2.1.6 Water discharge of the Chao Phraya River

The flow of the Chao Phraya River varies according to the seasons. The "Royal Irrigation Department" is in charge of gauging the river and its affluents. Since the flow analysis carried out by Nedeco in 1965, a number of regulating barrages have been completed.

Measurements of water discharge of the Chao Phraya River were made between 1974 and 1988 downstream of the Chainat Dam. The average flow of flood water is approximately 1,700 m^3/sec. and the average flow of low water is 90 m^3/sec.

2.2 Environmental Conditions

2.2.1 Natural Environment in Thailand

In Thailand there are some 15,000 vascular plants native to the country, but the number could be 30 to 40% higher than known presently. Thailand forests can be classified into 6 categories consisting of rain forest, evergreen forests, montane broadleaved evergreen forests, tropical broad-leaved or seasonal evergreen,mixed species deciduous and dry dipterocarp or deciduous dipterocarp. Also, there are small forests with precious habitats such as limestone crags, mangroves, freshwater swamps and pine forests.

There were 918 birds of 282 species found up to the end of 1989. Thailand's coast line fronts the Gulf of Thailand on the east coast and the Andaman Sea on the west. Consequently, the marine life includes flora and fauna which have the characteristics of both the Indian Ocean and the Indo-Pacific regions.

2.2.2 Pollution in Thailand

In Thailand, environmental pollution problems occur in the city area, especially in Bangkok. Most significant problems are air pollution, water pollution and noise. Air pollution and noise problems are caused by vehicles and the water pollution is caused by drainage discharge from houses and factories.

2.2.3 Environmental condition in Bangkok

Bangkok had favorable water conditions which are a base for society and the economy. However, environmental pollution problems have occurred with industrial urbanization in Bangkok. The most significant pollution is air pollution and water pollution. The

water pollution is caused by drainage discharges. The Chao Phraya River is the most important river which is taking the drainage discharges from houses and factories in Bangkok. The water pollution increases in the dry season(January - May). Oxygen content of the river(D.O) decreases to its lowest value during this season. Oxygen content of the Chao Phraya River is shown in Fig 2-2-1.

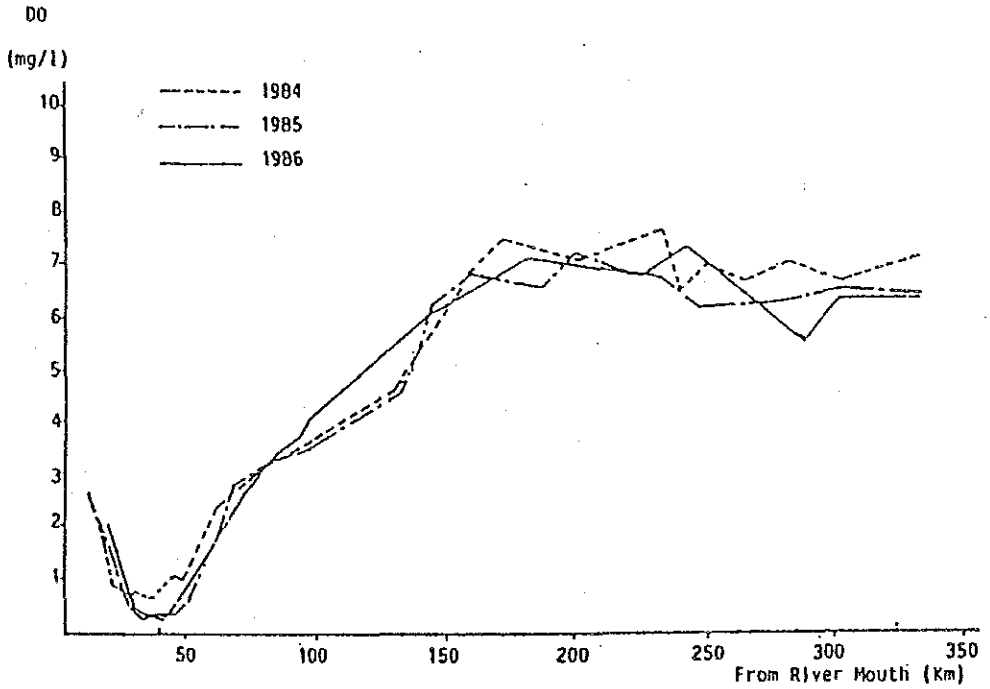


Fig. 2-2-1 Oxygen Content of The Chao Phraya River

The lowest value of oxygen content of the river occurs 30km-40km from theriver mouth. Bangkok port is located on the left bank of the Chao Phraya River about 30 km from the river mouth. This means that Bangkok Port(center of city) is in the zone of the excessive water pollution.

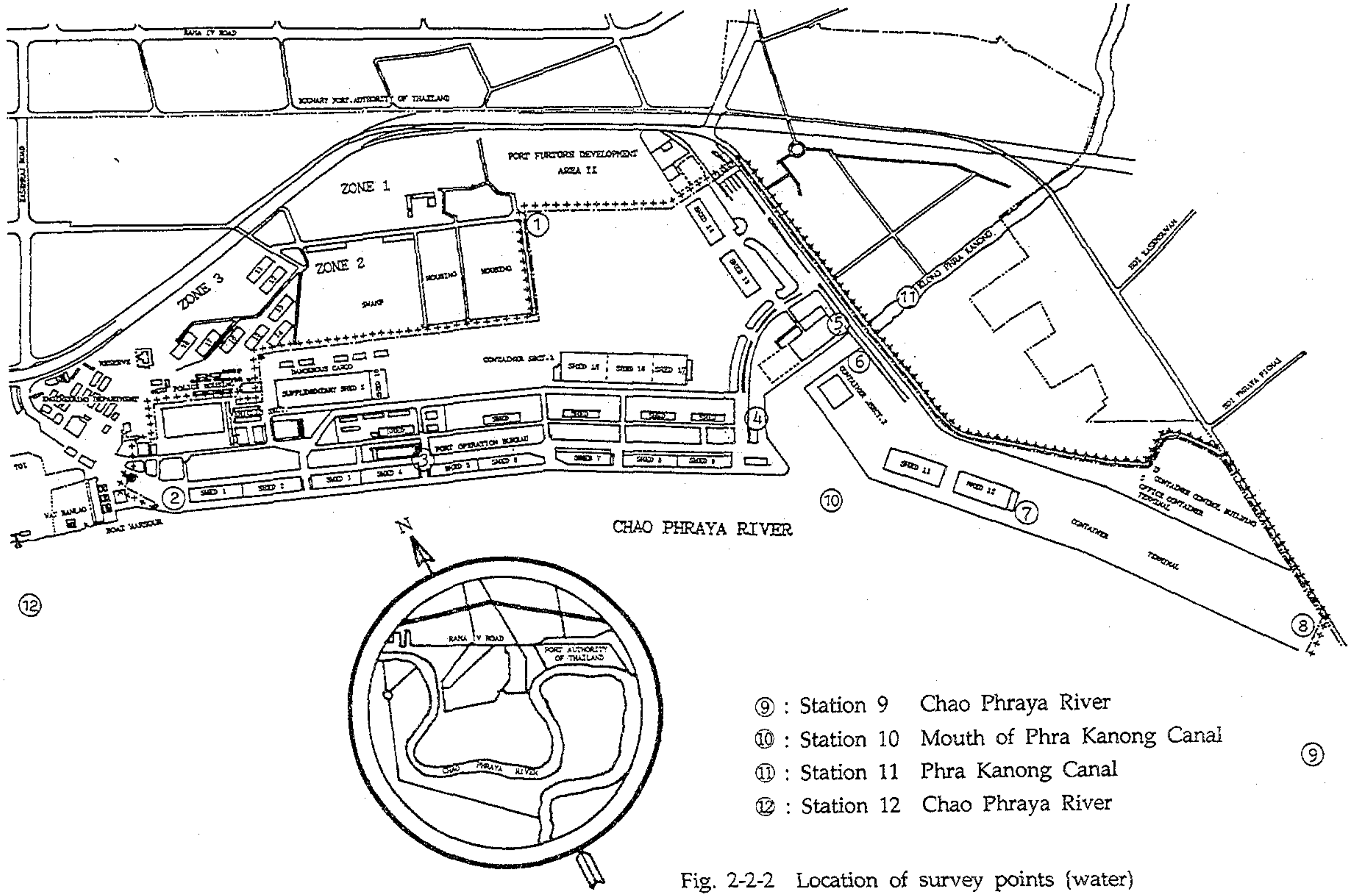
Port Authority of Thailand has been monitoring water quality, air quality, noise and so on from July, 1993.

Fig. 2-2-2 shows location of survey points and Table 2-2-1 shows water quality around Bangkok Port.

For air quality, samples were taken on Aug. 10, 1993 by high volume air sampler to measure particulate and lead in the air for three stations. Fig. 2-2-3 shows location of

Table 2-2-1 Water Quality of Bangkok Port

PARAMETERS	Station 9			Station 10			Station11			Station 12			Standard of Waste Water (Ministry of Industry)	unit
	Jul.8,'93	Aug.6,'93	Sep.7,'93	Jul.8,'93	Aug.6,'93	Sep.7,'93	Jul.8,'93	Aug.6,'93	Sep.7,'93	Jul.8,'93	Aug.6,'93	Sep.7,'93		
pH	7.58	7.39	7.55	7.46	7.30	7.64	7.25	7.48	7.44	7.43	7.58	7.32	5-9	
ACIDITY	10	28	12	10	16	4	20	12	16	5	8	8	-	mg/l
ALKALINITY	119	125	107	104	125	107	149	155	113	89	131	101	-	mg/l
SUSPENDED SOLIDS	74	50	56	38	16	50	32	26	56	82	24	72	150	mg/l
DISSOLVED SOLIDS	2,356	4,222	450	2,158	4,238	498	490	1,784	638	780	3,978	422	5,000	mg/l
SETTLEABLE SOLIDS	0.50	0.10	0.50	0.10	0.05	0.30	0.20	0.15	0.20	0.25	0.20	0.02	-	ml/l
BOD5	5.85	4.5	7.2	6.6	5.7	7.2	15.6	11.8	9.0	12	4.5	6.0	20	mg/l
TKN	3.82	3.61	2.78	2.85	3.05	2.36	6.67	7.30	3.48	3.61	3.61	2.71	-	mg/l
ORGANIC-NITROGEN	0.14	0.55	0.97	0.49	0.41	1.18	1.39	1.53	1.32	1.95	0.83	1.18	-	mg/l
AMMONIA	3.68	3.06	1.81	2.36	2.64	1.81	5.28	5.77	2.16	1.66	2.78	1.53	-	mg/l
NITRATE	0.035	0.059	0.001	0.005	0.035	0.008	0.019	0.025	0.005	0.035	0.015	0.009	-	mg/l
PHOSPHATE	0.72	0.68	0.08	0.72	0.92	0.64	1.04	0.48	0.32	1.30	0.64	0.04	-	mg/l
GREASE & OIL	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	5.0	mg/l
HYDROGEN SULFIDE	0.05	0.06	0.003	0.06	0.06	< 0.001	0.05	0.05	0.003	0.05	0.08	< 0.001	1.0	mg/l
FECAL COLIFORM BACTERIA	45	> 240,000	160,000	74	> 240,000	> 240,000	100	21,000	> 240,000	320	14,000	> 240,000	-	MPN/100 ml



⑨ : Station 9 Chao Phraya River
⑩ : Station 10 Mouth of Phra Kanong Canal
⑪ : Station 11 Phra Kanong Canal
⑫ : Station 12 Chao Phraya River

Fig. 2-2-2 Location of survey points (water)

survey points and Table 2-2-2 shows air quality.

For noise condition, noise level for 24 hours was measured using Integrating Sound Level Meter at 2 stations on Aug. 10, 1993. Fig. 2-2-3 shows the location of survey points and Table 2-2-3 shows the result.

Table 2-2-2 Air Quality of Bangkok Port Parameters

Parameters	St.1	St.2	St.3	STD>	UNIT
Particulate	1.324	0.215	0.198	0.33	mg/m^3
Lead	4.28	2.09	1.65	10	g/m^3

Table 2-2-3 Noise condition in Bangkok Port

Parameters	St.1	St.3	UNIT
Leq.	71.9	75.2	dBA

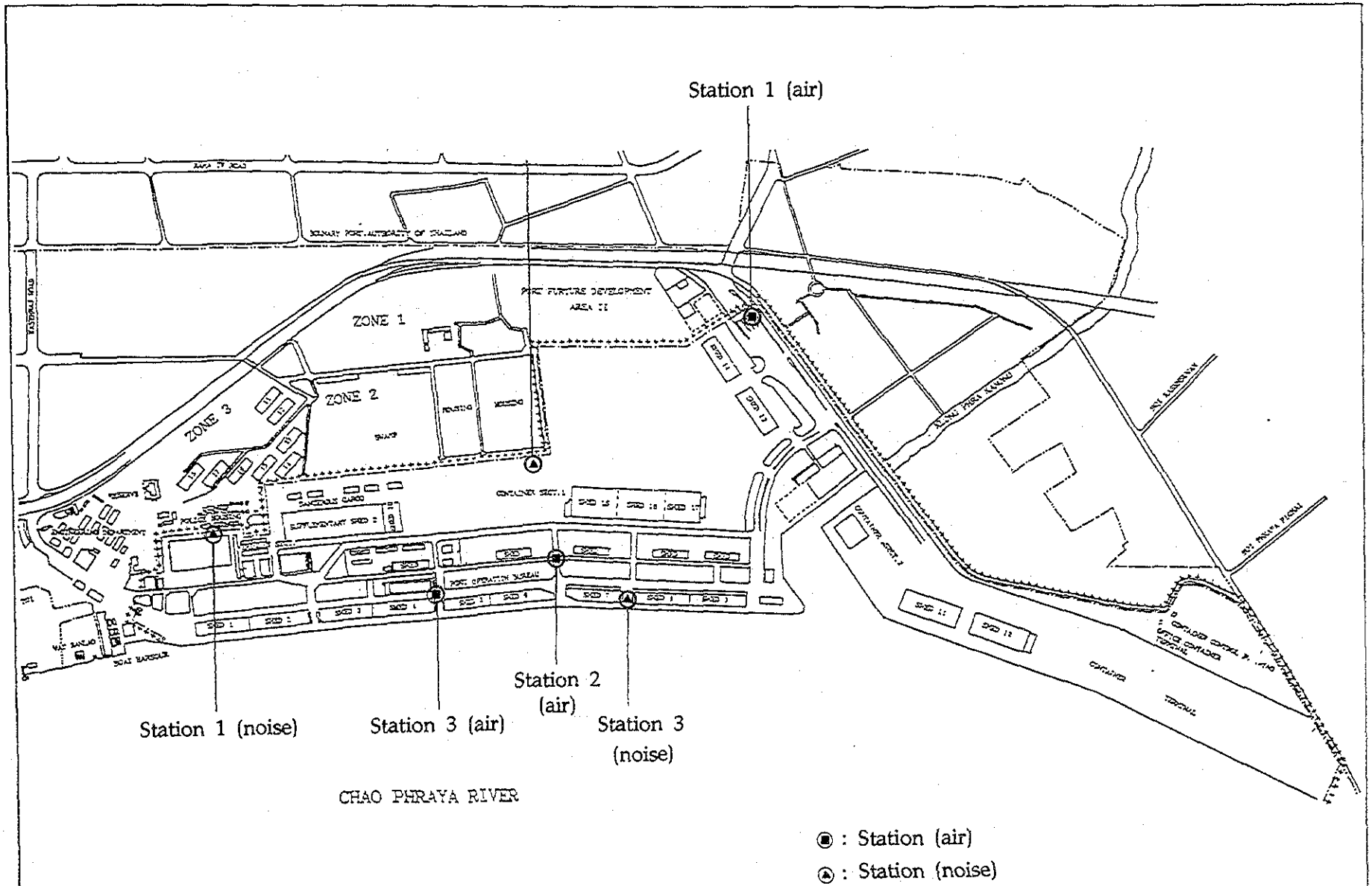


Fig. 2-2-3 Location of Survey Points (air, noise)

2.3 Government's Policy on Environmental Consideration

2.3.1 Environmental Impact Assessment (EIA)

Issues regarding development and environment conservation have been a common concern of the international community, i.e. both in developed and developing countries.

