6.5 Port Facilities

6.5.1 Mooring Facilities

In Bangkok port, there are five (5) mooring facilities, namely, West quay, East quay, Klong Toei dolphins, Bang Hua Sua dolphins and Sathu Pradit buoys.

The west quay consists of a deepwater quay and a boat harbor quay. The west deepwater quay has a design water depth of 11.5 meters under Mean Sea Level(MSL)and 10 berths of 1660 meters in total length. However, the actual water depth at the berths is maintained 10.7 m below MSL or 9.0 m below Lowest Low Water(LLW). The west boat harbor has a design water depth of 3.5 meters under MSL and is 130 meters in length. Both quays which are supported by wood piles were constructed in 1951 and have been utilized more than 40 years already but these structures are still in good condition, that is, no uneven settlement and no heavy cracks are observed.

The east quay also consists of a deepwater quay and a lighter quay. The east deepwater quay has a design water depth of 11.5 meters under MSL and 7 berths of 1228 meters in total length. The actual water depth at the berths, however, is maintained 10.7 m below MSL or 9.0 m below LLW. The east lighter quay has a design water depth of 6.0 meters under MSL and is 300 meters in length. Both quays which are supported by RC piles were constructed in 1979 and are structurally in good condition.

The Klong Toei dolphin berths consist of 36 dolphins which are located at 40 meter intervals and provide 7 berths with a design water depth of 11.5 meters under MSL. These dolphins were constructed using H-shaped steel piles in 1968. All dolphins except one are structurally in fair condition. One dolphin was bent by the collision of a vessel.

The Bang Hua Sua dolphin berths consist of 25 dolphins, of which every 4 dolphins compose one (1) berth with a water depth of 9.5 meters under MSL. No.1 and No.4 dolphins of the 1st berth are used as the mooring dolphins and No.2 and No.3 dolphins are used as the breasting dolphins, and No.4 dolphin is commonly used by the 2nd berth as the mooring dolphin. Therefore, 25 dolphins provide 8 berths. Each dolphin is made of a single pile of 1300 mm dia. Steel pipe and two (2) 65 ton bollards were installed on it. These dolphins were constructed in 1984 and maintain a fair structural condition.

The Sathu Pradit mooring buoy berths consist of 5 mooring buoys which are located at 360 meter intervals and provide 5 berths with the water depth of 9.0 meters below MSL. All buoys were installed in 1972 and are now in fair condition.

The mooring facilities of Bangkok port are summarized as shown in table below.

Mooring Facilities Of Bangkok Port

Facility	Total Length or No.of Dolphin	Number of Berth	Depth from MSL	Constructed Year
West Quay	1,660 m	10	-11.5 m	1951
West Boat Harbor Quay	130 m	-	-3.5 m	1951
East Quay	1,228 m	8	-11.5 m	1979
East Lighter Quay	300 m	-	-6.0 m	1979
Klong Toei Dolphin	36(1,377 m)	7	-11.5 m	1968
Bang Hua Sua Dolphin	25(1,535 m)	8	-9.5 m	1984
Sathu Pradit Buoy	5(1,555 m)	5	-9.0 m	1972

* MSL-LLW = 1.7m

The locations of these mooring facilities are indicated on Fig. A-7-1 and more detailed information on the berths is presented in Table A-7-1 in Appendix 7.

6.5.2 Cargo Sorting and Storage Facilities

(1) Transit Shed

In the west quay, there are 22 transit sheds of which total floor space is approx. 99,000 m^2.

Transit sheds No.1 to No.9 located behind quay apron are very old RC structures constructed in 1951 but have been maintained properly and still have a fair structural condition.

Transit sheds No.13 and No.14 which are used for CFS are RC column with steel roof beam structures constructed in 1983 and are structurally in good condition.

Transit sheds No.15 to No.17 are steel frame with block wall structures constructed in 1970 and have been maintained well.

The supplementary shed of transit shed No.3 is also steel frame with block wall structures constructed in 1970 and the structure is still in good condition.

The supplementary sheds of transit sheds No.4 to No.9 are steel frame with block wall structures constructed in 1968. These sheds were settled by consolidation of subsoil and the floor elevation is below 20 to 30 cm at the supplementary shed of transit shed No.4 and below 70 to 80 cm lower at the supplementary shed of transit shed No.9 from the surrounding road or pavement surface.

In the east quay, there are two(2) transit sheds of which total floor space is 18,000 m^2. Both transit sheds (shed No.11 and No.12) which are used for CFS are RC column and steel roof beam with block wall structures constructed in 1979. These structures have been maintained well and still maintain a good structural condition.

(2) Warehouse

In the west quay, there is one(1) bonded cargo warehouse, one(1) overtime cargo warehouse and three(3) dangerous cargo warehouses.
The bonded cargo warehouse is a three(3) story RC structure each having a floor space of 3000 m^2 constructed in 1951.
The overtime cargo warehouse consists of two(2) parts, namely, a part of steel frame with concrete block wall structure and a part of RC column with steel roof beams and concrete block wall structure. The former is still in good condition but the latter is in not so good condition.
There were five(5) dangerous cargo warehouses in the port but three(3) of them were destroyed by fire in 1991. It has been decided that the existing two(2) dangerous cargo warehouses of 2000 m^2 will be demolished upon completion of the two(2) new dangerous cargo warehouses of 10,000 m^2 for which construction will be commenced within a few months. The former supplementary shed of transit shed No.1 is now used for the dangerouse cargo warehouse for cotton and jute, but it is necessary to elevate the floor level of this building to protest it against heavy rain.

In the east quay, there is one(1) warehouse of 5,150 m^2 for general cargoes. This warehouse is a RC structure constructed in 1979 but the structural condition is very poor.

Outside of the customs fence in the west quay, there is one(1) in-transit warehouse of 9,600 m^2. This warehouse is a steel frame with brick wall structure constructed in 1970 and has been maintained well.

(3) Container Yard

In the west quay, there are two(2) container yards with total space of 178,200 m^2. These yards are paved with concrete blocks constructed in 1986 and 1992. The bearing capacity of these yards is designed to be 3.0 ton/m^2 and they are presently in good condition.

In the east quay, there is one(1) container yard of 124,000 m^2 which is largely paved by concrete and partially by asphalt, and some parts of it are still under reconstruction.

Outside the customs fence in the west quay, there are two(2) container stuffing yards of 35,700 m^2 for export containers. These yards were prepared in 1989 but the uneven settlement can be seen already. The rehabilitation works will not be so difficult since the pavement of these yards is made of concrete blocks.

(4) Open Storage

In the west quay, there is 176,860 m^2 of open storage in total for general cargoes. This area is divided into 12 blocks of open storages, of which one(1) open storage behind transit sheds No.15,16 and 17 is supported by piles and the storage capacity there is 1.5 ton/m^2 only. All other open storages are on ground and have a storage capacity of 3.0 ton/m^2.
It is recommended that the pavement of the open storages around the cotton warehouse, supplementary shed of transit sheds No.3 and the overtime cargo warehouse be improved. The pavement of other open storages is in good condition.
The new open storage for dangerous cargoes is planned to be built behind the existing warehouses for dangerous cargoes and it will be supported by pile foundation since the subsoil there is very poor.

In the east quay, there is 40,590 m^2 of open storage between the cargo warehouse and transit shed No.11. The pavement of this open storage is asphalt and settled significantly. Thus, to keep the same elevation with the adjacent container yard, rehabilitation work is required.

Outside the customs fence, there is 42,080 m^2 of open storage for the intransit cargoes and the import steel. The pavement of these open storages is made of reinforced concrete constructed in 1970 and 1973 and the structural conditions are still good.

The cargo sorting and storage facilities of Bangkok port are summarized in the table below. The figures indicated in this table include the space for offices and passage, and it is assumed that the effective storage space will be 60% to 80% of these figures.

Cargo Sorting / Storage Facilities of Bangkok Port

Facility	West Quay	East Quay	Out of Fence	Total
	(m^2)	(m^2)	(m^2)	(m^2)
1.Transit Shed	99,060	18,000	0	117,060
2.Warehouse	34,830	5,150	9,000	48,980
3.Container Yard	178,200	124,000	35,700	337,900
4.Open Storage	176,860	40,590	42,080	259,530

The location and details of cargo sorting and storage facilities of Bangkok port are presented in Fig. A-7-2 and Table A-7-2 to A-7-5 respectively in Appendix 7.

6.5.3 Operation Supporting Facilities

In the west quay, there are many kinds of operation supporting facilities such as the repair shops for handling equipment and vehicles, the garage and parking lots of handling equipment, a gas station, the store for marine equipment, the water tank and pump house, a substation, the fire engine stations and canteens. The total space occupied by these facilities is approximately 38,000 m^2. Most of these facilities are very old and their conditions is not so good.

In the east quay, there is a repair shop, a garage ,a store and parking lots for the handling equipment, a water pump house, a gas station, a substation for container cranes and the canteens. The total space occupied by these facilities is approximately 12,500 m^2. The substation is in good condition but the other facilities are in between fair to very poor condition.

Outside the customs fence, there are work shops and stores for the maintenance of port facilities, the water tanks and a pump house, a power station, a work shop and store for electricity supply, a parking lot, a public bus terminal, a store of quarantine and the canteens. The total space of these facilities is approximately 50,000 m^2. Most these facilities are in between fair to very poor condition.

The location and further details on these operation supporting facilities are indicated in Fig. A-7-3 and Table A-7-6 to A-7-9 respectively in Appendix 7.

6.5.4 Port Office Buildings

In the west quay, there are 21 port office buildings and several ship agent offices. The main office buildings are PAT operation building, Bangkok port operation building, Comptroller's department, Law division, Container division, Computer center, Crane section, Forklift section and Container section 1. The total floor space of 21 port office buildings is approximately 19,000 m^2.

In the east quay, there are three(3) port office buildings, namely, Mechanical handling equipment division, Crane section and Container section 2.
The total floor space of 3 port office buildings is approximately 2800 m^2.

Outside the customs fence, there are 12 port office buildings including a port police station and a quarantine office. The main offices are Engineering department, Technical office, Telephone section, Sanitary section, Electrical engineering division, Store and printing division and Security section. The total floor space of these buildings is approximately 11,500 m^2.

The location and further details on the port office buildings are indicated in Fig. A-7-3 and Table A-7-10 to A-7-12 respectively in Appendix 7.

6.5.5 Other Infrastructures

(1) Roads

There are three(3) rows of main roads running in parallel to the berthing line of the west quay. The road of the first row from the berthing line is for one-way vehicle traffic with four(4) lanes for out-going heavy duty trucks and paved by cement concrete. On the other hand, the road of the second row is for two-way vehicle traffic with two(2) lanes for passenger vehicles and paved by asphalt concrete. The road of the third row is for one-way vehicle traffic with two(2) lanes for in-comming heavy duty trucks and paved by asphalt concrete.

In the east quay, there is only one(1) main road which is for two-way vehicle traffic with four(4) lanes and paved by asphalt concrete.

The east quay and west quay are connected by a road bridge, which is 23.0 m wide and 90.0 m long prestressed concrete structure constructed in 1979. To provide sufficient clearance under the bridge to passing barges, the surface of this bridge was elevated approximately 4.0 m above adjacent ground level.

Uneven surface is observed very often all over the road network and since most parts of roadway have not the lay-by of suitable width which can provide the space for temporarily stopped vehicles, the safe and smooth flow of traffic is disturbed significantly.

(2) Railways

The State National Railway extended the line into the west quay in 1951. The two(2) lanes of railway were laid on the quay apron and also two(2) lanes were laid behind the transit sheds No.1 to No.9 and one(1) lane was laid in front of the bonded warehouse. However, the railway between sheds No.5 to shed No.9 on the quay apron and railway in front of the bonded warehouse were already demolished and the remaining railways have not been used for long time. In addition, some portions of railway behind the transit sheds are covered by the pavement of roadway.

The national railway was introduced into the east quay in 1979. The two(2) lanes of railway were laid on the quay apron and the other three(3) lanes were laid along the northern boundary of east quay. The latter is under utilization for the transportation of export cargoes but the former is not used now.

(3) Drainage System

The storm drain in the west quay is discharged by the under ground drain pipe network to the Chao Phraya river and Phra Kanong canal. The drain pipe network consists of 40 to 150 cm diameter pipes.

The storm drain in the east quay is also discharged by the under ground drain pipe network to the Chao Phraya river and Chek canal. The drain pipe network consists of 30 to 100 cm diameter pipes.
These drainage system is in good order, however, many rain water pools are found in the open storage yards after rain. This is not caused by the drain pipes but caused by the unevenness of the storage yards.

(4) Utilities

1) Water Supply

The water supply system of Bangkok port consists of the water supply from municipal water supply system and the water supply from its own well water supply system. This water is used for all purposes. The average consumption of water is approximately

80,000 m^3 per month.
For the water supply to the ships, the intakes of water supply taps are provided on the apron of the west and east quays.

2) Electricity Supply

The electricity for the port is received from the Metropolitan Electricity Authority (MEA). At present, the receivable capacity is 800 A at 12,000 V. By the end of 1994, the marine store section will be able to receive another 10 MVA at 69,000 V which is transformed to 12,000 V in the port.
Therefore, the present electricity supply capacity is 800 A at 12,000 V and at the end of 1994 another 481 A at 12,000 V will be available.
The maximum electricity consumption is now around 455 A at 12,000 V.

The voltage and capacity of distribution lines in the port are 12,000 / 380 / 220 V and 5,460 KVA.

Above electricity supply system is supported by an emergency supply system which consists of four(4) diesel engine generators of 3,225 KVA in total. However, these generators have been used for more than 38 years and are able to generate 2,875 KVA only.

3) Fuel Oil Supply

Bangkok port has no fuel oil supply system to the ships. In order to supply the fuel to the handling equipment and other vehicles, there are two(2) gas stations in the port. One is in the west quay and the other is in the east quay.

4) Fire Fighting System

The fire fighting system of Bangkok port consists of fire engines and fire hydrants. The fire engines are stored in the fire stations near the main gate and are under the control of the port police and the security center of PAT. The fire hydrants are under the control of PAT and are distributed around the sheds and warehouses in the west and east quays.

5) Sewage and Rubbish Treatment

There is no sewage treatment plant in the Bangkok port. All sewage and waste water are disposed in the septic tank provided for each building.

There is unconfirmed information that Bangkok municipal office has a plan to build a sewage treatment facility in the vicinity of the east quay.

There is no rubbish treatment facility in the port. Therefore, the rubbish produced within the port is collected by PAT two(2) times a day by five(5) trucks and transported to the municipal rubbish dumping site.

6.6 Present Conditions of Cargo Movements through Bangkok Port

6.6.1 Containers

(1) Usage of Port Facilities for Container-Handling inside Bangkok Port

1) Berths

In the Klong Toey wharf of Bangkok Port, most of the containers are discharged or loaded at the following seven berths of the east quay:

Berth No.	Berth No.
20A: east end	20D: next to the bend
20AB	20F:
20B	20F: west end
20C: next to the bend	

Between berths Nos. 20C and 20D, there is a bend. From the east end of the berth line of the east quay to the bend, the four berths, namely 20A-20C, are allocated. From the bend to the west end of the berth line, three berths, namely 20D-20F are allocated. Through the former and latter portions, six quay-side container gantry cranes are installed, respectively. In addition to these 12 cranes, another two cranes are going to be purchased soon.

On the other hand, containers are also discharged from or loaded onto container vessels equipped with ship cranes or conventional cargo vessels laden with small number of containers together with conventional cargoes at the west quay, especially at berth No. 22A.

2) Marshaling Yard

A marshaling yard for container-handling is prepared behind the above berths at the east quay. Containers are stacked by rubber-tired gantry cranes (RTGs).

3) Container Freight Stations

Seven sheds, Nos. 11-17, are designated as container freight stations (CFSs) to receive import CFS cargoes which are unstuffed and stored at the CFSs. Sheds Nos. 11-12 are located at the east quay, and the remaining sheds are located at the west quay. Besides these seven CFSs, 13 sheds comprising the sheds Nos. 1-9 and four small sheds behind

conventional berths at the west quay are also used to receive inbound CFS cargoes together with conventional cargoes. Most of the above CFS cargoes are supposed to be LCL cargoes which are laden in one container box and delivered to more than one consignee.

Open yards surrounding each shed are designated to receive import laden containers from which container cargoes are unstuffed and directly delivered to trucks in the open yards. The majority of such cargoes delivered directly to trucks inside of Bangkok Port are supposed to be FCL cargoes which are laden in more than one container boxe and delivered to one consignee. In the definition of PAT's tariff, the above import CFS cargoes and cargoes which are directly delivered to trucks after unstuffing inside the port are called "LCL" cargoes. The latter category of cargoes are called "LCL direct delivery" cargoes, though most of them are supposed to be FCL in international definition. In the definition of PAT's tariff, container cargoes which are brought into or brought out from Bangkok Port in container boxes are called "FCL" cargoes.

4) Storage Yards for Empty Containers

Open yards behind sheds Nos 15-17 and west of the sheds are used to store empty containers.

5) Stuffing Yard for Outbound Container Cargoes

The same yards as empty container storage yards are used for stuffing export container cargoes.

(2) Usage of Off-Dock Facilities outside Bangkok Port

Before being brought into or after being brought from Bangkok Port, containers are delivered or received at the following off-dock facilities which are located outside Bangkok Port and operated by private sectors:

1) Off-Dock CY/CFS for Export Containers

The following 15 off-dock CYs for export containers are operating at present (see Fig. 6-6-1):

1 Siam Shoreside
2 TIMCO (MOSK)
3 Sinthanachote (RCL)

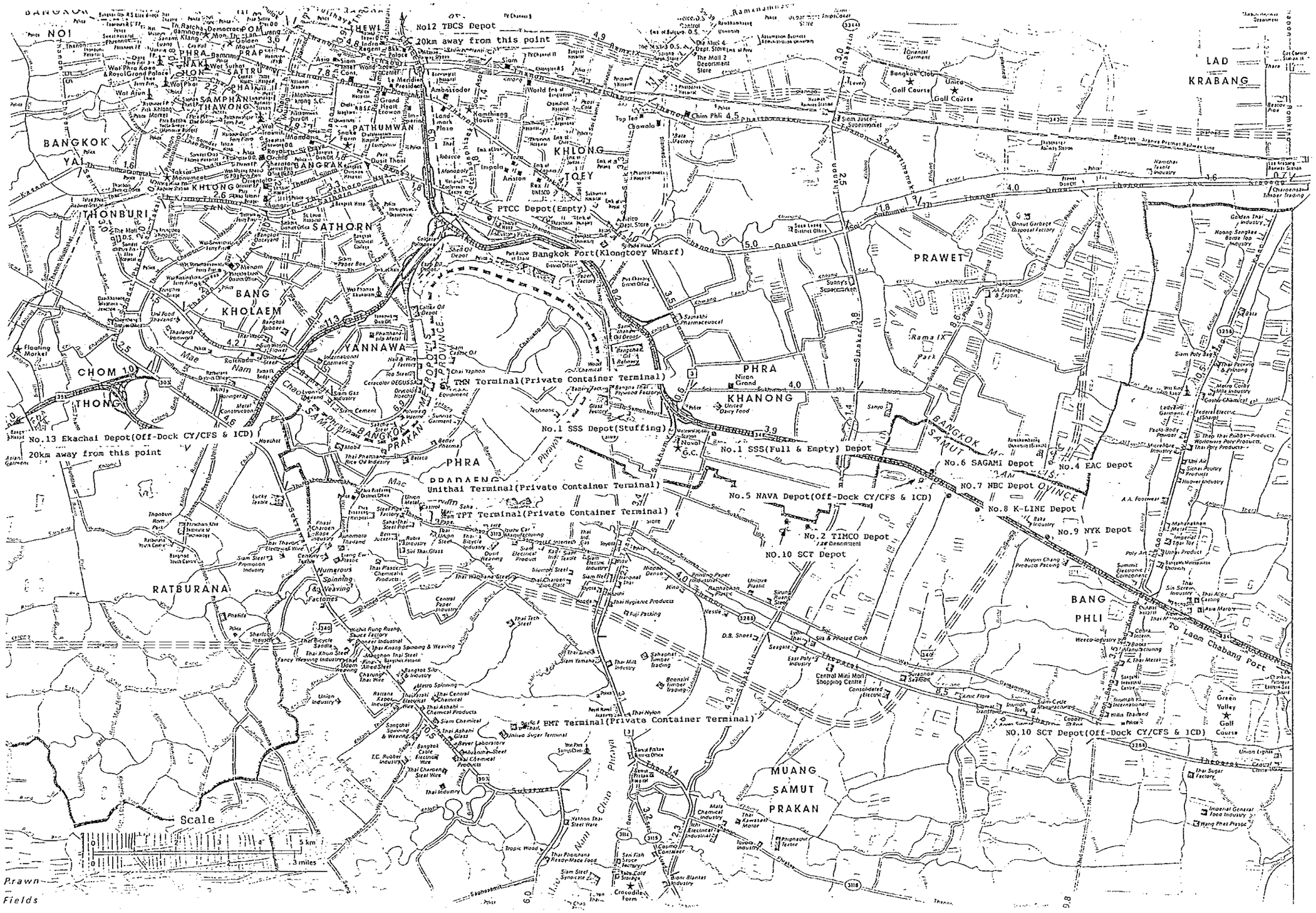


Fig. 6-6-1 Location of Off-Dock CYs/CFSs and ICDs

4 EAC
5 NAVA
6 SAGAMI (APL)
7 NBC (NOL)
8 K-LINE
9 NYK
10 SCT
11 NAVANAKORN
12 TBCS
13 NAKUTRAC
14 Ekachai
15 CRC(P & OCL/BEN LINE)

Those off-dock CYs mainly receive FCL (in the sense of the international definition) container cargoes. Some portion of FCL cargoes are brought into those off-dock CYs in container boxes after being stuffed in shippers' premises (one touch operations) or in loose cargoes. In the latter case, the loose cargoes are stored in off-dock CFSs and then stuffed into container boxes at the bays of CFSs. At those CYs/CFSs, B/Ls (bill of lading) are issued by shipping lines and then, the shipping lines take the responsibility of transporting and storing cargoes. Those off-dock CYs/CFSs have close linkage with export-oriented factories. Some of off-dock CYs/CFSs function as logistics centers of the above factories. The customs liaison offices are located within each off-dock CFSs, and therefore, customs document procedure, inspection and official sealing of containers of exported cargoes are done there. After ceiling, containers are brought into the ports in bonded conditions.

