal

Main Port Basin

2-4 Outline of Natural Conditions

2-4-1 Climate

Hai Phong is situated in Hai Phong Province of northern Vietnam with geographical condition of 20°53E and 106°40E. The meteorological and oceanographic conditions in Hai Phong Province are characterized by a dry season from November to May and a rainy season from June to October.

In the rainy season, the winds blow predominantly from SE to SSE and in the dry season from NE. According to the meteorological data at Hon Dan Weather Station, the rainy month is June with 325mm of rainfall and the dry month is December with only 16mm. The average daily temperature peaks at 27.6°c in August and plunges to 16.0°c in January. According to the Num Trieu Weather station, Hai Phong Port area is influenced by monsoon winds. The wind characteristics by direction and speed are presented in Table 2-4-1. This data shows that winds stronger than 10m/sec occur only in winter season, and then but very rarely. These strong blow predominantly in the NE direction, accounting for about 6.23%.

Table 2-4-1 Wind Characteristics of Hai Phong Port

Speed / Direction	6-10	11-15	16-20	21-25	25-30
N	5.59	0.26	0.07	0.01	-
N E	4.04	6.23	0.05	0.01	-
E	12.34	0.71	0.16	0.03	-
S E	6.56	0.23	0.07	-	0.01
S	6.22	0.77	0.06	-	0.01
S W	2.39	0.42	0.08	0.02	0.08
W	0.29	-	-	-	-
N W	0.32	0.02	-	0.01	-
Calm	0.22	-	-	-	-

During our investigation period, three typhoons smashed into North Vietnam including Hai Phong Port. Hai Phong Port experienced very heavy rain caused by typhoons approaching off the coast. The past typhoon records show that large-scale typhoons occurred 12 times between 1940 and 1959 and 16 times between 1960 and 1970. A tracking chart of these large typhoons is illustrated in Fig 2-4-1 and Fig 2-4-2.

2-4-2 Oceanography

Since Hai Phong Port is located on the right bank of Cua Cam River, there is no wave effect to the Port. The outer channel - Nam Trieu channel, though, is significantly affected by ocean waves. The wave records, observed off the Hon Dau, indicated that the predominant wave directions are SE, SSE and ESE, accounting for about 45% of all waves. The wave height

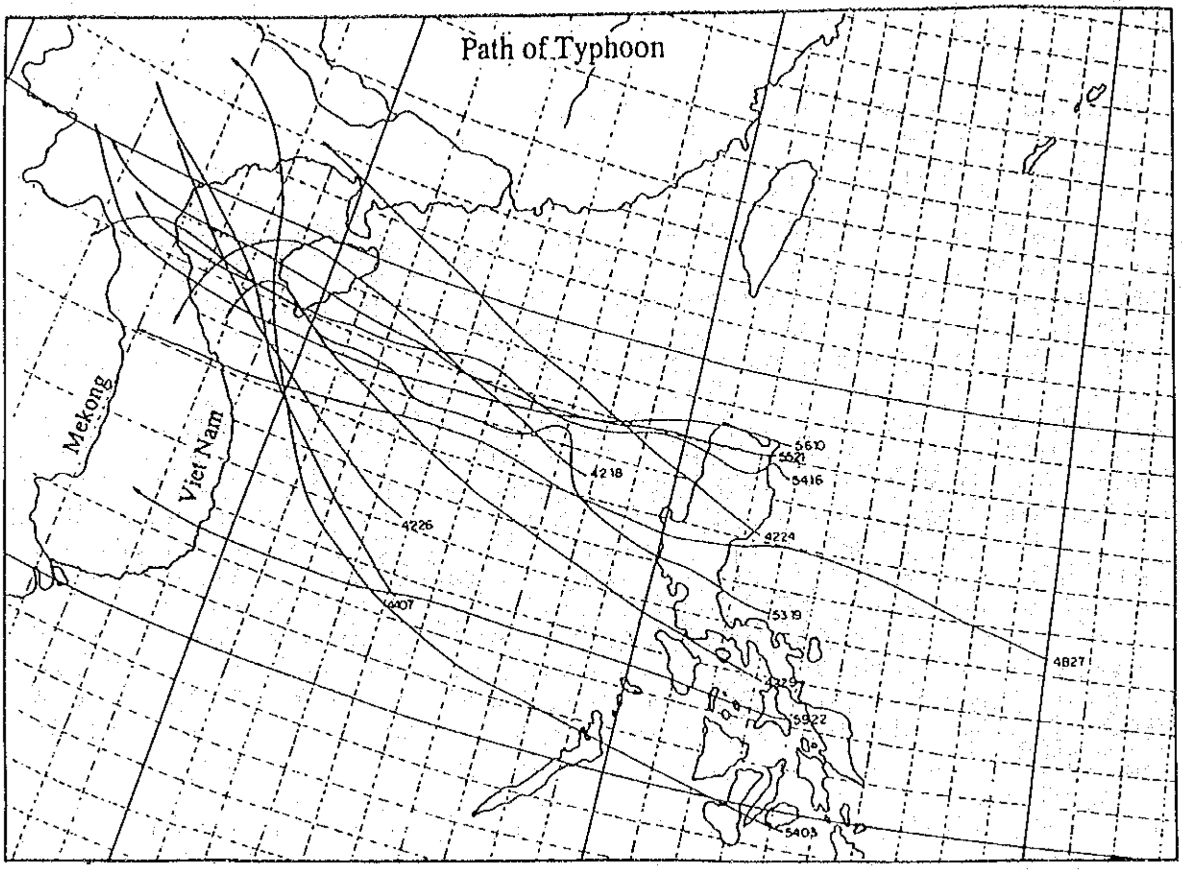


Figure 2-4-1 Tracking Chart of Typhoons (1940-1959)

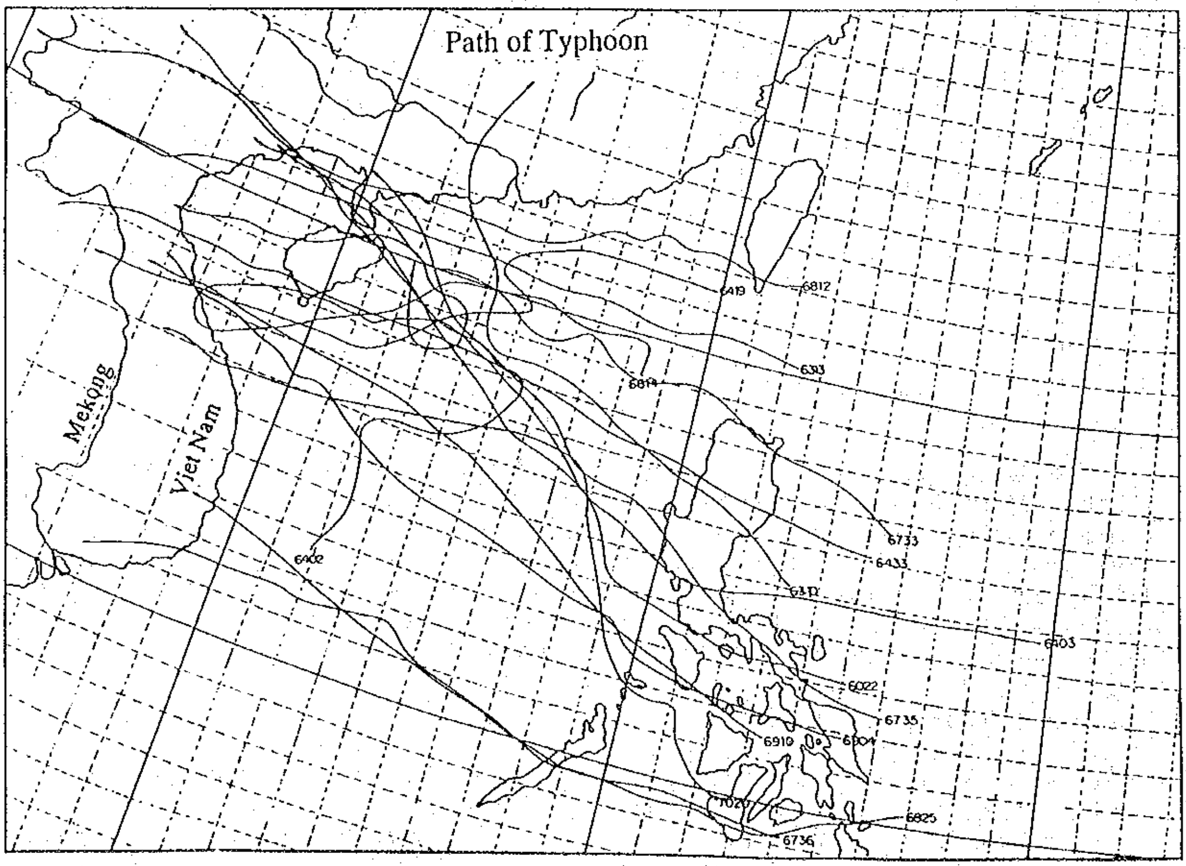


Figure 2-4-2 Tracking Chart of Typhoons (1960-1970)

Source: Japan Meteorological Association distribution shows that waves more than 1.29m occur only 11% of the time and the waves more than 2.0m only 2%. Generally, swells are mixed with wind waves, so that the ships, in entering the port, sometimes are affected by the swells from their sterns, which pose some difficulty in ship handling.

2-4-3 Geology and Soil Condition

Hai Phong Port is located in the alluvial plain of the Cua Cam river. According to the soil borings performed at Main Port and Chua Ve Port, the river bed is covered with muddy silt, under which clayey sand, clay and sandy clay alternate down to -30m.

The soil test reveals that C value of silty soil ranges from $0.4t/m^2$ to $3.0t/m^2$. The silty and clayey soil contain some sandy materials of $\phi 3°-12°$. At the level of -30~-40m, sandy soil with ϕ value of 30 can be noticed place by place. The labo-test result in Chua Ve Port is illustrated as follows.