"Sustainable development", the integrated idea for environmental consideration and development put forward by the World Committee of the United Nations Conference on Environment and Development in its Tokyo Declaration in February 1987, was later included in the Communique at the Arche Summit in July, and strengthened environmental consideration in development projects has been an international trend.

In Thailand also, the importance of environmental consideration has come to be acknowledged widely. The Office of Environmental Policy and Planning is set in the Ministry of Science, Technology and Environment as the examining body of environmental impact assessment (EIA).

The Enhancement and Conservation of National Environment Quality Act of 1975, as amended in 1978 and 1992, empowers the National Environmental Board in the Ministry of Science, Technology and Environment to issue proclamations for the types and sizes of projects or activities requiring EIA reports and measures for the prevention of and remedy for the adverse effects on environmental quality. The first proclamation issued on the 14th, July 1981 stipulates that commercial port and harbour projects in which vessel capacity is of greater than 500 ton gross require EIA reports and measures for the prevention of and remedy for the adverse effects on the environmental quality.

The approval process for EIA is shown in Fig. 2-3-1 and Fig. 2-3-2. The former is for EIA of private sector project and the latter is for EIA of government agency, state enterprise or project to be jointly undertaken with private enterprise.

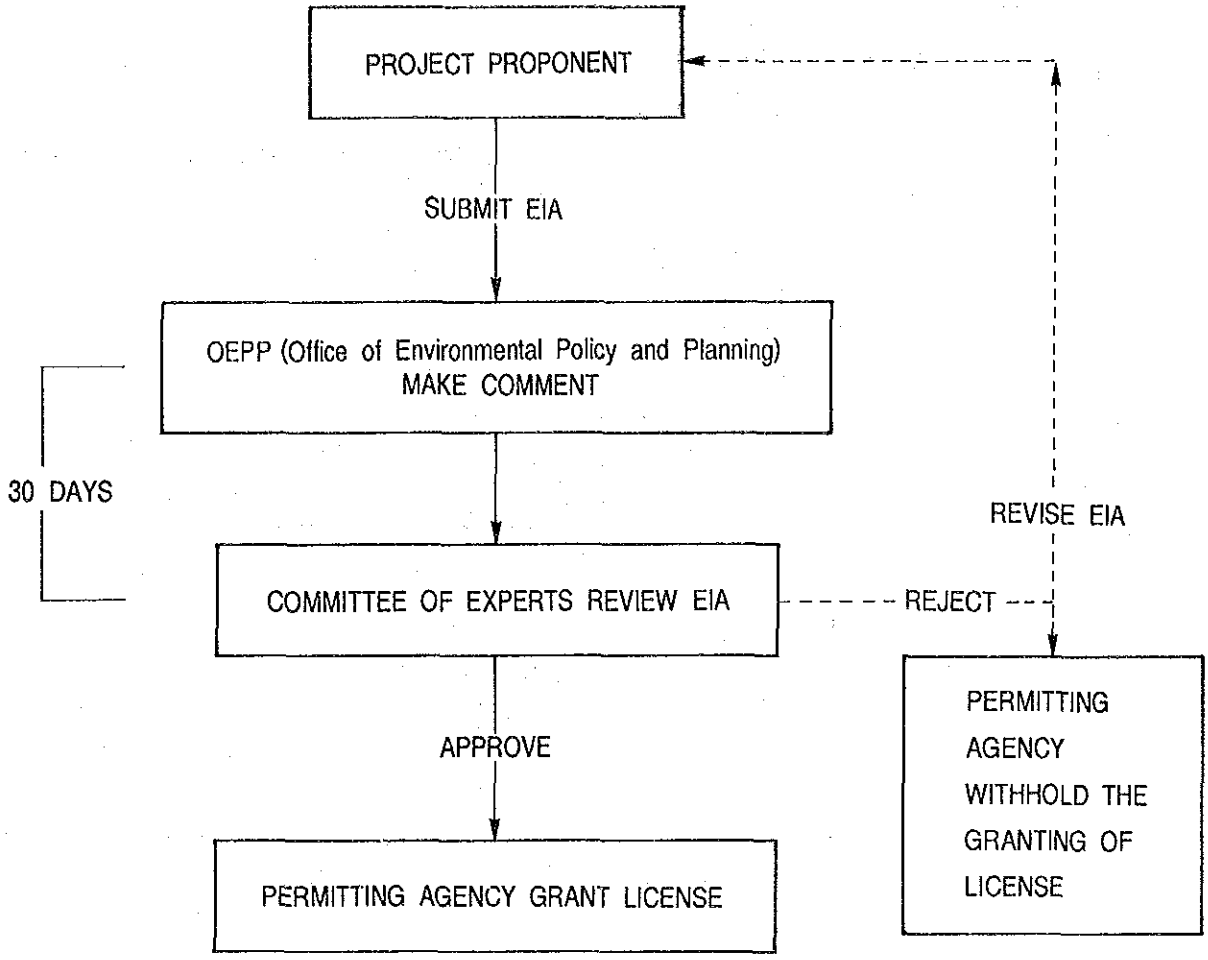


Fig. 2-3-1 Approval Process for EIA of Private Sector Projects (Revision Process)

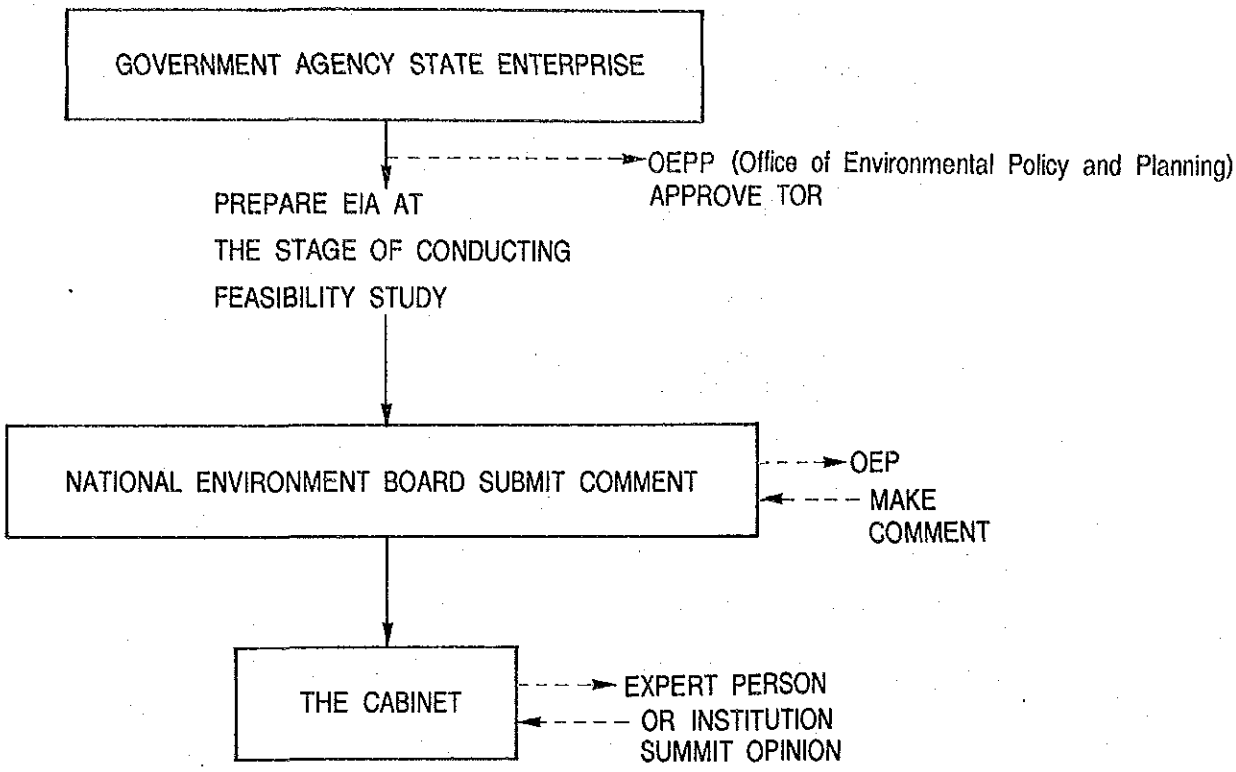


Fig. 2-3-2 Approval Process for EIA of Governmental Agency, State Enterprise or to be jointly undertaken with Private Enterprise

2.3.2 MARPOL 73/78 in Thailand

The International Maritime Organization (IMO) is a body of the United Nations and drew up the International Convention for the Prevention of Pollution from Ships of 1973 with Protocol of 1978 (MARPOL 73/78).

The MARPOL 73/78 convention is the principal convention on the prevention of pollution of seas from ships and a majority of the maritime nations of the world have already signed the convention. The Kingdom of Thailand is studying the convention and plans to sign it in the near future.

Five annexes are attached to the MARPOL 73/78 Convention, and Annex I refers to the regulations for the prevention of pollution by oil.

Two areas are defined by the regulations, special areas and other areas.

The required condition of reception facilities is also defined by regulations for the special areas and the other areas individually as follows:

(1) Special areas

The Government of each Party to the Convention, the coast line of which borders on any given special areas undertakes to ensure that all oil loading terminals and repair ports within the special area are provided with facilities adequate for the reception and treatment of all the dirty ballast and tank washing water from oil tankers. In addition all ports within the special area shall be provided with adequate reception facilities for other residues and oily mixtures from all ships. Such facilities shall have adequate capacity to meet the needs of the ships using them without causing undue delay.

(2) Other areas

The Government of each party undertakes to ensure the provision at oil loading terminals, repair ports, and in other ports in which ships have oily residues to discharge, of facilities for the reception of such residues and oily mixtures as remain from oil tankers and other ships adequate to meet the needs of the ships using them without causing undue delay to ships.

Chapter 3 Transport

3.1 Outline of Transport in Thailand

3.1.1 General

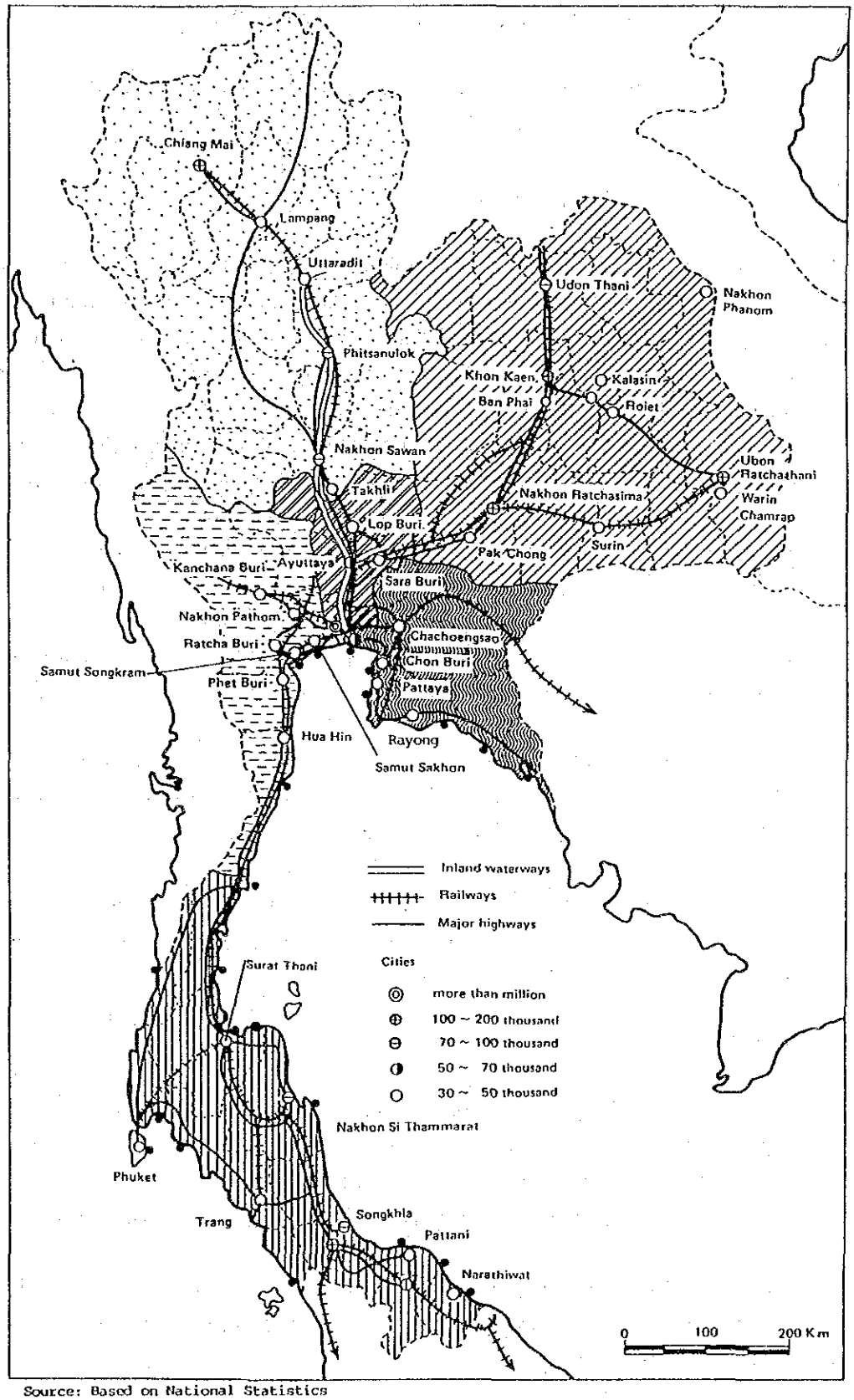
Before the start of the "Friendship Highway (Highway No.2)" project in 1955, transport by inland and coastal waterways, and railways had been the major for heavy and bulky cargoes in Thailand. After the completion of the road construction project, Thailand entered into a new era of road transport. In 1959, Thailand established the National Economic Development Board based on the recommendations of the IBRD, and, in 1961, the first national economic development plan was formulated by the board. Since the formulation of the first five-year plan, infrastructures for transport have been developed according to the subsequent five-year plans, resulting in the present well-developed transport systems comprising roads, railways, waterways and aviation (see Fig.3-1-1). Modal shares of freight transport in 1991 are shown in Table 3-1-1.

Table 3-1-1 Modal Split in Domestic Freight Transport 1991

Transport Mode	Freight			
	Million Tons	%	Million Ton · km	%
Road	300	89.4	56,064	89.3
Rail	8	2.3	3,259	5.2
Inland Waterways	13	3.9	1,627	2.6
Coastal Shipping	15	4.4	1,848	2.9
Air	0	0.0	11	0
Total	336	100.0	62,809	100.0

Source : Ministry of Transport and Communication

According to the current five-year plan, namely the 7th National Economic and Social Development Plan (1992-1996), high economic growth is projected onward to the year 1996. The plan also identifies present problems of infrastructures, and indicates the development guidelines in the field of transport.