2) Inland Container Depots for Import Containers (ICD)

The following four Inland Container Depots for import containers (ICD) are operating at present (see Fig. 6-6-2):

1 NAVA
2 SCT
3 N.S. Prosperity
4 Ekachai

Customs liaison offices are located within each ICD. Some of the imported laden containers discharged at the ports are brought into those ICDs in bonded conditions, and then, cleared and delivered to consignees there. The conditions to get a licence to operate an ICD which is authorized by the customs authority are severe compared with

the conditions for an off-dock CY/CFS for exports: area required for the ICD must be larger than 50 rais (80,000 sq. meters). The number of ICDs are much less than that of off-dock CYs/CFSs; presently, the percentage of containers through the ICDS to the total imported laden containers is very small.

3) Off-Dock Empty Container Depots

After import FCL containers are unstuffed at off-dock places i.e. consignees' premises or the ICDs, empty container boxes are hauled to off-dock empty container depots and kept there for a while. Then, the empty boxes are hauled again to stuffing places: shippers' premises, off-dock CFSs or on-dock stuffing yards inside Bangkok Port (Klong Toey Wharf). Some of the off-dock empty container depots are allocated adjacent to off-dock CFSs/ICDs to facilitate stuffing/unstuffing operations at the CFSs/ICDs. Some of the off-dock empty container depots are allocated adjacent to Bangkok Port to facilitate stuffing/unstuffing operations inside the port.

(3) Flow of Import Containers

Most of the containers are discharged at the berths of the east quay. Small amount of containers are also handled at the berths of the west quay as mentioned previously. After being discharged, containers are handled according to the respective container status in the sense of PAT's-tariff definition as follows:

- FCL(Definition of PAT's tariff):
  After being discharged from container vessels, import FCL containers are stacked on the marshaling yard at the east quay. Presently, free rent for import container storage is three days, and therefore, most import containers are brought out within the free days from the premise of Bangkok Port to consignees' premises or ICDs in bonded conditions.

- LCL((Definition of PAT's tariff) except for direct delivery:
  After being discharged, LCL containers are hauled to the CFSs or sheds behind the berths at the west quay, and then unstuffed, stored, cleared and delivered to consignees. Average dwelling time of import LCL cargoes is about seven days.

- LCL direct delivery ((Definition of PAT's tariff):
  After being discharged, LCL-direct-delivery containers are hauled to the designated open yards surrounding CFSs or sheds mentioned previously, and then, stored, cleared, unstuffed and directly delivered to consignees without being stored in loose cargoes inside sheds. Average dwelling time of import

LCL-direct-delivery cargoes is about five days.

- Empty Containers:
  Presently, laden export containers outnumber import laden containers, and consequently, discharged empty containers outnumber loaded empty containers. The number of discharged empty containers accounts for around 25% of the total of import containers. On the other hand, the number of loaded empty containers accounts for only around 5%. Those empty containers discharged from vessels are once stacked storage yards for empty containers at the west quay, and then hauled to directly stuffing places inside/outside the port or the above off-dock empty container depots.

(4) Flow of Export Containers

Containers are handled according to the respective container status in the sense of PAT's-tariff definition as follows:

- FCL(Definition of PAT's tariff):
  Presently, around 40% of the total export dry container cargoes are brought into Bangkok Port in container boxes, namely as FCL cargoes in the sense of the definition of PAT's tariff and once stacked on the marshaling yard at the east quay. Then the FCL containers are loaded onto container vessels. According to the existing tariff, free rent for export container storage is three days and therefore, most of the export containers are stored within the free rent period.

- LCL((Definition of PAT's tariff) except for direct delivery:
  Presently, around 60% of the total export dry container cargoes are brought into Bangkok Port in loose conditions, namely as LCL cargoes in the sense of the definition of PAT's tariff, stuffed at the stuffing yards at the west quay. It is roughly estimated that presently around 70% of the total number of export LCL containers are once stored at the stuffing yards for two to three days on an average after being stuffed. Then, the LCL containers are hauled to and loaded onto container vessels without being stacked on the marshaling yard at the east quay, namely by so-called direct loading.

(5) Historical Trend of the Percentage of Containers in terms of the Container Status defined by PAT's Tariff

Historical trend of the percentage of containers is shown in Table 6-6-1in terms of the container status defined by PAT's tariff: FCL, LCL, Reefer and Empty.

Table 6-6-1 Percentage of Containers in terms of Container Status defined by PAT's Tariff

Import										
Year	Empty		LCL		FCL		Reefer		Total	
	(TEUs)	(%)	(TEUs)	(%)	(TEUs)	(%)	(TEUs)	(%)	(TEUs)	(%)
1988/89	132,027	29.6	213,823	47.9	95,477	21.4	4,646	1.0	445,973	100
1992/93	150,023	24.4	192,843	31.4	265,344	43.2	6,349	1.0	614,559	100

Export										
Year	Empty		LCL		FCL		Reefer		Total	
	(TEUs)	(%)	(TEUs)	(%)	(TEUs)	(%)	(TEUs)	(%)	(TEUs)	(%)
1988/89	12,961	2.8	330,005	71.9	84,730	18.5	31,113	6.8	458,809	100
1992/93	31,173	4.5	390,158	56.2	226,661	32.6	46,507	6.7	694,499	100

Source: Bangkok Port Office of PAT

Notes: (1): The year of "1988/89" is the fiscal year.

(2): The year of "1992/93" is from March, 1992 to February, 1993

(6) Outline of Container Flow between Shippers/Consignees and Bangkok Port

An outline of container flow between shippers/consignees and Bangkok Port is shown Fig. 6-6-2. The terms of LCL and FCL in the figure are based on the international definitions shown in the figure.

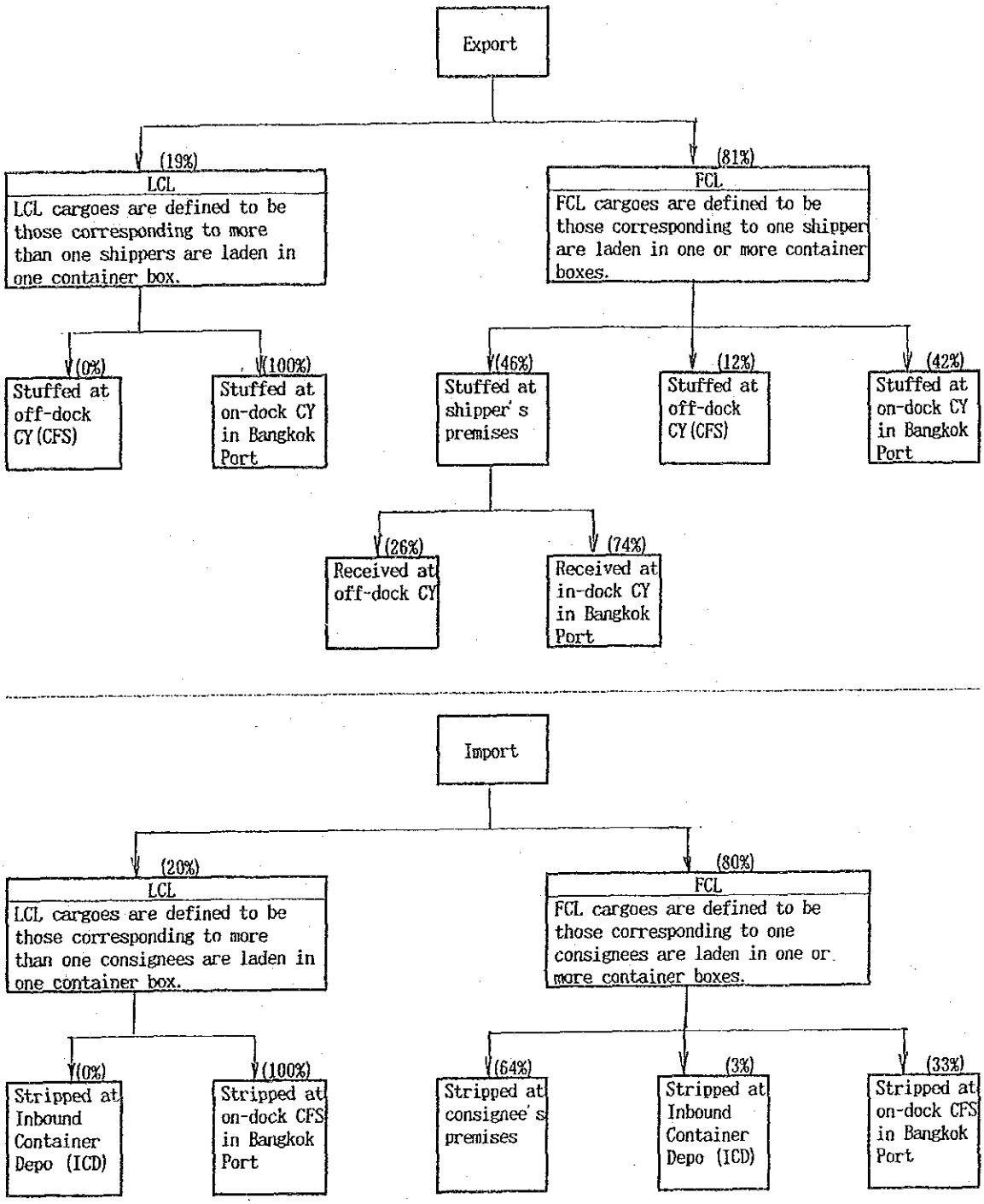


Fig. 6-6-2 Outline of Container Flow between Shippers/Consignees and Bangkok Port

6.6.2 Conventional Cargoes

(1) Usage of Port Facilities for Handling Conventional Cargoes

1) Berths

In the Klong Toey Wharf of Bangkok Port, conventional cargoes are discharged or loaded at the following ten berths of the west quay:

Berth No.	Berth No.
22A: east end	22F
22B	22G
22C	22H
20D	22I
20E	22J: west end

2) Transit Sheds

Thirteen sheds comprising the sheds Nos. 1-9 and five supplementary sheds behind conventional berths at the west quay are used to receive conventional cargoes together with inbound LCL container cargoes. Another transit shed is located outside the main gate of the port (the checking post one).

3) Open Storage Yards

Open storage yards surrounding each sheds are used to store bulky conventional cargoes such as vehicles, construction machines and agrimotors. In addition to these open storage yards inside the main gates, open yards to store steel products are located outside the main gate (Checking Post 1) adjacent to the above shed lying outside the main gate.

(2) Flow of Conventional Cargoes

Most of the conventional cargoes handled at the west quay are import cargoes. After being discharged from conventional vessels, those conventional cargoes are once stored in the transit sheds or the open yards. Then, those cargoes are delivered to consignees.

6.7 Information System

6.7.1 The Present Condition of Information Business in Thailand

(1) Overview of Computer Industry in Thailand

Thailand computer association reported that sales related to the information industry in 1990 reached 416.5 million dollars with an annual growth rate of 36.4 percent. Growth has been especially remarkable in the manufacturing industry and trading areas. The rapid growth of the computer industry contributes to more effective approaches to problem solving, to developing new products and services, and enhances national competitiveness across broad sectors of the economy.

The monetary growth of the computer industry is shown in table 6-7-1, 6-7-2 and 6-7-3.

(2) Measures for the Furtherance of the Information Industry

Thailand Government announced the seventh socio-economic development plan (1991 - 1996) relating to information industry as follows:

1) To support and promote joint ventures in official and private fields by reducing import taxes for machinery equipment by five (5) percent, in the past they ranged from thirty (30) to sixty (60) percent.

2) To enhance information system for all government bodies

3) To regard s the intellectual ownerships as important

4) To increase the budget for research and development of the information industry

5) To introduce a computer course to high school curriculums

(3) Computerization in the port related business, in general, is not so advanced as a whole while some shipping companies/shipping agents and private container terminal have highly advanced computer systems to support their management and operations.

6.7.2 Computerization of Port Related Bodies at Present Time

(1) The Port Authority of Thailand (PAT)

1) PAT has been appointed as the management body of Bangkok Port. It is also the

Table 6-7-1 Thailand Computer Market 1990-1992

Products	1990		1991		1992	
	Unit	Million Baht	Unit	Million Baht	Unit	Million Baht
Hardware						
Mainframe	40	1,070	35	1,693	37	2,312
Mini/Server	560	2,300	650	2,370	656	1,730
Workstation	100	70	300	180	505	252
Micro	60,000	2,490	77,500	3,410	120,000	5,080
Hard Disk	43,000	772	66,320	862	65,100	1,058
Printer	34,400	819	44,200	985		
Impact					5,200	1,120
Non-Impact					9,600	480
Total Hardware		7,521		9,500		12,032
Software & Services				2,918		4,010
Total Market		7,521		12,418		16,042

Source : ATCI

Table 6-7-2 Export Value of Computer Products
1988 - 1991 (Million Baht)

Products	1988	1989	1990	1991
Unrecorded Media	10	0	1	41
A D P Machines	2,685	11,466	9,139	13,096
Parts & Accessories	9,829	15,361	29,532	33,245
Total	12,525	26,827	38,672	46,382

Source : DEPT of Commercial Registration

Table 6-7-3 Import Value of Computer Products
1988 - 1991 (Million Baht)

Products	1988	1989	1990	1991
Unrecorded Media	65	75	788	1,974
A D P Machines	2,581	3,474	4,279	5,878
Parts & Accessories	19,889	21,555	22,076	24,072
Total	22,536	25,103	27,143	31,743

Source : DEPT of Commercial Registration

operator of the container terminal and conventional pier at Klong Toei Wharves.

2) PAT's IBM ES/9000 model 190 mainframe computer system came on line at Bangkok Port in December, 1992, responsible for the processing of salaries, accounts and budgets, import issue bills, export issue bills, miscellaneous issue bills and goods issue bills.

3) Plans for future development, especially in the area of its container service, will include the introduction of a computerized container system.

4) PAT will use the computerized container system to control container traffic at the eastern quay, Bangkok Port where it will solve the problems of delayed cargo movements, low productivities and long docking terms.

5) Further information about PAT's computerization of container system development plan is shown in Appendix A.8.1.

(2) Customs

1) Customs presently has a computer system with a database for trade statistics and accounting. The system is on-line not only with its own two divisions but also with the Ministry of Finance, which includes both realtime and batch processing. Customs also uses the work-stations of Thai International Airlines at Don Muang International Airport in order to check transit data.

2) Although they do not have a comprehensive computer network linked to other parties. Customs is presently planning to widen its system and to connect it with other related bodies, especilly with airports and seaports. According to the plan, Don Muang International Airport will first, Laem Chabang Port will second, be linked with the customs computer system, and Bangkok Port will go on-line afterward.

(3) The State Railway of Thailand (SRT)

1) SRT utilizes a computer system responsible for the processing of salaries, accounts, statistics and seat ticketing reservation.

2) SRT plans to introduce and develop new computer system including operation control and inventory control systems. The operation control system will be closely related to container operation and will improve transportation efficiency.

(4) The Express Transportation Organization (ETO)

1) ETO utilizes a computer system for such internal works as salaries, accounts, revenue and statistics.

2) As far as truck monitoring is concerned, ETO presently uses radio communication between trailer-head and sub stations, but not uses computer system to control truck operation. ETO has the idea to control truck operation using computer on-line system between head office and sub stations.

(5) Shipping Companies / Agents

1) Shipping companies/agents utilize computer to control their management and operation, in addition, most of them have advanced computer systems which cover almost all the container operations in the port area including the necessary documentation, and also have world-wide information networks using computer and telecommunications.

2) Most of shipping companies/agents attempt upgrading the existing system with minimized lead time and maximized return on investment. The forementioned shipping companies'/agents' computer system and advanced knowledge should be helpful to PAT.

6.7.3 Detail of Service Scope of PAT at Present Time

(1) Container Cargo Handing

1) PAT, has been appointed as the operator of the container terminal, takes charge of major roles in the container cargo handling at Klong Toei Wharves. All the shoreside cargo operations in the PAT area are, in principle, to be excuted by laborers and equipments belong to PAT. However due to insufficiency of resources, shipping agents have to provide laborers and equipments by themselves with PAT's permission.

2) At Klong Toei Wharves, PAT has not yet successfully been as the operator of the container terminal, therefore, shipping agents take charge of terminal operations and they entrust physical cargo handling to PAT and stevedoring companies. The sharing of responsibility for the necessary tasks are, in principle, as follows.

Shipping Agents : Operation planning including vessel-stowage and marshalling, container inventory work, checking container condition, documentation, etc.

Stevedores : Cargo handling on board.

PAT : Shoreside cargo handling.

3) The present system at Bangkok Port and popular container terminal in the world are shown in Appendix A.8.2 and A.8.3.

6.7.4 Documentation

(1) Container documents

Along with container movements, numerous documents and information are made and submitted by each parties concerned. After collecting all needed documents and information, containers can be deliver to each part. In PAT area, due to delay or insufficiency of documents, many containers should be stowed and delivery is delayed. Document work must be exact. However, it is costly, time-consuming and fraught with errors.

The most benefical solution to the documentation is electronic computer-computer communication system.

(2) Container documents in PAT

Many kinds of documents with many copies are submitted to each division and section in PAT at present time. PAT has amended form of the documents (No.8, No.201, No.202, No.204 and No.205) to correspond to new tariff structure of cargo handling in Bangkok Port on 1st June 1993. However, some kinds of information, such as container weight, port of destination, etc., are not included in the documents.

The documents which are submitted from shipping companies to PAT are shown in Appendix A.8.4.

(3) Data utilization for computer

The data, described in documents, are keyed-in to computer at container control center and stored in main frame computer, thenafter, the data are transferred to each remote termenals with on-line network. The data are used for checking containers passing through gates, however, are not used for yard control.

The data, utilized in container system at present, are the followings:

Import	Export
- Container Status	- Container Status
- Vessel Name	- Vessel Name
- Voyage Number	- Voyage Number
- Container Number	- Container Number
- Container Size	- Container Size
- Container Type	- Container Type
- Discharge Date/Time	- Gate In Date/Time
- Yard Location	- Yard Location
- Gate Out Date/Time	- Loading Date/Time
- Consignee Name	- Shipper Name
- Vehicle Number	- Vehicle Number
- Trailer Number	- Trailer Number
- Shed Number	- Shed Number
- Agent Name	- Agent Name
- Unstuffing Date	- Stuffing Date
- Vessel berthing Date/Time	- Vessel berthing Date/Time
- Shed Location	- Stuffing By PAT or not
- Gantry Crane or not	- Gantry Crane or not
	- Document Number
	- Document Date

6.7.5 Telecommunications

Each telephone exchange in Thailand is linked by optical fiber cable. An optical fiber cable can transport large amounts of information reliably regardless of the weather conditions, etc. The quality and quantity of the telecommunications medium are considered satisfactory.

6.7.6 Aspect of Future Development

Considering the future state as the container terminal operator, PAT should declare the detail of job and obligation. There are many divisions and sections, related to container terminal operation, in PAT. Exchange of informations is complicated. Each division and section should study necessary information and when informations are needed for their job. It is advisable that, PAT designate one section as a connective section with related bodies, assign stuffs for study and educate them for experts of container handling

operation. Computer system and advanced knowledge of shipping companies will be helpful to PAT.

In fact, shipping companies and container terminal operators have already utilized their own computer systems at container terminals and linked system throughout the world. The circumstances of container operation vary from country to country. Those shipping companies and container terminal operators have developed computer systems that can be used most efficiently. All the bodies related to the container cargo handling operation would like to have a common database from which they can verify or obtain the data or information they need for efficient container cargo handling operation by using an on-line computer information system. The on-line system could provide the necessary informations and documents at any time. An integrated information system, which can greatly contribute to the container cargo handling and connect closely to the related bodies, is one of the great and common concerns in this field.

It is also advisable that, PAT recognize the responsibilities of the container terminal operator, have view in the future and have a committee to reach a consensus on unifying various operational procedures and documentation forms with related bodies.

6.8 Navigation System

6.8.1 Regulations

(1) Navigation in Thai Territorial Waters Act(No.14), 1992

Regulations concerning vessel sailing are found in the captioned Act, which has been issued by the Thai Government, and applies to all Thai territorial waters, and any harbours, anchorages, rivers and canals in the Thai dominions. The relevant regulations extracted from the Act are as follows:

1) With regard to a vessel which wants to come in to dock or berth at pier, the captain or controller of the vessel must use low speed and be careful. A vessel which is navigating in a river or a canal must use a speed that is not more than the rate prescribed by the Harbour Master, and it is forbidden to cut in front of a mechanical vessel which is sailing downstream at a distance of two hundred metres. (Article 18)

2) No vessel is allowed to drop anchor within a distance of one hundred meters on each side of the place where an underwater cable, pipe or construction item is stretched, or to drag anchor across that cable, pipe or construction item that is stretched under the water. (Article 46)

3) If any offense is committed against the rules for preventing collision between vessels because of a tortuous act by a captain of a vessel, a controller of a vessel or an owner of a vessel, which is a tortuous act committed deliberately, that captain, controller or owner must be sentenced to not more than six months' imprisonment or fined one thousand baht to ten thousand baht, or both. (Article 54)

* The Minister of Communications is in charge of the enforcement of this Act.