Table 2-4-2 Typical Soil Characteristics in Hai Phong Port

Soil Layer	Level (m)	Thick. (m)	γ w (T/m³)	γ c (T/m³)	Φ o	C (kg/cm²)
- clay mud	-7.46	3.75	1.60	1.05	3°26'	0.0
- light clay	-7.41	1.95	1.68	1.43	4°04'	0.3
- clay mixes with heavy sand	-13.21	3.80	1.89	1.43	11°41'	0.1
- clay	-23.96	10.75	1.75	1.20	7°29'	0.2
- clay mixes with sand	-26.21	2.25	1.90	1.44	—	
- stiff clay	-28.71	2.50	1.92	1.47	—	
- soft clay mixes with sand	-30.71	2.00	2.04	1.68	19°50'	0.07
- silt sand saturated	-37.81	7.10	—	—	29°50'	

Chapter 3 Evaluation Analysis of Present Deteriorating Condition

Chapter 3 Evaluation Analysis of Present Deteriorating Condition

3-1 Channel and Basin

3-1-1 Present Deteriorating Condition at Channel and Basin

Function of the Channel and Basin is to enable easy maneuvering of the vessels and to accommodate required size and number of vessels whenever necessary. We have firstly studied the present condition of the Hai Phong Port in this respect.

Fig. 3-1-1 shows the vessel size distribution of the Hai Phong Port in the years 1989 and 1992. In this Fig. which was made by the Study Team in reference to the vessel in/out records, the recorded gross tonnage (GRT) has been converted into the dead weight tonnage (DWT) by the conversion formula. In order to monitor only the actual number of vessels directly enter into the Hai Phong Channel, those vessels whose cargo was taken by barge unloading operation (lighter) at the Ha Long Bay are not indicated in this diagram.

From Fig. 3-1-1, you can see that, in these three years, the number of larger vessels (10,000 DWT or more) entering into the channel has significantly decreased while the number of smaller vessels (6,000 weight ton or less) has increased.

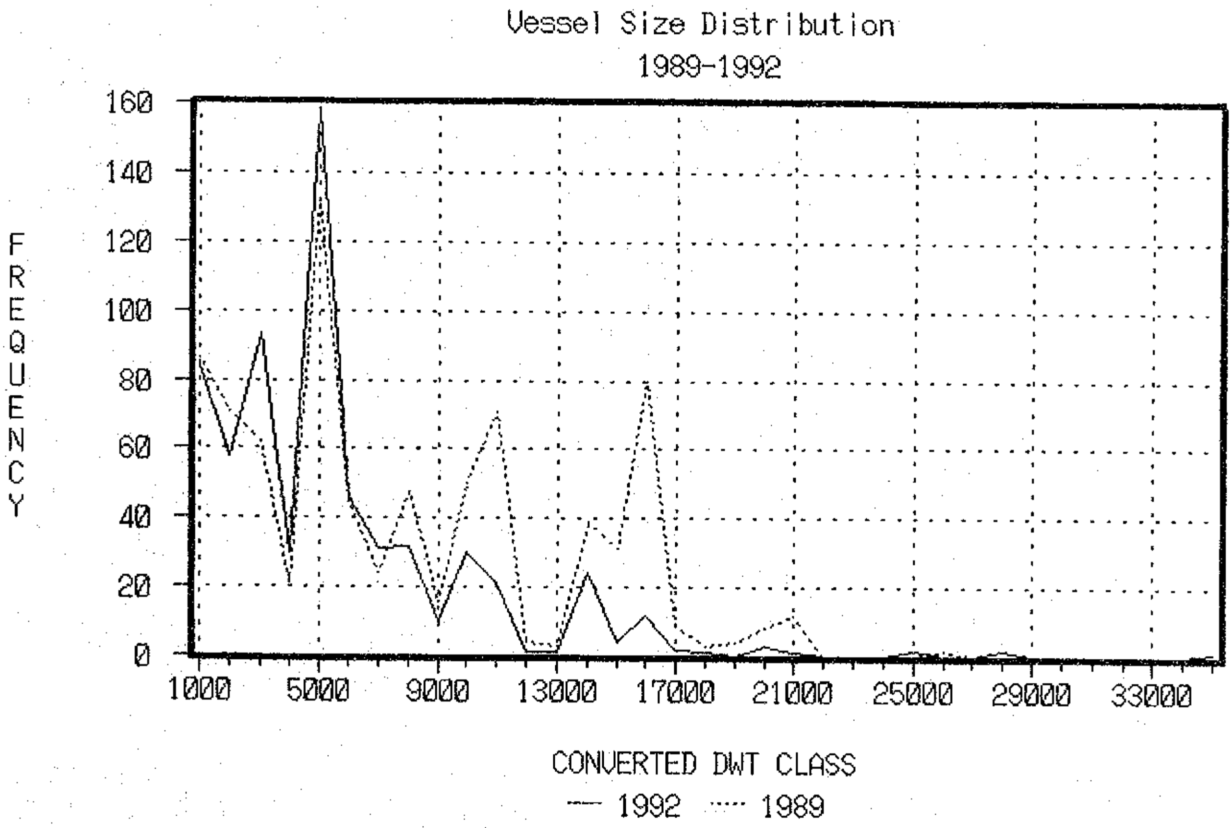


Figure 3-1-1 Frequency of Entering Vessels (1989/1992)

As the total cargo volume has also been decreased in these three years, the cause of the decline in larger vessels cannot be found simply by analyzing the channel conditions. However, the cause can be ascertained by studying the number of vessels not directly entering into the channel. Fig. 3-1-2 indicates the number and the size of vessels entering into the Hon Gai Port (outside the Hai Phong Port) and those of the vessels unloaded by the lighter at the Ha Long Bay. It can be said that the number and the size of vessels unloaded by the lighter outside the Hai Phong Bay have become larger. Thus, from the two figures, it can be seen that the number of large vessels coming into the channel has decreased and that the number of vessels which cannot directly enter into the channel has increased.

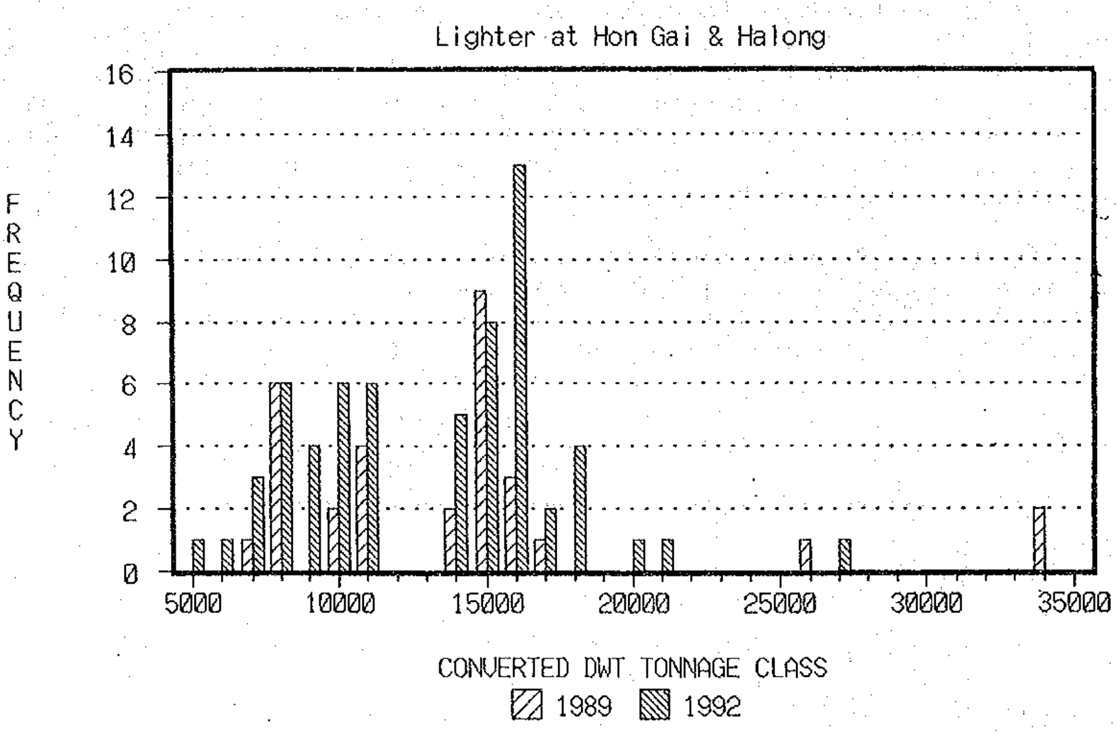


Figure 3-1-2 Frequency of Lightered Vessels (1989/1992)

Figures, 3-1-3 and 3-1-4 indicate entering drafts of vessels for the respective year. From the figures, it can be read that the vessels of 6,000 - 7,000 DWT could not enter the channel with full draft and, consequently, reduced their drafts down to approx. 7m when entering the channel. Channel depths and vessel entering drafts are closely related, as the official water depths indicate that, in these three years, the channel depths have become shallower by an average 60 - 70 cm and, at the same time, the maximum draft of entering vessels has become approx. 50 cm smaller.

Regarding the basin, according to the Hai Phong Port Administration Office, until about 1989, three basins existed (i.e. the Bach Dang area, the Ninh Tiep area and one other). These basins were used not only for their original purposes but also for the lighter operations. However, since the water depth has become shallower recently, present basins exist only at the upstream of the Bach Dang River and Ha Long Bay located outside