Source: Based on National Statistics

Fig. 3-1-1 Transportation Network in Thailand

3.1.2 Seventh National Economic and Social Development Plan

An outline of the Seventh National Economic and Social Development Plan(1992-1996) in the field of transport is shown as follows:

a. Results of past development

The network of services is still incomplete and inadequate and unable to offer efficient, convenient and rapid service. Particularly, although infrastructure projects have been started, such as Laem Chabang commercial port, outer ring road around Bangkok Metropolis, the second stage expressway, and the elevated tollway etc., their actual implementation takes a great deal of time. A number of these projects have been facing delays at various stages of implementation, particularly in increasing the private sector's role in the provision of infrastructure services.

b. Lack of a central body at the policy level to coordinate various networks into a system

b.1 Transport. Responsible agencies within the transport sector still lack coordination of networks in various forms to become an integrated system.

b.2 Communication. The Telephone Organization of Thailand(TOT) and the Communication Authrity of Thailand (CAT) still lack effective coodination, and have overlapping responsbilities and duplication of services.

b.3 Water supply. The development of raw water resources is dispersed in various public agencies without a core or central agency to formulate adominstrative and management policies.

c. Targets of infrastructure development

c.1 Increase capability and efficiency of the transport sector to provide services which are convenient, rapid, safe and at lower costs, to support development of other sectors and enhance international competitiveness of the Thai economy to ensure appropriately high sustained economic growth.

c.2 Utilize the transport sector as accelerator or catalyst of development, leading to dispersion of development benefits to the regions and a better quality of life of the people.

c.3 Emphasize safety and quality of land, sea and air environmental conditions.

d. Development guidelines by sectors

d.1 Solution of traffic congestion problems and organization of urban transport system.

d.1.1 Speed up construction of ring roads around the city and alternative routes bypassing the city for large urban areas and for those who have no need to get into city center, which should help reduce traffic congestion in the inner corner areas.

d.1.2 Speed up construction of secondary road in the out skirts of Bangkok Metropolis, together with networks to be connected with the main roads in a systematic manner.

d.1.3 Construct a central passenger transit center with an integrated network connecting all modes of travel from train, mass transit rail system, air travel to bus services to facilitate intermodal connection of all means of transport.

d.1.4 Speed up construction of elevated rail tracks, mass transit rail, community rail, and expressway services, while ensuring consistency and coordination with other road networks, as well as facilitate greater use of expressway system by public buses, together with provision of bus stop where appropriate.

d.1.5 Enforce restrictive measures and organization of traffic system to reduce use of private passenger vehicles by encouraging greater use of mass transit system, as well as ensuring the most efficient utilization of road space, such as the enforcement of parking bans, and improvement of traffic control at intersections to support greater traffic flows etc.

d.1.6 Construct public truck depots in appropriate locations for transport of goods in city ares.

d.1.7 Encourage passenger transport services along the Chao Phraya river and other interconnected canals in Bangkok Metropolis and other vicinity towns in a systematic manner. The government will individually or in

cooperation with the private sector construct modern and safe water transport service stations for passengers, together with other facilities and services, such as access roads, car park and bus stops.

d.1.8 Improve organization and mechanism related to the solution of traffic problems to encourage more efficient supervision and coordination.

d.1.9 Promote public and private sector cooperation to alleviate environment problems caused by the traffic situation, including polluted air, excessive noise level, dust particles, and scenery. There must be a clear work plan for prevention and solution of environmental problems, the costs of which should be included as part of investment expenses of the project.

d.2 Land transport

d.2.1 Develop networks of inter-urban expressways, or special system and contribute to dispersion of development benefits to the regions.

d.2.2 Develop transportation by road, high speed rail and pipeline systems to meet the requirements of economic zone development in a timely manner.

d.2.3 Develop road and rail networks to respond to the demand of the expanding industrial and agricultural sectors by constructing, improving and upgrading road standards to link sources of raw materials, production units and consumers together.

d.3 Water transport

d.3.1 Develop and promote Thai merchant marine system by carrying out studies for long-term planning in development of the fleets and the number of docks, both in quantity and quality terms. Furthermore, encourage joint ventures with foreign companies and open up new shipping routes, together with establishment of Freight Booking and Cargo Consolidation Center, as well as coordinate air and sea transport services in order to boost efficiency in marketing of services, together with an adjustment of relevant tax measures in order to develop and promote the Thai merchant system.

d.3.2 Increase capacity of international seaports in accordance with development guidelines of coastal areas, designated as having high priority.

d.3.3 Accelerate improvement of work on planning, policy coordination and operation in connection with development of seaport, marine and coordination of networks to transport system and services which are port-related to ensure systematic and efficient movements of goods into and out of the seaport.

d.3.4 Develop international seaports for maximum utilization by developing related infrastructure facilities, such as road, rail, inland container depot(ICD), together with prior marketing exercises to fit in with timing of opening of port services.

d.3.5 Promote the private sector to invest in construction and operation of boat/ferry services for tourism. The government will facilitate private sector operation by the relaxation of rules and regulation, and will provide other related infrastructure support.

d.3.6 Encourage greater use of rivers, canals and coastal areas for transportation of goods and passengers, particularly for seaport which has already been constructed. In the latter case, the government must ensure maximum utilization of the port as soon as possible by promoting private sector role in administration and management of selective services.

e. Development of infrastructure facilities in the regions

e.1 Land transport

e.1.1 Develop expressway networks between cities, or special highway with controlled entries and exits to promote efficient transport system and redistribution of development benefits to the regions.

e.1.2 Develop land transport network to be linked with neighboring countries to ensure low transportation costs across the borders, as well as rapid and convenient transport of people.

e.1.3 Build, reconstruct and upgrade standards of national highways to enable the road system to fully handle traffic and transport volumes. In so doing, a drainage system should be built along the routes to prevent flooding.

e.1.4 Improve and reconstruct rural highways and local highways and for all-seasons transport, by giving emphasis to impoverished rural areas and border villages.

e.1.5 Modernize and enhance efficiency of train services by developing high speed train services in major economic areas. Service quality should be improved, particularly on security aspects, punctuality and convenience, and application of modern technology, as will as promotion of private sector participation to increase operational efficiency.

e.1.6 Stress importance of control measures and law enforcement to ensure strict adherence to land transport laws and regulations, particularly overloaded trucks and use of stimulants while driving.

e.1.7 Encourage either public or private organizations to build bus terminals in all provinces to facilitate people's travel all over the country.

e.2 Water transport

Promote fuller utilization of coastal ports and coastal freight transport, as well as improve dredging and maintenance of water channels in the shipping routes, with high priority to ensure adequate depth and water volume suitable for vessels.

3.1.3 Policy of The Ministry of Transport and Communications

The Ministry of Transport and Communications has the following policy as of April, 1993 in the field of transport and communications:

a. To construct land transport facilities to connect all parts of the country, which includes expansion to four traffic lanes on main roads and laying double tracks on all established rail lines.

b. To improve the traffic saturation problem in main cities by using a town lay-out system, expanding established roads, introducing a rapid mass transport system, encouraging driver discipline and taking action to prevent these same problems occurring in other cities in the future.

c. To lay the foundations for transport and communications to meet the rapid expansion both in the economic development of the country and society in the future. To assist with this, the Ministry will invite the private sector to invest and provide reliable and convenient transport and communications services for the public.

d. To develop international waterway and seashore transport by constructing piers to connect conveniently with land transport that will reduce the cost of transport throughout the country and help save energy.

e. To support Thailand as the center of the region and expand domestic air transport services throughout the country.

f. To develop, update and introduce new technology into the telecommunications network of the country, so that Thailand will be the economic and monetary system center in the region.

3.2 Road

3.2.1 General

According to the road regulation in Thailand, highways are classified into seven categories: special highway, national highways, provincial highway, concession highway, rural highway, municipal highway and sanitary highway. Expressway administrated by the ETA is another category. The highways included in the first four categories are under the Department of Highway. The authorities that administrate the above highways and the total length by each category are listed in Table 3-2-1.

Table 3-2-1 Total Length by Each Category

Administered by	Road Type	1991 Route kms
Department of Highways	National Highways	18,437
Department of Highways	Provincial Highways	27,163
Department of Highways	Construction/Minimum Maintenance	6,801
The Office of Accelerated Rural Development	Rural Roads	26,661
Public Works Department	Rural Roads	12,827
The Royal Irrigation Department	Rural Roads	11,178
Bangkok Metropolitan Administration	Municipal & Sanitary Highways	2,800
Local Authorities	Municipal & Sanitary Highways	N.A.1
Department of Local Administration	Rural Roads	N.A.2
Expressway and Rapid Transit Authority of Thailand	Special Highways	27

Remarks : 1 Latest available data : 11,900 in 1985 Source : MOTC, Department Land Transport

2 Latest available data : 82,400 in 1987

In the national highway network, paved roads account for 99.6% of the total approx. 18,437km in length. The highways radiate from Bangkok to principal regions and neighboring countries. In the provincial highways, paved roads account for 78.1% of the total, approx. 27,163km in length (see Table 3-2-2). The total length of the remaining roads is around 146,000km.

Table 3-2-2 Pavement Conditions of National and Provincial Highways

(Unit : km)

Fiscal Year	National Highways				Provincial Highways				Total			
	Paved	Unpaved	Under Const.	Total	Paved	Unpaved	Under Const.	Total	Paved	Unpaved	Under Const.	Total
1965	5,046	4,436	4,600	14,082	405	2,389	5,475	8,269	5,451	6,825	10,075	22,351
1970	8,260	1,781	4,284	14,325	1,479	4,413	11,426	17,318	10,099	6,194	15,710	32,003
1975	11,840	818	2,776	15,434	3,396	4,043	15,447	22,986	15,236	4,861	18,233	38,330
1980	13,733	160	980	14,873	8,670	5,587	14,709	28,966	22,403	5,747	15,689	43,839
1985	15,132	86	483	15,701	17,124	4,893	8,440	30,457	31,256	4,979	8,923	45,158
1990	17,401	85	959	18,445	22,531	5,428	5,901	33,860	39,932	5,513	6,860	52,305
1991	18,365	72	1,468	19,905	21,216	5,947	5,333	32,496	39,581	6,068	6,801	52,450

Sourse : Department of Highways,MOTC

3.2.2 The Five-Year National Highway Development Plan (1992-1996)

The Department of Highways indicated the following guideline and objectives for the development:

a. Objectives

a.1 To increase the highway transportation efficiency.

a.2 To raise the quality of life of the people in the rural area.

a.3 To ensure safety for road users.

b. Direction of Development

b.1 To develop "Inter-city Motorway" in order to increase the efficiency of the highway system.

b.2 To increase the highway structure standard by widening traffic lanes in highways connecting the Bangkok Metropolis with other regions, major cities and some special areas to reduce traffic congestion on highways.

b.3 To emphasizes reconstruction and rehabilitation of existing highways to function effectively.

b.4 To take the important role in traffic accident prevention to reduce the accidents on highways.

c. Project Plan

To correspond with the development direction and its objective, the definitions of the project plan are as follows:

c.1 The Inter City Motorways Project is to increase the efficiency and reduce the transportation cost. It will be the regional highway network and control access with at least two traffic lanes in both directions.

c.2 The widening traffic lane projects are to lesson and solve traffic congestion and to render the convenience in highway transportation. At present, the traffic volume is quickly increasing. The highways with two or even four traffic lanes cannot bear the increasing traffic volume. Then in the Master plan, the highways with over two or four traffic lanes in some routes from Bangkok to other regions and some major cities especially on Routes No.1,2,3 and 4 will be constructed.

c.3 Interchange and Flyover Construction Projects are to respond to the traffic congestion and accidents in big intersections. The construction will concentrate on areas with over 10,000/day vehicles on main highways and 8,000/day vehicles on secondary highways.

c.4 The New Alignment Construction Projects are to implement a completion highway network to connect potential ares from economic and social point of view, to open and to develop the new areas, or to serve as a bypass to solve the traffic congestion.

c.5 Paved road Construction Project is for the construction of laterite road to standard paved roads to reduce the bad pollution faced by the people who live on both sides of the roads, to reduce also the travel time and vehicle operating cost. The project will have a direct effect on the people's quality of life in the rural areas and will generate high income from the convenience in goods transportation to the market.

c.6 Flyover Across the Railway project is to help prevent the accidents in the intersections of highways and railways and to reduce lost time when the train is passing. It is also a part of accident prevention project.

c.7 The reconstruction and rehabilitation highway project is to strengthen the existing paved roads whose service lives have been exceeded lasted for or the road users' convenience and safety.

This highway development plan from 1992-1996 is composed of 667 projects with a total length of 14,681km. The total construction cost is 95 billion Bahts.(See attached Table 3-2-3)

Table 3-2-3 Highway development Plan (1992-1996)

Type of Project	Links	Distance (km)	Cost (Mill.Baht)	Budged Amount(Mill.Baht) 1992	1993	1994	1995	1996	1992-1996 Length(km)	Mill.Baht
Inter-city Motorway	5	198	14,800	0	0	700	2,800	5,700	122	9,200
Widening Project	98	2,394	30,036	935	3,177	6,176	7,330	7,070	1,891	24,688
Interchanges and Flyovers	38	14	6,004	0	362	1,124	1,703	1,813	15	4,802
New Alignment Construction	61	987	6,882	75	743	1,600	1,674	1,583	790	5,675
Paved Road Construction	215	5,086	15,221	89	1,200	2,832	3,552	4,235	4,002	11,908
Flyover Across the Railway	15	7	627	0	0	60	199	230	6	489
Reconstruction/Rehabilitation	235	5,995	22,263	0	1,472	4,517	6,444	5,557	4,793	17,990
Total	667	14,681	95,833	1,099	6,954	17,009	23,702	25,988	11,619	74,752

Source : Department of Highways,MOTC

3.2.3 Traffic Congestion in Bangkok Metropolis and Bangkok Port

Along with the recent rapid economic growth in Thailand, especially in and around Bangkok Metropolis, the urban areas of the metropolis suffering from serious traffic congestion. Average traffic speed in the area is 6km/hr during peak traffic times. In and around the Klong Toei Wharf of Bangkok Port which is located in the above urban areas, traffic congestion is also serious partly due to the traffic generated by urban activities and partly to the traffic generated by port activities. Even inside the port, traffic accidents often occur and the number of accidents shows an upward trend year by year along with the increase of the volume of cargoes through the port (see Table 3-2-4).