(2) Harbour Department Regulations B.E.2530(1987)

In order to maintain efficiency and navigational safety in the Port of Bangkok, the Harbour Department prescribes regulations for practice and control of vessels requesting governmental pilotage service in the Port of Bangkok. The points in the said Regulations are as follows:

1) Pilotage is compulsory in the territorial waters and port limits of the Kingdom of Thailand.(11)

2) Regulations for Ordinary Vessels(LOA;172.2m, B;25m) concerning max. length and departing time;(5)

* Sathupradit Midstream Buoys: Not to exceed 137.16m in length, (5.3)

* Vessels exceeding 106.68m mooring between Buoy No.2 and northern Buoys, are required to depart against the tide or at slackwater only. (5.3)

* Sathupradit Midstream anchoring: Not exceeding 106.68m,

* Anchoring/weighing anchor at the above is only against the tide. (5.4)

* Paknam, Samut Prakarn Province anchorage: Not exceeding 91.46m LOA drawing not exceed 4.26m. (5.5)

* Anchorage at Bangplakot, Samut Prakarn Province midstream are allowed only for vessels discharging dangerous cargoes, and for vessels which need temporary anchorage in case of emergency. (5.6)

* Vessels permitted to pass beneath Krungthep Bridge can not exceed 85.34m LOA drawing 5.18m when loaded with cargoes, and 100.58m LOA entering/departing to/from Bangkok Dockyard without cargoes. (5.7)

* Schedule for vessels crossing Bangkok bar:
For Zone 1; Inbound vessels shall proceed from Bangkok Bar Pilot Station between 0300 and 1400. (5.8.1)
For outbound vessels from area north of Rama IV bridge, pilotage service will be provided during daylight hours only. (5.8.1)

For vessels departing form Buoy No.2 or other buoys on the north as well as vessels departing from wharf No.32 or other wharf on the north up to Rama IV Bridge, pilotage service will be provided during hours of daylight only. (5.8.1)

For Zone 2; For inbound/outbound vessels, pilotage service will be provided 24 hours except for vessels to berth beyond wharf No.21C upward. A vessel requiring to turn, shall enter Pilot Station between 0400 and 1500, an outbound vessel requiring to turn shall depart only during the hour of daylight. (5.8.2)

For a vessel to be shifted and to berth at Wharf No.21C and above, if such vessel requires to turn, it shall reach the anchorage before 18 hours. In the case of shifting

out, if a vessel requires to turn, it can only be shifted during daylight hours.

For Zone 3; For inbound/outbound vessels, pilotage service will be available 24 hours, with the exception of pilotage for vessels intending to moor at the midstream dolphins at Bang Hua Sue, which shall enter from Bangkok Bar pilot Station between 0500 and 1500 hours.

Vessels to be shifted to moor at the midstream dolphins at Bang Hua Sue shall arrange to be moored prior to 1800 hours.

*Schedule for Vessels to be shifted in Zone 1, 2 and 3

Vessels may be shifted during the period from 0600 to 1800 hours, in general.

3) Draft Restrictions

a) Ordinary Vessels

Maximum draft of vessels to cross Bangkok Bar to/from the Port of Bangkok is as follows:

from/to	**Max. draft**
Zone 1	7.62m
Zone 2	
Inbound	8.23m
Outbound(except tanker)	7.92m
Zone 3 (except tanker)	8.23m
Tanker within Zone 2 & 3	8.23m

* However, the max. draft for tanker shall be adjusted by Pilot Division on a case by case basis.

b) Super Vessels

Maximum draft of super vessels is restricted by bredth of vessels as follows:

Breadth	**Max. draft**
Not exceeding 25m	7.62m
25m - 27m	7.31m
27m - 29m	7.01m

Exceeding 29m; shall be fixed by the Chief Pilot on a case by case basis.

4) Bar Adders

Bar adders are the rate of maximum draft of vessels to cross Bangkok bar at the lowest ebb. In order to ensure a safe crossing, the value added to the figures from the Tide Table of each day and time, shall be the draft of vessels allowed to pass Bangkok Bar. The value is prescribed by LPP/B of vessels e.g. 48 dcm for vessels of LBP not exceeding 135.64m, and 42dcm for vessels of LBP exceeding 152.4m whose breadths do not exceed 25m.

* Ordinary Vessel: Vessel of LOA not exceeding 172.21m and breath not exceeding 25.0m.
* Super Vessel: Vessel of LOA exceeding 172.21m.
* LOA: Length over all.
* LBP: Length between perpendiculars.

6.8.2 Outline of Piloting Activity

(1) Status, Number of Pilot

Pilots are Government Officials belonging to the Harbour Department, MOTC.64 pilots have been licensed and are engaged in piloting activities.

(2) Qualifications of the pilot

1) Certificafe of competency; Master of foreign trade vessel or equivalent.

2) Career; At least one year experience as a master of foreign trade vessel.

3) Age; 30-45 at the time of application for employment and is obliged to retire at 60.

4) Physical requirement; Meeting to the standards of 'Navigation in Thailand Act B.E. 2530.

(3) Working result

1) Average annual working days of a pilot: 330 days

2) Average annual number of maneuvered vessels par one pilot:6630/64=104

3) Average piloting hour from the east quay to off harbour; four hours

6.8.3 Navigational aids

(1) **Bangkok Bar Pilot Station**(13°23'N,100°36'E)

A conspicuous concrete building on a round base stands two miles SE of the entrance to the buoyed channel across Bangkok Bar.
A light is exhibited from a metal framework tower, painted rad and white in bands, standing on the pilot station: a fog signal is sounded. There is a helipad on the pilot station.

(2) **Bangkok Bar Light-beacon**(13°27'N,100°36'E)

A white metal framework tower,seven meters in height, is situated near the seaward end of the channel, five and a quarter miles S of Phra Chunlachomklao Fort Flagstaff. A tidegauge is situated at the beacon.

(3) Leading light-beacons and buoys

The channel over the bar is marked by leading light-beacons and buoys, the positions of which are frequently changed to conform to the changes in the dredged channel through the bar.

Each leading light is exhibited from a white metal framework tower except 'H' which is exhibited from the top of a white water tower: front light structures have red daymarks with a white stripe, rear light structures have black daymarks with a white stripe. Entrance light-buoy(safe water) is moored two miles NW of Bangkok Bar Pilot Station.

1) The first pair of **leading light-beacons 'A'** and **'B'** are situated on detached drying banks, with the beacon 'B' $2^3/_4$ miles NNE of Bangkok Bar Light-beacon. The front beacon 'A' is situated one mile SSW of beacon 'B'. In line bearing 034°, these two light-beacons lead over the outer park of the bar.

'A' lighted yellow pile with a red cross topmark stands on the leading line $5^3/_4$ cables SSW of 'A' leading light-beacon.

2) **Leading light-beacon 'C'** and **'D'** for second part of the channel are of similar construction; the rear beacon 'D' is situated on the mudflats W of the river entrance 23/4 miles SE of the flagstaff at Phra Chunlachomklao, and is 10m in height; the front light-beacon 'C' situated one mile SSW one mile SSW of the rear beacon 'D' is four

meters in height. These two light-beacons are in line bearing 018°.

'C' lighted yellow pile with a red cross topmark stands on the leading line five cables SSW of 'C' leading light-beacon.

3) **Leading light-beacons 'E'** and **'F'** for the third part of the bar channel are also of similar construction; the rear 'F' is situated on the right bank of the river $1^3/_4$ miles NE of light-becon 'D', and is 12m in height. The front beacon 'E' is situated on the mud-flats E of the dredged channel one mile SSW of the rear beacon 'F'. In line these two beacons bear 030°.

East and West shoulder light-beacons stand 50m each side of leading light-beacons 'A' to 'F' at right angles to the direction of the channel. Each pair in line indicates the E and W limits of the channel. The structures of the shoulder light-beacons are white framework tower on wooden or concrete bases with daymarks:

Front	Diamond
Rear	Circle
East	Black on a white ground
West	Red on a white ground

4) **Leading light-beacon 'I'** stands eight cables SE of light-beacon E: these two light-beacons in line bearing 126o1/2 astern lead into the river entrance.

5) **Leading light-beacons 'G'** and **'H'** are situated on the W bank one mile NW of Phra Chunlachomklao Fort: in line bearing 306o1/2 ahead they lead along the same reach as leading light-beacons E and I into the river entrance.

(4) Lateral marks

The dredged channel through the bar and the fairway beyond are marked by starboard and port hand pillar lighted-buoys in accordance with the IALA Maritime Buoyage System(Region A).

(5) Distance beacons

A series of beacons mark the distance in kilometres between Bangkok city and Phra Chunlachomklao. These beacons (square in shape; red bands) stand on the both banks of the river. They are numbered from 42 to zero: zero beacon stand 087o 310m from the flagstaff on Phra Chunlachomklao.

6.8.4 Tug fleet

12 tugs of 1,000ps to 2,400ps owned by PAT are available to assist in berthing. They are also equipped for fire-fighting.

6.8.5 Natural Condition from the Navigational Aspect

(1) Weather/sea conditions in the Gulf of Thailand

1) General remarks

The climate is hot, except in the N in winter. Both temperature and humidity are high throughout the year in the S. The temperature is also high in the N in summer while the humidity is a little lower with little seasonal variation. This is a 'monsoon' region with NE winds in winter and SW winds in summer. Tropical storms rarely track S of 10°N. Fog is rare and visibility is good except sometimes at dawn in Bangkok in winter. Among the driest places are the inner parts of the Gulf of Thailand.

2) Pressure, depression

There is a fairly regular seasonal change is the average monthly pressure over most of the area. The rise in pressure in winter is due to the large anticyclone which forms over S Siberia. There is a corresponding decrease is pressure in spring to given a low pressure area of about 996hpa over N India in July. These two seasonal pressure systems are large enough to be the dominating influence on the coasts. The seasonal variations of pressure varies according to latitude, being very marked in the N and almost negligible towards the equator. Fig.6-8-1 shows the reversal of the pressure pattern for winter(January) to summer(July) corresponding with the two monsoons. The pressure gradient becomes slack during the transition periods in May and October.

3) Winds and gales(within 20 miles of the coast)

Gulf of Thailand; Western shore. The NE Monsoon prevails from December to April, and the SW Monsoon from May to October. NW squalls occur at times in the SW Monsoon. (See Table 6-8-1 Climatic table of Bangkok)

Gulf of Thailand; Eastern shore. Land and sea breezes are well developed, the sea breezes reinforcing the SW Monsoon in summer, with average force of four to five. The NE Monsoon is weaker here than on the W side of the gulf since the local sea breeze

opposes it. The skies are often clear for days on end during this season.

4) Typhoon

Most typhoons originate E of the Philippines, but some originate farther W in the South China Sea. Although typhoons have been known to move W near the S coast of Vietnam, appreciable penetration of the Gulf of Thailand is rare. None have been reported on the coasts of Malaysia, and few are known near the Isthmas of Kra which joins Peninsular Malaysia to the mainland N.

5) Rainfall, thunderstorms

In contrast to the generally abundant rainfall of the South China Sea area, the innermost parts of the Gulf of Thailand area considerably drier, with an average annual total of about 150 cm. On the coast of Thailand the rainy season is earlier than that along the S coast of Vietnam, and coincides with the SW Monsoon and the traditional period before the onset of the NE Monsoon. The wettest period is from September to November followed by a drier spell from December to March.

Thunderstorms are rather common from April to October, but infrequent in the remaining months.

6) Tidal streams, currents

In the Gulf of Thailand the main S-going tidal stream of the South China Sea meets the W shore of the gulf in the vicinity of 7 deg. N. Here the stream divides, one half setting N along the coast of Thailand and the other S along Peninsular Malaysia. To the N of 7oN the N-going set is associated with the rising tide and to the S with the falling tide. The streams run for about 12 hours in each direction but their duration is subject to large variations.

The monsoon currents of the South China Sea set across the mouth of Gulf of Thailand, but in the gulf itself currents are though to be weaker and much more variable. A counter-clockwise flow predominates from October to May and a clockwise drift from June to September. Rates appear to be greatest in the NE side of the Gulf, where currents exceeding one and a half knots have been reported, but the mean rate is probably less than half a knot.

7) Fog and visibility

Fog is very rare at sea throughout the year in the Gulf of Thailand. Report of 'poor visibility', that is visibility of less than five miles is also rare. However, the riverine channel of Bangkok is affected by radiation fog around dawn, but this inconvenience soon disappears after sunrise.

8) Climatic table etc.

Table 6-8-1 shows the climatic table compiled from 13 to 28 year's observations, 1941 to 1970. (Source: M.O.Bracknell; H.D.Taunton) And, Fig. 6-8-1 shows annual average pressure & wind rose in Thailand Bay.

Table 6-8-1 Climatic table of Bangkok

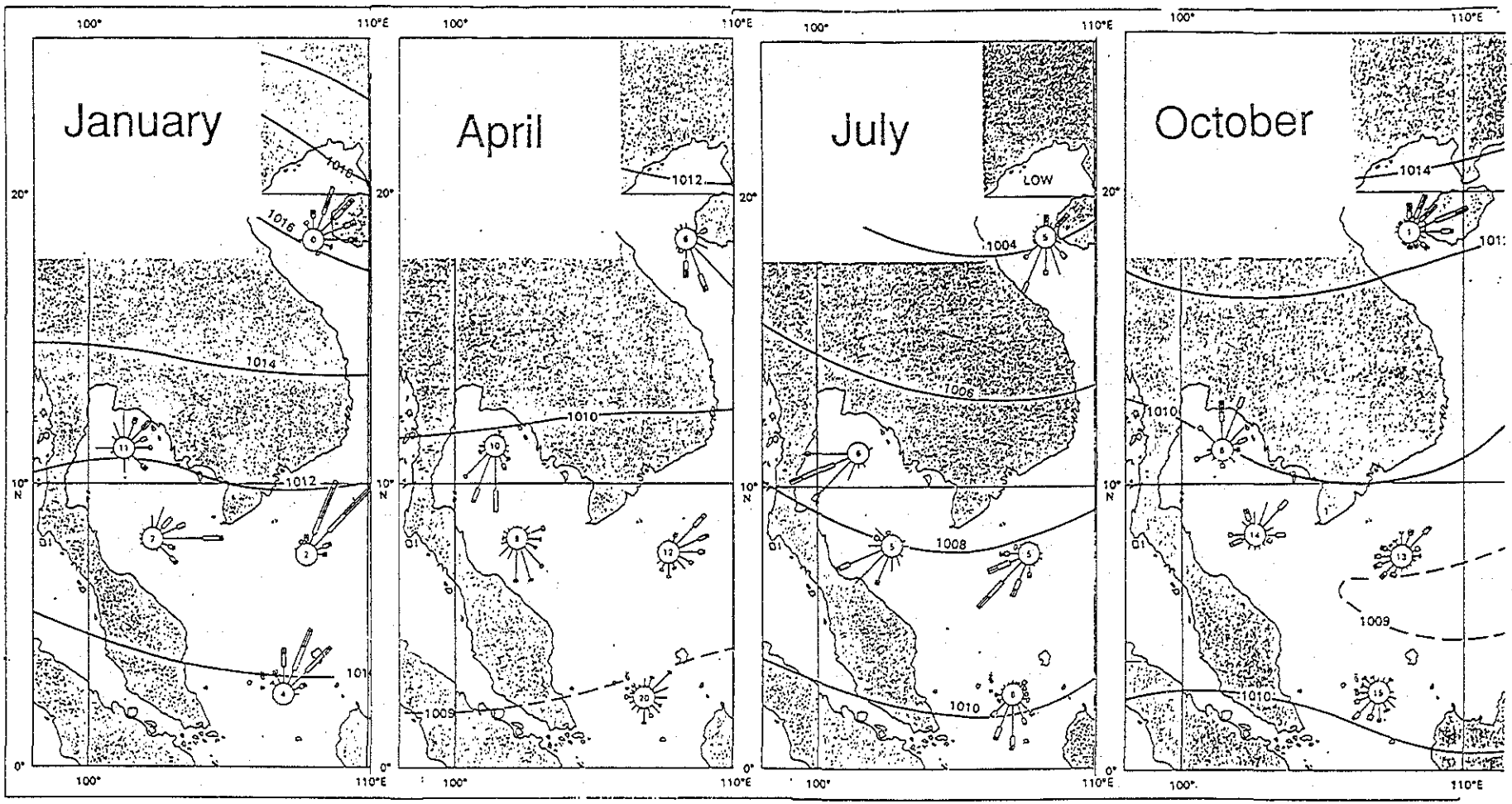
Climatic Table compiled from 13 to 28 Years' Observations, 1941 to 1970

Month	Average pressure at M.S.L.	Temperature: Average daily max.	Temperature: Average monthly max.	Temperature: Average daily min.	Temperature: Average monthly min.	Average humidity 0700	Average humidity 1300	Average cloud amount 0700	Average cloud amount 1300	Rain: Average fall	Rain: No. of days with more than 1 mm.
	mb	°C	°C	°C	°C	%	%	Oktas	Oktas	mm.	
January	1013	32	35	21	14	91	53	4	3	13	1
February	1012	33	36	23	18	91	56	4	4	23	2
March	1010	34	37	25	21	91	57	4	5	38	3
April	1009	35	38	25	23	89	59	5	5	91	5
May	1008	34	37	25	23	90	62	6	6	157	6
June	1007	33	36	25	23	90	67	6	6	152	10
July	1007	32	35	24	23	90	66	6	6	168	11
August	1007	32	35	24	23	91	67	6	7	173	11
September	1008	32	34	24	22	92	70	7	7	298	14
October	1010	31	34	24	22	92	71	7	6	234	12
November	1011	32	33	23	19	90	65	5	5	58	5
December	1013	31	33	21	15	89	56	4	4	12	1
Means	1010	33	38*	24	14**	91	62	5	5	—	—
Totals	—	—	—	—	—	—	—	—	—	1417	81
Extreme values	—	—	41†	—	10††	—	—	—	—	—	—
No. of years' observations	23–28										

Month	Wind direction 0700 (Percentage of observations from) N	NE	E	SE	S	SW	W	NW	Calm	Wind direction 1300 (Percentage of observations from) N	NE	E	SE	S	SW	W	NW	Calm	Mean wind speed 0700 (Knots)	Mean wind speed 1300 (Knots)	No. of days with wind 22 knots or more	No. of days with fog	No. of days with thunder
January	9	9	8	3	2	3	3	5	58	21	22	16	6	4	4	2	3	21	2	4	●	4	0
February	5	7	9	6	3	2	3	3	58	4	11	10	10	26	19	4	3	13	2	5	0	2	2
March	3	6	11	9	5	3	3	2	53	3	3	6	13	41	23	4	3	6	2	5	0	●	5
April	3	7	8	7	9	7	4	3	50	3	3	3	15	31	21	8	2	14	2	5	●	●	11
May	3	4	7	6	4	3	6	3	62	3	1	1	8	23	28	12	4	20	1	4	0	●	17
June	3	3	3	7	8	10	10	3	53	1	0	2	6	26	33	13	6	3	2	5	●	●	11
July	2	3	3	3	8	14	12	3	52	1	1	1	4	16	44	22	5	5	2	5	●	1	11
August	2	2	4	2	8	13	8	3	58	2	0	1	4	17	37	26	2	11	1	4	●	●	11
September	4	4	4	3	5	8	9	4	59	8	4	3	3	12	22	27	8	13	2	5	0	●	13
October	12	6	6	3	3	3	4	7	56	32	19	6	2	4	8	7	11	11	1	4	0	1	11
November	20	11	6	3	2	2	2	7	46	43	23	9	2	1	1	2	9	11	2	5	0	1	4
December	19	10	6	2	2	2	3	8	48	44	23	10	2	1	0	1	8	6	2	5	0	1	0
Means	7	6	6	5	5	6	6	4	53	14	10	5	6	17	20	11	5	12	2	5	—	—	16
Totals	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	11	96
Extreme values	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
No. of years' observations	13									15									18	18	15	15	20

*Mean of highest each year.
**Mean of lowest each year.
†Highest recorded temperature.
††Lowest recorded temperature.
●Rare.

Source: M.O. Bracknell; H.D. Taunton.



EXPLANATION.

Arrows fly with the wind. The frequency of wind from any direction is given according to the scale:—

0% 10 20 30 40 50%

This scale is further subdivided to indicate the frequency of winds of different Beaufort force according to the legend:—

1-3 4 5-6 7 8-12

The figure in the centre of the circle indicates the percentage frequency of light variable winds including calms.

Fig. 6-8-1 Annual average pressure(hPa) & wind rose in Thailand Bay

6.8.8 Results of Sea Accidents within Bangkok Port Area

According to the records which were collected in the Harbour department, MOTC, the number of sea accidents in the last 10 year reached 157 and 20 deaths & 10 injuries resulted from the accidents. (Sinkings owing to collisions/fires were recorded under both relevant categories)

In the table below we concentrate only on the area within Bangkok port and have classified sea accidents by five types over this period.

Table 6-8-2 Sea Accidents in the last 10 Years

Type/Year	*83*	*84*	*85*	*86*	*87*	*88*	*89*	*90*	*91*	*92*	*Total*
Collision	3	8	9	3	6	10	12	13	21	10	95
Sinking	10	3	1	3	1	3	4	3	7	11	46
Fire/Explosion	-	1	-	-	2	-	-	1	2	1	7
Eng./St'g Trouble	-	-	2	1	-	-	1	-	4	-	8
Grounding	-	-	1	-	-	-	-	-	-	-	1
Death/Injury	-	-	0/6	5/1	1/0	1/0	3/0	4/0	5/3	1/0	20/10
Total	13	12	13	7	9	13	17	17	34	22	157

As the above table indicates, collisions and sinkings which are related closely to waterway conditions and/or circumstances compose nearly 90% of accidents; thus, these two types can be regarded as the representative accidents in channels of the Bangkok port.

And an analysis pertaining to collisions by type(vessel against vessel, vessel against lighters in tow, vessel against port facilities) and by cause (weather, engine trouble, negligence, unkown) is shown in Table 6-8-3.