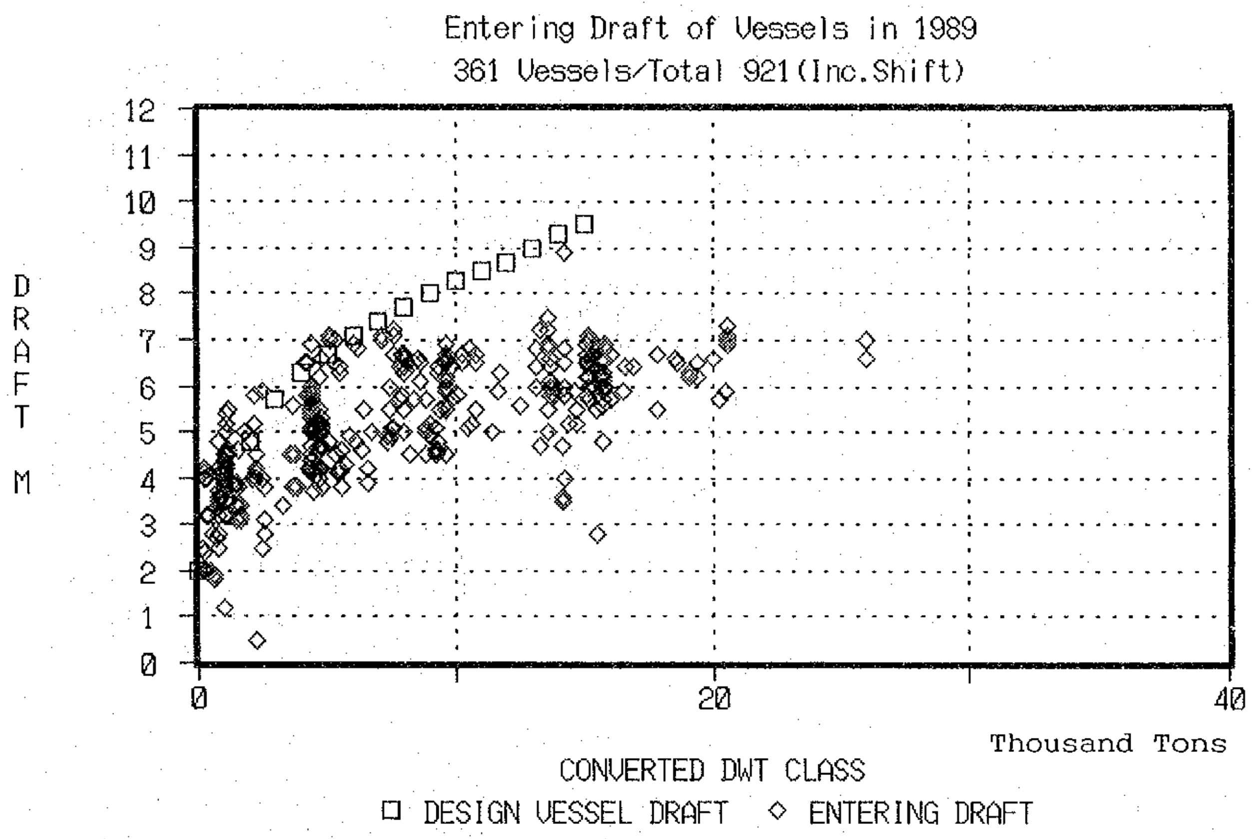


Figure 3-1-3 Entering Draft of Vessels in 1989

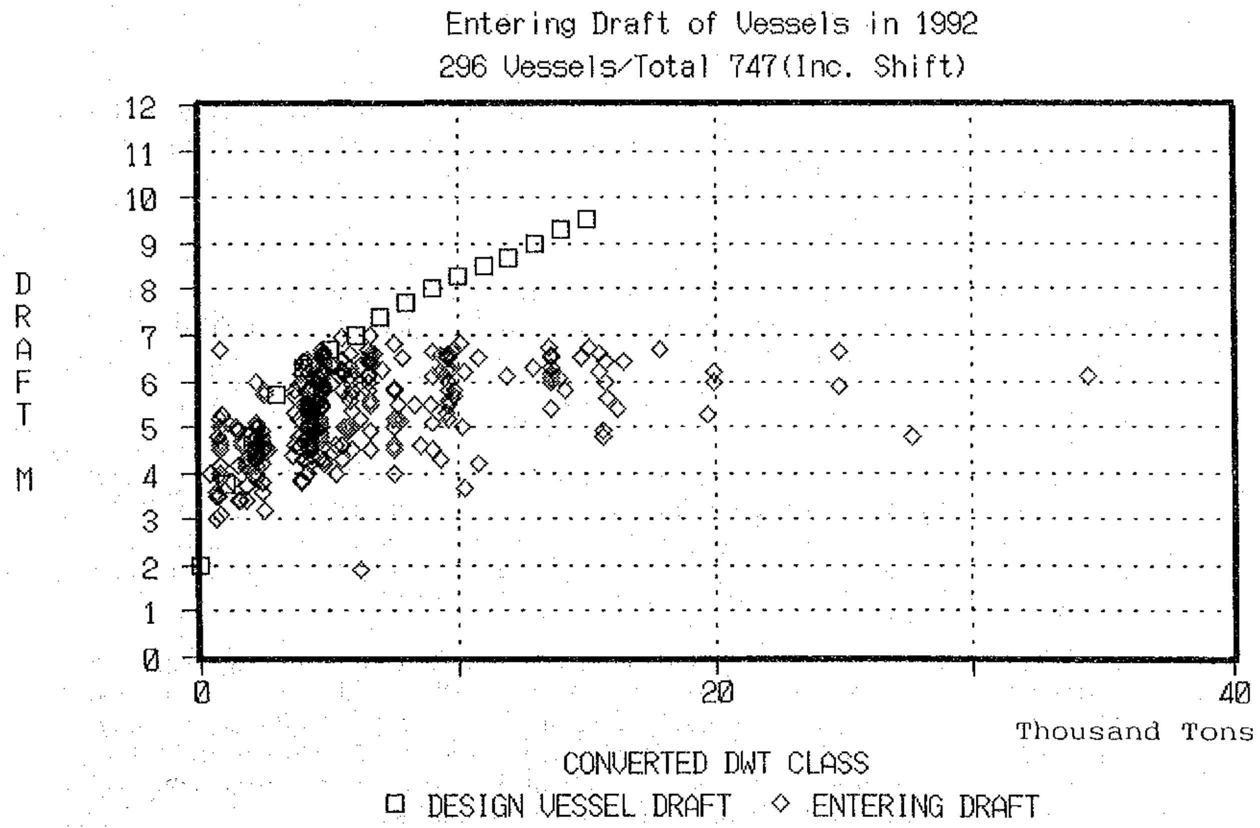


Figure 3-1-4 Entering Draft of Vessels in 1992

the channel. The Ho Long Bay is the only current lighter basin. Ha Long Bay is located very close to both the Hon Gai and the Quang Ninh Ports and, compared with past basins, it is far from the Hai Phong Port. Although the Quang Ninh Port was used for the lighter for the Hai Phong Port until 1989, its operation is currently separated from the Hai Phong Port. For this reason, it may be advantageous to unload cargoes for northern districts at the Quang Ninh Port by the lighter. In other words, as the cargoes for the Hai Phong Port cannot directly enter into the port, they could possibly be unloaded at more convenient ports.

From the above analysis, it has become clear that, at the Hai Phong Port, vessels larger than 6,000 - 7,000 DWT could not enter into the Port with full draft at required time and on many occasions, cargoes were unloaded by the lighter. This may have resulted in the decline in the number of vessels coming into the port and the decrease in the volume of cargos. As such, it is obvious that the main cause of these declining figures is the deteriorating condition of the Channel and Basin such as the draft limitation due to the shallower channel depth.

3-1-2 Cause of Deteriorating Condition

In consideration of the present condition, we list below causes of such deterioration at the Channel and Basin. When necessary detailed analysis of such causes will be made in forthcoming chapters.

CAUSE 1: Shallowing of Channels

Shallowing of channels is a significant obstacle to vessel entrance to the port. The reasons for the shallowing are considered to be as follows;

(1) Siltation Increase

As the present status of siltation and its mechanism will be discussed in 6-1, only a simple explanation of causes of siltation increase will be given here.

1) Influence of the Dinh Vu Dam

The completion of Dinh Vu Dam in 1982 significantly changed natural/environmental conditions of the Cua Cam River, the Bach Dang River, the Nam Trieu Channel and their estuaries, and as a result, the siltation volume increased. Also the volume of maintenance dredging has been increased accordingly.

Fig. 3-1-5 indicates the volumes of maintenance dredging and the maintained depths at the Nam Trieu Channel in the time series. After the completion of the Dam, the volumes to maintain the same channel depth have increased (1983-1986), and the maintained depth has become shallower as the volume of maintenance dredging has decreased in comparison.

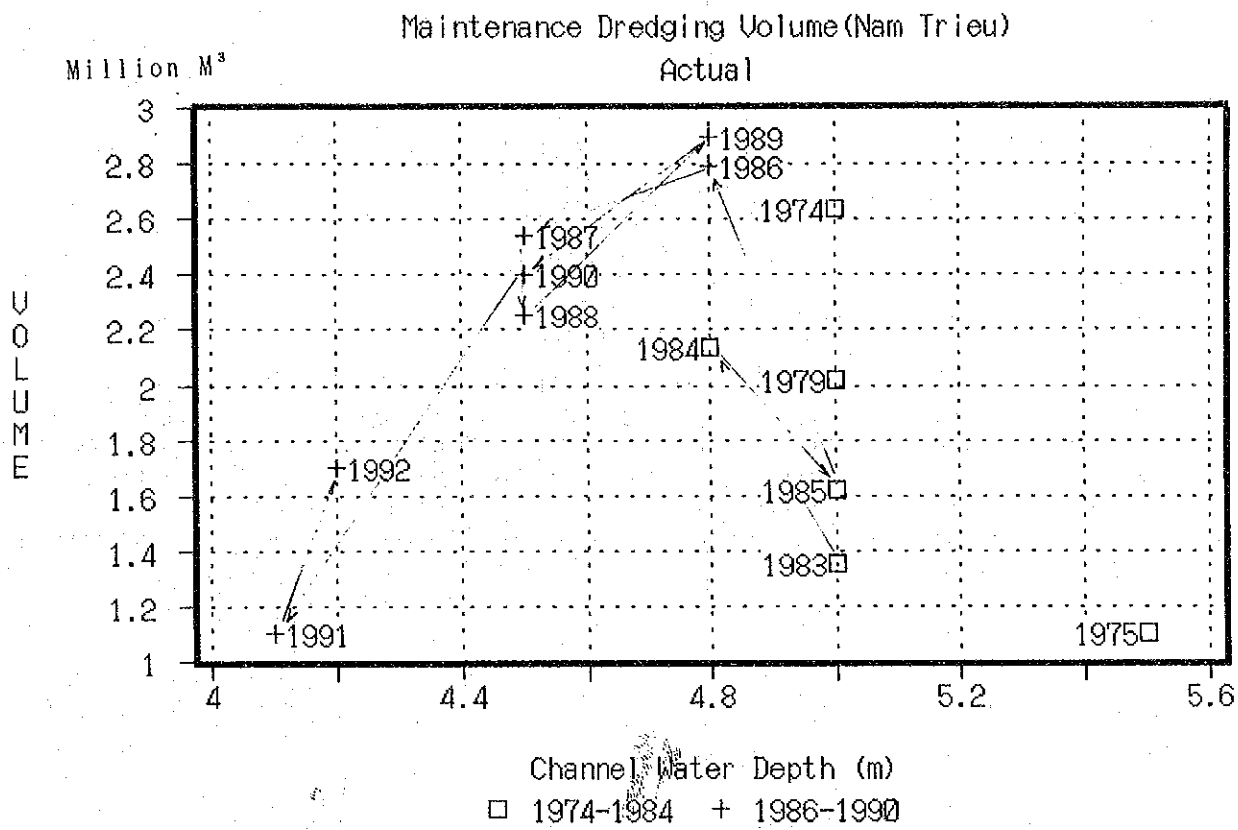


Figure 3-1-5 Maintenance Dredging Volume in Nam Trieu Channel

2) Change in Silt Density of Inflow

Although there is no quantitive data, cutting trees at upper stream mountainous areas caused increase in the silt density of inflow and, as such, increased the sedimentation volume.