Table 3-2-4 Traffic Accidents in Bangkok Port

Year	No. of Accidents	Fatalities	Volume of Freight Handling(Ton)
1988	38	2	10,446,908
1989	68	3	11,984,964
1990	136	3	13,834,343
1991	169	4	15,372,147
1992	170	5	16,114,564

Source : Port Police, Stastic Division, PAT

Due to the Bangkok's traffic congestion, E.T.A and Traffic Officer have regulations prohibiting certain trucks as follows:

a. Regulation by E.T.A Officers

Vehicle Type : 10-wheel truck & trailer
Prohibited Time : 6:30 a.m.-8:30 a.m. excluding national holidays
Route : Bang Na-Klong Toei Port(Chalerm Mahanakorn Express way)

b. Regulation by Police Deprtment Officers

Vehicle Type : 4-wheel truck & 6-wheel truck
Prohibited Time : 6:00 a.m.-9:00 a.m.,16:00-20:00 excluding national holidays
Route : Every route in Bangkok area
Vehicle type : 10-wheel truck, over 3 axles & trailer
Prohibited Time : 6:00 a.m.-10:00 a.m., 15:00-20:00
Vehicle Type : Heavy lifted truck
Prohibited Time : 6:00 a.m.-21:00
Route : 1) Arch Narong road from Klong Toei Port-Expressway
2) Kasem Raj road from Klong Toei Port-Expressway
3) Every route of Expressway
4) Suvintavong road from Ram Indra junction-End of Bangkok area
5) Rom Klao road from Ram Indra junction-On Nuch junction
6) On Nuch road from Rom klao junction-Hihgway No.3256(Lard Krabang-On Nuch)
7) Highway No.3256(Lard Krabang-On Nuch) from On Nuch junction-End of Bangkok area
8) Bang Na-Trad from Sukhumvit junction-End of Bangkok area

9) Sukhumvit from Bang Na-Trad junction-End of Bangkok area
10) Rama 2 road (Tonburi-Pak Tho) from Suk Savat road-End of Bangkok area
11) Suk Savat road from bridge across Dao Kanong canal- End of Bangkok area
12) Somdej Prajao Taksin road From Mahaisawan junction- Bridge cross Dao Kanong canal
13) Mahaisawan road from Taksin junction -Charoen Krung junction
14) Krungthep bridge
15) Rama 3(Liab Chao Phraya River)from Charoen Krung junction-Expressway
16) Nimitr Mai Road from Suvintavong junction-End of Bangkok
17) Highway No.340(outer ring road)from Bangkok Noi-Nakorn Chaisri junction-End of Bangkok area
18) Bangkok Noi Nakorn road from Highway No.340-End of Bangkok area
19) Phuthamontol 2 road from Bangkok Noi-Nakorn Chaisri
20) Petch Kasem road exit side from Jaran Sanitivang junction- Petch Kasem junction end of Bangkok, Entrance side from Highway No.340(outer ring road)-End of Bangkok
21) Rachadapisek road from Taksin junction-Jaran Sanitvang junction

ETO (state enterprise) and trucking companies conduct forwarding business for cargoes from/to Bangkok Port. The regulations to restrict the traffic of heavy vehicles are applied to ETO and the above trucking companies without exception. The amount of freight handled by ETO in 1989 totaled 5,990,047 tons, accounting for 50% of the total volume through Bangkok Port. According to Table 3-2-5, 74% of the hauls by ETO's trucks is less than 35km in terms of the distance per haul from/to the port and origins/destinations outside the port. Presently, the number of trips of ordinary trucks and tractor-trailer units are 2,000 and 600 times/day on average.

Table 3-2-5 Distribution of Truck Utilization for ETO Truck Jan., 1993

(Jan, 1993)

Distance In Kilometers From The Port		<5 km	<10 km	<15 km	<20 km	<25 km	<30 km	<35 km	<40 km	<50 km	<60 km	>60 km	Total
Type Of Cargo	A	289	2,224	2,574	1,684	1,945	1,572	1,072	926	1,036	685	21	14,028
	B	32	98	80	242	93	109	118	59	22	123	1	977
	C	57	96	64	338	244	284	131	84	88	40	1	1,347
	D	12	312	128	70	219	122	10	5	37	47	4	966
Total		390	2,730	2,846	2,334	2,501	2,087	1,331	1,074	1,183	895	27	17,318

A : General Cargo, B : Dangerous Cargo, C : Cargo To Storage, D : Used Engine

Source : Express Transport Organization (ETO)

3.2.4 Highway Projects Supporting the Eastern Seaboard Development

Newly developed Laem Chabang Port is expected to receive not only cargoes from/to the areas around Laem Chabang Port but also cargoes overflowed from Bangkok Port which seems to be already saturated. To promote such cargo flow from the areas in and around Bangkok Metropolis and Laem Chabang Port, it is essential to develop infrastructures of roads and railways connecting them. For that purpose, the following highway projects are proposed in the Eastern Seaboard Development Plan (see Fig. 3-2-1):

a. Eastern Bangkok Outer Ring Road(New highway Construction)

This new highway will start in Bang Pa In at the intersection of Route 1 and Route 32, from whence it follows a new alignment around the Eastern extremities of the capital before jointing Route 34,(Bang Na-Bang Pakong) at Bang Phli. Total length will be about 62 kilometers. The construction is expected to begin in 1993.

b. New Bangkok-Chonburi Highway Project(New highway Construction)

This new special highway having 4-6 Traffic Lanes will be constructed on a new alignment beginning at the intersection with Rama 9 Road, passing through Lad Krabang, and ending at Chonburi where it will connect with the existing Chonburi Bypass. The total length will be about 83 kilometers. This project is under construction and a part of the route has already been opened to the public.

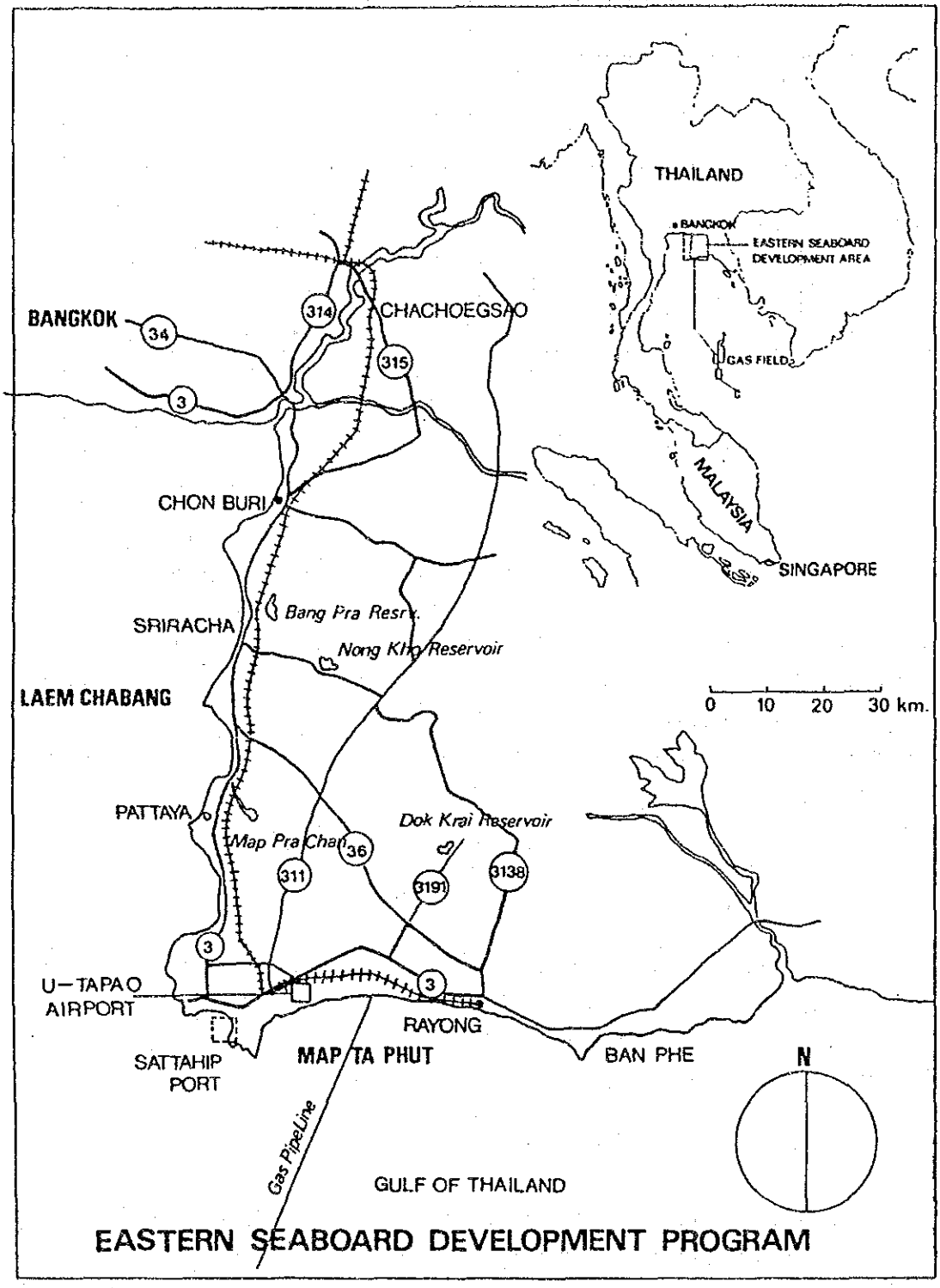


Fig. 3-2-1 Eastern Seaboard Development Program

c. Chonburi-Pattaya highway(New Highway)

The new Chonburi-Pattaya highway includes the existing Chonburi Bypass which is already being rehabilitated with a concrete road pavement and widened into a 4-lane divided highway. The remainder of the project is already under construction on a new alignment, parallel to and east of the existing Sukhumvit Road with a spur road connecting to the new port at Laem Chabang. Both directions will have 7 meter wide concrete pavements with 2.5 meter wide asphalt surfaced shoulders. There are 5 interchanges to be constructed. The whole project will be completed in 1994, it will relieve the burden on the Bang Na-Bang Pakong-Chonburi highway which is already carrying a traffic volume in excess of 50,000 vehicles daily.

d. Highway Route 34,Bang Na-Bang Pakong(Widening Project)

The existing Highway No.34 from Bang Na to Bang Pakong is the primary route for traffic traveling between Bangkok and the Eastern Seaboard. The existing divided highway is already being widened by the construction of Frontage roads on both the inbound and outbound directions. Each frontage road consists of a 7 meter wide asphalt shoulders. The total length of construction is 21.7 kilometers. A part of the first sections has already been completed, but the whole project will not be completed until 1993.

e. Minburi-Chachoengsao-Phanom Sarakham(Widening and Rehabilitation)

The existing Highway No.304 connects Bangkok with the Eastern Part of the Central Region and, also provides an alternative access to Nakhon Ratchasima Province. The existing heavily trafficked 2-lane road is already being widened into a 4-lane divided highway with a concrete road pavement constructed in both directions. Each pavement will be 7 meters wide with 2.5 meters wide asphalt shoulders when the whole 100 km. Project will be completed at the end of 1994.

f. Bang Pakong-Chachoengsao(Widening and Rehabilitation Project)

The existing Highway No.314 is being rehabilitated and widened into a 4-lane divided highway with concrete road pavements. Project will be completed in 1993.

g. Sukhumvit Road(Rehabilitation and Widening project)

The present 4-lanes divided highway will be extended to Sattahip and Rayong, in order to support the Eastern Seaboard Project. The total length of construction

required is about 64 kilometers. The construction is expected to begin this year and will be completed in 1994.

3.2.5 Expressway Development Plan

The Expressways and Rapid Transit Authority of Thailand(ETA) is responsible for construction and maintenance of expressway. Bangkok Port has 2 checking posts (west gate, east gate) that access to expressway(1'st stage expressway). ETA set up Expressway Development Plan as shown in attached Table 3-2-6.

Table 3-2-6 Expressway Development Plan

	Route	Distance (km)	Opening Year	Construction Cost(million baht)	Remarks
1'st Stage	Din Daeng-Port	8.9	1982		
	Bangna-Port	7.9	1983		
	Dao Kanong-Port	10.3	1987		
	Sub-Total	27.1		8,519	
2'nd Stage	North-South Chaeng Wattana-Bang Khlo	25	1993		B.O.T method
	East Phaya Thai-Srinakharindra	13	1995		
	Sub-Total	38		20,000	
	Atnarong-Ram Indra	18.7	1995	11,000	
3'rd Stage	Nonthaburi-Bang Kapi-Minburi Bangna-Samutprakarn		after 1998		B.O.T method
4th Stage	Under the feasibility study		after 1997		

Source : ETA

3.2.6 Road Traffic Investigation

On May 12th, 1993, road traffic investigation was conducted to grasp the data of present traffic condition in and around Bangkok Port. Traffic survey included interview survey to truck drivers at the two checking posts for analyzing actual traffic condition such as traffic volume originating from or destined to the hinterland of Bangkok Port classified by region. From results of investigation, total traffic volume in and out of Bangkok Port was 51,129 vehicles including 38,035 passenger cars and motorcycles. High persentage of passenger cars and motorcycles is one of the reasons of traffic congestion. Data results are attached to Appendix 2.

3.3 Railway Transportation

3.3.1 Railway Network

The railway system is managed and operated by the State Railway of Thailand (SRT) which was first set up as a government department; however it afterwards became an independent legal entity under the SRT Act of 1951, taking over the business as well as the assets and liabilities of the State Railway Department. The first inauguration line commenced in 1892 and the line was then extended to Nakhon Rachasima in 1900, with a distance of 264 kilometers. For all the earlier lines, the railway tracks used the 4 feet 8.5 inches gauge system. From the year 1900 onwards, the construction of the southern main line had brought into use the one meter gauge system, the intention was to link Thailand with Malaysia and the Union of Myanmar. The conversion to meter gauge system was decided upon in 1919, and completed in 1930. At the end of the fiscal year 1990, the length of the railway lines totaled of 4,609 kilometers. Starting from the Bangkok Station, the Southern line connects with the Malaysian Railway at Padang Besar and Sungai Kolok in the South. Railway construction between Si Racha to Laem Chabang began in the middle of 1991. SRT and American President Line (APL) reached an agreement in May 1992 for container management and operation at Bang Sue Terminal, and for the general container transportation for 5 years term. In the first month after reaching the agreement, SRT had the transport quantity of 760 TEUs/month which was 608,000 Baht/month for freight calculation. The volume increased accordingly till it reached 5,553 TEUs/month which is 9,525,600 Baht/month for freight calculation at present.

3.3.2 The Construction Investment and Operation at Paholyothin Terminal

APL(private company) has developed the area to be able to support a transportation volume of up to 120,000 TEUs/year and has all the facilities as follows:

a. In/out container stacking area at the back of Phaholyothin Terminal able to stack 1,084 TEUs of container each time if double stacked, or 1,626 TEUs if triple stacked.

b. Trailer and empty container stacking area in front of Phaholyothin Terminal able to park 116 trailers each time with the parking lot of about 40 cars.

3.3.3 Present Rail - Container

a. Eastern : transport from Phaholyothin terminal to LCP

b. Northern : transport from Mae Nam station and Phaholyothin terminal to Pa Sao, Sarapee and Chiengmai Station

c. North - Eastern : transport from Mae Nam station to Udorn Thanni station

d. Southern: transport from Mae Nam station and Phaholyothin terminal to Had Yai and Padang Bezarr station

3.3.4 Future Rail-Container Project

a. ICD Lard Krabang project : To transport between Lard Krabang station to Laem Chabang Port which is now under construction and may be finished by the end of 1994

b. Klong Sip Kao to Kaeng Koi Rail road Construction Project : To support the transportation in north-eastern route which may be finished in the middle of 1995

c. Establish Saraburi Station as an Temporary Container Loading : To support the transportation of Saraburi Industry Estate which is now under the selection of appropriate site

d. Bangkok Garbage Carrier in Container System by Train from Ban Tab Chang Station to Drop in Eastern Province : Waiting for assessment from feasibility study

e. Establish Container Terminal at Koan Kaen : Feasibility study now being undertaken.

f. The Intersection Construction Project from Klong Pudsa Station to Bang Pa-in Land Co.,Ltd.from Bang Pa-in Station to Hi-tech Industrial Estate.from Hua Takae Station to Container Terminal of N.H Property Co.,Ltd. : Under consideration

3.3.5 Handling Charge for container transport from Bangkok(Bang-Sue) to Laem Chabang Port is as follows;

a. 1,400 Bahts for 20 ft.container(TEU)
b. 2,800 Bahts for 40 ft.container(FEU)

Above charges are same for empty container, full container, departure or arrival between Bang Sue to Laem Chabang.

3.3.6 Double Track Train Project

Double track railway project around Bangkok is as follows :

	Route		Distance
North	: Rangsit	- Lop Buri	104 kms
East	: Huamak	- Cha Choeng Sao	45 kms
South	: Bang sue	- Nakorn Patom	41 kms
North-east	: Ban Pa Chee	- Mab Ka Bao	44 kms

Details of double track railway projects are shown in Appendix 3.1.