Table 6-8-3 Analysis of Collisions

No.	Time	Location (km)	Type V/V	V/L	V/F	Wr.	Cause E/T	Neg.	Unknown
83- 1	-	R 10-11	-	-	*	-	-	-	*
83- 2	2030	R 39	*	-	-	-	-	-	*
83- 3	1400	R 29	-	*	-	-	-	-	*
84- 1	1520	R 24	*	-	-	-	-	-	*
84- 2	1510	R 14	*	-	-	-	-	-	*
84- 3	2115	R 5	*	-	-	-	-	-	*
84- 4	0640	R 26-27	-	-	*	-	-	-	*
84- 5	1840	R 5	*	-	-	-	-	-	*
84- 8	0230	R 6	-	*	-	-	-	-	*
84- 9	1845	R 0	*	-	-	-	-	-	*
84-10	1500	R 41-42	-	-	*	-	-	-	*
85- 1	1730	R 22	-	*	-	*	-	-	-
85- 2	1720	R 38	-	*	-	-	-	-	*
85- 3	1900	R 12	*	-	-	-	-	-	*
85- 4	1100	R 8-9	*	-	-	-	*	-	-
85- 5	1519	R 24-25	*	-	-	*	-	-	-
85- 6	2157	R 1-2	*	-	-	-	*	-	-
85- 7	1015	R 29-30	*	-	-	-	-	-	*
85- 9	1930	R 18	*	-	-	-	-	-	*
85-10	1512	B 20-21	*	-	-	-	-	-	*
86- 2	2130	R 35	*	-	-	-	-	-	*
86- 4	1800	R 8-9	*	-	-	-	-	-	*
86- 6	2250	R 18	-	-	*	-	-	-	*
87- 3	0528	R BAP	*	-	-	-	-	-	*
87- 5	1330	B 9	-	*	-	-	-	-	*
87- 6	1930	R 18	*	-	-	-	-	-	*
87- 7	2030	R B.Luang C	*	-	-	-	-	-	*
87- 8	-	R 30	*	-	-	-	-	-	*
87- 9	1640	R 7	-	*	-	-	-	-	*
88- 1	1430	R 40	*	-	-	-	-	-	*
88- 2	1630	R -	*	-	-	-	-	-	*
88- 3	-	R 37	*	-	-	-	-	-	*
88- 4	0645	R -	*	-	-	-	-	-	*
88- 7	1100	R 31	-	*	-	-	-	-	*
88- 8	1545	B 1	*	-	-	-	*	-	-
88- 9	0915	R 22	-	-	*	-	*	-	-
88-11	1200	R 11-12	-	*	-	-	-	-	*
88-12	0715	R 10-11	*	-	-	-	-	-	*
88-13	1230	R 6	-	-	*	-	-	-	*
89- 1	1030	R Above42	-	-	*	-	-	-	*
89- 2	1530	R Above42	-	-	*	-	-	*	-
89- 3	2200	R 34-35	*	-	-	-	-	*	-
89- 5	1400	B 27-29	*	-	-	-	*	-	-
89- 6	2056	R 8	*	-	-	-	-	-	*
89- 8	2120	R 41	*	-	-	-	-	*	-
89-10	1900	B 31	*	-	-	-	-	*	-
89-11	1950	R 15	-	-	*	-	-	*	-
89-12	1040	R Above42	*	-	-	-	-	-	*
89-13	0435	B 7-9	-	*	-	-	-	-	*

No.	Time	Location (km)	Type V/V	V/L	V/F	Wr.	Cause E/T	Neg.	Unknown
89-14	0600	B 25	-	*	-	-	-	*	-
89-15	0920	R 29-30	-	*	-	-	-	*	-
90- 1	0410	B 9-11	*	-	-	-	-	-	*
90- 2	1930	B 12-14	*	-	-	*	-	-	-
90- 4	1430	R 40	*	-	-	*	-	-	-
90- 5	0920	B 12-14	*	-	-	*	-	-	-
90- 6	1140	B 1	-	*	-	*	-	-	-
90- 8	0700	B 14-16	-	*	-	-	-	-	*
90- 9	0300	R 25	*	-	-	-	-	*	-
90-10	0825	R 22	-	*	-	-	*	-	-
90-12	0830	R Above42	*	-	-	-	-	-	*
90-13	1446	B 12	-	*	-	-	-	-	-
90-14	1800	R 19	-	*	-	-	-	-	*
90-17	0845	B 1-2	*	-	-	*	-	-	-
90-18	0245	R 33-34	-	*	-	-	-	*	-
91- 1	0015	R 26	-	*	-	-	-	*	-
91- 2	1450	R 34-35	-	*	-	*	-	-	-
91- 3	1730	R 36-37	-	*	-	*	-	-	-
91- 5	1820	R 14-15	-	*	-	-	-	-	*
91- 6	0400	R 26	-	-	*	*	-	-	-
91- 7	0700	R 49-50	-	*	-	-	-	*	-
91- 8	2300	R 16-17	*	-	-	-	-	*	-
91- 9	0920	R 30	*	-	-	-	*	-	-
91-10	2034	R 6	*	-	-	-	-	*	-
91-11	1300	R 17-18	*	-	-	-	-	*	-
91-12	1835	R 21	-	*	-	-	-	*	-
91-14	1730	R 38	*	-	-	-	-	*	-
91-15	2200	R Above45	*	-	-	-	-	*	-
91-16	1930	B 18-19	*	-	-	-	-	*	-
91-17	0820	R 17-18	-	*	-	-	*	-	-
91-18	1100	R 37-38	-	*	-	-	-	*	-
91-19	0721	R 27	-	*	-	-	*	-	-
91-20	0400	R 36	-	*	-	*	-	-	-
91-21	0600	R 4-5	*	-	-	-	-	*	-
91-22	2215	R 25	*	-	-	-	*	-	-
91-24	0415	R 6	*	-	-	*	-	-	-
92- 2	0940	R 20	-	*	-	-	*	-	-
92- 7	0800	R 21-22	-	*	-	-	-	-	-
92- 8	1630	R 13	-	*	-	-	-	-	-
92- 9	1915	R 40	-	*	*	-	-	*	-
92-11	1900	R 17-18	*	-	-	-	-	*	-
92-12	-	R 7	-	-	*	*	-	-	-
92-15	2300	R Above42	*	-	-	-	-	*	-
92-17	1730	R 25-26	-	*	-	*	-	-	-
92-19	1700	R Above42	*	-	-	-	*	-	-
92-20	0820	R 20	*	-	-	-	-	*	-

R x: River channel, xkm from the mouth, B x: Bar channel, around x buoy

Table 6-8-3, "Analysis of collisions", shows that regarding the type of collision among 95 cases, the majority were 52(55%) cases of vessel against vessel, followed by 32(34%) cases of vessel against lighters in tow ad 12(13%) cases of vessel against port facilities such as quay/bridge pier. The major causes are assumed to be results of professional negligence (malmaneuvering) and unfavourable hydrographical conditions.

On the other hand, these accidents tended to converge in the following locations:

* neighboring of sharp bend
* where the navigable width becomes narrow
* vessel's turning areas around the berths, and
* where the traffic is highly dense.

6.9 Cargo Handling System

6.9.1 General

Presently, within the Klong Toei wharf, containers are discharged from/loaded onto container vessels at the seven berths of the east quay. As to the river side (vessel side) operations, it seems that containers are handled under fairly good conditions. It is possible to cater for seven vessels simultaneously, provided the container gantry cranes are kept in good conditions by PAT's maintenance. According to the Equipment Division of PAT, the ratio of repairs for the gantry cranes is 5.49%.

On the other hand, as to the land side operations, it seems to happen that containers are handled in poor conditions: some full or empty containers are stacked roughly, and various kinds of machines run disorderly on narrow roads in the yard, causing serious traffic congestion even within the yard.

Furthermore, it is considered that the number of existing RTGs, namely ten units, comes considerably short of the required number. As for stuffing/unstuffing operations inside the port, although such operations are not allowed in the east quay in principle, such operations are still found at some spots in the east quay, fact contributing to the traffic congestion in the yard.

Open yards behind and west of shed Nos 15-17 at the west quay are used for stuffing export container cargoes. Within the yards, a lot of heavy machines such as cranes, top loaders, top lifters, tractor-chassis units and ordinary trucks move disorderly on the narrow roads inside the yards, stack up many empty containers above empty containers during stuffing operations, all of which causes chaotic conditions. Thus, it is advisable to improve the operations at the yards behind and west of shed Nos. 15-17.

6.9.2 Cargo-Handling Equipment

Cargo-handling equipment as of the end of April, 1993 is listed in Table 6-9-1.

Table 6-9-1 Handling Equipment of Bangkok Port as of the end of Sept. 1993

Equipment	Name	Capacity (Tons)	Year	Age	Unit	Bath/Unit	Total Price	Car Number
1. Mobile Crane	PPM	50	1991(34)	2	2	16,500,000.00	3,300,000.00	5009-5010
	KRUPP	50	1991(34)	2	1	22,609,430.00	22,609,430.00	5008
	PPM	50	1990(33)	3	2	15,780,000.00	31,560,000.00	5006-5007
	P&H	50	1988(31)	5	2	13,945,000.00	27,890,000.00	5004-5005
	P&H	10	1988(31)	5	2	4,485,000.00	8,970,000.00	1020-1021
	P&H	50	1987(30)	6	1	9,979,000.00	9,979,000.00	5003
	P&H	10	1986(29)	7	2	3,539,000.00	7,078,000.00	1018-1019
	TADANO	10	1984(27)	9	3	2,500,000.00	7,500,000.00	1015-1017
	TADANO	50	1983(26)	10	2	8,900,000.00	17,800,000.00	5001-5002
	LEO	30	1970(13)	23	1	2,511,684.48	2,511,684.48	307
	LEO	30	1968(11)	25	2	2,247,417.19	4,494,834.38	305,306
				TOTAL	20	102,993,531.67	173,392,948.86	
2. Semi Portal	KRUPP ARDELT	5	1955(98)	38	4	1,500,000.00	6,000,000.00	1-12
	KRUPP ARDELT	3	1955(98)	38	8	1,019,433.00	8,155,464.00	
				TOTAL	12	2,519,433.00	14,155,464.00	
3. Motor Truck	ISUZU	6	1993(36)	0	25	624,000.00	15,600,000.00	184-208
	ISUZU	6	1991(34)	2	15	668,980.00	10,034,700.00	169-183
	ISUZU	6	1990(33)	3	10	656,631.50	6,566,315.00	159-168
	ISUZU	6	1989(32)	4	7	619,000.00	4,333,000.00	152-158
	HINO	6	1979(22)	14	12	321,634.66	3,859,615.92	25,41-45,60, 147-151
	HINO	6	1978(21)	15	12	294,592.33	3,535,107.96	135-146
	BENZ	6	1972(15)	21	3	178,248.50	534,745.50	127-129
	BENZ	6	1971(14)	22	14	178,242.50	2,495,395.00	110-126
	BENZ	6	1971(14)	22	4	178,248.00	712,992.00	37-40
	BENZ	6	1970(13)	23	14	164,346.08	2,300,845.12	22-36
	BENZ	6	1969(12)	24	17	161,537.98	2,746,145.66	1-20
	BENZ	6	1969(12)	24	22	127,500.00	2,805,000.00	76-108
	BENZ	6	1967(10)	26	8	178,248.00	1,425,984.00	45-49,66-75
				TOTAL	163	4,351,209.55	56,949,846.16	

Equipment	Name	Capacity (Tons)	Year	Age	Unit	Bath/Unil	Total Price	Car Number
4.Trailer	-	10	1993(36)	0	5	290,000.00	1,450,000.00	136-140
	PANUS	10	1989(32)	4	6	292,500.00	1,755,000.00	130-135
	-	10	1987(30)	6	4	199,400.00	797,600.00	126-128
	-	30	1987(30)	6	1	330,000.00	330,000.00	308
	-	10	1984(27)	9	4	275,000.00	1,100,000.00	122-125
	-	10	1972(15)	21	10	819,000.00	8,190,000.00	108-117
	-	10	1971(14)	22	5	76,900.00	384,500.00	103-107
	EGEB BEAKER	30	1970(13)	23	1	291,695.00	291,695.00	307
	FRUHAUF	30	1969(12)	24	2	239,000.00	478,000.00	304-305
	FRUHAUF	30	1968(11)	25	1	239,000.00	239,000.00	303
	-	20	1968(11)	25	4	114,500.00	458,000.00	201-204
	FRUHAUF	30	1967(10)	26	1	307,444.22	307,444.22	306
				TOTAL	44	3,474,439.22	15,781,239.22	
5.Multipurpose	-		1993(36)	0	5	314,000.00	1,570,000.00	06-10
Traller	-		1983(26)	10	5	199,850.00	999,250.00	01-05
				TOTAL	10	513,850.00	2,569,250.00	
6.Towing	PETTIBONE	12,000P.	1993(36)	0	10	1,530,000.00	15,300,000.00	601-610
tracktor	TUG	10,000P.	1991(34)	2	5	1,645,000.00	8,225,000.00	416-420
	TUG	10,000P.	1990(33)	3	5	1,470,000.00	7,350,000.00	411-415
	TUG	8,000P.	1988(31)	5	10	895,000.00	8,950,000.00	220-229
	CLARK	2,600P.	1969(12)	24	1	102,517.56	102,517.56	119
				TOTAL	31	5,642,517.56	39,927,517.56	
7.Forklift	KOMUTSU	10	1993(36)	0	5	1,922,000.00	9,610,000.00	1001-1005
	KOMUTSU	10,000P.	1993(36)	0	21	733,809.53	15,410,000.13	5071-5091
	KOMUTSU	8,000P.	1993(36)	0	80	687,500.00	55,000,000.00	3523-3602
	KOMUTSU	5,000P.	1992(35)	1	15	602,290.00	9,034,350.00	2058-2072
	KOMUTSU	8,000P.	1992(35)	1	32	690,625.00	22,100,000.00	3491-3522
	KOMUTSU	8,000P.	1990(33)	3	100	777,000.00	77,700,000.00	3391-3490
	DALIAN	10,000P.	1990(33)	3	8	657,500.00	5,260,000.00	5063-5070
	TOYOTA	5,000P.	1988(31)	5	5	500,000.00	2,500,000.00	2053-2057
	KOMUTSU	11,000P.	1988(31)	5	6	783,750.00	6,270,000.00	5055-5062
	KOMUTSU	11,000P.	1987(30)	6	10	686,000.00	6,860,000.00	5045-5054

Equipment	Name	Capacity (Tons)	Year	Age	Unit	Bath/Unil	Total Price	Car Number
	KOMUTSU	8,000P.	1986(29)	7	34	369,700.00	12,569,800.00	3357-3390
	MITSUBISHI	5,000P.	1985(28)	8	5	243,700.00	1,218,500.00	2048-2052
	KOMUTSU	7,000P.	1985(28)	8	20	313,500.00	6,270,000.00	3337-3356
	KOMUTSU	8,000P.	1984(27)	9	30	329,000.00	9,870,000.00	3307-3336
	KOMUTSU	10,000P.	1984(27)	9	8	450,000.00	3,600,000.00	5037-5044
	TOYOTA	5,000P.	1983(26)	10	5	330,000.00	1,650,000.00	2043-2047
	TOYOTA	5,000P.	1983(26)	10	6	255,000.00	1,530,000.00	2037-2042
	TOYOTA	10,000P.	1983(26)	10	7	485,000.00	3,395,000.00	5030-5036
	BALCAN	7,000P.	1982(25)	11	3	305,880.00	917,640.00	3271,8,9
	TOYOTA	10,000P.	1982(25)	11	6	415,000.00	2,490,000.00	5024-5029
	TCM	5,000P.	1981(24)	12	4	204,000.00	816,000.00	2027-2032
	TOYOTA	5,000P.	1981(24)	12	3	199,500.00	598,500.00	2034-20366
	Clark	10,000P.	1971(14)	22	4	341,041.35	1,364,165.40	5008-5022
	Clark	7,000P.	1971(14)	22	6	312,240.44	1,873,442.64	3028-3214
	Clark	7,000P.	1971(14)	22	10	288,647.65	2,886,476.50	3179-3204
	Clark	10,000P.	1969(12)	24	1	345,503.33	345,503.33	5001
	Clark	7,000P.	1969(12)	24	12	281,428.18	3,377,138.16	3141-3162
	Clark	7,000P.	1968(11)	25	16	250,825.00	4,013,200.00	3104-3137
				TOTAL	464	13,760,440.48	268,529,716.16	
8.Rail Mounted	Metalna	32.5	1993(36)	0	4	77,641,626.94	310,566,507.76	1,10,11,12
Gantry Crane	Metalna	32.5	1991(34)	2	3	74,905,350.00	224,716,050.00	7,8,9
	Metalna	32.5	1989(32)	4	3	51,475,682.00	154,427,046.00	4,5,6
	Metalna	32.5	1988(31)	5	2	51,475,682.00	102,951,364.00	2,3
				TOTAL	12	255,498,340.94	792,660,967.76	
9.Bubber Tyred	Mitsubishi	30.5	1990(33)	3	4	25,920,309.00	103,681,236.00	10-13
Gantry Crane	Mitsubishi	30.5	1988(31)	5	6	17,671,396.75	106,028,380.50	04-09
				TOTAL	10	43,591,705.75	209,709,616.50	
10.Top Loader	Lansing	7	1990(33)	3	5	4,175,000.00	20,875,000.00	706-710
	Lancer	7	1989(32)	4	5	4,174,000.00	20,870,000.00	7001-7005
	Luna	6	1987(30)	6	5	2,785,296.00	13,926,480.00	601-605
	TCM	10	1981(24)	12	2	1,380,000.00	2,760,000.00	1001-1002
				TOTAL	17	12,514,296.00	58,431,480.00	

Equipment	Name	Capacity (Tons)	Year	Age	Unit	Bath/Unil	Total Price	Car Number
11.Top Loader	PPM	40	1993(36)	0	5	13,120,000.00	65,600,000.00	4027-4031
	PPM	40	1992(35)	1	8	15,646,383.00	125,171,064.00	4019-4026
	PPM	40	1990(33)	3	9	15,775,000.00	141,975,000.00	4009-4018
	PPM	40	1989(32)	4	8	15,775,000.00	126,200,000.00	4001-4008
	LUNA	30	1987(30)	6	6	6,480,216.00	38,881,296.00	3004-3008
	LUNA	30	1986(29)	7	2	6,750,000.00	13,500,000.00	3001-3002
	LANCER	35	1985(28)	8	1	5,450,000.00	5,450,000.00	3505
	LANCER	16	1985(28)	8	1	3,299,000.00	3,299,000.00	
	TCK	35	1981(24)	12	2	5,879,000.00	11,758,000.00	3501-3502
				TOTAL	42	88,174,599.00	531,834,360.00	
12.Yard Hustler	Ottawa	30	1993(36)	0	15	202,000.00	3,030,000.00	384-398
	Ottawa	30	1990(33)	3	15	1,999,250.00	29,988,750.00	369-383
	Ottawa	30	1989(32)	4	13	1,989,250.00	25,860,250.00	354-366
	Ottawa	30	1988(31)	5	20	1,921,990.00	38,439,800.00	334-353
	Champion	30	1984(27)	9	4	1,347,000.00	5,388,000.00	325-328
	Champion	30	1981(24)	12	1	1,147,000.00	1,147,000.00	318
	Ottawa	30	1981(24)	12	8	954,000.00	7,632,000.00	319-322,329-333
	Ottawa	30	1976(19)	17	2	757,500.00	1,515,000.00	311-312
				TOTAL	78	10,317,990.00	113,000,800.00	
13.Chassis	-	30	1993(36)	0	5	320,000.00	1,600,000.00	99-103
	-	30	1988(31)	5	20	340,000.00	6,800,000.00	79-98
	ASOKE	30	1983(26)	10	2	419,000.00	838,000.00	57-58
	ASOKE	30	1982(25)	11	5	318,000.00	1,590,000.00	25-29
	ASOKE	30	1982(25)	11	12	274,900.00	3,298,800.00	30-41
	ASOKE	30	1981(24)	12	35	285,000.00	9,975,000.00	43-78
	ASOKE	30	1977(20)	16	24	263,250.00	6,318,000.00	1-24
				TOTAL	103	2,220,150.00	30,419,800.00	

6.9.3 Main Container-Handling Equipment

(1) Rail Mounted Gantry Crane.

At present, 12 units of rail mount container gantry cranes are installed on the dock side of the east quay. In addition to the existing 12 cranes, another two cranes are under procurement procedure. The repair ratio of 5.49% mentioned above is not so bad and working ratio of 89.93% is considered to be fairly good. Gross container-handling productivity seems to be a little poor, whereas the net productivity is estimated at least in the range of 20-25 boxes/hr. The poor achievement in terms of the gross productivity seems to be induced by long waiting times for tractor-chassis units on the dock side due to the congestion in the marshaling yard mentioned previously.
As for the dimensions of the existing cranes, judging from the principal dimensions of container vessels which actually call at Bangkok Port and actual stevedoring operations on the dock side, in some cases, the crane dimensions seems to be a little bit short as follows:

a. Out reach (26.0m) is a little bit short in the following case. When a wide vessel with ten rows of containers on deck (maximum number of rows among the vessels calling actually at Bangkok Port) berths, the outreach of the cranes is too short to lift most of outside containers.

b. Rail gauge (15.0m) is a little bit narrow which poses a problem for the passage of tractor-chassis units. When many vessels berth and handle containers at the same time, there are only four lanes which can be arranged between the crane's legs for tractor-chassis units. Hence, it is necessary to keep other lanes at the back reach of the cranes.

c. Lifting height (20.5m) is a little bit low in the following case. When a tall vessel with five high containers on deck (the maximum among the vessels calling actually at Bangkok Port) berths, the lift height of the existing cranes is too short to lift containers of the top layer.