3) Change in the Shore Lines of the Nam Trieu Channel

The shorelines of the Nam Trieu Channel have been changed to the present status due to the influence of the war. There are some angles to the outflow line at the estuary and to the main direction of the waves and this creates complex siltation conditions and significant increase in the volume of siltation from the places of such angles.

4) Effect of Littoral Drift

Although this will be discussed in more details in 6-1, the wave scoured sand at the shoreline possibly drifts into the channel by the tidal waves. As such, the materials dredged by the maintenance dredging include not only silt by siltation but also some sand.

5) Location of Disposal Areas

Until the year of 1991, the disposal area was located at a place approx. 500 m away from the channel, however, a survey result indicated that part of the disposed material had flown back into the channel with the effects of the current and the waves. The present disposal area has been shifted to 1 km north of the Nam Triue Channel entrance.

(2) Maintenance Dredging

While the siltation volume has increased, the efficiency of the maintenance dredging has not been improved. This resulted in the shallowing of the channel.

1) Problems with the Execution Method

a) Dredging Method

Mainly hopper suction dredgers are employed except the areas in front of the wharves, where grab dredgers are used. According to the captain of the hopper suction dredger, the positioning operations are carried out by using navigational buoys, and the actual dredging works are carried out by simply dredging down to the configurations of the dredged areas. This is not effective, though they have an abilities to dredge.

b) Type of Material

As has been mentioned, at the Nam Trieu Channel, part of the siltation materials are sand, and this lowers efficiency of the maintenance dredging operation.

2) Administration Aspects

a) Contract Signing

Contract signing body has been repeatedly changed. During 1982 to 1988, it was MOTAC, then it changed to the Hai Phong Port (1989 - 1991) and again changed to the VINAMARINE (1922 - present). Moreover, because the basic data has not been collected and kept properly, no administrative controlling system was established (i.e. keeping daily report indicating positioning, dredged volume, operational hours, idling time, etc..) This is because the interests of the client and the contractor have only been focused on contractual dredge volumes and depths. It is doubtful that the efficiency and the quality of the future maintenance dredging can possibly be improved under this administrative and controlling system.

b) Dredge Volume Measurement

Since the siltation volume after each intermediate sounding survey has not been considered and paid for by the client, dredging unit rates may not properly reflect the dredging costs, and this causes constant arguments between the client and the contractor.

c) Budget

Budget for the maintenance dredging is not large, and as such, a sufficient dredging volume can not be usually expected in the maintenance dredging operation.

3) Problems in the Natural Conditions

a) Seasons for Dredging

As the siltation volume differs by season, continuous dredging throughout the year is not applicable. This will lead to the fact that seasonal maintenance dredging for siltation, although it is not economical nor efficient, may have to be employed.

b) Typhoon

Significant harm was rendered by the inflow silt caused by the typhoon in July 1989. Since the Hai Phong Port is located on the passage route of typhoons, this type of adverse effect may have to be considered.

CAUSE 2: Tides

Fig. 3-1-6 shows part of the harmonic analysis of the Hai Phong Port Tide Table. It has only one daily tide. Because most of the current incoming and outgoing vessels at the Hai Phong Port are taking advantage of high tides, the fact that the port has only one tide makes the shallow channel depth even more critical.

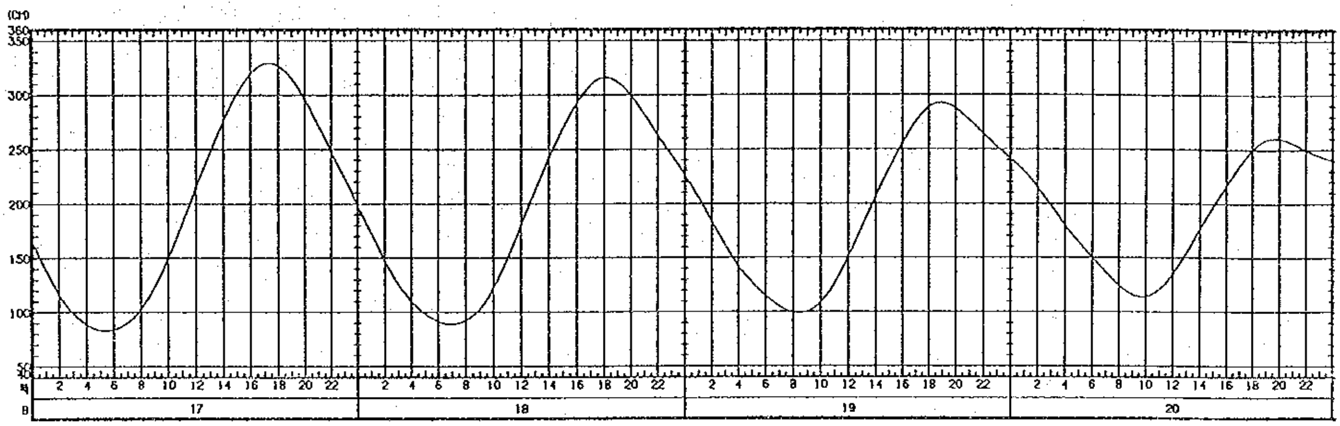


Figure 3-1-6 Predicted Tide of Hai Phong Port (Aug 17-20, 1993)

CAUSE 3: Channel Navigation

(1) Depth Control

Currently, four to six sounding surveys are performed annually, and the official channel depths are modified each time. However, since the siltation takes place continuous in between those official channel depths modification, vessels are facing potential danger in the port. Although it is not officially announced, there are a few drifting cases.

(2) Channel Width

The narrow channel width of 100m makes the facing traffic impractical. This fact, together with the tidal traffic and the long navigational length causes longer standby times for vessels.

(3) Nighttime Navigation

Figs. 3-1-7 and 3-1-8 indicate the time and frequency of the vessels' incoming and outgoing operation. Generally, the reason for less navigation during the night is the port's less activity during the night, however, for the Hai Phong Port, the following facts make things worse, on top of the general difficulty in operating the vessels;

* The locations of navigational buoys do not produce straight lines.
* The vessel control is difficult due to the existence of the Dinh Vu Canal where the width is limited and tidal condition is severe.
* The brightness of the lights of fishing boats makes it difficult to identify the lights of navigational buoys.
* There are occasional outbreaks of night mist

In any case, the fact that the night time navigation is much less than that of the day makes the number of actually usable tides practically half in number. Thus for the vessels taking advantage of tidal navigation, the higher the tide they require, the less chances they will have for navigation.