3.3.7 Elevated Way Project

Ministry of Communication and State Railway of Thailand signed the contract with Hopewell Co. on November 9th, 1990. This elevated way project type is a combined expressway mass transit. The concession routes consist of 60.1 kms of railway and split into two distinct lines in Bangkok. The whole project is scheduled for completion in December 1999.

Details of Elevated Way Project are shown in Appendix 3.2.

3.4 Marine Transport (Excluding Riverine Shipping/Coastal Shipping)

3.4.1 Outline of Marine Transport

In recent years, marine transport activities involving Thailand have been developing remarkably in line with the great strides being taken to improve the socioeconomic situation of the country. According to the MOTC's 'TRANSPORT STATISTICS in 1991' international shipping accounted for 76.4% of the value and 95.2% of the quantity of the total foreign trade for the year, highlighting the important role of marine transport.

Keeping in step with the global practice of container shipment, most of the general cargoes have been containerized; as for the other major commodities such as mineral oils, raw materials, steel products, cereals, vehicles etc, conventional ships, tankers, and/or bulk carriers are employed. Based on the customs's data of 1992, the distribution ratio of total shipping cargoes is estimated at about 20(container):80(others) in terms of quantity.

Those cargoes are being handled at five major ports, among which Bangkok port complex shares in almost all types, i.e. containers are handled mostly at the East Quay while other commodities are handled at several public berths and 72 private berths scattered along both banks of the Chao Phraya river. (See Chapt.6.6.2)

3.4.2 Major Commodities

Major imported/exported commodities with respective shares in 1991 are listed in Table 3-4-1. (MOTC' Transport Statistics, 1991)

Table 3-4-1 Major Imported/exported commodities with each share in 1991

Value	%	*Volume*	%
		IMPORT	
1. Boiler Machines	19.8	1. Mineral Oil	43.8
2. Mineral Oil	11.8	2. Salt Sulfur, Cement	14.3
3. Electrical Machinery	10.2	3. Fertilizer	5.1
4. Iron & Steel	10.0	4. Wood & Articles	2.9
5. Vehicles	7.0	5. Organic Chemicals	2.5
6. Organic Chemicals	3.5	6. Spirit Vinegar Beverage	2.1
7. Fishery Products	3.3	7. Boiler Machines	1.7
8. Artificial Resin, Plastic	3.1	8. Fishery Products	1.3
9. Cotton	2.4	9. Inorganic Chemicals	1.3
10. Iron/Steel Products	1.8	10. Wood Pulp	1.2
11. Special Transaction	1.7	11. Cereals	1.0
12. Salt Sulfur, Cement	1.6	12. Artificial Resin, Plastic	1.0
13. Wood & Articles	1.4	13. Paper	0.9
Others(86 Articles)	22.4	Others	20.9
		EXPORT	
1. Electric Machinery	10.2	1. Salt Sulfur, Cement	21.7
2. Textile Goods	8.5	2. Vegetable	21.3
3. Fishery Products	7.1	3. Cereals	17.6
4. Cereals	6.4	4. Sugar & Confectioneries	12.7
5. Boiler Machines	6.1	5. Rubber & Synthetics	3.5
6. Processed Fish Foods	5.4	6. Mineral Oil	3.0
7. Apparel & Clothing Acc.	4.9	7. Prep. of Veg./Fruits	2.7
8. Rubber & Synthetics	4.8	8. Milling Products	2.1
9. Vegetables	4.0	9. Processed Fish Foods	1.4
10. Footwears	4.0	10. Artificial Resin, Plastic	1.1
11. Prep. of Veg./Fruits	3.3	11. Fishery Products	1.0
12. Staple Fiber	2.5	12. Iron/Steel Products	0.9
13. Furniture	2.4	13. Electric Machinery	0.6
Others(86 Articles)	30.4	Others	10.4

Remark:

Crude oil is imported at Siracha Oil Terminal by huge tankers and refined products are distributed to consuming districts by coasting tanker vessels.

3.4.3 Number & Size of Calling Vessels at Major Ports

(1) Increase of Vessels

The number of seagoing vessels calling at major Thai ports has been increasing for years, e.g. the rates of increase in Bangkok complex(1987-1992), Sattahip(1987-1991), Songkhla(1989-1992), and Phuket(1989-1992) were 52%, 176%, 222% and 202%, respectively. As for Bangkok complex, the increasing rate at the private wharves of 82%(1987-1992) was particularly remarkable. However, the trend of steady growth which continued till 1990 has been gradually reducing in recent year. Based on the MOTC's Transport Statistics combined with the PAT's Annual Report, the transition in number of calling vessels is shown in Table 3-4-2.

Table 3-4-2 No. of calling Vessels at major ports in the last six years

PORT	*1987*	*1988*	*1989*	*1990*	*1991*	*1992*
Bangkok Complex	4,180	5,010	5,787	6,366	6,367	6,364
Wharves, Bangkok port	1,807	2,072	2,203	2,354	2,395	2,517
Klongtoey dolphins	337	384	428	421	410	417
Bang Hua Sua dolphins	217	202	189	253	279	272
Sathupradit anchorage	212	216	198	269	231	230
Private wharves	1,607	2,136	2,769	3,069	3,052	2,928
Laem Chabang	-	-	-	-	68	223
Sattahip	63	118	185	239	174	-
Map Ta Phut	-	-	-	-	-	37
Songkhla	-	-	145	307	284	467
Phuket	-	-	198	124	464	598

(2) Larger Vessels

In addition to the increase of calling vessels, the size of vessel shows a tendency to become lager. In 1982, the majority of ships fell in the 1,000 - 2,999 NRT type(42%) followed by the 5,000 - 9,999 NRT type(20%) and the 3,000 - 4,999 NRT type (16%); but in 1991, these shares had changed to 30%(1,000 - 2,999 NRT), 23%(5,000 - 9,000 NRT) and 22%(3,000 - 4,999 NRT), respectively. Based on the MOTC's statistics, the transition in number of calling vessels by size is shown in Table 3-4-3.

Table 3-4-3 Transition in number of calling vessels by size in the last ten year

Size of Vessel	*1982*	*1987*	*1988*	*1989*	*1990*	*1991*
less than 999	577	454	657	916	981	868
1,000 - 2,999	**1,676**	**1,817**	**1,906**	**1,969**	**2,164**	**1,945**
3,000 - 4,999	**651**	**764**	**1,048**	**1,248**	**1,309**	**1,433**
5,000 - 9,999	**786**	**901**	**982**	**1,173**	**1,313**	**1,489**
10,000 - 14,999	104	251	275	314	440	428
15,000 - 19,999	12	26	41	50	68	93
20,000 - 24,999	36	38	34	44	54	58
25,000 - 29,999	50	30	16	27	23	33
30,000 - 49,999	95	110	99	117	113	117
50,000 - 59,999	12	4	12	5	5	-
60,000 - 74,999	8	2	9	2	2	-
75,000 - 99,999	3	-	7	2	4	1
more than 100,000	-	-	1	-	-	-
Total	4,010	4,397	5,087	5,867	6,476	6,465

3.4.4 Thai Merchant Fleet and Government Policy on Marine Transport

(1) Thai Merchant Fleet

Thai holding fleet of large than 500 GRT vessel has reached 800,000 GRT (1,230,000 DWT) in 1992. Although the fleet is gradually growing, the transport capacity still leaves something to be desired.

The fleet composition as of 1992 is shown in Table 3-4-4.

Table 3-4-4 Thai Merchant Fleet(1992)

Source: Lloyd Maritime Directory (larger than 500GRT)

Owner	*Type*	*Number*	*GRT*	*DWT*	*Flag*
AMARIN SHIPPING	GC	2	3021	3904	T(T:THAI)
AREEVANICHAKUL	TANK	1	2255	1212	T
C.P.COMPANY	TANK	17	21296	43936	T
C.S.K.MARIN	TANK	4	2839	5351	T
CHARINDHORN CO.	GC	1	1089	1603	T
CHARINDHORN CO.	TANK	1	1781	2874	T
COASTAL SHIPPING CO.	TANK	1	499	1001	T
COASTAL SHIPPING CO.	BULK	1	9731	17214	T
COASTAL SHIPPING CO.	GC	6	12629	22912	T
COSMO OIL CO.	TANK	1	3928	6170	T
GREAT CIRCLE SHIPPING	BULK	2	19431	33751	PANAMA
GREAT CIRCLE SHIPPING	GC	8	71142	117863	PANAMA
IMG CO.	REEFER	2	2253	3158	T
INDOTHAI	REEFER	1	1161	1581	T
INDUSTRY PROMOTION ENT.	CHEMI.T	2	7584	11911	T
INDUSTRY PROMOTION ENT.	TANK	1	2903	4723	T
JALAPRATHAN CEMENT	CEMENT	1	1542	1684	T
JOLLISTER SHIPPING	GC	1	6878	12016	PANAMA
JURAIRAT LTD.	LPG	4	4761	4629	T
JUTHA MARITIME CO.	GC	5	45198	61430	T
MAH BOONKRONG SHIPPING	GC	4	27112	35432	T
NARAI SHIPPING	GC	1	5770	8669	T
NEPTUNE MARITIME	GC	2	5234	9656	T
DARA SAMUT	GC	1	2987	5976	T
P.I.N.K.	TANK	1	1046	2536	T
PETROL LINE	TANK	5	10137	18629	T
PETROLANE LP GAS	LPG	4	3497	3078	T
PHULSAWAT NAVY CO.	GC	12	37638	63166	T
REGIONAL CONTAINER LINE	GC	8	68904	96152	T
REGIONAL CONTAINER LINE	GC	6	41564	59260	SINGAPORE
SAHAKIJ VIRIYA CO.	GC	1	4794	6060	T
SANG THAI MARITIME	GC	20	52174	92657	T
SAETRAN SHIPPING CO.	TANK	2	2377	3914	T
SAETRAN SHIPPING CO.	FERRY	1	2210	466	T
SAETRAN SHIPPING CO.	GC	1	1128	571	T
SIAM CHEMICALS	GC	1	5523	8100	T
SIAM CRUISE CO.	RO/RO	1	5097	115	T
SIAM UNITED SERVICES	TANK	5	5214	12420	T
SIRICHAI FISHERIES	REEFER	1	1573		T

Owner	*Type*	*Number*	*GRT*	*DWT*	*Flag*
SONGSERM TRAVEL CENTER	RO/RO	1	2822	856	T
SUTHAROM	GC	5	9416	13272	T
T.J.T. SERVICES	TANK	7	11178	15381	T
T.J.T. SERVICES	GC	1	2228	3517	T
TCP MARINE CO.	TANK	2	2294	4473	T
THAI INTERNATIONAL	GC	2	16903	27073	T
THAI MERCANTILE MARIN	GC	5	40055	55300	T
THAI OCEAN MARITIME NAV.	GC	1	2629	4626	T
THAI OIL CO.	TANK	8	18258	26846	T
THAI SHIPPING/CHARTERING CO.	GC	2	18024	28458	PANAMA
THAI SHIPPING/CHARTERING CO.	GC	1	9058	15139	MALAYSIA
THAIVIROJ CO.	GC	1	3982	6147	T
THAVATCHAI	GC	1	1585	2533	T
THORESEN	GC	7	65779	92207	T
UNITED HI-TECH	TANK	1	1842	3883	T
UNITED THAI SHIPPING	GC	3	39681	62359	T
UNITED THAI SHIPPING	BULK	1	12143	20814	T
UNITED TRANSPORT	GC	1	1049	1698	T
WANSHAI SANGSUKIAM	REEFER	2	1891	2255	T
WONG SAMUT NAVIGATION	GC	5	16696	28261	T
WORLD GAS CO.	LPG	3	3449	3190	T
WORLD GAS CO.	TANK	2	3393	6334	T
Total		**202**	**800,070 GRT**	**1,226,688 DWT**	

Summary by Type

Type	**Number**	**GRT**	**DWT**
GC	115	619,870	946,017
BULK,CEMENT	6	52,662	89,731
REEFER	6	6,878	6,994
TANK, CHEMI.,LPG	72	110,531	182,509
FERRY, RO/RO	3	10,129	1,437
Total	**202**	**800,070**	**1,226,688**

(2) Policy on Marine Transport

In 1978, The Merchant Marine Promotion Act was enacted; since then Thai flag fleet has been admitted following priority;

* The Maritime Promotion Commission may set the cargo allotment for Thai flog vessels, and lightening tax against a shipper/consignee who carries the cargo by Thai flag vessels.

* All imported cargo from Japan, Korea, Taiwan, Hongkong, Europe and USA by the Government shall be carried by Thai flag vessels excluding crude oil, ODA commodities under a specified contract, and certain cases in which permission of the Government is issued.

Chapter 4 Principal Ports

Ports in Thailand are divided into sea ports which face the Gulf of Thailand or Andaman Sea and river ports which were developed along rivers (Fig. 4-1, Fig. 4-2). Sea ports which are mainly used for international trade and capable of accepting big vessels are called deep sea ports. On the other hand, sea ports for domestic trade are called coastal ports. Principal ports for international trade are Bangkok Port (Klong Toei Port), which is the only river port used for international trade, Laem Chabang Port, Map Ta Phut Port, Songkla Port and Phuket Port. (cf. Appendix 4)

Among these ports, only Bangkok Port has long been in operation as a gateway to Thailand. The port area of Bangkok Port is about 65km up to Rama 6 Bridge from the mouth of the Chao Phraya River. Klong Toei Port which is managed by PAT is situated about 28km from the mouth of the river on the left bank. There are many terminals other than Klong Toei Port and among them there are three private terminals which handle container cargo.

The other ports for international trade have opened just recently.
Songkla Port and Phuket Port were opened in 1988. Laem Chabang Port and Map Ta Phut Port were opened in 1991 and 1992 respectively as key projects of the Eastern Seaboard Development Plan.
In addition, there is Sattahip Port on the eastern seaboard. This port, which is at present used as a military port, was used temporarily until 1991 as a commercial port before the opening of Laem Chabang Port.

River ports are distributed along the Chao Phraya River and are mainly used to shuttle goods to and from the Bangkok area. Most of the ports only have wooden jetties. There are about thirty coastal ports and most of them are located along the Gulf of Thailand Coast and Andaman Sea Coast in South Thailand. As most of the coastal ports are located at the mouth of the river, these ports need constant dredging to maintain the water depth.

Besides these ports, there is a berthing area of Si Racha just north of Laem Chabang Port and is used by big vessels for importing oil or exporting tapioca.