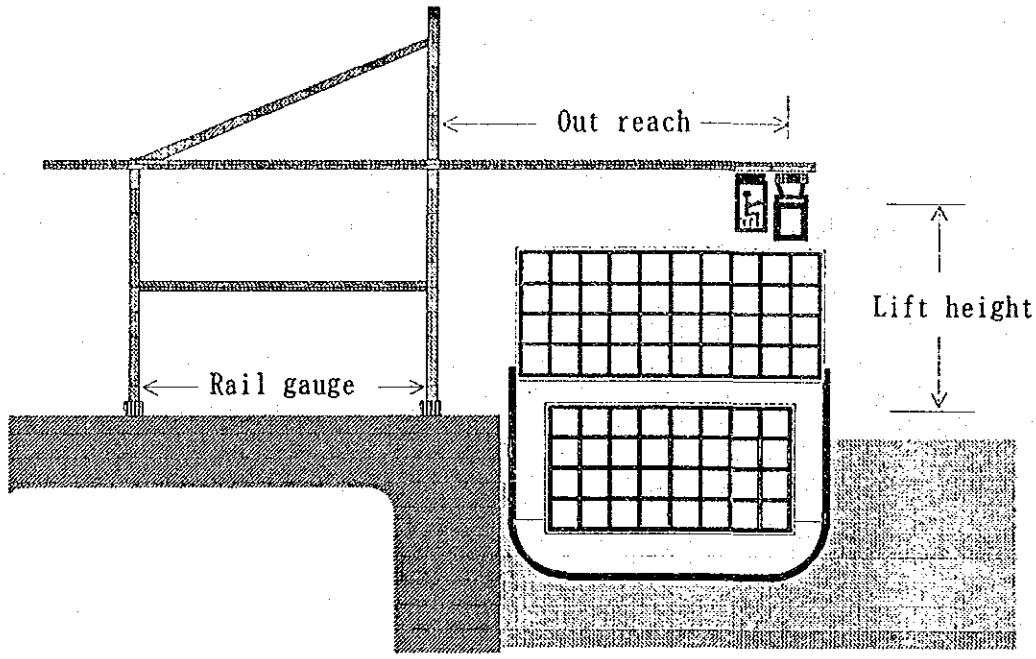


Fig. 6-9-1 Cross Sections of a Container Vessel and a Gantry Crane

Table 6-9-2 shows specifications of gantry cranes which were installed at the leading container ports in the period of 1992-1993 (Source: World Cargo System August, 1992).

(2) Rubber Tired Gantry Crane (RTG)

RTG repair ratio of 8.41% is normal and working ratio of 90.82% is very high: almost all the RTGs are used up to the full capacity. At present, many cases are found in which tractor- chassis units are forced to wait for RTG in the marshaling yard due to the shortage of RTGs. There are 12 RTG lanes on the marshaling yard of the east quay. As is well known, shifting within the same lane for RTGs does not take much time. On the contrary, the shifting between different lanes takes longer than the former case. The present shortage of RTGs at the east quay forces the latter type of shifting. To resolve this problem, PAT is in the process of procuring an additional 14 RTGs.

Table 6-9-2 Specifications of Gantry Cranes

Supplier	Client	No.	Capacity on Speader (tonnes)	Out reach (m)	Rail gauge (m)	Lift height (m)	Hoist speed (full/empty) (m/min)	Trolley Speed (m/min)
Ansaldo	Puertos Maxicanos	4	40	38.1	16	30.5	52/122	152
Bardella	Puertos Maxicanos	4	40.6	38.1	16	30.5	52/122	152
	Santos Cont Term	1	35	37.6	18	26	31/74	150
Caillard	Port Said	1	42	39	20	32	50/96	120
	Sega, Le Hevre	1	40	47.5	21.5	33	51/120	180
IHI	HIT, Hong Kong	6	40	45	24.5	33	55/130	180
	Yokohama	1	55	40	30	42	50/120	160
	Osaka	2	40	44.5	30.5	46.5	60/140	180
IMPSA	Jexport, USA	1	40	36	15.2	26.8	46/114	150
	Jeddah	2	50	45	17	35	60/120	200
	Johor, Malaysia	1	40.6	46	30.5	34	55/130	190
	Kelang, Malaysia	1	45.9	45	30.5	32	55/130	190
Kone	Black Sea Shipping, Ilichevsk	2	35	40	20	28	50/100	180
	Marseille PA	1'	40	47	30.5	33	53/130	180
	Reunion	2'	40	41.5	21.5	30	52/120	150
	Llobregat Docks, Barcelona	2'	40	47	30.5	30	53/130	180
Liebherr	Lyttelton, NZ	1	40	43.3	19	30.5	60/120	180
	Belfast	2	40	28.5	30.5	24.4	30/75	150
	Tyne PA	1	32	24.5	36.5	20.8	25/60	100
	Aden	1	40	38	29.5	29.5	50/120	120
	Casablance	2	40	35	18	25	60/150	180
Metaina	Bangkok PA	4	32.5	26	15	20.5	30/60	120
Mitsubishi Heavy Industry	Klang PA	1	45	44.5	30.5		53/130	210
	Nagoya	2	43.6	35.5	25	25	50/120	150
	Yokohama	3	40.6	45	30	33	60/140	210
	Yokohama	1	30.5	43.5	16	34.8	60/130	180
	Keelung	3	40	47	30	33	50/120	180
	Keelung	1	40	37	15	28	50/120	180
	Johor	1	40	48	30.5		55/130	180
	MTL, Hong Kong	7	40.6	45	24.4	34.5	55/130	180
Mitsui	Tokyo	1	30.5	43.2	16	32	65/156	180
	Kobe	2	40	44.5	30.5	33.1	60/140	180
	HIT, Hong Kong	2	41	44.5	24.4	33	53/128	168
Morrie	Southampton CT	3	40.6	45.1	19.9	31	70/130	150
MH	Waterford	2	35	30	48	21	50/120	180
Nelcon	Hessonatie, Antwerp	2	35	47.5	23	34.5	90/110	190
Noell	Fujariah, UAE	1	40.6	44.3	20	30	55/130	185
	Durban	2	40	45.7	20	34	51/120	180
	PSA	6	40	48	30.5	34	70/150	210
Paceco	Maersk, Long Beach	2	50	45.7	30.5	30.5	46/110	152
	Trepac, Oskland	2	40	45.7	30.5	31.5	53/128	183
Pacaco	OPCSA, Les Palmes	1	40	38.5	28.5	43.5	35/70	120
Espana	Honduras PA	1	45	38.5	18.3	24.4	45/90	140
Reggiane	Shuwaikh, Kuwait	2	40	38	30.5	26	40/110	130
	Rashid, UAE	2	41	38.5	17	28	40/110	150
	Jebel Ail, UAE	2	41	47	30.5	32.3	60/120	180
Samsung	Everglades	3	40.6	44.5	30.5	32	55/116	183
HI	PSA	4	40	48	30.4	34	70/150	210
SPMP	Vancouver	1		44.2	24.4			
Vulcan	Chiwan, PRC	2	40	44	23.4	30	50/120	150
Kocks	Eurokai	1	35	48	18	31	45.90	120
	Contship, La Spezia	1	40	44.2	18	30	35/110	136
	HHLA	2	44	47.5	18	29.5	53/120	150

6.9.4 Required Number of Drivers to Operate the Existing Machines

Required number of drivers to operate the existing machines for containerhandling in case of being used up to their full capacity is shown as follows:

	Main Equipment	Units	Persons	Total Persons
1.	Mobile Crane	17	2	34
2.	Semi Portal Crane	12	2	24
3.	Motor Truck	154	1	154
4.	Towing Tractor	35	1	35
5.	Forklift	254	2	508
6.	Rail Mounted Gantry Crane	12	3	36
7.	Rubber Tired Gantry Crane	10	3	30
8.	Top Loader (Empty)	16	2	32
9.	Top Loader (Full)	39	3	117
10.	Yard Hustler	78	2	156

6.9.5 Present Conditions of Operations at the East Quay

(1) Arrangement of Ground Slots

Arrangement of ground slots for RTGs on the marshaling yard of the east quay is shown in Fig. 6-9-2.

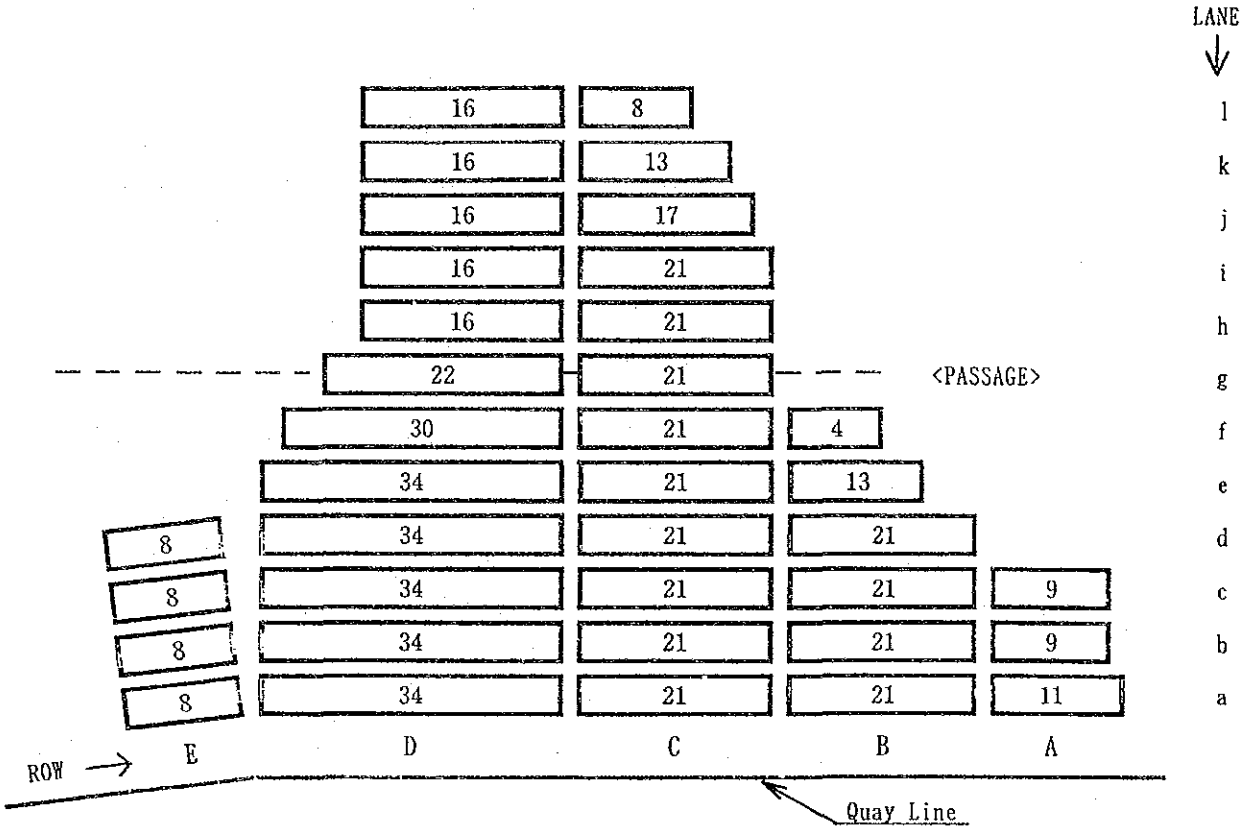


Fig. 6-9-2 Arrangement of Ground Slots for RTGs

The number of the ground slots corresponding to each row and lane in the above figure is shown below.

	a	b	c	d	e	f	g	h	i	j	k	l	Total
A	44	36	36										116
B	84	84	84	84	52	16							404
C	84	84	84	84	84	84	84	84	84	68	52	32	908
D	136	136	136	136	136	120	88	64	64	64	64	64	1208
E	32	32	32	32									128
Total	380	372	372	336	272	220	172	148	148	132	116	96	2764

Total stacking capacity of containers is computed as follows:

2764 x 3.0 = 8292 TEUs (Physical maximum)
8292 X 0.75= 6219 TEUs (Operational maximum)

Among the above maximum stacking capacity, the following lanes under construction are included:

E-a, E-b, E-c, E-d ------- 128 ground slots
A-a, B-a, C-a, D-a ------- 348 ground slots

In addition to the above capacity for RTGs, the following number of containers are stacked presently by using top loaders:

a. About 600 TEUs on the apron (Back reach of Gantry Crane)
b. About 500 TEUs Empty Containers on the east of shed No.12
c. About 200 TEUs Empty Containers on reefer container space.
d. About 400 TEUs Reefer Containers on reefer container space.

(2) Berthing Situation of Container Vessels.

In ordinary container terminals, a vessel side alongside a berth is fixed; the direction of bow and stern is fixed, and therefore, container handling sequence can be programed before the vessel's arrival at a port. In that case, in terms of the movements of tractor-chassis units, one way traffic on the marshaling is generally applied. Usually the tractor-chassis units proceed on the apron to the direction from vessel's a afterword to forward. However, in the Klong Toei wharf, a vessel's side alongside the wharf is not fixed, because the direction of river flow parallel to the berth line fluctuates as it is affected by ebb/flow to/from the river mouth of the Chao Praya river. Hence, it often happens that tractor-chassis units move in different directions on the apron due to the difference of berthing times of the individual vessels.

(3) Stacking of Containers on the Back Reach Space of Gantry Cranes

Presently, many containers are stacked on the back reach space of the gantry cranes of the apron. Those containers are handled by toplifters.

Such stacking conditions cause traffic congestion on the apron. At most international container terminals, gantry crane's back reach space is generally used for tractor's passage or miscellaneous space. Sometimes such back reach space is used for emergency cases. For example, when some trouble occurs and import delivery chassis does not arrive in

time, containers are stacked directly on back reach space of the gantry cranes. Likewise, when there is no space to put a hatch cover on the vessel, the hatch covers are temporarily laid on the space. Hence, the back reach space of the gantry cranes should be kept for the above emergency cases without stacking any containers.

(4) Traffic Congestion and Subsequent Dangerous Conditions on the Marshaling Yard and the Apron

a. Many heavy machines such as toplifters, toploaders, forklifts are in operation together with RTGs in the marshaling yard of the east quay due to the above-mentioned extreme shortage of RTGs, demanding intricate movements if interference is to be avoided.

b. As mentioned previously, stuffing/unstuffing operations for container cargoes are still conducted at some spots in the marshaling yard of the east quay, a fact contributing to the traffic congestion within the yard.

c. Presently, many people belonging to shipping agents and private companies for various kinds of operations such as stevedoring and stuffing/unstuffing etc. are working on ground of the marshaling yard of the east quay together with the heavy machines, whereas, in ordinary international container terminals, it is strictly prohibited for people to enter the marshaling yard without permission of a control center in view of security and safety of people.

d. RTGs are not repaired or maintained at a repair shop specialized for the RTGs, but at the places where RTGs are usually in operation, a fact which also causes a dangerous situation both for mechanics repairing/maintaining the RTGs and other mobile machines.

e. As is well known, the strength of a ordinary container is defined in the condition of being supported by four corner fittings made of strong materials. At Bangkok Port, however, many containers are found to be stacked and supported by upper or lower beams outside of the strong corner fittings. Sometimes two 20′ containers are stacked on top of a 40′ container, and that causes some damage to the upper beam of the 40′ container because the load in such condition evidently exceeds the design load of the container box. Moreover, some containers are lifted up by using forklifts without inserting their forks to the right positions, namely fork pockets of containers, and that also causes some damages to lower beams of the container boxes.

f. Many empty containers are found to be stacked at the reefer container yard along the customs fence. Such empty containers are stacked on or between reefer containers, and therefore, sometimes disturb normal checking or maintenance of reefer containers. At some places in the reefer container yard, drainage conditions are poor, especially in the rainy season, and this possibly causes some electric trouble for the reefer containers.

6.9.6 The Present Situation of the Open Yard for Containers at the West Quay

a. At the open yard behind and west of the sheds Nos. 15-17 a large number of empty containers are stacked at random, and at the same place, a lot of containers are stuffed with export cargoes. As these containers are stacked disorderly, the passages for heavy mobile machines are not controlled suitably; various kinds of machines work and pass on very narrow and curved passages, causing serious traffic congestion within the yards.

b. To conduct the stuffing operations of export cargoes, a lot of people comprising stevedores, shipping agent's clerks, tally men, checkers, etc. are working in the narrow space on the open yards. Also various kinds of motorcycles and ordinary trucks are moving and passing through the heavy mobile machines, producing unsafe conditions for people working on the ground. Hence, it is advisable to separate stuffing zone and passages for the heavy mobile machines. As mentioned in 6.9.5,"f", to keep safe conditions for working people is one of the most important matters nowadays in international container terminals.

c. At some places of the above open yards, many dented and scraped spots are found at the pavement surface. Such bad ground conditions possibly induce not only spoilage of smooth cargo operations but also damages to containers. Moreover, in the rainy season, water pools made at the above dented spots evidently cause cargo damages.

d. This place is the most confused and dangerous section in Klong Toei wharf so that the improvement of this section is urgently requested as follows : (Image guide as fig. 6-9-3)

- 1st Separate perfectly the empty containers from export cargo stuffing containers

- 2nd Set straight and wide passages (at least 20m wide) where main heavy equipment is used.

· 3rd Insure stuffing work place where only tracks and forklift move for LCL cargo handling.

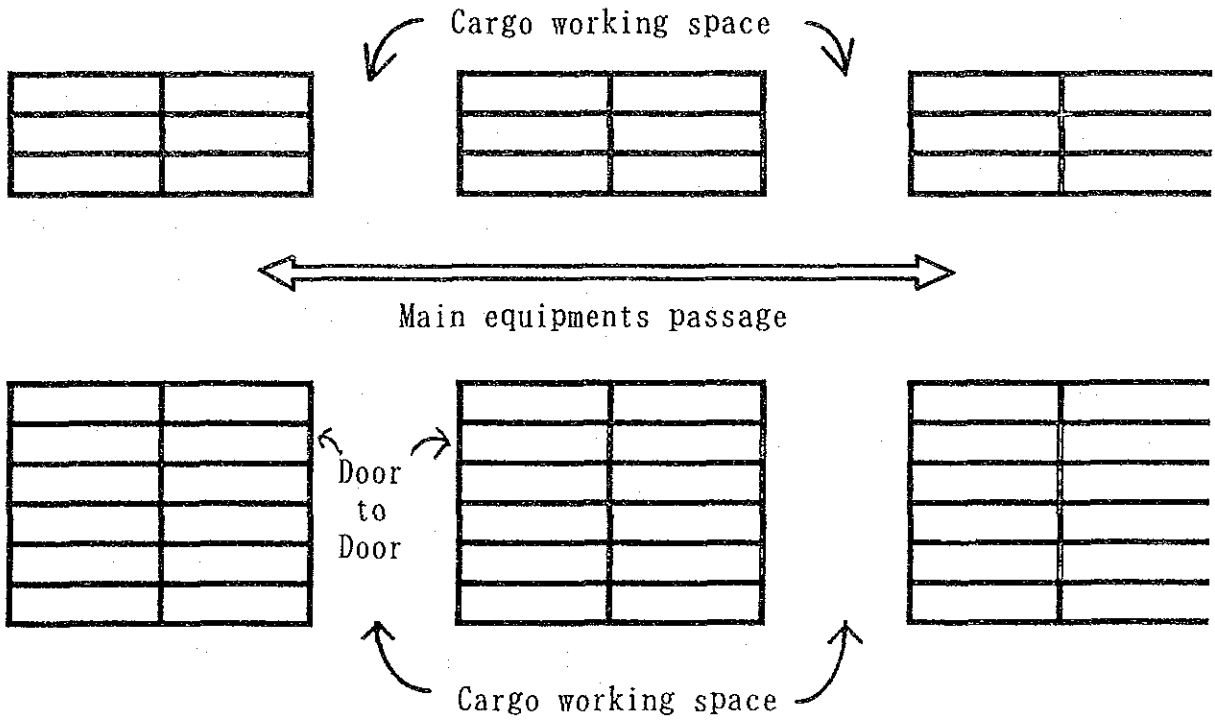


Fig. 6-9-3 Image Guide of Stuffing yard

6.10 Management and Operations

6.10.1 Outline of Port Management and Operations at Bangkok Port

(1) The Port Authority of Thailand

The Port Authority of Thailand (PAT) is a Public Utilities State Enterprise under the Ministry of Transport and Communications and is the only agency which manages and operates the existing international ports: Bangkok Port and Laem Chabang Port. Its objective is to conduct the business pertaining to the port or the interest of the state and the public by implementing the development plan in line with the National Economic and Social Development Plan and to render efficient services and facilities to all port users on a fair basis.

According to the PAT Act, PAT has the powers to act within the scope of its objectives and such powers shall include,

1) to construct, purchase, acquire, dispose of, hire, let and operate port equipment, services and facilities,
2) to purchase, acquire, lease, hire, let, own, possess, dispose of or operate movable and immovable properties,
3) to determine charges for the use of its ports, services and facilities, and to issue regulations regarding the method of payment and such charges,
4) to issue regulations regarding safety, the use of its port services and facilities,
5) to borrow money,
6) to dredge and maintain channels in the Authority Area,
7) to control, develop and provide facilities and safety in the port undertakings and navigation in the Authority Area,
8) to fix the rate of various charges within the Authority Area.

At Bangkok Port, PAT owns land areas including all of Klong Toei Wharf area used for cargo handling operations by PAT. Almost all facilities within the Customs fence are property of PAT, and port operations and maintenance are the responsibility of PAT.

(2) Governmental Control over PAT

As ports are very important infrastructures for socioeconomic development and PAT is a state enterprise, some important activities of PAT are controlled by the Government as follows.