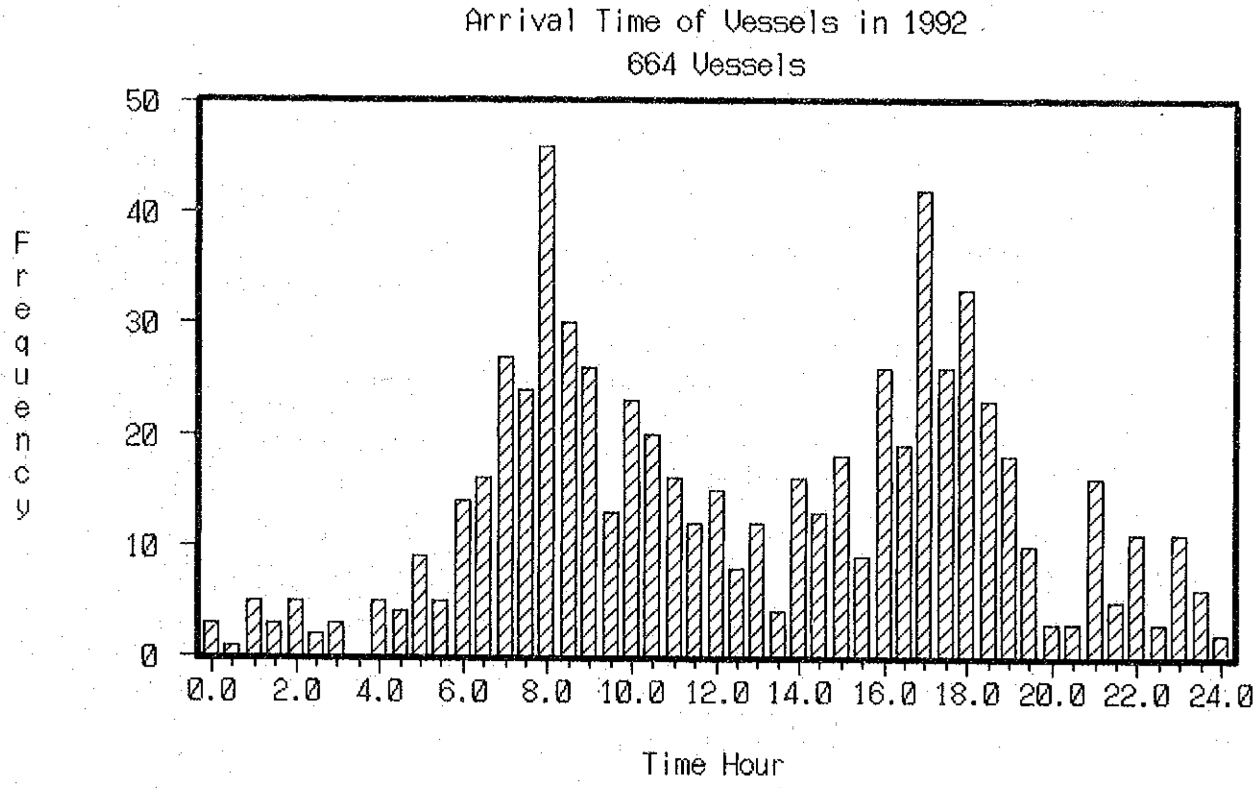


Figure 3-1-7 Arrival Time of Vessels in 1992

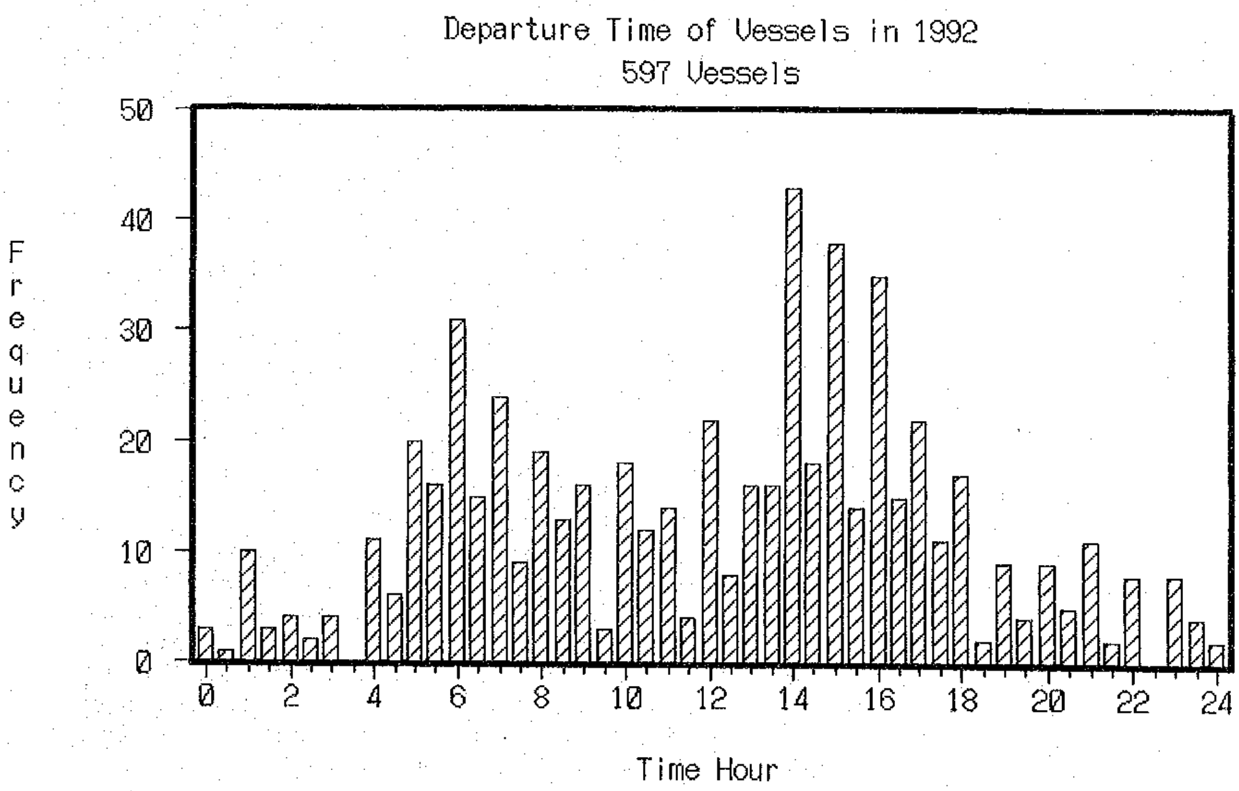


Figure 3-1-8 Departure Time of Vessels in 1992

3-2 Quaywall Structure

3-2-1 Main Port

The quaywall the Main Port was first constructed as a wooden structure and later replaced by detached pier structure. About 20 years ago, all the berths were reconstructed with steel-sheet piled structure with financial assistance from U.S.S.R. The detailed drawings (as built) could not be obtained during our study period, so a very rough structural analysis has been made.

Judging from the typical cross section of the wharf (see Fig 3-1-2), it can be said that the steel pile is a type of LARSSEN-V and the sheet pile is driven to -20m. The tie-rods with a diameter of 85mm span between the sheet pile and concrete anchor block located about 24m inshore.

On the apron of Main Port travel jib cranes with hoisting capacity of 5-16 tons. Between the 10.5 crane rail gauge run two railway lines. According to the design data obtained from TEDI, the maximum wheel load induced by 16 ton crane operation is 28t/wheel and liner load from locomotive is 14 t/m. In designing the berth structure, such uniform loads as 4 t/m^2 on the apron, 6 t/m^2 inshore of the apron and 10 t/m^2 about 21m away from the berth face line were also considered.

Applying these design criteria into the existing typical cross section of sheet-piled structure, the likely stress forces arising in sheet-piles and anchor rods have been calculated. As a result, in case that both the maximum wheel loads and two locomotive loads are taken into account, the resulting pile stress reaches 2,400kg/cm^2 and tie-rods reaction 112 ton per rod, exceeding normal allowable stress in both structural element.

This trial calculation indicates that this kind of combination loads, very rare in probability of occurrence should be interpreted as a short-time load. Otherwise the stability of the existing structure can not be assured. Furthermore, the steel-sheet piles have already experienced corrosion for more than 20 years, so that no definite conclusion can be reached yet without the actual data on steel corrosion of sheet piles. (During the period of our investigation, the lowest tidal level did not occur, so eye observation of the sheet pile surface could not clarify the extent of erosion.)

Applying full uniform loads mentioned above, it has been calculated that the sheet-pile structure could not withstand these loads in terms of allowable strength of steel materials. As such, it can be preliminarily concluded that the existing berths have no surplus in terms of structural capacity. When introducing heavy cranes such as container cranes at the births in future, more detailed and through study and investigation is mandatory. Nevertheless, it can be said now that the current berth usage, which does not entail such critical load condition as discussed above, would not pose any imminent risk to the existing berth stability.

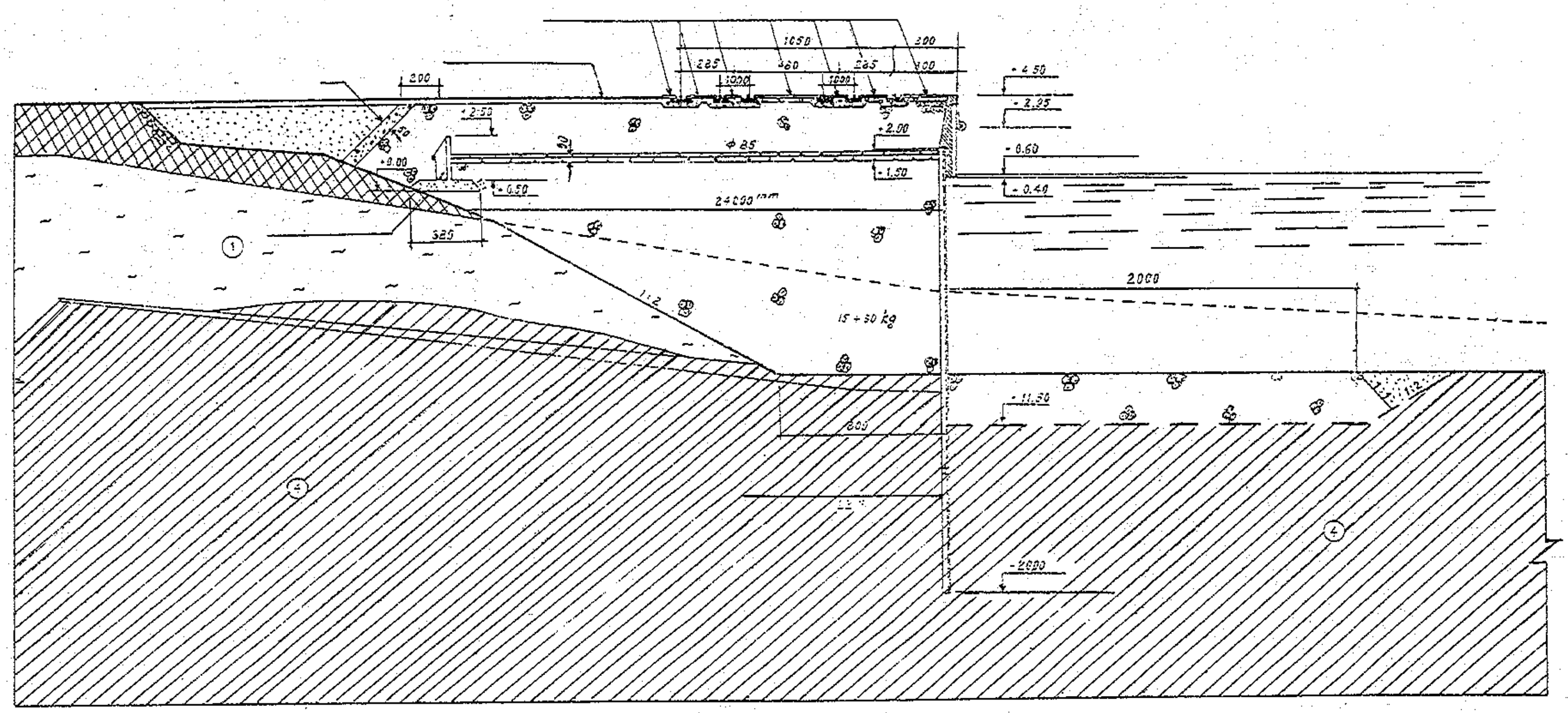


Fig.3-2-1 Main Port Area Typical Section of Berth

3-2-2 Chua Ve Port

The design of Chua Ve Port was originally made in 1975. Basically following this design concept, Berth No.1 was constructed between 1975 and 1978, and berth No.2 between 1978 and 1982. During this construction stage, though, some design conditions were modified. The 1975 design concept was to install a 16 ton crane (KIROF 35) on the pier, but this KIROF crane was replaced by a 40 ton crane (KONDOR) in order to enable the pier to unload/load container cargo whose traffic demand gradually increased in the early 1980's. This variation necessitated some reinforcement to the open desk pier. To build up the horizontal reaction of berth structure, tie-rods were placed behind the pier and anchored 15m inshore. (See Fig 3-2-2).