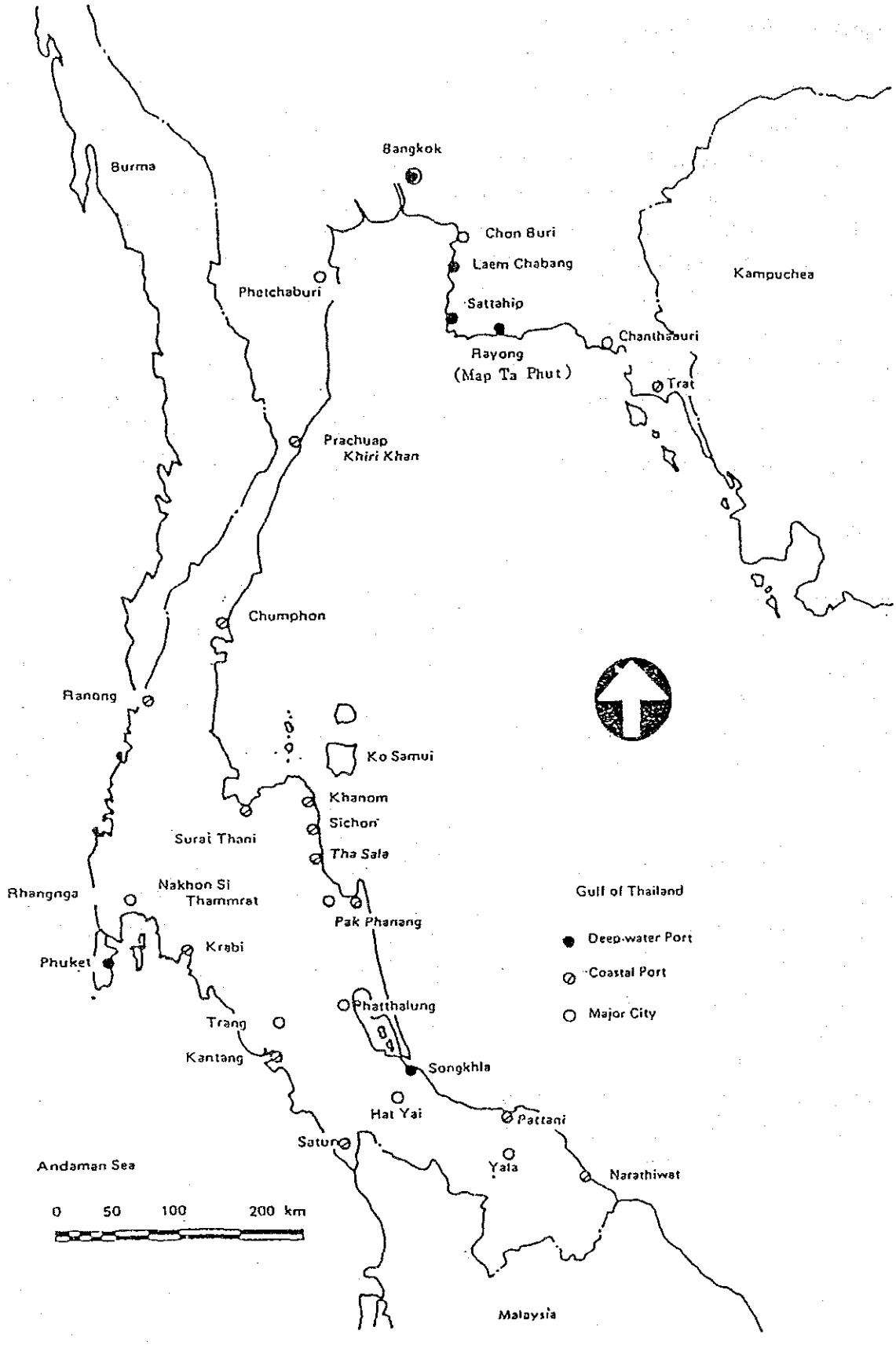


Fig. 4-1 Location of Sea Ports in Thailand

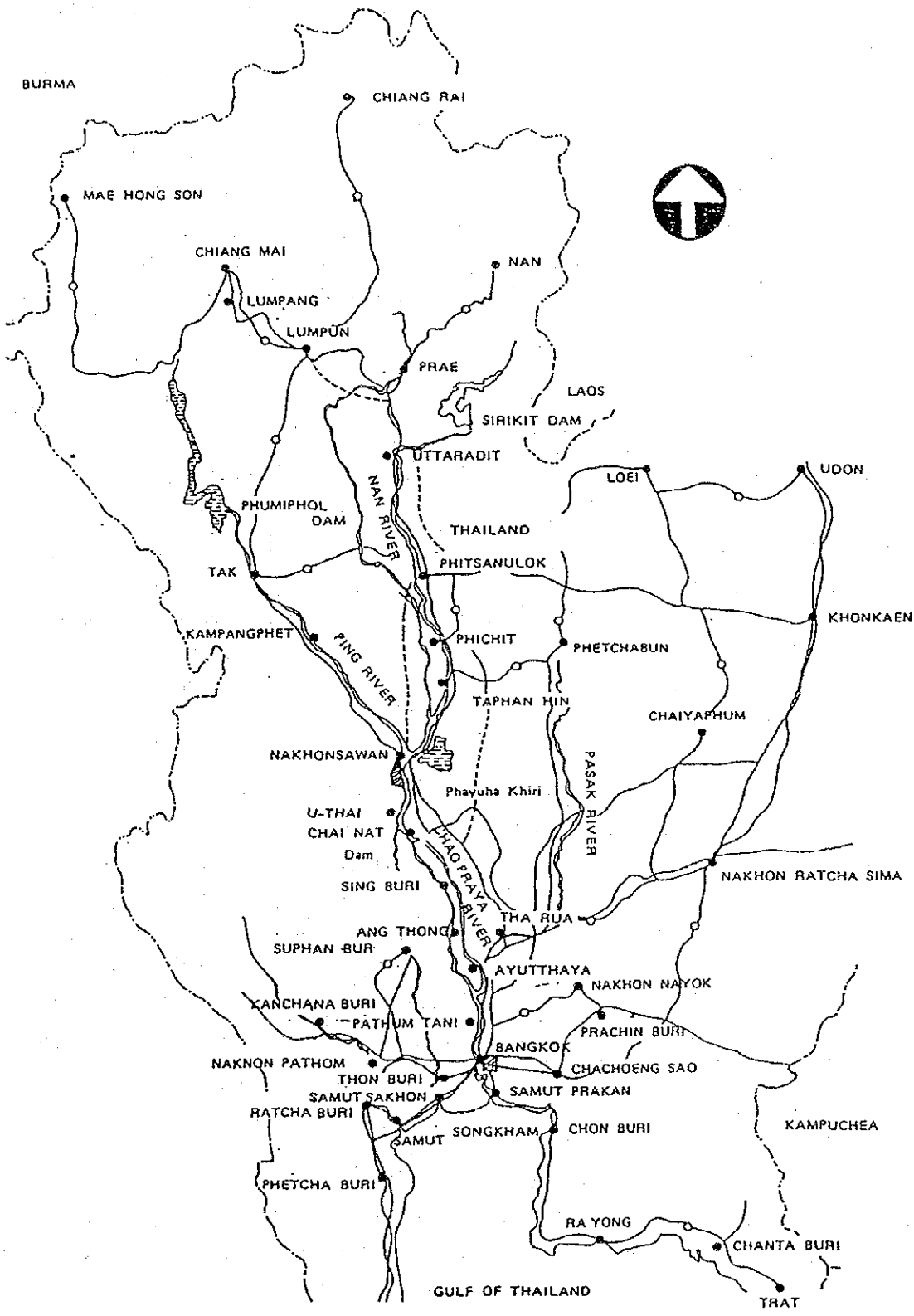


Fig. 4-2 Location of River Ports in Thailand

Table 4-1-1 shows foreign trade volume by commodities of maritime transportation from 1982 to 1992. These figures suggest that about 49.7 million tons of imports and 34.3 million tons of exports in 1992 were handled in the ports of Thailand.

Concerning the volume of imports, Mineral Fuel Oil Wax ranks first (45.6 % of total imports) followed by Metal & Steel (17.3%), Fertilizer (5.7%), and Chemical Products (5.3%) in 1992. Since 1982, main commodities which have increased their proportion of total volume are Metal & Steel (13.2%→17.3%), Fresh & Frozen Food (0.3%→1.4%) and Other Food Stuff (1.7%→2.9%). Conversely, the proportion of Mineral Fuel Oil Wax has fallen (61.1%→45.6%).

Concerning the volume of exports, Agricultural Product, Food Product & Frozen Goods ranks first (62.1% of total exports) followed by Mineral (19.4%), Plastic Product & Other Rubber Article (4.5%), Metal Machinery Electrical (2.3%). Among Agricultural Product, Food Product & Frozen Goods, Edible Vegetable such as tapioca ranks first(39.5% of Agricultural Product Food Product & Frozen Good), followed by Cereal such as rice and maize (23.6%), Sugar and Confectionery (23.0%), Preparation of Vegetable Fruit Plant such as pineapple (4.1%), Product of Milling Industry such as cassava flour and cassava starch (3.3%) in 1992. As compared with 1982, the proportion of Agricultural Product Food Product & Frozen Goods has decreased (89.4%→62.2%). The proportions of other commodities have increased.

Table 4-1-2 shows total import and export volume of Thailand and total import and export volume of Klong Toei Wharf by commodity in 1992.
Commodities handled at Klong Toei Wharf which represent a high proportion of the total volume of Thailand are Vehicle Car Spare Part, Electric equipment, Jute-Cotton-Kapok and Machinery & Used Engine in import and Textile Yarn Leather Product, Kanef Cotton Kapok and Metal Machinery Electrical in export. On the other hand, commodities handled at Klong Toei Wharf which represent only a small proportion of the total volume of Thailand are Mineral Fuel Wax, Fertilizer, Fresh & Frozen Food, Metal & Steel and Chemical Products in imports and Mineral, Chemical Product and Agricultural Product Food Product & Frozen Good in exports.

Klong Toei Dolphins, Bang Hua Sua Dolphins and Mooring Buoys at Sathupradit which are operated by PAT handled 995 thousand tons, 925 thousand tons and 414 tons respectively in imports in 1991. Main commodities are Wood, Chemical Liquid, Dangerous Chemical Product, Paper and Metal & Steel.
Klong Toei Dolphins handled 569 thousand tons in exports in 1991. Main commodities are Vegetable Product, Rice and Mineral Product. The volume handled at Bang Hua Sua Dolphins and Mooring Buoys at Sathupradit is unknown.

Table 4-1-1 Foreign Trade Volume by Commodities of Maritime Transportation

Import

Unit: Tons

Commodity	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
01 Vehicle, Car Spare Part	215,743	1,658,396	243,029	193,412	229,489	439,215	294,839	568,379	715,812	367,527	464,930
02 Machinery & Used Engine	249,940	238,591	307,706	215,523	140,472	259,406	421,048	535,931	713,000	784,406	577,268
03 Electric Equipment	61,610	77,463	97,102	62,401	55,783	64,113	111,215	159,613	271,925	240,070	268,294
04 Metal & Steel	2,074,752	2,887,194	2,326,608	2,847,414	3,223,078	3,679,167	5,792,748	5,441,646	7,072,472	6,937,840	8,501,295
05 Chemical Products	698,481	974,833	936,682	1,072,812	1,351,337	1,754,096	1,556,238	1,665,522	2,009,310	2,035,725	2,531,135
06 Pharmaceutical Products	3,593	3,444	4,518	3,610	2,379	3,219	3,656	4,006	4,997	5,056	7,952
07 Fertilizer	919,665	1,454,668	1,246,139	1,175,724	1,317,780	1,307,392	2,036,682	2,529,487	2,802,132	2,331,436	2,839,091
08 Paper	349,274	427,111	358,216	428,008	394,631	563,233	557,504	582,614	750,247	946,654	1,075,040
09 Plastic & Rubber Products	174,394	246,224	204,184	294,731	266,164	299,937	332,168	411,230	534,931	444,502	589,682
10 Lubricating Oil-Soap-Wax	10,927	14,427	14,006	15,545	17,752	25,284	30,659	36,761	43,252	49,171	58,036
11 Textile, Filament, Clothing	89,118	57,500	65,067	43,753	67,777	90,041	97,137	128,584	125,032	120,573	144,524
12 Jute-Cotton-Kapok	69,816	126,860	487,187	205,300	224,543	307,044	276,494	338,112	402,456	410,787	415,162
13 Fresh & Frozen Food	50,174	85,425	153,319	181,898	292,153	260,894	376,574	453,637	735,947	693,140	672,842
14 Other Food Stuff	268,149	356,494	307,690	277,512	245,640	335,132	478,795	524,625	599,115	755,131	1,444,199
15 Mineral Fuel Oil Wax	9,818,358	10,384,040	11,080,545	9,411,876	9,558,014	11,877,178	11,927,647	16,389,152	17,192,095	19,892,356	22,626,900
15 Others	881,887	957,902	1,074,366	1,660,414	1,430,918	1,421,859	1,849,283	2,805,053	5,834,832	9,325,073	7,157,084
Total	15,735,881	20,030,572	18,905,364	18,089,933	18,817,910	22,687,215	26,142,747	32,574,352	39,854,556	45,399,447	49,673,425

Remarks: Calculated based on Transport Statistics (MOTC)

Export

Unit: Tons

Commodity	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
01 Agricultural Product	18,877,370	14,810,407	17,547,894	18,368,310	19,122,597	16,457,276	19,049,324	22,470,245	18,675,805	18,526,749	21,342,524
Food Product & Frozen Good											
(Edible Vegetable)	7,654,282	5,041,431	6,335,360	6,925,431	6,060,813	6,088,082	7,849,634	9,452,654	7,756,548	6,526,649	8,434,472
(Cereal)	6,685,128	6,197,996	7,782,503	6,938,980	8,555,319	6,088,254	6,870,228	7,225,956	5,202,756	5,405,526	5,039,410
(Sugar and Confectionery)	3,125,030	2,253,946	2,017,148	2,755,844	2,795,548	2,510,127	2,276,151	3,528,689	3,259,390	3,884,218	4,904,784
(Prep of Veg Fruit Plant)	181,112	181,811	229,519	273,365	333,332	426,083	554,779	624,157	716,956	830,811	882,151
(Product of Milling Industry)	508,894	443,434	497,579	578,457	536,714	438,540	539,100	572,726	609,616	646,777	700,137
(Preparation of Meat Fish)	67,256	74,076	99,068	130,598	203,428	224,765	297,857	323,070	352,092	413,817	395,885
(Fish Crustacean Mollusc)	99,608	85,570	92,474	101,058	135,644	162,372	179,849	225,864	242,153	302,081	356,414
(Others)	556,060	533,143	494,243	664,777	503,899	519,053	481,726	507,129	515,279	516,870	629,271
02 Textile Yarn	93,929	94,686	141,465	125,338	149,793	256,707	340,804	310,371	322,129	384,621	403,722
Leather Product											
03 Kenaf Cotton Kapok	144,961	118,788	189,221	139,669	149,019	170,996	212,354	227,527	263,273	295,985	305,883
04 Metal Machinery Electrical	117,958	105,993	171,371	275,564	359,310	372,910	503,338	492,917	529,690	686,252	775,232
05 Chemical Product	13,774	13,320	14,562	21,781	43,409	61,102	75,995	170,601	220,650	299,746	345,177
06 Plastic Product &	505,304	455,147	527,040	612,639	726,331	879,594	896,242	1,044,349	1,164,546	1,397,519	1,529,935
Other Rubber Article											
07 Mineral	1,045,770	1,004,661	1,279,661	1,425,374	1,684,265	3,014,696	4,413,920	5,571,451	5,506,515	6,715,829	6,578,228
08 Wood Products	93,306	108,581	91,277	108,157	130,228	312,655	367,142	380,533	339,061	329,255	449,970
09 Others	217,223	302,037	304,254	659,762	993,459	980,473	1,345,633	1,341,008	1,543,103	2,013,217	2,504,076
Total	21,110,595	17,013,620	20,266,745	21,737,594	23,368,511	22,506,409	27,204,752	32,009,102	29,564,872	30,549,174	34,335,747

Remarks: Calculated based on Transport Statistics (MOTC)

Table 4-1-2 Total Import and Export Volume of Thailand and Klong Toei Wharf

Export

Unit: Tons

Commodity	Total Volume of (A) Thailand	Total Volume of Klong (B) Toei Warf	B/A
01 Agricultural Product Food Product & Frozen Good	21,342,524	5,818,880	27%
02 Textile Yarn Leather Product	403,722	372,660	92%
03 Kenaf Cotton Kapok	306,883	240,148	78%
04 Metal Machinery Electrical	775,232	483,723	62%
05 Chemical Product	345,177	39,245	11%
06 Plastic Product & Other Rubber Article	1,529,935	301,384	20%
07 Mineral	6,678,228	26,754	0%
08 Wood Products	449,970	64,498	14%
09 Others	2,504,076	816,115	33%
Total	34,335,747	8,163,408	24%

Import

Unit: Tons

Commodity	Total Volume of (A) Thailand	Total Volume of Klong (B) Toei Warf	B/A
01 Vehicle, Car Spare Part	464,930	393,283	85%
02 Machinery & Used Engine	677,268	339,453	50%
03 Electric Equipment	268,294	193,270	72%
04 Metal & Steel	8,601,295	2,460,316	29%
05 Chemical Products	2,631,186	1,050,296	40%
06 Pharmaceutical Products	7,952	17,530	-
07 Fertilizer	2,839,091	61,397	2%
08 Paper	1,075,040	506,695	47%
09 Plastic & Rubber Products	589,682	342,663	58%
10 Lubricating Oil-Soap-Wax	58,036	77,430	-
11 Textile, Filament, Clothing	144,524	175,617	-
12 Jute-Cotton-Kapok	415,162	236,887	57%
13 Fresh & Frozen Food	672,842	78,980	12%
14 Other Food Stuff	1,444,199	345,916	24%
15 Mineral Fuel Oil Wax	22,626,900	63,312	0%
16 Others	7,157,084	1,638,113	23%
Total	49,673,485	7,587,875	15%

Table 4-1-3 shows cargo traffic volume by port. Others are Sriracha Oil Jetties and Buoys and Ko Sichang Anchorage and so on. At Sriracha Esso, Thai Oil Refinery Company (TORC) has refineries and terminals. Petroleum Authority of Thailand (PTT) also has LPG terminal at Sriracha. At Ko Sichang Anchorage, the main commodities are handled steel, coal and fertilizer on the import side, and handled tapioca, maize, rice, gypsum and sugar on the export side.