The Cabinet has authority on,

1) approval of the construction of new ports
2) approval of the termination of business in any port under operation
3) decision of the maximum and minimum limits of the tariff
4) approval of the increase or deduction of capital
5) approval of capital budget
6) receipt of reports on the operating budget
7) approval of loans
8) approval of the disposal of immovable properties
9) approval of rules and regulations concerning the management of provident funds for the staff

The Minister of Transport and Communications shall have the power and duty to control the affairs of PAT. For this purpose, he, together with the Finance Minister, has the power to issue Ministerial regulations concerning the control, development and provision of facilities and safety for port undertakings and navigation within the authority area, and other activities for the execution of the PAT Act. He may also instruct PAT to state facts, give opinions, submit reports or stop any act which is contrary to the policy of an Government or to the resolution of the Cabinet. He shall have the power to order an inquiry into the facts concerning the management. Moreover, any matter that is to be submitted by PAT or its Board for the consideration of the Cabinet must first be presented to him for subsequent submission to the Cabinet.

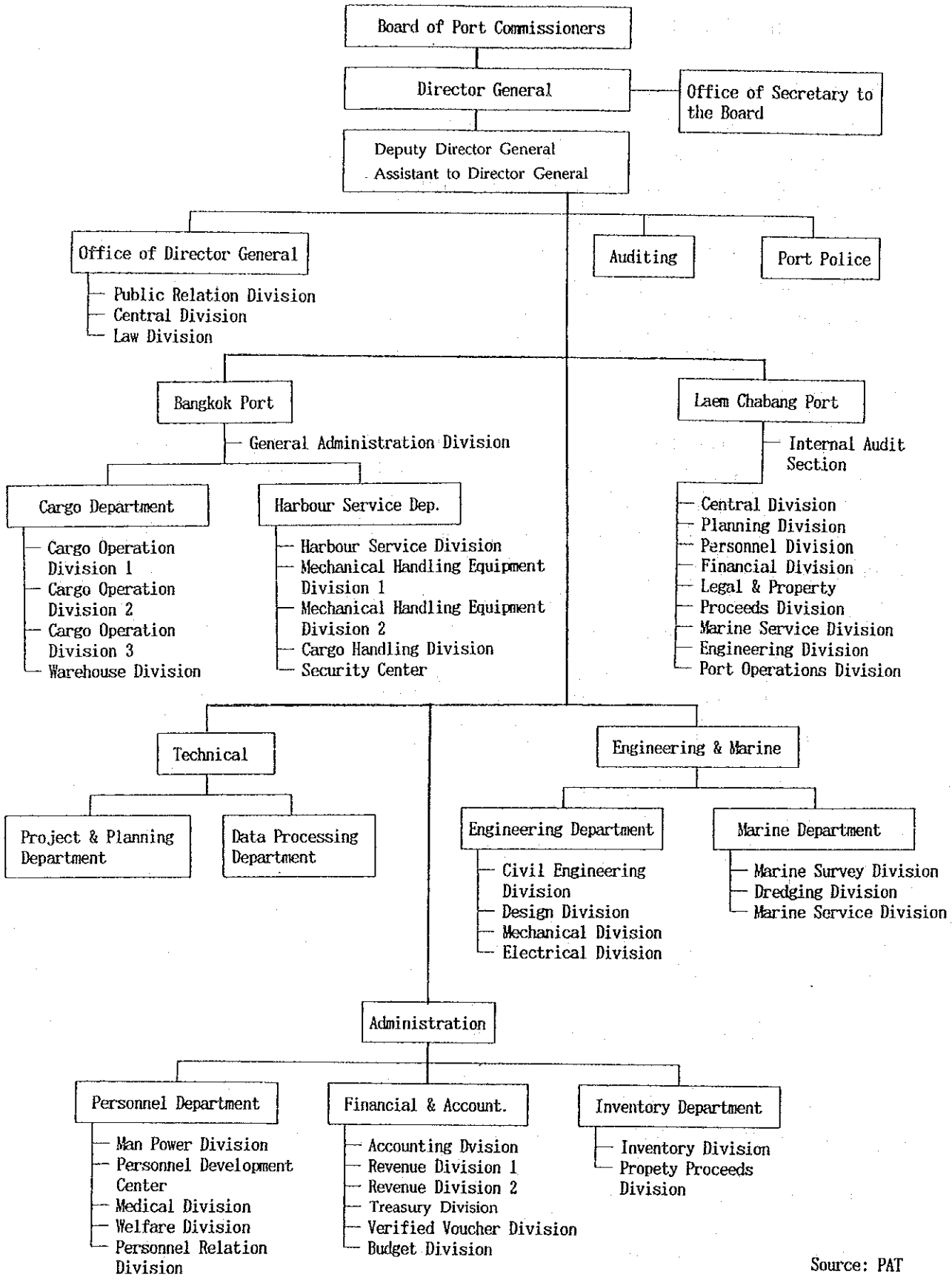
6.10.2 Organization of PAT

(1) Organization of PAT

Figure 6-10-1 shows the organization chart of PAT. PAT is managed by the Board of Commissioners and Director General of PAT, assisted by Deputy Director Generals and Directors of the various service and operational departments who are responsible for day to day management and operations. The major departments include the Port Operations (Bangkok Port and Laem Chabang Port), Project and Planning, Data Processing, Personnel, Finance and Accounting, Inventory, Engineering and Marine Departments. There are about 7000 permanent employees.

1) Board of Commissioners

The Board of Commissioners of PAT which consists of a Chairman and not less than six



Source: PAT

Fig. 6-10-1 Organization Chart of PAT

but no more than ten other members is entrusted with the power to formulate policies and carry out the overall control of the affairs of PAT. The Board shall include at least one member with knowledge and experience in port management and one member in economics or finance. Chairman and members of the Board shall be appointed by the Cabinet. The Board appoints Director General, but the Cabinet holds the right to approve or disapprove its appointment or removal. Director General may also be appointed as a member of the Board by the Cabinet.

2) Director General

Director General administrates the affairs of PAT in accordance with policies laid down by the Board, and is in charge of the staff of PAT. He is responsible to the Board for management and operations of PAT and has the following powers:

a) to appoint, remove, increase or decrease salaries of the staff of PAT in accordance with the regulations laid down by the Board (except those of advisers, experts and the heads of departments who assist the Director.)
b) to issue regulations governing the operation of PAT

3) Executive Organs of PAT

As PAT executes not only port development and management but also terminal operations, it has operational departments within its executive organs. The duties of main Departments are as follows.

Office of Secretary to the Board acts as coordinator between the Board and the Office of the Director General and arranges the meetings and performs all functions relating to the Board.

Office of the Director General is responsible for management according to the general objectives of PAT and supervision of the work performance of the whole organization, both administration and operations including public relations.

Technical Department performs works regarding project control, research, statistics, project and port development planning, project analysis including project follow up and evaluation.

Data Processing Department performs works concerning computerization for management and operation of the port.

Personnel Department is responsible for personnel administration, controlling of manpower, recruitment, personnel records, labour protection and labour relations, personnel development, training and seminars, medical care and hygiene and welfare.

Financial & Accounting Department is responsible for all financial matters including preparation of budgets and annual accounts. Acts as a receiver/paymaster of the Authority revenue/expenditure and manages its cash flow, bank accounts and investment, tariff charges and revenues.

Inventory Department is responsible for management of properties like lands and real estates owned by PAT and general stores including printing and stationary.

Engineering Department maintains all infrastructure and facilities of the port, provides and maintains water supply, electricity, telephone services within the port and repairs and maintains workshop and vehicles.

Marine Department carries out the marine survey of the Channel and maintenance dredging of the bar channel and berths, installs, maintains navigation aids and repairs and maintains dredgers and floating equipment.

Bangkok Port's responsibilities include providing all port users with services and facilities regarding discharging and loading of cargoes, receipt of cargoes from vessels, cargo storing, delivering cargoes to consignees, providing services and facilities to vessels berthing at the port, communicating with foreign vessels, controlling vehicles, cargoes and passengers passing through the port area, providing mechanical handling equipment, providing security to port properties, buildings, premises and personnel within the port area.

Laem Chabang Port, located at Sriracha District, Cholburi Province, is under PAT supervision. The port provides services to container and conventional vessels, stores and delivers cargoes to consignees.

(2) Organization of Bangkok Port

Figure 6-10-2 shows the organization of Bangkok Port. Bangkok Port has two operational departments, namely, Cargo Department and Harbour Service Department consisting of four and five divisions respectively. The main functions of each division are as follows.

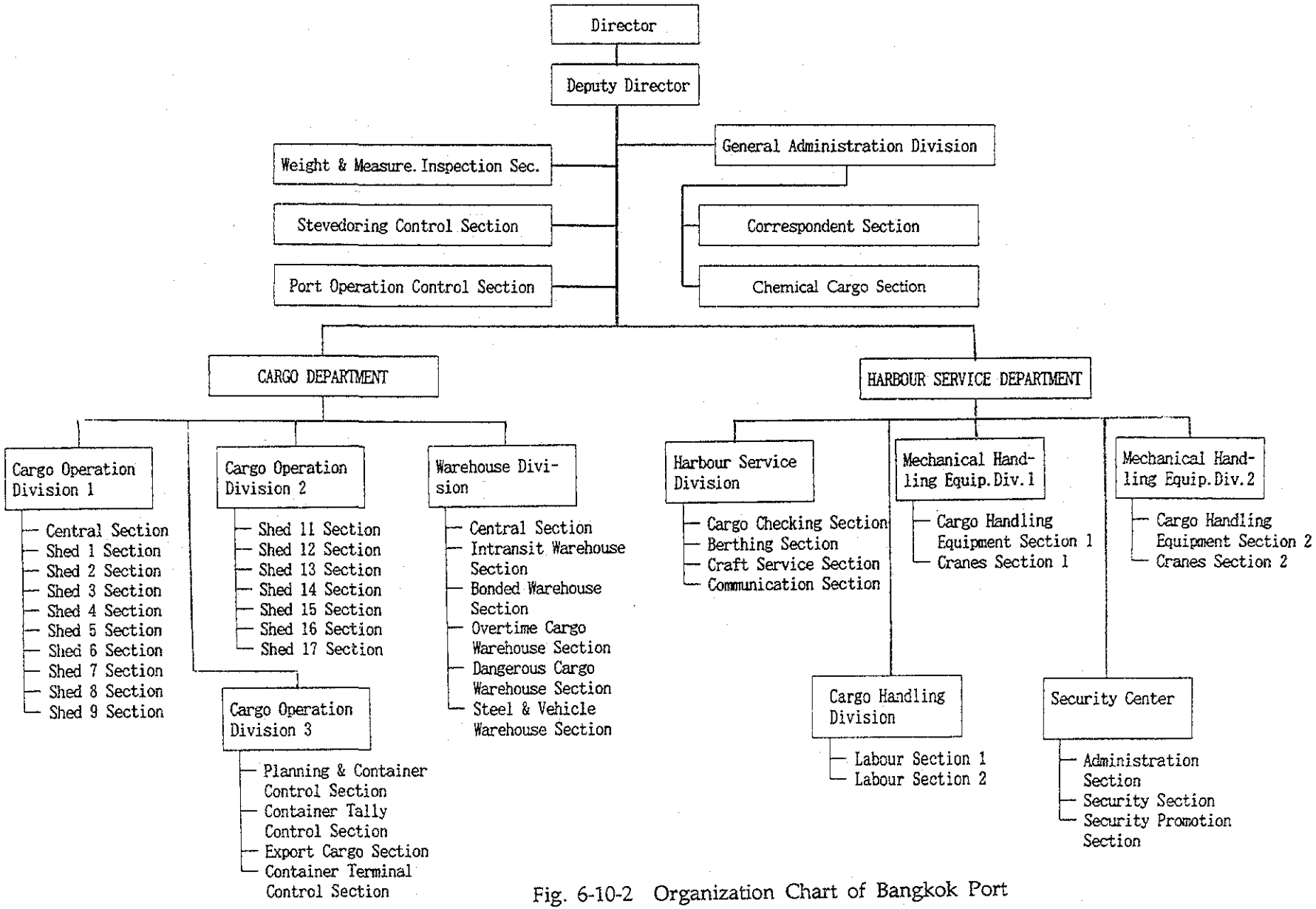


Fig. 6-10-2 Organization Chart of Bangkok Port

(Cargo Department)

Cargo Operation Division 1 is responsible for management and operations of transit sheds 1 to 9 where inbound containers unstuffed in the port area (LCL containers) and conventional cargoes are handled.

Cargo Operation Division 2 is responsible for management and operation of transit sheds 11 to 17 where inbound LCL containers are handled.

Cargo Operation Division 3 is responsible for planning of the container terminal and its computerization and for handling of inbound containers not unstuffed in the port area (FCL) and outbound LCL and FCL containers.

Warehouse Division manages several kinds of warehouses owned by PAT namely the intransit warehouse, the bonded warehouse, the overtime cargo warehouse, the dangerous cargo warehouse, and the steel & vehicle warehouse.

(Harbour Service Department)

Harbour Service Division is in charge of providing vessels berthing at the port with services and facilities such as berth allotments and tug services and communications with foreign vessels through the port radio.

Mechanical Handling Equipment Division 1 provides port users with light cargo handling equipment like forklifts and mobile cranes which are mainly used in the west quay.

Mechanical Handling Equipment Division 2 provides port users with heavy cargo handling equipment like quay side gantry cranes, transtainers and top loaders which are mainly used in the east quay.

Cargo Handling Division consists of labours who are engaged in port services such as stuffing and unstuffing of container cargoes.

Security Center conducts its business in cooperation with the Port Police to ensure the safety of persons and properties at the port. Port Police is a division of PAT consisting of personnel dispatched from Thai National Police Department of Ministry of Interior. It prevents and suppresses crime, searches for and arrests criminals and patrols around the port. PAT pays the salaries of Port Policemen.

6.10.3 Personnel

(1) Number of Personnel and Compulsory Retirement Age

Table 6-10-1 shows the number of personnel of PAT by Department as of May 1st in 1993 and Table 6-10-2 shows the number of personnel of Bangkok Port by Division as of the same date.

According to the PAT Act, Director or employee of PAT shall retire from the office at the end of the year in which he reaches the age of sixty. However, his term of employment can be extended on a one-year basis until the age of sixty-five is reached.

(2) Labour Association

Labour unions of state enterprises like PAT were the largest and most powerful in the country until they were outlawed by the first Anand Panyarachun administration, appointed by the now-defunct National Peace-keeping Council (NPKC). The "1991 State Enterprises Labour Relation Act" which was enacted in April 1991 outlawed the labour unions.

Before that act, labours of state enterprises had formed labour unions under the "Labour relation Act" which was applied to private enterprises. Under this act, eight labour unions had been formed in PAT.

The contents of the "1991 State Enterprises Labour Relation Act" are as follows.

1) Labour relation of state enterprises shall be regulated by "State Enterprises Labour Relation Act" in place of "Labour Relation Act".
2) Labour of each state enterprise shall have the right to form a labour association with no less than 25% of the membership being permanent employees.
3) The labour association discusses requests of labours with state enterprises.
4) Each state enterprises shall found a state enterprises labour relation committee and discuss pending problems
5) Striking shall be prohibited.

According to the Act, labours of PAT below the class of director of each division have formed a labour association which consists of about 2600 members, or 35% of the total employees. The labour relation committee chaired by Director General has been formed with attendance of representatives from both labour and PAT, and discusses issues about labour relations.

Table 6-10-1 Manpower of PAT by Department
(as of May 1 1993)

Name of Department	Number	Share
Office of the Director General	177	2.52 %
Office of Secretary to the Board	11	0.15 %
Auditing	108	1.53 %
Port Police	287	4.08 %
Bangkok Port	3373	48.0 %
Laem Chabang Port	259	3.68 %
Personnel	442	6.29 %
Technical	93	1.32 %
Project & Planning	50	0.71 %
Data Processing	43	0.61 %
Engineering & Marine	1723	24.5 %
Engineering	1145	16.3 %
Marine	578	8.23 %
Administration	548	7.80 %
Finance & Accounting	411	5.85 %
Inventory	137	1.95 %
Total	7021	100 %

Source: PAT

Table 6-10-2 Manpower of Bangkok Port by Division
(as of May 1 1993)

Name of Department	Number	Share
Cargo Department	960	28.8 %
Cargo Operation Division 1	396	11.8 %
Cargo Operation Division 2	330	9.90 %
Cargo Operation Division 3	100	3.00 %
Warehouse Division	134	4.02 %
Harbour Service Department	2281	68.4 %
Harbour Service division	283	8.49 %
Mechanical Handling Equipment Division 1	500	15.0 %
Mechanical Handling Equipment Division 2	421	12.6 %
Cargo handling Division	778	23.3 %
Security Center	289	8.67 %
Others	10	0.30 %
Others	90	2.70 %
Total	3331	100 %

Note: Diference in total number from Table 6-10-1 occurs because some saff worlt in more than one department.

Source: PAT

However, receiving accusations from foreign countries that this Act violates labour rights, the Government is now going to amend the "1991 State Enterprises Labour Relation Act" to again give state enterprises the right to form unions and has submitted the bill to the parliament, which is now under discussion. It does not allow unions to strike, but allows them to negotiate with employers on pay and benefits without having to going through the labour relation committee.

(3) Training System

The Personnel Development Center (PDC) of PAT implements all PAT training programs. The PDC plans training courses according to the overall business needs of PAT reflecting various requests from other departments. The training programs carried out by PDC can be divided into three categories as follows.

1) Training courses and seminars conducted by PDC

PDC holds many kinds of training programs taking up various themes as follows.

a) basic computer training using software like Lotus 123
b) safety at the port
c) safe handling of dangerous cargoes
d) safe work
e) fire prevention & fire fighting
f) psychology for administration
g) seminars for senior managers by different levels
h) orientation for new recruits
i) courses for preparation for retiring officers
j) training for cargo handling officers
k) development of container control system
l) environmental situations in the port
m) seminars on implementation of corporate plan for heads of each department, division and section
n) English language courses

Since computerization of the port, environmental protection and safety at the port are very important issues, PDC tries to put these themes in every program even if time is limited. Lecturers of courses and seminars are to be PAT officers who have much knowledge and experience in certain fields or persons invited from outside PAT. In fiscal year 1992, 1633 port officers participated.

These kinds of training programs mainly target PAT personnel only, however in case of important issues closely concerned with private shipping companies and stevedoring companies like revision of tariff, PDC arranges courses on these matters and allows staff of private companies to attend.

2) Training courses and seminars conducted by external agencies

PAT officers attend training courses and seminars conducted by external agencies. They include several public entities such as universities (Chulalongkorn, Thammasat and Mahidol), National Institute of Development Administration (NIDA), ESCAP, Office of Civil Service Commission, Association of Public Enterprises Personnel, Harbour Department and Royal Thai Navy and private enterprises such as Siam Computer Institute and British American English School. In fiscal year 1992, 302 port officers attended these courses and seminars.

3) Participation in training courses, seminars and meetings abroad

In fiscal year 1992, 98 port officers participated in training courses, seminars and meetings held in foreign countries such as Japan, the United States, the Netherlands, Sweden, Belgium, Germany, Singapore, Australia etc..

PAT makes much of personnel development and received approval from the Cabinet in February this year to expend three percent of net profits for education, training, and acquiring equipment such as computer hardware for training.

6.10.4 Port Management

(1) Berth Allotment

The Berth Assignment Committee consisting of Director of Cargo Department (Chairman), Director of Harbour Service Department, Director of Harbour Service Division, Chief of Communication Section, Director of Cargo Operation Division 1, 2, 3, and Director of Revenue Division has a meeting for allocation of the berth and the transit shed at 10:00 a.m. every morning except Saturday, Sunday and National holidays.

"First Come, First Serve" is the PAT regulation offered to vessels calling at Bangkok Port. Vessels with imported general cargoes are berthed at the west quay, and the dolphins and buoys are used to moor vessels for both export and import of general cargoes. Almost all container vessels are berthed at the east quay and the berth 22A (in front of OB) at the west quay.

In order to mitigate the congestion of the port, PAT has applied a priority berthing rights scheme. This system gives the priority berthing right to groups of shipping lines who guarantee minimum cargo tonnages per year to be handled through the terminal. The minimum requirement of cargo handling was 120,000 TEU/Year/group in 1991, and raised to 145,000 TEU in 1992. But it has been reduced to 135,000 TEU in 1993 after requests from shipping companies.

At present, one berth at the east quay is used as an open berth without priority, and six berths at the east quay and one berth at the west quay are designated as berths for this scheme. Table 6-10-3 shows the groups of shipping lines with priority berthing rights and their berths at present. The location of each berth is shown in Fig. 6-10-3.

Table 6-10-3 Priority Berthing Right Scheme

Wharf No.	Names of Shipping Lines who have priority
20A	Public
20AB	K-Lines, Mollers'
20B	Mitsui OSK Line, Eastern Maritime Borneo Agencies, Uni Thai Line
20C	Ngow Hock, NYK
20D	Ngow Hock, NYK
20E	Maersk Line, Transport & Freight Forwarding International, Thai Shipping, Wuan Hai
20F	Green Siam, Sea Land Service, Transport & Freight Forwarding International
22A (West Quay)	Uni Thai

Source: PAT

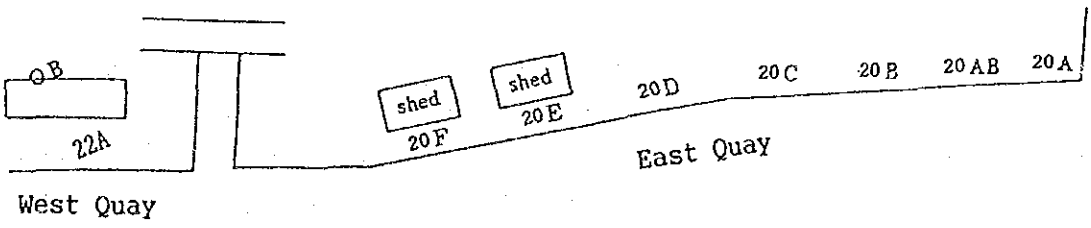


Fig. 6-10-3 Locations of Berths for the Priority Berthing Right Scheme

(2) Port Services

1) Hydrographic Survey and Dredging

PAT carries out a hydrographic survey of the channels from once every other month to twice a month in order to control the effectiveness of dredging works, to assess siltation, to determine areas to be dredged and to prepare hydrographic charts for navigation.