According to Hai Phong Port's information, some horizontal displacement of the open deck pier appeared after the KONDOR crane had been installed. It was reasoned that the heavy load induced by KONDOR crane may have occasioned this unexpected deformation. Nevertheless, no definite reason for this reported mishap has been confirmed to date. On the basis of this limited information, the following investigation has been conducted.

- Structural analysis on stability of the existing pier.
- Eye observation of the existing open deck pier.

First, the design drawings in 1975 and associated fundamental design criteria have been collected from TEDI, who carried out the original design of Chua Ve Port. On that basis, simple structural analysis has been made. Considering heavy crane load of KONDOR (490 ton in total) and railway load, the vertical load distributed to each concrete pile (45cm x 45cm x 36m) has been estimated. As a result, it has been proved that the resulting vertical load of 60 ton per pile. As to horizontal load, the maximum horizontal load of bollard pull (75 ton) has been checked. it is understood that these horizontal loads will be shared with tie-rod tension and concrete pile's horizontal reaction. Since detailed data on allowable bending moment of concrete piles was not available, no definite conclusion has been made. In fact, as the likely load of bollard pull would be 30 - 40 ton at maximum, current berth operation will not pose any critical problem in structural stability of berth operation will not pose any critical problem in structural stability of berth itself.

The eye observation was conducted on foot under the pier deck, checking the present status of concrete deck slab/beam, pile head/connection and service deck that partly functions as retaining wall. Several concrete piles have been driven in nearby. No fatal damage like cracks have been noticed at all, so that no indicative sign that the berths had experienced horizontal deformation before was observed in our field investigation.

Construction workmanship, generally, seems poor. Only a very small number of concrete piles are placed in the right position. Most of piles are set out of the designated spot (the

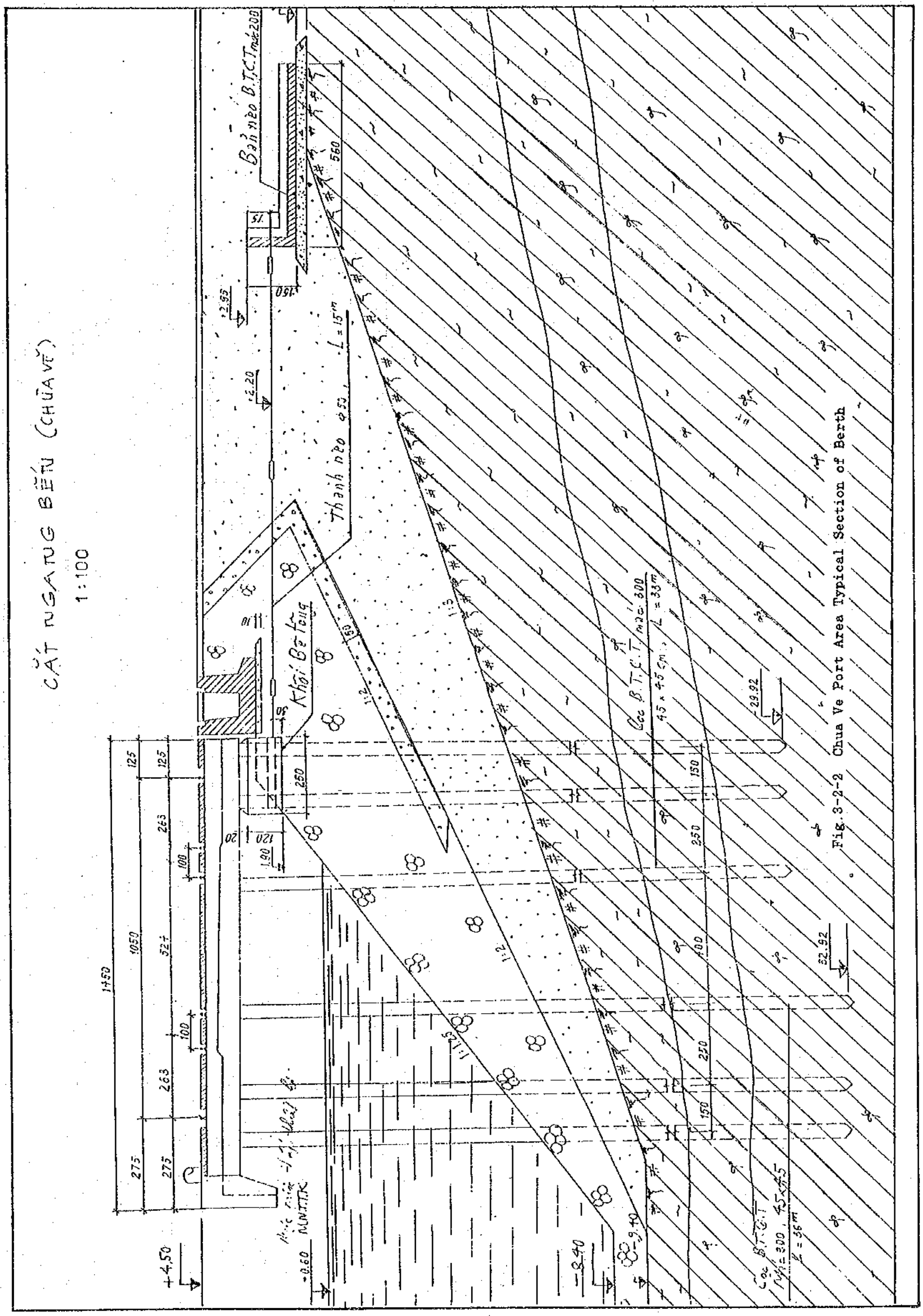


Fig.3-2-2 Chua Ve Port Area Typical Section of Berth

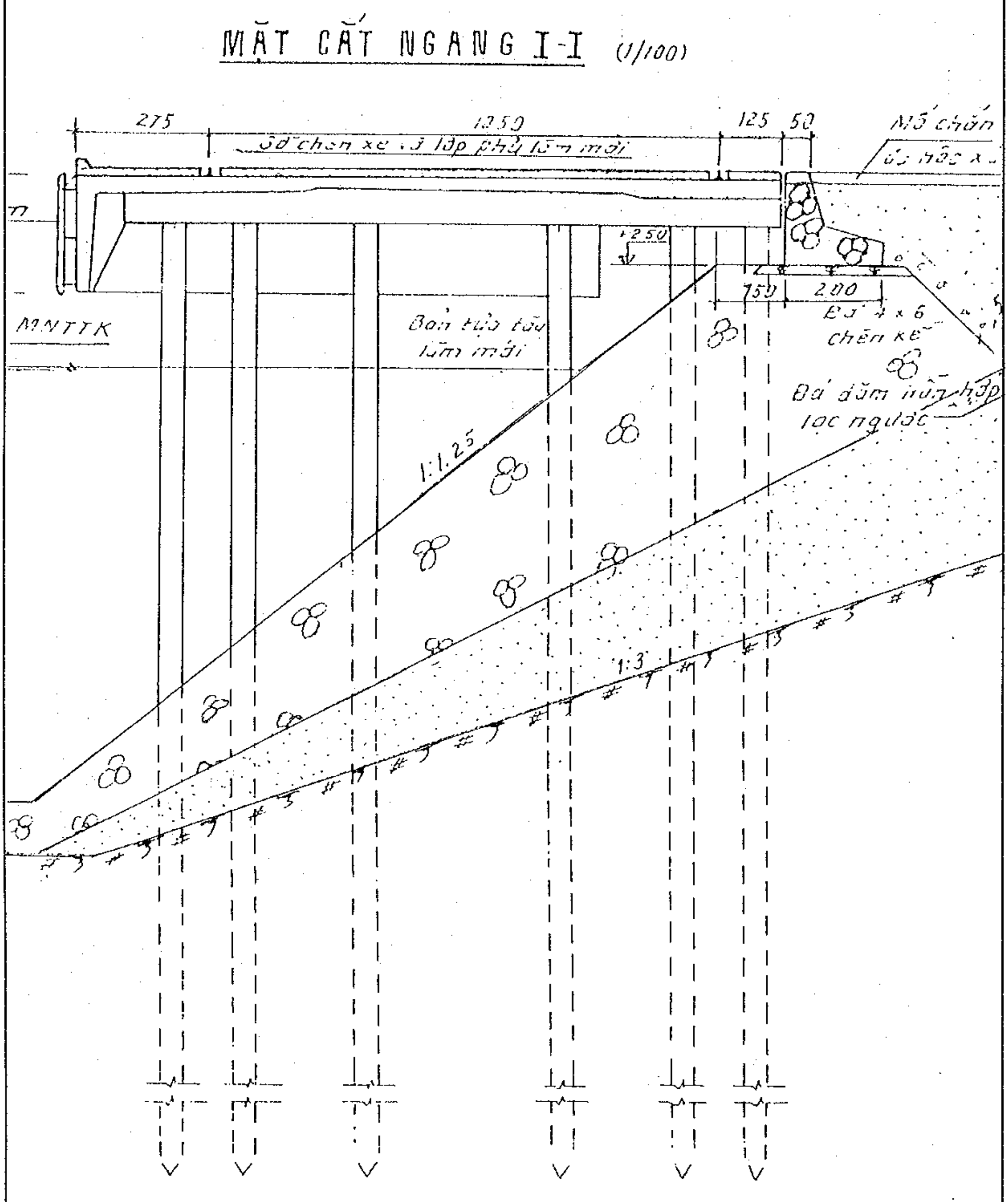
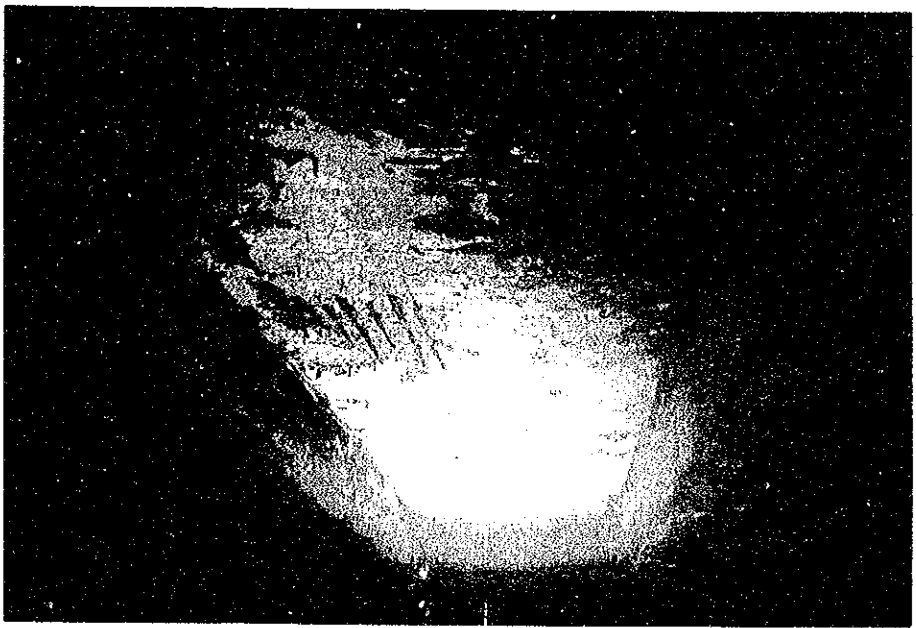


Fig.3-2-3 Chua Ve Port Area Typical Section (Berth Edge)

Chua Ve Port Area
Underneath of Berth
Crack on the service duct



Exposed reinforcement on the bottom surface of the slab

Concrete piles
Additional pile

center of the beam). Some service ducts hold crack in the riverside surface, which may have some relationship with the past reported deformation of the pier due to landslide under the pier.