Table 4-1-3 Cargo Traffic Volume by Port

Unit:Million Ton

	1988	1989	1990	1991	1992
	(10.44)	(11.98)	(13.83)	(15.38)	(16.14)
Bangkok	32.16	39.83	39.90	na	na
Laem Chabang	-	-	-	0.68	1.28
Sattahip	0.17	0.37	0.52	0.54	na
Map Ta Phut	-	-	-	-	0.13
Songkhla	-	0.16	0.37	0.50	0.60
Phuket	-	0.06	0.05	0.08	0.07
Others	31.02	24.16	28.59	na	na
Total	63.35	64.58	69.43	76.05	84.01

Bangkok Port: exclude oil jetty, ( ) is Klong Toei Wharf

Chapter 5 Trend of International Container Transport in Thailand

5.1 Outline of International Container Transport

In 1991, total foreign trade value (customs base) of Thailand amounted to 725.6 billion Baht for export (increase of 23.0% over 1990) and 958.8 billion Baht for import (increase of 13.5%) both showing high growth rates. In recent years, the volume of cargoes originating from or destined to South East Asia has increased remarkably along with the economic growth of the region. Reflecting the above, the number of container handled at the Klong Toei wharf of Bangkok Port, which has the largests container terminal in Thailand, amounted to about one million TEUs in 1990 and 1.3 million TEUs in 1992, respectively. Presently, Bangkok Port is ranked ninth in terms of number of containers handled among the ports in Asia and the Pacific. Table 5-1-1 shows the historical trend of the number of containers handled at the leading container ports in the region.

Table 5-1-1 Number of Containers handled at the Leading Ports in Asia and the Pacific

Unit:TEUs

Port	1987	1988	1989	1990	1991
1. Singapore	2,634,500	3,375,100	4,361,100	5,223,500	6,354,000
2. Hong Kong	3,457,182	4,033,427	4,463,709	5,100,637	6,161,912
3. Kaohsiung	2,778,786	3,082,838	3,382,512	3,494,631	3,913,108
4. Busan	1,949,143	2,065,462	2,158,828	2,348,475	2,694,115
5. Kobe	1,996,626	2,263,214	2,458,964	2,595,940	2,635,425
6. Keeliug	1,939,854	1,187,830	1,253,613	1,828,144	2,004,655
7. Yokohama	1,348,383	1,452,857	1,506,338	1,647,891	1,796,368
8. Tokyo	1,287,974	1,396,026	1,438,521	1,555,138	1,783,837
9. Bangkok	649,530	791,584	924,040	1,018,290	1,170,697
10. Manila	411,040	454,426	602,974	1,038,905	1,069,999
11. Nagoya	547,949	665,621	815,351	897,78	1,001,055
12. Tanguing Priok	273,641	415,960	559,617	643,963	737,323
13. Colombo	429,298	620,940	544,197	583,811	669,489
14. Melbourne	536,969	615,467	665,973	604,367	622,983
15. Osaka	466,547	515,924	513,658	483,036	541,267
16. Sydney	418,371	436,972	516,239	477,395	521,749

Source: The Containerization International

5.2 Characteristics of the Liner Services for Containers in Thailand

5.2.1 Services with Feeder

Most containers originating from or destined to Thailand are loaded or discharged at Bangkok Port at present. After or before being handled at Bangkok Port, long haul containers from/to the USA, Europe, etc. are transhipped from/to trunk liners at Singapore, Hongkong, Kaoshung, the ports in Japan, etc.; liner services with feeder connecting Bangkok Port and the trunk routes are in operation (see Fig. 5-2-1). The latest liner shipping network from/to Bangkok Port is shown in Table 5-2-1.

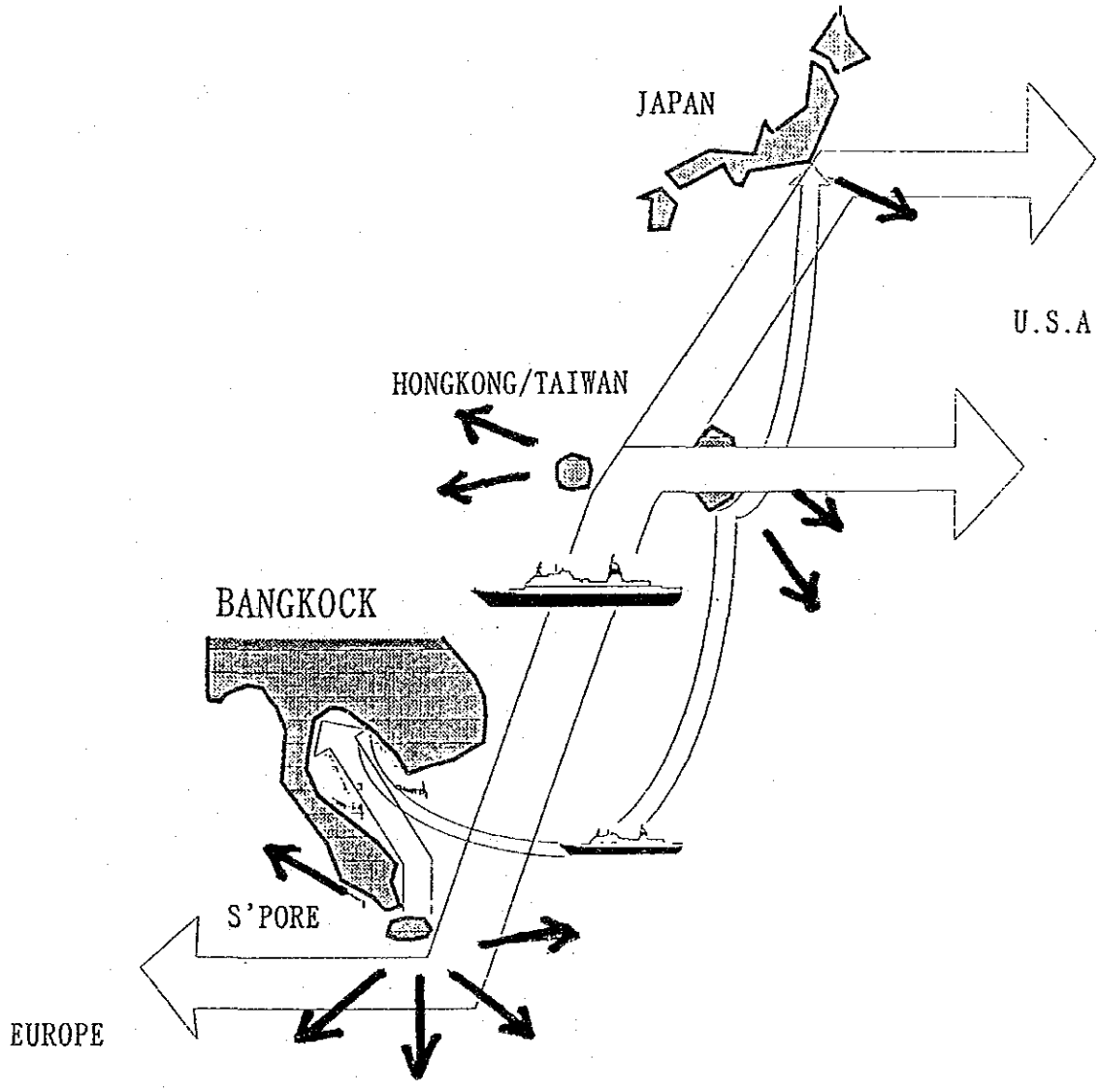


Fig. 5-2-1 The liner services with feeder connecting Bangkok Port and the trunk routes

Table 5-2-1 Liners' Network Bangkok (Services with Feeder)

Carriers	*Frequency*	*T/S Port*	*Destinations*
		A. For North America	
K Line 1	FD	Tokyo	Tacoma, Portland, Chicago, Kansas, Tor, Boston, Newyork, Motreal
K Line 2	FD	Tokyo	L.Beach, Oakland, Houston, Dallas, Chicago
M-OSK 1	FD	Kaohsiung	Seattle, Vancouver, Portland
M-OSK 2	FD	Kaohsiung	L.Angels, Oakland, Chicago
M-OSK 3	3/M	Kaohsiung	Savannah, Newyork, Norfolk, Toront, Philadelphia, Baltimore
NYK 1	FD	Kaohsiung	Seattle, Vancouver, Portland, Chicago
NYK 2	FD	Tokyo	L.Angels, Oakland
NYK 3	FD	Tokyo	L.Angels, Oakland, Chicago, Newyork
NYK 4	FD	Tokyo	Seattle, Vancouver, Portland, Chicago, Newyork
NYK 5	3/M	Singapore	Charleston, Norfolk, Halifax,
NYK 6	3/M	Tokyo	Savannah, Newyork, Norfolk
NOL 1	FD	SP/TYO	Seattle, Portland
NOL 2	FD	Singapore	L.Angels, Oakland, Vancouver
NOL 3	3/M	Singapore	Chaleston, Norfolk, Newyork, Halifax
OOCL 1	FD	Kaohsiung	Seattle, Vancouver
OOCL 2	FD	Kaohsiung	Oakland, Various Inland Points
OOCL 3	FD	Kaohsiung	Oakland
APL 1	FD	Singapore	Seattle
APL 2	FD	Singapore	L.Angels, Oakland, Inland, Newyork, Montreal
APL 3	FD	Singapore	L.Angels, Oakland, Inland, Newyork
Evergreen 1	FD	Kaohsiung	Tacoma, Vancouver
Evergreen 2	FD	Kaohsiung	L.Angels, Frisco, Portland, Tacoma
Evergreen 3	FD	Kaohsiung	L.Angels, Charleston, Baltimore, Newyork Europe(Around World E-bound)
Yang Ming 1	FD	Kaohsiung	L.Angels, Frisco
Yang Ming 2	FD	Kaohsiung	Savannah, Willmington, Newyork
Hanjin 1	FD	Hongkong	Seattle, Vancouver, Chicago, Newyork, Montreal
Hanjin 2	FD	Singapore	L. Beach, Oakland, Newyork, Chicago, Montreal
Hanjin 3	FD	Hongkong	Savannah, Charleston, Willmington, Newyork Montreal
Hyundai	FD	Kaohsiung	L.Beach, Oakland, Seattle
Cosco 1	3/M	Yokohama	L.Angels, Frisco, Seattle, Chicago, Houston, Vancouvr
Cosco 2	3/M	Yokohama	Vancouver, Seattle, Newyork, Charleston, Houston
Hoegh Ls.	1-2/M	Singapore	Halifax, Newyork, Baltimore, Norfolk
Hoegh Ls.	1-2/M	Singapore	Halifax, Newyork, Baltimore, Norfolk
ABC Cont.	1-2/M	Singapore	(Con.Bulker) US E-coast (continue)

Carriers	*Frequency*	*T/S Port*	*Destinations*
(continued)		*North America*	
FESCO	1/M	Direct	Singapore, P.Kelang, Bangkok, T.Priok, Vancouver
ZIM Cont.	4/M	Hongkong	L.Angels, Kingston, Savannah, Newyork, Halifax
UASC	2/M	Singapore	Newyork, Baltimore, Norfolk, Savannah
TMM(Mexican)	3/M	Hongkong	L.Beach, Frisco, Mexican Ports
		B. For Europe	
(Neo Trio)			
M-OSK/NYK/H.Lloyd	FD	Singapore	Sothampton, Hamburg, B'haven, LeHavre, Rotterdam
M-OSK/NYK/H.Lloyd	FD	Singapore	Jeddah, Sothampton, Hamburg, B'haven, Rotterdam
(Ace)			
K-Line/OOCL/NOL	FD	Singapore	LeHavre, Felixstowe, Rotterdam, B'haven
K-Line/OOCL/NOL	FD	Singapore	Rotterdam, B'haven, Felixstowe, LeHavre
(POCL/Maersk)			
POCL/Maersk	FD	Singapore	Jeddah, Sothampton, Rotterdam, Hamburg
POCL/Maersk	FD	Singapore	Sothampton, Rotterdam, Hamburg
POCL/Maersk	FD	Singapore	Antwerp, Hamburg, Rotterdam, Argeciras
(Nedlloyd/CGM/MISK)			
Ned/CGM/MISK	FD	Singapore	LeHavre, Rotterdam, Hamburg, B'haven
Ned/CGM/MISK	FD	Singapore	Jeddah, Damietta, Fos, Laspesia, Barcelona
EAC Ben	FD	Singapore	Sothampton, Rotterdam, Hamburg, G'burg, LeHavre
DSR/Senator/Cho Yan	FD	Singapore	Rotterdam, B'haven, Felixstowe, Antwerp, LeHavre(Around World Service)
DSR/Senator/Cho Yan	3/M	Singapore	KhorFakkan, Jeddah, Larnaca, Valencia, Fos Laspecia
CMA/Polish O.L.	FD	Singapore	Marseille, Barcelona, Hamburg
Evergreen	1/6D	Singapore	Hamburg, Thames, Rotterdam, Antwerp, LeHavre
Evergreen	1/W	Singapore	Jeddah, Limasol, Laspesia, Fos, Valencia P.Said, Alexandria, Piraeus, Thessalonik
Hanjin	FD	Singapore	LeHavre, Rotterdam, Hamburg, B'haven, Felixstowe
Hyundai/Sealand	3/M	Singapore	Rotterdam, LeHavre, Hamburg, Felixstowe