Dredging works within the PAT responsible area, namely from the entrance of the bar channel (K.M. -18) to the Krungthep Bridge (K.M. +42) and the installation of navigation aids and other related facilities are also done by PAT. PAT is not financially supported from other governmental agencies like Royal Thai Navy and Harbour Department for the works.

2) Communication Service

The port radio station to communicate with foreign vessels for berthing of wharves, anchorages or dolphins is operated by PAT for the use of port business only.

3) Tug Service

Tug boats and officers are provided by PAT at the time of vessel's arrival to the port. At present, 12 tugboats are ready for service.

4) Cargo Handling Service

At Klong Toei Wharf, cargo handling service is provided by PAT and private companies as well. An outline of cargo handling service is presented below.

a) Working Hours

The cargo handling operation of PAT is carried out in three shifts according to the following timetable. It is possible to extend its works through meal times and outside of the following table, if necessary. Overtime charges have been abolished by the newly revised tariff that has come into effect from June 1, 1993.

*Weekday		*Saturday, Sunday and National holiday	
8:00-12:00	day shift	8:00-12:00	day shift
12:00-13:00	meal time	12:00-13:00	meal time

13:00-16:30	day shift	13:00-16:00	day shift
18:00-19:00	meal time	16:00-18:00	meal time

(Weekday and holidays are the same.)

19:00-24:00	night shift (first half)
0:00- 1:00	meal time
1:00- 5:00	night shift (second half)
7:00- 8:00	meal time

b) Cargo Handling Service for Conventional Cargoes

Discharging/Loading cargoes from/to vessels to landside/from waterside using ship cranes is carried out by private stevedoring companies. PAT is in charge of transferring cargoes between quay side and sheds/warehouses/open storages by forklifts, trucks and trailers. Storage and delivery to forwarders are also done by PAT.

In case of imported cargoes, forwarding service from the port area to the outside is carried out primarily by ETO (Express Transportation Organization of Thailand) in principle, a state enterprise under the Ministry of Transportation and Communication. But when ETO's trucks are short, private forwarding companies contracting with consignees can be engaged in the transportation by applying to PAT.

In the case of exporting cargoes, however ETO does not hold such a priority, so private forwarding companies can compete with ETO to transport cargoes into Klong Toei Wharf.

Water transportation using lighter is done by private lighter operators.

c) Cargo Handling Service for Container Cargoes

Discharging/Loading containers from/to vessels using gantry cranes is carried out by PAT. But those works using ship cranes are done by private stevedoring companies. The quay transfer of imported containers from quay side to shed or CFS and that of exporting containers from stuffing areas/export CY are, in principle, carried out by PAT. But in case of lack of PAT equipment and labours, shipping agents have to hire private stevedoring companies.

Unstuffing/stuffing of imported/exporting LCL containers is carried out by private stevedoring companies but unstuffed imported cargoes are moved to CFS/sheds by PAT.

Taking imported container cargoes after customs clearance out of Klong Toei Wharf is

primarily carried out by ETO but in case of shortage of ETO's trucks and trailers, private forwarding companies can be engaged in the inland transportation. ETO does not have any priority on bringing exporting containers into Klong Toei Wharf.

As mentioned above, at Klong Toei Wharf, PAT carries out the physical cargo handling in coopration with private companies. However, various types of planning such as stowage planning, arrangement of loading/discharging sequence, stacking planning are done by the shipping lines/shipping agents.

PAT is now planning to purchase more cargo handling equipment and exclude private stevedoring companies from cargo handling service. Private stevedoring companies will be hired by PAT rather than shipping agents when it's necessary.

PAT also has a plan for introducing a container control system by using computers in the near future.

5) Water and Electricity Supply and Telephone Service

Water, electricity and telephone services are supplied in the city area by state enterprises like Metropolitan Water Works Authority (MWWA), Metropolitan Electricity Authority (MEA) and Telephone Organization of Thailand, respectively. PAT takes responsibility for laying pipes and cables installing necessary equipment inside port area. PAT buys water and electricity from MWWA and MEA and resells them to private port users.

6.10.5 Customs Clearance

For the customs clearance procedure, the advance entry system is applied in Thailand. Necessary documents can be submitted at any time prior to arrivals of vessels. The amount of the duties is approved if customs officers are satisfied with them after checking. But the payment of duties is made after the arrival of the vessel.

Customs inspections of imported conventional cargoes are done in the PAT bonded area (sheds) or the lighter where cargoes are discharged overside. Outdoor inspections, for example, at the importers' factories are also done by customs officers who are sent there.

In case of exporting conventional cargoes, the inspections are done at the export customs inspection wharf, the lighter or shippers' premises like warehouses. At Bangkok Port, since wharves are used for only import and exporting cargoes are loaded on vessel in the mid-stream in principle, lighters are necessary for export.

Imported containers are inspected at PAT bonded area/CFS (in case of LCL), importers' premises such as warehouses and factories or inland container depots (ICDs) for imports. ICDs for imports are located somewhere in the hinterland far away from the port area where customs clearance of inbound containers of several consignees is conducted. In Thailand, four ICDs for imports are permitted by the customs at present. Customs permits setting up the ICDs for imports to persons who satisfy the following standards, that is,

1) A juridical person who owns an international transportation business and whose capital is held by Thai stockholders (not less than 60% of registered capital)
2) To provide a public service
3) The area of location must not be less than 50 rai (8 ha) and must be fenced.
4) It should have a suitable customs station together with the necessary facilities and equipment like tables, chairs, telephones and fascimiles etc. enough for 40 staffs per area of 50 rai.

Exporting containers are also inspected at PAT bonded area or shippers' premises such as warehouses and factories or off-dock CFSs/CYs of shipping companies/agencies. Customs also has standards for setting up the off-dock CFSs/CYs. Candidate must:

1) be a juridical person who owns an international transportation business and whose capital is held by Thai stockholders (not less than 60 %).
2) provide a public service
3) obtain a suitable area not less than 20 rai with a stable fence and entrance-exit gates.
4) The area should have a suitable customs station with necessary instrument for customs offices and not less than 9 persons or more depending on the size of area.

The rate of physical inspection does not exceed 10% on average, although it is variant depending on the cases.

Bonded transportation is admitted when it is carried out by reliable forwarding companies with customs seals. It is not necessary for customs officers to accompany the containers but they are checked at the time of both departure and arrival. Transported containers cannot be opened before being checked.

6.10.6 Port Tariff

The Board of Commissioners of PAT fixes the rates of dues and charges for the use of the facilities and services provided by PAT between the maximum and minimum rates determined by the Cabinet.

The new tariff which has come into effect since June 1, 1993 is classified into five categories, namely charges against shipowners or ships' agent, charges against consignees or consignors, container charges against shipowners or ships' agents, container charges against consignees or consignors and equipment hire and admission fee inside PAT. Table 6-10-4 shows the Port Tariff at Bangkok Port.

Although PAT provides port users with cargo handling service by using its own equipment in principal, shipping lines/shipping agents have to hire private stevedoring companies for cargo handling with their own cost because of the shortage of PAT's equipment in actuality. PAT has an idea to introduce more cargo handling equipment in near future and to improve the situation so as that shipping lines/shipping agents will not have to hire private stevedoring companies.

In order to make it clear on which items the tariff is imposed, the study team has identified the container charges and drafted Table 6-10-5. It indicates a typical case of tariff charged against one container box by its status (FCL, LCL, Reefer or Empty). To make the case simple, the storage charge is not considered based on the assumption that a container is moved within the free rent period when the charges are exempted.

Tariff of Laem Chabang Port is presented in Appendices 9 for reference.

Table 6-10-4 Port Tariff of Bangkok Port (Main Items only)

1. Charges Against Shipowners or Ship's Agents

Tariff Items	Description	Unit	1993	1994	1995	1996	1997
Port Dues	Vessel from 750-2250 GRT	Baht/GRT	3	3	4	4	5
	Vessel over 2250 GRT	Baht/GRT	6	6	8	8	10
Tug Services	Per tug boat	Baht/GRT/Hour	0.4	-	-	-	-
	Minimum charge per tug boat						
	Capacity less than 2000HP	Baht/Hour	3000	-	-	-	-
	Capacity more than 2000HP	Baht/Hour	6000	-	-	-	-
Berth Hire	At container berth	Baht/100GRT/Hour	7	7.5	8	8.5	9
	At general cargo berth	Baht/100GRT/Hour	6	6.5	7	7.5	8
	At dolphin	Baht/100GRT/Hour	4.5	5	5.5	6	6.5
	At Buoy	Baht/100GRT/Hour	3	3.25	3.5	4	4.5
General Cargo Wharfage	Import Cargo	Baht/Tonne	4	-	-	-	-
	Export Cargo	Baht/Tonne	5	-	-	-	-
Gabage Charge	From all vessels over 750GRT						
	At berth	Baht/Vessel/Day	150	-	-	-	-
	At Klongtoey Dolphines	Baht/Vessel/Day	300	-	-	-	-
	At Bang Hua Sue Dolphines	Baht/Vessel/Day	500	-	-	-	-
Telephone Service on Board Charge							
	Use of telephone on board	Baht/Phone/Day	300	-	-	-	-
Water Supply Service Charge		Baht/Cubic Meter	25	-	-	-	-
Labour Stand By Charge		Baht/Event	2000	-	-	-	-
Passenger Fee		Baht/Person/ Passage	500	-	-	-	-
Quay Cleaning Charge		Baht/Vessel/Day	500	-	-	-	-

Source: PAT

Table 6-10-4 Port Tariff of Bangkok Port (Continued)

2. Charges Against Consignees or Consignors

Tariff Items	Description	Unit	Rate
Wharf Handling Charge			
Import Cargo	Discharging on wharf and store at storage place	Baht/Tonne	80
	Overside to conveyance by land at wharf	Baht/Tonne	35
	Overside to conveyance by water way at wharf	Baht/Tonne	30
Export Cargo	Entering into the Custom premises by land		
	Truck not over 1.1 ton	Baht/Truck	50
	4 wheel truck	Baht/Truck	150
	6 wheel truck	Baht/Truck	300
	8-10 wheel truck	Baht/Truck	400
	Trailer	Baht/Truck	850
Extra Labour Charge		Baht/Ton	15
Cargo Storage Charge	Minimum Charege	Baht	20
	Import Cargo (General Cargo)	3 Days Free Baht/Tonne/Day	
		1-7 Days	4.2
		8-14 Days	7
		15 Days over	10
	Export Cargo	3 Days Free Baht/Ton/Day	5
Fire Control Charge		Baht/Vehicle	100

Source: PAT

Table 6-10-4 Port Tariff of Bangkok Port (Continued)

3. Container Charges (Against Shipowners or Ships' Agents)

Tariff Items	Description	Unit	20'	40'	over 40'
Container Lifting charge	Bangkok Port gantry crane	Baht/Box/ Lift	1000	1700	2000
	Ship crane or private crane	Baht/Box/ Lift	250	425	500
Container Wharfage	At berth				
	FCL container	Baht/Box	370	630	740
	LCL container	Baht/Box	810	1380	1620
	Empty container	Baht/Box	340	580	680
	At dolphin, Buoy				
	FCL container	Baht/Box	300	510	600
	Empty container	Baht/Box	260	440	520
Shifting or Transhipment Container Charge	Discharge to berth	3 Days Free (shifting) 15 Days Free (transhipment)			
	Not more than one day from final discharge	Baht/Box	550	825	880
	More than one day	Baht/Box	1100	1650	1760
	Discharge to barge	Baht/Box	370	550	590
Empty Container Lift On Charge	Taken out from Customs premises by land	Baht/Box	400	680	800
	Taken out from Customs premises by water way				
	Using Bangkok Port crane	Baht/Box	1330	2020	2280
	Using ship crane	Baht/Box	980	1425	1580
Extra Container Movement Charge	Within the same day	Baht/Box/Movement	350	600	700
	From one Bay to another	Baht/Box/Movement	930	1430	1630
Container Storage Charge	(Inward Container)	3 Days Free for LCL and Empty Baht/Box/Day			
		1-7 Days	25	50	100
		8-14 Days	50	100	200
		15 Days over	60	120	240
	(Outward Container) LCL container	3 Days Free Baht/Box/Day			
		1-7 Days	160	275	390
		8-14 Days	320	550	780
		15 Days over	360	615	875
	FCL container	same as Outward LCL container			
	Empty container	same as Inward containers			
Stuffing or Unstuffing Service Charge		Baht/Box	1000	2000	2250
Facilities Usage Charge		Baht/Box	200	400	450
Container Weighing Service Charge		Baht/Container/ Weighing	30	40	50
Reefer Container Services Charge	Pre-trip inspection	Baht/Box	200	325	375
	Electricity supply	Baht/Plug/Day	400	650	750

Source: PAT

Table 6-10-4 Port Tariff of Bangkok Port (Continued)

4. Container Charges (Against Consignees or Consignors)

Tariff Items	Description	Unit	20'	40'	over 40'
Lift On or Lift Off Charges	Lift On Charge				
	FCL container taken out from Customs premises by land	Baht/Container/ Lift	1550	2650	3100
	LCL container taken out from Customs premises by water way				
	Using Bangkok Port crane	Baht/Container/ Lift	2010	3040	3360
	Using barge private crane	Baht/Container/ Lift	1660	2445	2660
	LCL container unstuffing and direct delivery	Baht/Container/ Lift	1850	3150	3700
	Relocation charge	Baht/Container/ Lift	350	600	700
	Lift Off Charge				
	Entering into Customs premises by land				
	FCL container	Baht/Box	500	900	1000
	Empty Container	Baht/Box	400	680	800
	Entering into Customs premises by water way				
	FCL container	Baht/Box	1530	2320	2630
	Empty Container	Baht/Box	1330	2020	2280
	Using ship/private crane				
	FCL container	Baht/Box	1180	1725	1930
	Empty container	Baht/Box	980	1425	1580
Inward FCL Storage Charge	(Free 3 Days)	same as outward LCL container storage charge			

Source: PAT

Table 6-10-5 Container Related Charge against One Container Box

1. Export

Unit: Baht/Box

Items	LCL			FCL			Reefer			Empty		
	20ft.	40ft.	45ft.	20ft.	40ft.	45ft.	20ft.	40ft.	45ft.	20ft.	40ft.	45ft.
Container Lift Off Charege	-	-	-	500	900	1000	500	900	1000	400	680	800
Loose LCL Wharf Handling	Rate:Baht/Ton			-	-	-	-	-	-	-	-	-
Stuffing Service Charge	1000	2000	2250	-	-	-	-	-	-	-	-	-
Container Wharfage	810	1380	1620	370	630	740	370	630	740	340	580	680
Pre-trip Inspection	-	-	-	-	-	-	200	325	375	-	-	-
Electric Supply	-	-	-	-	-	-	400	650	750	-	-	-
Container Lifting Charge	1000	1700	2000	1000	1700	2000	1000	1700	2000	1000	1700	2000

2. Import

Unit: Baht/Box

Items	LCL(Shed)			LCL(D/D)			FCL			Reefer			Empty		
	20ft.	40ft.	45ft.	20ft.	40ft.	45ft.	20ft.	40ft.	45ft.	20ft.	40ft.	45ft.	20ft.	40ft.	45ft.
Loose LCL Wharf Handling	Rate:Baht/Truck			-	-	-	-	-	-	-	-	-	-	-	-
Container Lift On	-	-	-	1850	3150	3700	1550	2650	3100	1550	2650	3100	400	680	800
Container Wharfage	810	1380	1620	810	1380	1620	370	630	740	370	630	740	340	580	680
Unstuffing Service Charge	1000	2000	2250	1000	2000	2250	-	-	-	-	-	-	-	-	-
Pre-trip Inspection	-	-	-	-	-	-	-	-	-	200	325	375	-	-	-
Electric Supply	-	-	-	-	-	-	-	-	-	400	650	750	-	-	-
Container Lifting Charge	1000	1700	2000	1000	1700	2000	1000	1700	2000	1000	1700	2000	1000	1700	2000

Note: This Table is made by the Study Team from PAT Tariff.
LCL(D/D) stands for LCL container unstuffing and direct delivery.

6.10.7 Finance

(1) *Financial Condition*

Since its establishment in 1951, PAT has been aiming at realizing a self-supporting accounting system as the PAT Act stipulates that revenue resulting from its operation shall accrue to PAT for the purpose of meeting expenses. PAT has adopted a corporate accounting system and been regulated to publish an annual report showing the balance sheet and profit and loss statement together with the report of an auditor.

Table 6-10-6 shows the Profit and Loss Statement of PAT in recent five years. Actually, PAT earned a great amount of revenue that amounted to 4.8 billion Baht in fiscal 1992 and net earnings for the year reached 2.4 billion Baht (net earnings have doubled in the five years). So in principal, PAT can afford to expend all costs for construction of port facilities, cargo handling equipment, dredging etc. and costs for their management and operations. No subsidy is granted to PAT by the Government. Through these earnings and improvements and developments of the ports like Laem Chabang, total assets of PAT have also dramatically increased as Table 6-10-7 shows. Total assets reached 12 billion Baht in fiscal 1992.

On the other hand, the annual revenue remaining after deducting operation expenses and allowing for proper charges, such as charges for maintenance and depreciation, bonus, providential fund for the staff upon retirement, accident, sickness etc., and reserve fund for expansion and investment shall be turned over to Treasury as revenue of the State. This is referred to as the "contribution to the Government", which is actually conveniently calculated as a certain percentage of the net earnings in the previous fiscal year. This percentage has gradually been raised from 30%, which was decided based on the rate of corporation tax before 1975, to 40% during 1976-1978, and finally to 60% since 1979.

PAT shall be exempted from payment of taxes and duties under the Revenue Code, and all of its buildings and land other than those leased shall also be exempted from payment of any taxes, duties or fees under any other law.

Table 6-10-6 Profit & Loss Statement of PAT

Unit: Baht

	1988	1989	1990	1991	1992
Operating Revenue					
Ship handling	194,263,870.56	265,824,589.73	364,174,947.06	385,242,043.52	376,538,045.24
Cargo handling	2,327,358,329.50	3,204,785,336.82	3,805,169,709.54	4,366,650,427.84	4,328,102,252.39
Service	44,831,722.18	65,254,891.11	79,701,314.40	80,515,869.76	97,236,377.15
Total operating revenues	2,566,453,922.24	3,535,864,817.66	4,249,045,971.00	4,832,408,341.12	4,801,876,674.78
Operating expenses					
Ship handling	209,557,801.43	214,346,442.28	247,226,793.29	282,047,299.04	300,495,752.23
Cargo handling	727,705,843.01	727,719,805.49	763,268,552.57	897,685,585.48	974,527,982.67
Service	152,701,028.75	172,332,942.42	209,425,691.15	240,861,701.66	251,075,466.63
Administration	239,768,984.52	279,524,200.03	337,278,963.30	418,210,442.22	448,599,963.61
Loss from exchange rate on Loan	9,630,290.06	9,525,066.27	11,474,543.80	21,665.33	15,933,708.40
Depreciation	114,354,943.20	141,034,438.30	415,333,137.54	366,481,029.11	676,597,078.19
Total operating expenses	1,453,718,890.97	1,544,482,894.79	1,984,007,681.65	2,205,307,722.84	2,667,229,951.73
Net operating revenues	1,112,735,031.27	1,991,381,922.87	2,265,038,289.35	2,627,100,618.28	2,134,646,723.05
Other revenues					
Interest earned	70,387,323.63	127,549,610.26	174,281,492.32	300,031,005.48	265,144,126.12
Profit (Loss) on sales of fixed assets	-2,152,185.70	4,713,321.59	3,778,625.76	992,566.37	4,305,823.09
Non-trading revenues	75,465,731.78	76,872,477.35	152,691,836.81	114,265,044.23	146,216,811.36
Total	143,700,869.71	209,135,409.20	330,751,954.89	415,288,616.08	415,666,760.57
Net operating revenues and other revenues	1,256,435,900.98	2,200,517,332.07	2,595,790,244.24	3,042,389,234.36	2,550,313,483.62
Less Non-trading expenses	4,923,310.29	5,734,071.98	8,271,987.57	8,236,587.53	9,797,663.23
Interest paid on loan	15,284,251.13	17,529,633.58	7,174,062.34	5,776,813.17	111,360,205.55
Total	20,207,561.42	23,263,705.56	15,446,049.91	14,013,400.70	121,157,868.78
Net earning	1,236,228,339.56	2,177,253,626.51	2,580,344,194.33	3,028,375,833.66	2,429,155,614.84