Hai Phong Port has established a monitoring system to trace deformation of the pier deck by use of distance meter stationed across the river on the left bank of Cua Cam River. These records will be indispensable in evaluating the berth stability. It can be concluded that the current status of berth structure is still safe, even a controversy exists over the deformation of open deck pier.

In terms of future berth usage, the upstream section of 66m should be reinforced to allow the berthing of container shops. To this end, tie-rod anchoring and crane rail expansion will be required.

3-3 Cargo Handling System

3-3-1 Main Port

(1)Container cargo handling

1) Berth No.1

(a) Shortage of yard equipment

Berth No.1 exclusively used by GEMATRANS which is a joint venture between France and Viet Nam. Cargo handling on the ship side is carried out by ship crane because there are no quay side cranes.

The productivity of container handling is as follows:

11-14 TEU/g/hr.(according to interviews)
10.2TEU/g/hr.(according to team investigation)

The above productivity is considered normal. Container handling in yard is conducted by two top-lifters, fork-lift truck and chassis. All yard equipment is assigned to containers coming from ship side when the ship side works are conducted. Therefore there is no yard equipment to deliver containers to/from land side. More yard equipment is necessary.

There is a problem in that a big container (40') must be handled by a fork-lift truck by inserting its fork under a container due to lack of proper yard equipment. This causes damage to both container and fork-lift truck. Stuffing and unstuffing of container cargoes are carried out manually. Small fork-lift trucks with 1 - 3 tonnage capacities are necessary for these works.

The present container handling methods by top-lifter, fork-lift trucks, etc. are not necessarily the most the preferable, especially when the volume of containers increases . Specialized container handling equipment such as transfer crane or straddle carrier is much more preferable. In addition, equipment like tractors and tractor heads must be employed in order to make full use of the transfer crane or straddle carrier.

(b) Necessity of containers in the yard is managed by the card system. This system causes some trouble that proper containers do not brought under the ship gears timely and a consignee picks up his container in the yard after checking the numbers of a container.

Container cargo handling, different from conventional general cargo, requires various data such as ship condition, yard condition, land transport, work schedule in the yard and C.F.S., etc. In order to carry out quick and smooth container handling, terminal operator usually makes the ship stowage plan, yard location plan, gate slip plan, C.F.S. work plan and prepares the various related documents using computers. A card system could not control a large amount of containers. Computers should be introduced to this port considering the future increase of containers.

(c) Shortage of communication devices

Communication devices such as VHF(Very High Frequency) are beneficial for communication between control center and various places(supervisor, crane operators, checker, yard manager, yard equipment operator, C.F.S., etc.) VHF devices are needed in the container handling berth.

2) Berth No.7

(a) Unsuitable quay-side crane and shortage of yard equipment

The containers on ship side are handled by two quay side jib cranes with rated load of 16 ton and ship gears. Heavy containers more than 14 tons must be handled by ship gears because the maximum lifting capacity of quay side jib cranes is 14 tons.

Productivity of the quay side jib crane is as follows:

7 TEU/g/hr.(according to interviews)
7.8 TEU/g/hr.(according to team survey)

In case of handling by quay side jib crane, and container is placed firstly on apron or yard, and then another jib crane picks up the container and places it in the yard. In case of handling by a ship gear, a container is placed on a chassis, and transferred to the yard with the chassis and then yard jib crane or top-lifter picks it up and places it in the yard.

In case of using top-lifters and chassis, they are brought from berth No.1 due to the lack of such equipment at berth No.7.

As there are cases where containers with different weights (less than 14 tons and over 14 tons) are stowed in a ships hold, the loading and unloading works must be carried out by combining the quay side jib cranes and ship gears. Such works cause a delay in cargo handling.

The jib cranes in the yard are widely used for lifting and moving containers. However,containers are only stacked in the area covered by the outreach of the jib crane in the yard. The lifting capacities of jib cranes in the yard are also limited to 10 - 14 tons.

It is said that the quay side jib cranes and yard side jib cranes are not appropriate for handling heavy container cargoes. It is preferable to move the present container handling berth No.7 into berth No.2, adjacent to berth No.1. The gantry cranes, if they were settled, will be used at berth No.1 and berth No.2 after converting berth No.7 to berth No.2. Yard equipment are also used in the both berths.

(b)Unsuitable container management

The positioning of containers in the yard is determined by a note from the director of berth No.7. Under this method,it was observed that side jib crane had to stop loading and wait a long time because the container to be loaded was not brought under the jib crane.

Once the handling operation stopped, everybody including agent, crane operator began shouting something, which further delayed in operation. The supervisor must take proper measures when trouble occurs. The card system will be an interim solution in establishing more effective container management. The introduction of a computer system will be by transferring berth No.7 to berth No.2 is good for cargo handling. All containers in both container yards will be controlled form one control center using computers

(c) shortage of yard area

The containers handled at berth No.7 are stacked in the yard of berth No.6 due to lack of space at berth No.7. As berth No.6 is very far away from berth No.7, the handling efficiency buffers considerably. The capacity of yard No.7 is not sufficient to meet the further increase of containers.

(d) Shortage of communication devices

There are no communication methods such as VHF at berth No.7, and communications rely solely on human voices. The introduction of VHF is necessary.

(2) General Cargo and Bulk Cargo

1) Cargo handling equipment

(a) Jib crane

a) Superannuated equipment

General cargoes are handled both by quay side jib cranes and ship gears, while bulk cargoes are handled by quay side jib cranes. Purchase dates of the quay side jib cranes are given in table 2-3-2. The number of jib cranes by age is as per table 3-3-1 below.

Table 3-3-1 Numbers of jib cranes by age

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

The depreciation period of a jib crane is set at 10 years by the Port of Hai Phong and 15 years by UNDP. More than half of the jib cranes are over 16 years old. All of the jib cranes were made by the USSR and the procurement of spare parts is very difficult because the cranes are not produced at present.

The capacity of jib cranes ranges from 5 to 16 tons, but there are only three of the letter capacity. Usage of cranes is limited to comparatively light cargoes.

b) Low use rate of jib crane

The use conditions of jib cranes are shown in table 3-3-2. The work days in table 3-3-2 show the total annual work days including the days consumed for both cargo handling of ship side and yard side.

One jib crane is used for handling cargo on the ship side and in the yard. For example, cargo once moved to the yard by jib crane is again loaded to a wagon or truck by the same jib crane. Therefore the cargo volume handled by each jib crane is actually handled volume but not throughput volume of cargoes.

A crane works only 60 days on average each year only 22% of the total annual work days (274 days) as shown in table 3-3-2. Break-down and repairing required 71 days on average, though 170 days were required in one case. It goes without saying that the frequency of break-down and repairing is too high.

c) Low productivity of jib crane

The productivities as well as cargo volume handled by jib cranes and ship gears are shown in table 3-3-3. The following conclusions are drawn.

General cargo and bagged cargo: The productivities by quay side jib crane and ship gears are almost the same.
Steel products: Jib cranes have a higher productivity than ship gears.

Bulk cargoes: All bulk cargoes are handled by quay side jib cranes and their productivities are of reasonable values.

From the description above,the jib cranes should be used for handling heavy cargoes(mainly steel products)while ship gears are better for handling general cargoes and bagged cargoes. However, the quay side cranes must be used for handling the cargoes transported by ships without ship gears.

(b) Mobile crane

Mobile cranes are used for moving(and handling) the steel cargos in the yard but two units form berth No.7 were moved to the Chua Ve area. The use rates of mobile cranes are less than 30% and the movement of steel products from apron to yard or to warehouse could be done by tractors more effectively.

(c) Fork-lift truck

Fork-lift truck is very useful for handling cargoes on apron, yard and warehouse. Two units of fork-lift trucks are transferred to Enterprise I for stuffing and unstuffing of container cargoes. Old cranes made by USSR and those over 5 years old should be replaced with new ones because of the high cost of

Table 3-3-2 Use condition of equipment

Jib Crane	Handling Volume (Ton/Year)	Cargo Descri-tion	Working Day		Suspend Day	
			Operation (Days)	Stand by (Days)	Repair (Days)	Others (Days)
No.11	39,016	st.eq.b.	64	207	74	20
No.12	45,378	sb.gc.	57	228	60	20
No.17	55,171	st.b.	72	212	61	20
No.23	48,867	sb.st.	60	225	60	20
No.24	49,585	sb.	56	224	65	20
No.30	58,120	st.b.	100	189	56	20
No.31	48,056	st.eq.b.	75	130	140	20
No.36	14,221	st.eq.	38	234	73	20
No.26	37,198	b.gc.st.eq.	58	209	78	20
No.27	54,071	b.gc.st.eq.	73	202	70	20
No.28	48,181	b.gc.st.eq.	84	208	53	20
No.29	10,250	st.eq.b.	19	255	71	20
No.32	-	-	-	-	-	-
No.34	34,811	co.b.	72	223	50	20
No.10	31,339	co.b.	69	194	82	20
No.16	46,244	co.b.	97	196	52	20
No.35	39,335	co.	29	266	50	20
No.02	53,389	b.gc.st.eq.	97	181	67	20
No.03	28,793	b.gc.st.eq.	68	196	81	20
No.04	12,255	b.gc.st.eq.	36	238	71	20
No.13	25,925	st.eq.	57	118	170	20
No.18	43,788	st.b.	38	257	50	20
No.25	17,147	st.b.	47	248	50	20
No.37	9,317	co.	21	274	50	20
No.09	17,649	b.gc.st.eq.	55	234	56	20
Total	868,106		1,442	5,148	1,720	480
Average	36,000		60	214	71	20

Note: st. :steel

eq. :equipment

b. :bag

gc. :general cargo

sb. :solid bulk

co. :container

Table 3-3-3 Productivities of Jib crane and ship gear

Cargo Description	Quay Side Jib Creane				Ship Gear				All Total
	Ton ⓐ	Ton/Shift	Shift Total	t/g/h	Ton ⓑ	Ton/Shift	Shift Total	t/g/h	ⓐ + ⓑ
* Cargo Handling Enterprise II									
General Cargo	7,958	45	176	7	5,306	38	139	6	13,264
Baggage Cargo	151,213	125	1,210	21	226,821	120	1,890	20	378,034
Steel Products	48,046	270	178	45	32,032	157	204	26	80,078
Bulk Cargo	21,647	283	77	47	0	0	0	0	0
Sub Total	228,864		1,641		264,159		2,233		493,023
** Cargo Handling Enterprise I									
General Cargo	55,845	75	744	13	103,713	50	2,114	8	159,558
Baggage Cargo	118,650	125	949	21	427,452	83	5,150	14	546,102
Bulk Cargo	39,867	326	122	54	0	0	0	0	39,867
Sub Total	214,362		1,815		531,169		7,264		745,527
All Total	443,226		3,456		795,324		9,497		1,238,550

*:4 Berths From No. 2 to No. 5

**:5 Berths From No. 6 to No. 11
Excluded No. 7

repair work.

(d) Other minor handling machines and devices

-Bulldozer : Some bulldozers are needed for collecting bulk cargoes in the yard and in ship's hold.

-Truck : The port of Hai Phong operates trucks for forwarding cargoes between ports and consignee or shipper. Half of the trucks owned at present are superannuated and should be replaced.

-Communication device : The VHF or similar devices are necessary in order to enhance communications between office and various related places.

-Pallet : Palletization is good way to improve the productivities of general cargoes and bagged cargoes The cost is very cheap, requiring only that the necessary number of pallets be kept in the port.

-Attachment and slings : Special attachment of fork-lift trucks and various cargo handling slings should be prepared in the port.

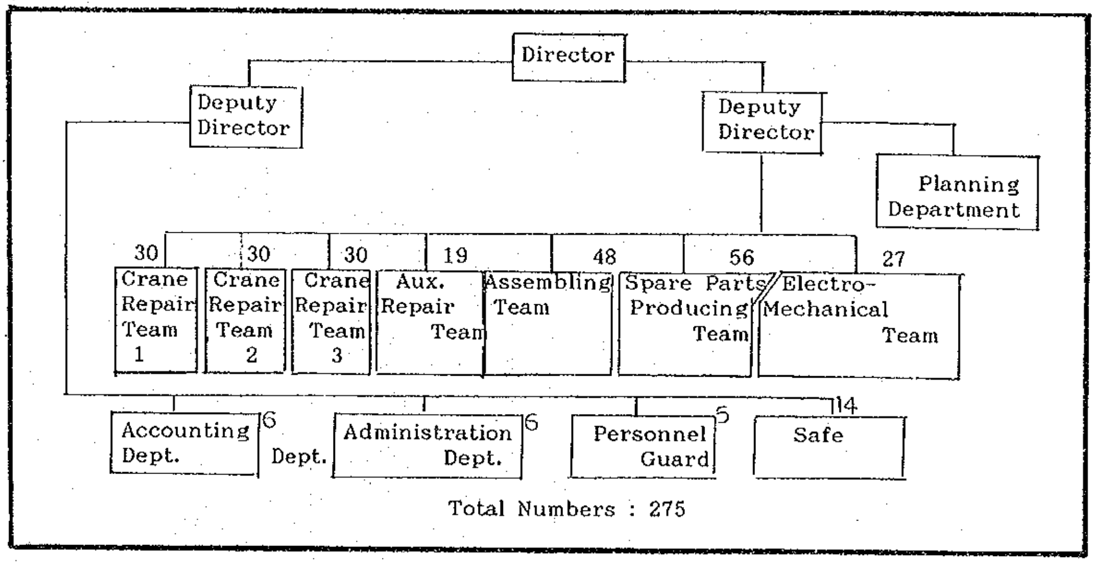
(3) Maintenance

1)Organization

There are two separate organizations, one being the Repair Work Enterprise and the other being a repair group belonging to Enterprise I and II.

The big repair works are carried out by the Repair Work Enterprise while periodical maintenance including minor repairs are done by the repair group. The organization of the Repair Fig. 3-3-1 below.

Fig.3-3-1 Organization of the Repair Work Enterprise



2) Maintenance method

Periodical maintenance is conducted annually and in three month periods. The annual maintenance inspection lasts 15 days while the quarterly inspections last 5 days.

The periodical maintenance is conducted according to the manuals and the amended manuals made by makers.

All maintenance and repair works have been carried out by the ports themselves and therefore these works are not commissioned to outside bodies.

The technical skill of workers is comparatively high and the workshop is equipped with the necessary machines for maintenance and repair.

3) Spare parts

The shortage of spare parts is a very serious problem due to the lack of funds. The spare parts for equipment made in the USSR (jib cranes, fork-lift trucks) are now difficult to procure.The port makes some of the necessary parts themselves but parts not manufactured by the port are purchased on the domestic or foreign markets.

It takes long time to purchase parts form foreign markets and that results in a long repair time. The necessary parts should be well maintained in order to keep the cargo handling equipment in good condition.

4) Workshop

The Repair Work Enterprise has two big workshops with necessary machines and tools for maintenance and repairs. A list of the machines in the workshop is provided in table 3-3-4. There is a sufficient number of main machines such as lathes, milling machines,drillings etc.and they are kept in good condition.

Table 3-3-4 List of Machines in the Workshop

Description	Made In	No.	Purchase	Condition
Later	USSR	1	1972	Good
Later	USSR	8	1984	Good
Milling	USSR	4	1984	Good
Grinding	USSR	2	1972	Good
Hand Grinder	USSR	6	1984	Good
Boring	USSR	4	1984	Good
Drill	USSR	4	1984	Good
Grinder	USSR	3	1984	Good
Compressor	USSR	3	1984	Good
Pressure Washer	USSR	2	1968	Good
Forging	USSR	2	1984	Good
Drier	USSR	1	1984	Good
Saw	USSR	2	1984	Good
Cutter	USSR	2	1984	Good
Cutter	USSR	5	1992	Good
Tester	USSR	1	1984	Good

3-3-2. Chua Ve Area

(1) Shortage of yard equipment

Containers on the ship side are handled by two quay side jib cranes with rated loads of 40 tons. The productivity of the cranes is as follows :

17 - 20 TEU/g/hr.(according to interviews)
17 TEU/g/hr.(according to team survey)

The productivity of container handling by quay side jib crane is said to be reasonable. If a spreader were used,productivity could be increased further.

The containers are handled by mobile cranes on yard and trucks are used for transverse containers from apron to yard. The stocking height is maximum 2 tiers because the length of mobile cranes boom is very limited. The delivery work of container could not be conducted during the ship side handling because all yard equipment has to be assigned to the receiving work of container from ship side. Although two mobile cranes were moved here from the main port, they are not designed for container handling and therefore, the total quantity of yard equipment is insufficient.

The area is considered to be the main container terminal in the future, and a significant amount of containers will be handled here even sooner. The present mobile crane system for yard equipment is not necessarily the most appropriate system for handling a large amount of containers. New specialized yard equipment such as transfer crane or straddle carrier should be introduced.

2) Necessity of container management by computers

Location of containers in the yard is carried out by card system at present. However,this system cannot effectively control a large amount of containers. Introduction of computer is indispensable.

3) Shortage of communication devices

VHF and similar devices are necessary in order to enhance communications between control center and various related places(supervisor,crane operator,checker,yard manager,etc.)

3-4 Transit Shed

3-4-1 Main Port

In Main Port, there are 14 transit sheds that store general cargo and other seaborne cargo. Major features of each transit shed are summarized in Table 3-4-1 including shed area, location, commodity stored and utilization. The cargo flow, at present, seems rather stagnant except for container cargo. Most of the cargo, after being unloaded, is directly transported out of the port and inbound cargoes also follow the same pattern, so that most of the time, the transit sheds are almost empty. During the harvest season, part of the transit sheds are full of agricultural products. During our survey period, second hand cars were observed to be stored temporarily in the sheds, waiting for their delivery.

The storage capacity of the transit sheds seems satisfactory, but significantly aging and deteriorated. Lighting and ventilation is poor. In the long term, the usage plan for each transit shed should be determined, whether it is to be improved, repaired or demolished to serve as the open storage yard for container stacking. Transit shed No.12A is now being converted to CFS and there are plans to redevelop transit shed No.10 and No.13 into bonded warehouses.

Most transit sheds are located at a considerable distance from the quayside and in between lies a large open storage yard and sidelines of railway. This long yard handling from the wharfs to the transit sheds causes some inconvenience, forcing temporary stacking at the apron in many berths. The existing arrangement of transit sheds should be carefully reviewed when a more efficient cargo flow is established in future.

3-4-2 Chua Ve Port

Chua Ve Port has three transit sheds, all of them very small (280m^2 each) and aging, serving as temporary CFS's. With the opening of the large scale container terminal, more efficient and modernized facilities shall be established.

3-5 Port Traffic Handling

3-5-1 Main Port

There is a marshaling yard along the shore side boundary of Berth No.1 and Berth No.2. This marshaling yard has a total of seven(7) spur lines, of which one line extends up to Chua Ve Port. This Marshaling line is not fully utilized yet. The main railway line connecting to the outside of the port comes into the port through Port Gate No.3.

The currently utilized major railway line runs from the marshaling yard up to Berth No.1, traveling through the eastern boundary of the port. This railway line runs over the apron along the entire stretch of the berth line from No.1 to No.11. On the apron, two railway lines are installed. In many cases, the