Source: PAT

Table 6-10-7 Balance Sheet of PAT

Unit: Baht

Items	September 30, 1988	September 30, 1989	September 30, 1990	September 30, 1991	September 30, 1992
(Assets)					
(Current assets)					
Cash on hand and at bank	1,479,492,828.31	1,993,649,973.10	2,097,568,413.36	2,822,728,467.96	2,979,669,290.12
Accounts receivable	75,060,436.07	187,049,230.22	314,048,268.52	314,185,830.82	251,061,459.10
(Less res. for doubtful debts)					
Other debtors	64,766,319.80	23,447,514.94	42,519,821.93	44,259,122.47	101,476,561.17
Inventories	50,566,450.15	108,775,452.00	133,763,785.45	151,157,342.48	193,986,086.19
Current other assets		53,409,971.25	51,291,292.71	54,754,611.19	63,133,876.74
Total current assets	1,669,886,034.33	2,366,332,141.51	2,639,191,581.97	3,387,085,374.92	3,589,327,273.32
Land, Building and Facilities	2,166,124,216.93	2,620,694,980.09	3,283,369,591.18	3,310,548,426.91	7,615,180,858.29
(Other assets)					
Construction work in progress	636,279,669.79	1,397,653,277.74	2,648,333,497.53	4,590,551,871.42	804,692,628.28
Deferred assets	75,351,244.67	86,579,478.39	103,586,481.22	79,004,309.36	76,721,572.36
Prepayment of Construction work in prgress	211,062,813.83	157,196,578.26	19,875,496.88	25,542,043.88	
Unused assets	217,910.01	217,910.01			
Assets under 5,000 Bht.		0.00	6,796,427.50		
Total other assets	922,911,638.30	1,641,647,244.40	2,778,591,903.13	4,695,098,224.66	881,414,200.64
Dues receivable	90,782,572.90	83,498,131.64	71,931,330.50	71,877,021.55	73,215,367.20
Total assets	4,849,704,462.46	6,712,172,497.64	8,773,084,406.78	11,464,609,048.04	12,159,137,699.45

Source: PAT

Table 6-10-7 Balance Sheet of PAT (Continued)

Unit: Baht

Items	September 30, 1988	September 30, 1989	September 30, 1990	September 30, 1991	September 30, 1992
(Liabilities & Fund)					
(Current Liabilities)					
Voucher payable	27,202,483.39	39,011,820.89	206,655,473.76	72,983,954.98	58,632,715.11
Loan due within 1 year	35,401,574.40	26,373,120.65	6,191,960.86	6,240,735.66	8,869,036.56
Accuruals		42,228,398.01	28,259,262.29	26,345,704.56	87,864,215.61
Deposits		32,716,073.19	45,171,082.28	43,160,127.67	43,437,156.21
Refundable deposits		16,474,477.10	19,687,598.65	17,767,866.57	20,497,491.38
Other creditors	94,070,397.57	26,533,396.22	24,547,326.61	32,890,278.11	24,918,068.19
Total current liabilities	156,674,455.36	183,337,286.06	330,512,704.45	199,388,667.55	244,218,683.06
Long term debt	537,467,839.06	938,523,179.90	1,549,787,881.67	2,750,112,263.57	3,219,969,722.51
Confiscated goods fees	90,782,572.90	83,498,131.64	71,931,330.50	71,877,021.55	73,215,367.20
Total liabilities	784,924,867.32	1,205,358,597.60	1,952,231,916.62	3,021,377,952.67	3,537,403,772.77
(Fund)					
Capital	726,053,941.27	839,552,854.23	1,061,939,225.49	1,427,467,999.95	1,637,012,327.60
Surplus on donated capital	40,135,902.22	34,086,051.63	30,552,344.31	27,327,085.00	24,189,762.35
Surplus on revaluation of assets	91,461,746.19	90,137,085.87	88,812,425.55	87,487,765.23	86,163,104.91
Earned surplus					
Net earning for the year	1,236,228,339.56	2,177,253,626.51	2,580,344,194.33	3,028,375,833.66	2,429,155,614.84
Reserve for expansion	1,989,259,296.91	2,375,687,143.47	3,058,937,795.98	3,872,789,064.87	4,837,182,661.51
Total	4,083,139,226.15	5,516,716,761.71	6,820,585,985.66	8,443,447,748.71	9,013,703,471.21
Gain (Loss) on					
Deferred exchange rate on Loan-SCP/BKK PORT	-18,359,631.01		1,108,373.16	548,681.81	-391,280,742.90
Loss on exchange rate on Loan			-841,868.66	-765,335.15	-688,801.63
Total gain (loss)	-18,359,631.01	-9,902,861.67	266,504.50	-216,653.34	-391,969,544.53
Total Fund	4,064,779,595.14	5,506,813,900.04	6,820,852,490.16	8,443,231,095.37	8,621,733,926.68
Total Liabilities & Fund	4,849,704,462.46	6,712,172,497.64	8,773,084,406.78	11,464,609,048.04	12,159,137,699.45

Source: PAT

(2) Method for Depreciation of Fixed Assets

The policy of depreciation of fixed assets is based on the straight-line method. This method is more suitable for ports which require an enormous amount of initial investment than the fixed percentage method, because the depreciation of assets can be calculated on even bases annually over a comparatively long term. Durable years of PAT assets are shown in Table 6-10-8.

Table 6-10-8 Durable Years of PAT Assets for Depreciation

Item	Durable Years
1. Building & Structure	25
2. Cranes	10
3. Forklifts	5
4. Trucks & Trailers	5
5. Pallets	5
6. Other Handling Equipment	5
7. Buses	8
8. Cars	5
9. Motorcycles	4
10. Other Vehicles	5
11. Marine Service Div.'s Ships	15
12. Survey Div.'s Ships	10
13. Dredging Div.'s Ships	20
14. Other Ships	10
15. Surveying Instruments	10
16. Printing Instruments	10
17. Office Equipment	10
18. Medical Equipment	10
19. Car Repairing Equipment	10
20. Mainframe Computer	6.67
21. Mini-Computer	6.67
22. Communication Net Work	6.67
23. Personal Comouter	5
24. Computer Equipment	5
25.Software Application	5
26. Other Equipment	4

Source: PAT

6.11 Dredging

6.11.1 General

The Bangkok port is a river port including various types of public and private facilities located on both banks of the Chao Phraya River and midstream extending from the river mouth to the Rama VI Bridge 56 Km upstream.

The public facilities owned and managed by PAT are Bang Hua Sua Dolphin, East Quay, West Quay, Klong Toei Dolphin and Sathu Pradit Buoy, which are located 14 Km, 26 Km, 28 Km, 28 Km and 37 Km from the river mouth respectively. These facilities provide 18 berths at quays, 15 berths at midstream dolphins and 5 berths at mooring buoys.

There are also 67 private berths for ocean-going vessels and more than 24 lighter berths from the river mouth to the Krung Thep Bridge and at least another 4 private ship berths and 21 private lighter berths from this bridge to the northern limit of the port at Rama VI Bridge.

Access to the Bangkok port is through a 18 Km long bar channel. Before 1939, the old access channel at the estuary entrance, was 4.5 m deep below MSL. In the early fifties, this depth was increased to 8.5 m below MSL, which is equivalent to 6.08 m below LLW, by dredging works. The design width is 100 m in the straight reaches and 250 m in the bends. Vessels entering the bar channel and the river port, up to 21.5 Km from the river mouth are limited to a draft of 8.2 m. Water depth in the bar channel is the main factor governing this vessel draft limitation.

The river channel is 56 Km in length and 200 m to 400 m in width with depth more than 8.5 m below MSL. The river channel exhibits sharp bends, the sharpest is located at 17 Km upstream with a turning angle of 120°. Due to this bend, ships with L.O.A. exceeding 172 m are not allowed to enter the river channel. Vessels with L.O.A. exceeding 172 m but not exceeding 182 m and having certain qualifications are called "Super Vessels", for which approval to enter the Bangkok port may be considered for the reason that they are for the benefit of the nation as a whole and with the agreement of the Harbor Department.

6.11.2 Maintenance Dredging

(1) PAT Organization for Maintenance Dredging

In order to maintain a -8.5 m MSL depth, maintenance dredging has been performed continuously since 1954. The maintenance dredging from the entrance of bar channel to the Krung Thep Bridge is the responsibility of PAT. Three divisions of PAT's Marine Department share this responsibility:

1) Marine Survey Division	:	In charge of conducting periodic hydrographic survey of the channels to control the effectiveness of dredging works, to assess siltation, to determine area to be dredged and to prepare hydrographic charts for navigation, and responsible for aids to navigation and beaconing on the bar channel and on the river.
2) Dredging Division	:	In charge of dredging works.
3) Marine Service division	:	In charge of the maintenance of PAT dredgers (workshops, spare parts, fuel, etc.) as well as other PAT craft and buoys.

(2) Hydrographic Survey

In order to maintain the channel navigable for the vessel of 172 m in L.O.A. and 8.2 m in draft, several portions of the channel which become shallower by siltation or sedimentation are required to be checked periodically.

Now, the following portions are the most frequently surveyed to confirm the required depth and width;

Location and Frequency of Hydrographic Survey

Location	Maintained Depth MSL	Maintained Width	Frequency
Bar Channel (KM 0 to 3 & KM 7 to 18)	8.5 m	100 m in straight	2 Times/1 Month
- (KM 3 to KM 7)	8.5 m	250 m in bend	2 Times/1 Month
Tai Ban (KM 3.5 to KM 6.5)	8.0 m	150 m	1 Time/2 Months
Bang Plakot (KM 8.5 to KM 11)	8.0 m	300 m	1 Time/2 Months
Bang Hua Sua Dolphin (KM 13 to KM 15)	10.78 m	50 m at berth	1 Time/1 Month
Bang Chak (KM 24 to KM 25.5)	8.5 m	200 m	1 Time/2 Months
Bangkok Port (KM 25.5 to KM 26.8)	10.72 m	200 m at east quay	1 Time/1 Month
Bangkok Port (KM 26.8 to KM 28.5)	10.72 m	275 m at west quay	
Sathu Pradit Mooring	8.5 m	300 m	1 Time/2 Months

(3) Maintenance Dredging

The dredging division executes the maintenance dredging works following the instruction of the marine survey division on a 24 hour basis. PAT has four (4) hopper suction dredgers, one (1) bucket dredger and two (2) clam shell dredgers. The four (4) hopper suction dredgers, named Sandon 4, 5, 6 and 7 are used for the maintenance dredging of the Bar channel. The Sandon 4, 5 and 6 are all steam powered and only Sandon 7 is equipped with diesel engines.

Their dates of construction, which are also their dates of acquisition by PAT, together with such characteristics as hopper capacities, length, mean and maximum draft with spoil in hopper and dredging depth below high water level are indicated in the table below;

Main Characteristics of Hopper Suction Dredgers

Name of Dredger	Sandon 4	Sandon 5	Sandon 6	Sandon 7
Year built	1955	1956	1960	1990
Hopper Capacity (m^3)	2000	750	2000	2500
Length Overall (m)	87.4	67.9	87.0	77.0
Mean Draft (m)	5.1	4.7	6.4	6.2
Maximum Draft (m)	5.2	n.a	7.1	6.4
Dredging Depth (m)	14.0	14.0	14.0	14.0

The one(1) bucket dredger, named Rua Khut 2, and two (2) clam shell dredgers of 3.3 m^3 and 3.8 m^3 are used to maintain an adequate water depth near the quay walls, the lighter berth and the dolphins at Klong Toei and Bang Hua Sua. The Rua Khut 2 is a barge equipped with a chain of 51 buckets which also discharges spoil into barges. The main characteristics of Rua Khut 2 are as follows;

Main Characteristics of Rua Khut 2 Bucket Dredger

Year built		1967
No. of Buckets		51
Bucket Capacity, each (m^3)		0.25
Length Overall (m)		35.0
Draft (m)		1.5
Dredging Depth (m)	normal	10.0
(below HWL)	maximum	13.0

All the material dredged in the bar channel is dumped close to the dumping ground buoy which is located 2.5 miles west of the pilot station. On the other hand, the materials dredged in the river are generally dumped into the deep portions of the river. According to the dredging reports, the maintenance dredging volumes of the bar channel and the river in last 4 years were as follows;

Maintenance Dredging Volume of Bangkok Port

Year	Bar Channel	River Channel
1989	2,534,200 m^3	261,360 m^3
1990	5,071,650 m^3	255,940 m^3
1991	3,481,425 m^3	276,300 m^3
1992	4,306,575 m^3	304,419 m^3

These maintenance dredging volumes of the Bar channel were estimated by taking the number of working hours and the number of round trips made by the hopper suction dredgers, assuming that 75% of the capacity of the hopper was filled with dredged material and considering the in-situ density. This is equivalent to a bulking factor of 1.33 for each cycle. The volume of the river channel which was dredged by the bucket and clam shell dredgers was estimated assuming that 100% of the capacity of the hopper, was used and considering the dredged material's in-situ density.

(4) Improvement Plan

The feasibility study for the Bangkok bar channel improvement was conducted by French consultants in 1990 with the aims of increasing the size of ships that can call at the port of Bangkok through the bar channel, allowing ships to navigate in acceptable safety conditions based on traffic growth prospects, reducing the waiting time of fully laden ships which reach the port of Bangkok at high tide, and reducing barge traffic and transshipment between barges and big ships at Koh Sichang anchorage area, and hence to reduce navigation hazards owing to barge traffic in the bar channel.

In this study, the realignment, widening and deepening of the bar channel was examined. However, this plan has not been realized. One of reasons, among others, is the possibility of an increase of salt intrusion into the Chao Phraya River, which may contaminate the fresh water supply to irrigation systems. The report said that deepening the navigation channel to -9.8 m MSL downstream from Bangkok over the entire length of the river/sea reach, between the mouth and Bangkok would entail the risk of increasing the salt penetration length from 8 to 10 Km.

Apart from the problems of salt intrusion, deepening the bar channel is not recommendable, since if the channel in the shallow mud flats is deepened, the required volume of maintenance dredging will increase in a geometrical progression in proportion

to the extra depth.

Now, PAT only has a plan to widen the existing bar channel from 100 m to 135 m. As explained above, three (3) of the existing four (4) hopper suction dredgers are obsolete and worn-out, subject to frequent repairs and drydocking with high immobilization periods. Therefore, PAT has ordered one (1) hopper suction dredger of 2500 m^3 capacity, named Sandon 8, which will be available by the end of July 1993. Upon completion of the Sandon 8, the existing Sandon 4 and 5 are planned to be scrapped. PAT also has a plan to replace Sandon 6 with a new hopper suction dredger of 2500 m^3 capacity, Sandon 9, in the near future.

Chapter 7 Conditions for Design and Cost Estimation

7.1 General

If there are prevailing design standards of Thailand or of other foreign countries in Thailand for the facilities concerned, these design standards shall be adopted for this study. Only when there are no prevailing design standards for the facility, like a marine facility, the Japanese design standards such as "Technical Standards for Port and Harbour Facilities in Japan" will be applied.

In addition to the above and to say nothing of the consideration of meteorological, topographical and geographical conditions of Bangkok for the design, all facilities shall be designed considering the availability of construction materials, equipment, technical capability, labour force, etc. in Bangkok.

In resent years, the economy of Thailand, especially of Bangkok has been growing rapidly and in accordance with that the material costs and labour costs have been increasing at a high rate. Therefore, the estimation of construction costs for this project shall be conducted considering these trends carefully.

7.2 Design Standards and Design Criteria

7.2.1 Marine Facilities

Marine facilities such as quay walls, dolphins, mooring buoys, shore protections, dredging and reclamation, etc. should be designed based on the following design standards and manuals.

(1) Design Standards and Manuals

- Technical Standards for Port and Harbour Facilities in Japan
- American Concrete Institute (ACI) 318-83
- American Institute of Steel Construction (AISC)

(2) Design Criteria

- Maximum Objective Vessel
  L.O.A.: 172m , Maximum Draft: 8.2 m

- Tide at Klong Toei
  H.H.W. : +3.83 m

M.S.L.	:	+1.72 m
L.L.W.	:	0.00 m

- Live Loads

Quay Wall	:	3.0 t/m^2
Open Storage	:	3.0 t/m^2
Container Yard	:	3.0 t/m^2
CFS	:	3.0 t/m^2
Warehouse	:	3.0 t/m^2

- Wind Load

  Wind pressure equivalent to wind speed of 20 m/s is applied with appropriate shape factor.

- Dead Loads

Reinforced Concrete	:	2.45 t/m^3
Plain Concrete	:	2.30 t/m^3
Steel	:	7.85 t/m^3

- Seismic Force

  No seismic force is considered

(3) Materials

The materials to be used for this design should conform to the following standards.

- American Society for Testing Materials (ASTM)
- Japanese Industrial Standard (JIS)
- Thailand Industrial Standard (TIS)

The strength of fundamental materials to be used for this design should be as follows;

- Concrete	:	240 Kg/cm^2 concrete cylinder strength at 28 days
- Reinforcement Bar	:	2,400 Kg/cm^2 yield strength for TIS-SR24 round bars
	:	3,000 Kg/cm^2 yield strength for TIS-SD30 deformed bars
- Structural Steel	:	2,520 Kg/cm^2 yield strength for JIS G 3101-SS41 steel

7.2.2 Port Buildings

The port buildings such as transit sheds, warehouses, work shops, office buildings, gates, fences, etc. should be designed based on the following design standards and manuals.

(1) Design standards and Manuals

- Building Code and Typical standard Regulation of Government Buildings (1979)
- Fire Code of National Fire Protection Associates (NFPA)
- American Concrete Institute (ACI)
- The Engineering Institute of Thailand under H.M.the King's Patronage (EIT)
- Bangkok Municipal Administration (BMA)

(2) Design Criteria

- Live Loads

Office Building	:	0.25 t/m^2
Service Building	:	0.25 t/m^2
Corridor, Stairways	:	0.30 t/m^2

- Wind Load

Wind Speed	:	20 m/s

- Seismic Force

  No seismic force is considerd.

7.2.3 Roads and Pavements

The roads and pavements for open storages and parking lots should be designed referring to the following design standards and manuals.

(1) Design Standards and Manuals

- Highway Design Standard by Department of Highway (DOH)
- Design Guidelines Volume 1 - Geometric, Drainage and Structure by DOH
- American Association of State Highway and Transportation Office (AASHTO)
- The design standards for Urban and Rural Highway by Japan Highway Institute

(2) Design Criteria

- Live Loads

Roads	:	40′ Container Trailer
Open Storage	:	40 Ton Top Loader and 3.0 t/m^2

7.2.4 Railway

All facilities related to the railway traffic should be designed conforming to the design standard of the State Railway of Thailand;

- The Design Standards of the State Railway of Thailand (SRT)

7.2.5 Utilities

(1) Water supply

The system should be designed to maintain the pressure head not less than 20 m at any connection to buildings or at any part of the network.
All pipes should be sized to allow flow at a velocity of 0.9 m/s to 1.5 m/s.
Fire hydrants should be provided at spacing about 100 m to 200 m apart.

(2) Drainage

The surface drain from pavement through curb inlet, grating or small channel should be designed to sustain 5 year storm recurrent period. And for drain through cross drain pipes, major channel or ditches, the 10 year recurrent period of rainfall should be used.

(3) Electricity Supply

The power supply and area lighting should be designed conforming to the following design standards;

- The Metropolitan Electricity Authority Standard (MEA Standard)
- National Electric Code (NEC)
- Illumination Engineering Society Standard (IES Standard)

(4) Fire Fighting

The fire fighting system should be designed conforming to the following standard;

- National Fire Protection Association Standard (NFPA Standard)

7.2.6 Navigation Aids

The navigation aids should be designed conforming to the regulations recommended by the International Association of Lighthouse Authorities (IALA).

7.3 Salary and Wages of Construction Workers

Unit prices of salary and wages for the construction engineers and labours based on data of the Ministry of Commerce and local construction firms are shown in Table 7-3-1.

Table 7-3-1 Unit Price for Labor

Type of Worker	Baht/Hour 8.0h/Day	Over Time Rate Baht/Hour
Civil Engineer	200	300
Supervisor	180	278
General Foreman	75	115
Skilled Laborer	30	45
Unskilled Laborer	16	24
Carpenter	30	45
Electrician	30	45
Mechanic	30	45
Welder	40	60
Truck Driver	20	30
Hevy Equip't Operator	65	100
Surveyor	30	45
Watchman	25	40

These unit prices of wages will be adjusted for the increase of salary based on the increase rate of minimum wage in Bangkok shown in Table 7-3-2 and Fig. 7-3-1.

Table 7-3-2 Minimum Wage in Bangkok

Year	Bath/Day	(%) Increase Rate	Remarks
80	54	20	
81	61	13	
82	64	5	
83	66	3	
85	70	3	
87	73	2	
89	78	4	
90	90	15	
91	100	11	
92	115	15	
93	125	9	

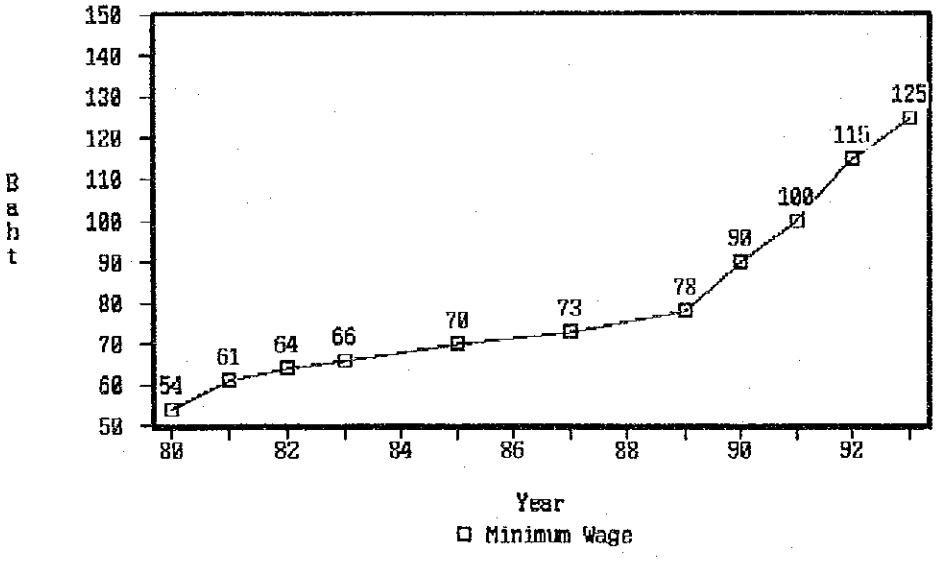


Fig. 7-3-1 Minimum Wage in Bangkok

According to the above mentioned, unit prices of wages in the future are estimated based on increase rate of 10% every year.