Carriers	*Frequency*	*T/S Port*	*Destinations*
(continued)		*B. For Europe*	
COSCO	4/M	Singapore	Rotterdam, Hamburg, Felixstowe, LeHavre
Yang Ming	4/M	Singapore	Genoa, Hamburg, Rotterdam, Felixstowe, LeHavre
Balt Orient Line	4/M	Singapore	Hamburg, Tibury, Rotterdam, Antwerp
CONTSHIP	4/M	Singapore	Felixstowe, Hamburg, Rotterdam, LeHave
ABC Container Line	1-2/M	Singapore	(Con-Bulker)Ad.import only USA Europe
ABC Container Line	1-2/M	Singapore	(Con-Bulker)Ad.import only USA Europe
(Med. Club) M-OSK/NYK/L.Triest	FD	Singapore	Piraeus, Barcelona, Fos, Genoa, Trieste
(Concord) M-OSK/NYK	FD	Singapore	Piraeus, Istanbul, Alexandria, P.Said
M-OSK/NYK	1/M	Singapore	(MPV)Casablanca, Algiers, Aquaba
ZIM Israel	3/M	Singapore	Alexandria, Piraeus, Trieste, Venice, Koper
BLASCO Oriental	2/M	Singapore	Mersin. Trieste, Iyechevsk
Odessa Ocean	2/M	Singapore	Jeddah, Pireaus, Naples, Genoa
Croatia Line	1/M	Singapore	P.Said, Limassol, Beiruit, Lattakia, Mers Istanbul, Venice, Trieste, Koper, Rijeka
		C. For Africa	
(SAFARI) M-OSK/K-Line/NYK Safmarine/N'lloyd Gold Star/Maersk	3/M	Singapore	Durban, P.Elizabeth, Capetown
Nantari Line	1/2W		P.Louis, Durban, Capetown, P.Elizabeth
Kien Hung	1/2W		P.Louis, Durban
(East Africa) M-OSK	2/M	Singapore	P.Louis, ReUnion, Tamatave, D.E.Salaam
NYK	1/M	Singapore	Mahe, Mombassa, D.E.Salaam
Nedlloyd	2/M	Singapore	P.Louis, ReUnion, D.E.Salaam, Tanga, Mombassa
(West Africa) M-OSK/K-Line/Delma	1/M	Singapore	Lagos/Apapa, Lome, Abidjan
	1/M	Singapore	Lagos/Apapa
	1/M	Singapore	Matadi, Lome, Abidjian
Gold Star	1/M	Singapore	Monrovia, Abidjian, Tema, Lome, Lagos, Cotonou, Douala, P.Harcourt
Nedlloyd	2/M	Singapore	Lome, Apapa/Lagos, Douala, Tema, Abidjian

Carriers	*Frequency*	*T/S Port*	*Destinations*
		D. For Central/South America	
a. East Coast			
M-OSK	1/M	Unspecified	Japan, Busan, Kaohsiung, Panama,Caribbean Argentine, Durban, Singapore, Japan
M-OSK	1/M	Unspecified	Japan, Singapore, E/S Africa, Argentine, Brazil, Durban, Hongkong, Japan
NYK	1/M	Unspecified	Japan, Keelung, Singapore, Durban, Argentine, Brazil, Durban, Hongkong, Japan
Frota Oceanica			
	2/M	Singapore	Rio, Santos
ELMA	1/M	Singapore	Colombo, Durban, Capetown, Santos, Monte, B.Aires
Lloyd Brasilero			
	1/M	Singapore	Rio, Santos, Pranagua
Nedlloyd	1/M	Singapore	B.Aires, M'video, SFdoSul, R.Grande, Paranagua, Santos, Rio
Pro Line	1/M	Singapore	Durban, Rio, Santos, B.Aires
COSCO	1/M	Singapore	Rio, Santos, M'video, B.Aires
CSAV	1/M	Singapore	B.Aires, Santos, Rio
b. West Coast			
K-Line/M-OSK/NYK			
	2/M	Unspecified	Keelung, Hongkong, Japan, Chile, Peru, Ecuador
Nedlloyd	1/M	Singapore	Frisco, Iquique, S.Antonio, Arica, Callao Guayaquil, B'ventura, P.Quetzal
FMG	1/M	Singapore	P.Quetzal, Acajutla, S.Lorenzo, Corinto, P.Caldera, B'ventura, Cartragena, B'quilla
c. Central America & Caribbean			
K-Line/M-OSK/NYK			
FMG(joint-CACTUS)			
	2/M	Unspecified	Hongkong, Keelung, Japan, Manzanillo, Corint, B.Tura, Catagena, B.Quilla, Santa Marta
K-Line/M-OSK/NYK			
	2/M	Unspecified	Hongkong, Keelung, Busan, Japan, Panama, San Juan, LaGuaira, P.Cabello
CAVIN	1/M	Singapore	Caracus, P.Sucre, Maracaibo, P.Cabello Georgetowm, Paramaribo
Nedlloyd	1/M	Singapore	Frisco, M'nillo, Acapulco, A'jutla, S.Lorenzo, P.Caldera, P.Quetzal, Frisco, Cristobal, Laguaira, Port of Spain

Carriers	*Frequency*	*T/S Port*	*Destinations*
		E. For South & West Asia	
K-Line/M-OSK/NYK	3/M	Singapore	Dubai, Damman, Kuwait, Baharain, Muscut
Maersk/Sealand	1/W	Singapore	Dubai, Damman, Abudabi, Baharain, Muscut
Maersk/Sealand	2/M	Singapore	P.Said, Jubaiari, Kuwait, Jeddah
UASC/OOCL	1/W	Singapore	Muscut, Dubai, Sharjah, Damman, Kuwait, Bahrain, Abudabi, Doha
NSCSA	2/W	Singapore	Dubai, Riyadh, Jeddah, Kuwait, USA, Med.-Sea, Mid.East, Singapore
Uniglory	1/8D	Singapore	Dubai, Abudabi, Damman, Bahrain, Belawan
APL	1/W	Singapore	Colombo, Dubai, Damman, Kuwait, Bombay
COSCO	3/M	Singapore	Dubai, Damman, Riyadh, Kuwait, Karachi
PIL	3/M	Singapore	Dubai, Karachi, Bombay
PIL	3/M	Singapore	Aden, Aquaba, Djibuti, Hodeida, Jeddah
PNSC	3/M	Singapore	Colombo, Karachi
UASC	2/M	Singapore	Colombo, Jeddah, Salerno, Leghorn
M-OSK/NYK	1/M	Singapore	Djibuti, Aden, Hodeida, Aquaba, Bengazi Toripoli
K-Line/M-OSK/NYK	1/W	Singapore	Colombo, Karachi, Bombay
NYK/NOL	1/W	Singapore	Bombay, Karachi, Madras, Colombo
		F. For Australia, New Zealand, Pacific	
Tong Soon	1/M	Singapore	P.Moresby, Lae, Rabual
Tasman Asia	2/M	Singapore	Suva, Noumea, Auckland, Napier, Tauranga, Nelson
COSCO	1/M	Singapore	Sydney, Melbourn, Brisbane
Nedlloyd	2/M	Singapore	Surabaya, Auckland, Nelson, Bluff, Tauranga, Jakarta
Stateships	2/M	Singapore	Fremantle, P't Headland,
EAC	2/M	Singapore	Fremantle
Wilhelmson	2/M	Singapore	Auckland, Melbourn, Sydney, Newcastle, Brisbane
M-OSK	2/M	Singapore	Sydney, Melbourn
Jakarta Lloyd	1/8D	Singapore	Sydney, Melbourn, Brisbane
Jakarta Lloyd	2/M	Singapore	Fremantle, Adelaid
NYK	3/M	Singapore	Sydney, New Plymouth, Lyttelto, Melbourn Fremantle, Auckland
NYK	2/M	Kobe	Honolulu
CCNI/CSAV	1/M	Singapore	New Guinea, NewCaledonia, Fiji, Tahiti, Chile
Yang Ming	1/10D	Kaohsiung	Sydney, Melbourn, Brisbane (continue)

Carriers	*Frequency*	*T/S Port*	*Destinations*
(continued)		*Australia, New Zealand, Pacific*	
Hanjin	3/M	Singapore	Sydney, Melbourn
NZ Orient	1/M	Singapore	Noumea, Suva, Aucland
ABC Container	2/M	Singapore	Fremantle, Melbourn, Sydney
Perkins	1/M	Singapore	Darwin, P't Headland
ANL/NOL	1/W	Singapore	Sydney, Melbourn, Brisbane
ANL/NOL	2/M	Singapore	Adelaid, Fremantle
Kyouwa	1/M	Singapore	Manila, Guam, Saipan, Lautoka, Suva, Noumea
MISC	2/M	Singapore	Fremantle, Sydney, Melbourn, Adelaid, Brunei
Knutsen	2/M	Hongkong	Fremantle
ZIM	3/M	Hongkong	Sydney, Melbourn, Brisbane, Adelaid
		G. For South East Asia	
Thong Soon		Singapore	Brunei
Thong Soon		Singapore	Jakarta
Thong Soon		Singapore	Surabaya
Thong Soon		Singapore	Kuchin
Thong Soon		Singapore	Labuan
Vigour		Singapore	Cebu, Manila
EAC		Singapore	Sihanoukville, Phnom Penh
EAC		Singapore	Ho Chi Minh, Haiphong
Jakarta Lloyd		Singapore	P't Kelang, Penang
Jakarta Lloyd		Singapore	Jakarta, Surabaya
NYK		Singapore	Jakarta
NYK		Singapore	Ho Chi Minh
PIL		Singapore	P't Kelang, Belawan, Penang
PIL		Singapore	Sabah Muara
PIL		Singapore	Jakarta, Samarang, Surabaya
PIL		Singapore	Chittagon
PIL		Singapore	Ho Chi Minh
Five Star		Singapore	Rangoon
K-Line		Singapore	P't Kelang, Penang
K-Line		Singapore	Ho Chi Minh, Haiphong
K-Line		Singapore	Manila, Cebu
NOL		Singapore	Ho Chi Minh
P.T.Pul		Singapore	Jakarta, Surabaya, Semarang
Wan Hai		Singapore	Manila
MISC		Singapore	Kinabalu, Muara, Sandakan
MISC		Singapore	P't Kelang, Penang
MISC		Singapore	Jakarta, Semarang, Surabaya

(Extracted 'Bangkok Post' & 'Nation' as of Aug.1992.)

Remark 1. (---) is joint operation of plural shipping companies.
2. M:Month, W:Week T/S:Transshipment FD:Fixed Day Service
3. Almost all services are by container vessels except specified.

5.2.2 Direct Liner Services

In addition to the above-mentioned liner services with feeder for containers, direct liner services from/to Bangkok Port are presently provided (see Table 5-2-3). In recent years, the number of vessel calls for direct shipping services shows an upward trend. The services on each route are summarized as follows:

a. Routes For Japan, Korea, Hongkong, Taiwan and China

Presently, service with fixed day calls for Japan, and once per week for both Kaoshung-Keelung and Hongkong-Kashung is provided five times per week. On the other hand, service for the port in Taiwan is twice weekly and for Kaoshung is twice weekly without fixed day calls. In addition, more than 10 direct services are being developed for the ports of Asia and the Pacific at a frequency of one to four per month.

b. Route for Singapore

Fourteen shuttle services between Singapore and Bangkok are operated every week by five carriers.

c. Routes for Other Areas

Monthly service for Europe, Bangladesh, South Africa, Durban Cambodia and UAE is operated by six carriers, respectively.

Table 5-2-2 Liner Shipping Network from/to Thailand

A. Direct Service

Carriers	Frequency	Ports of call
a-1. Japan Korea Hongkong Taiwan China		
**********		
K Line (1)	FD	BKK Tokyo Yhama Shimizu Y'ichi Nagoya BKK
K Line (2)	FD	BKK Hakata Kobe Yhama Nagoya BKK
Mitsui-OSK	FD	BKK Tokyo Yhama Nagoya Kobe Moji
NYK (1)	FD	BKK Tokyo Shimizu Kobe Nagoya Busan BKK
NYK (2)	FD	BKK LCB Kaoshung Kobe Nagoya Tokyo Yhama BKKK
*UNITHAI	FD	BKK Tokyo Yhama Nagoya Kobe (same vsls as M
*Thai Marine Line	3/month	Kobe Nagoya Yhama BKK Kobe
*JUTHA line	4/month	BKK Kobe Nagoya Yhama BKK
*Thai Maritime Navig	2~/month	Yhama Nagoya Kobe BKK Japan
*Siam Paretra 2 x FD	(same as NYK 1&2 - space charter)	
*Norwegian Asia	3/month	BKK Yhama Nagoya Kobe Moji BKK
CNC Lines	4/month	BKK HK Kaoshung Yhama Nagoya Kobe Moji Tokuyama Busan HK SP BKK
Liner Class	4/month	(same as CNC Lines - Space Charter)
F.E. Line	2/month	Taiwan BKK Keelung Kaoshung
Dongnama Shipping	1/week	BKK HK Busan Inchon BKK
Heung-A Shipping	1/week	BKK HK Inchon Busan BKK Moji Hiroshima Imabari(t/s at HK Busan)
COSCO	3/month	BKK Shekou Moji Yhama Kobe Manila BKK
COSCO	2-3/month	BKK HK Shanghai Qingdao BKK
PIL	1~/month	BKK KohShichang Songkhla Japan Shanghai
Wan Hai	1/week	BKK Kaoshung Taichung Keelung (*) Busan HK BKK
RCL	FD	BKK Kaoshung Keelung BKK
Chu Kong Shipping	1/week.	BKK HK BKK
UNIGLORY	1/4-5 day	BKK Kaoshung Keelung HK Ho Chiminh BKK Manila Cebu Penang P.Kelang Jakarta Semarang Surabaya (transship at Surabaya)
Yong Long Line	1/week	BKK HK Keelung Kaoshung HK BKK naha Shibushi (t/s at Keelung) Macau Saipan Guam Taichung China(t/s at Kao)
OOCL	FD	BKK Kaoshung HK BKK

Table 5-2-3 Liner Shipping Network from/to Thailand (Continued)

a-2. Singapore Shuttles

****

RCL	5/week	BKK SP BKK
PI L	4/week	BKK SP BKK
Tong Soon Lines	2/week	BKK SP BKK
NOL/P.T.Pul	1/week	BKK SP BKK
EAC-Ben/POCL	2/week	BKK SP BKK

a-3. Other Areas

****

(Europe)		
*UNITHAI	1/month	(MPV)BKK Amsterdam Hamburg Antwerp BKK
(Bangladesh)		
Atlas Line		(Conv)BKK Chittagon BKK
(Africa)		
Gold Star		(Conventional) BK SP Reunion Mombasa Dar es Sa Durban Capetown SP BK
Phoenix Shipping	1~/month	(Conventional) BK Durban
Orient Express	1/month	(Conv) Bk Phnonpenh SP Bk
PNSC	1~/month	(Conv) Bkk Karachi Cubai Damman Bk

Note: "*" mark shows shipping company of Thailand. As shown in the table, shipping companies of Thailand are still scanty. In the future, an increase in the number of shipping companies is expected.

Chapter 6 Present Situation of Bangkok Port

6.1 Historical Background of the Port

Bangkok Port has been playing an important role as the main gateway of the international trade in Thailand. Bangkok Port comprises private and public wharves and is spread along some 40 km of the River Chao Phraya upstream from its mouth. (Fig. 6-1-1)

In olden days, only vessels of medium tonnage and light draught could pass the channel to Bangkok. Vessels of deep draught had to be discharged and loaded in the deep water anchorage off Ko Sichang (Sichang Island), about 80km from Bangkok. Cargo had to be sent up to Bangkok or brought down for shipment by lighters, which caused problems both in terms of time and expense.

These problems confronted the government for many years and prompted them to consider the possibility of dredging the channel through the bar and constructing a new port with modern facilities.

In 1934, three consultant engineers with experience in port construction were charged to carry out a technical mission to survey the commercial and economic situation in Bangkok. They suggested in their report to dredge the bar channel to accommodate vessels of deeper draught and to construct a modern new port at Klong Toey sub-district in order to promote Bangkok's commercial and economic situation.
The government agreed with the suggestions and appointed a committee to carry out a plan to construct a new port and dredge the bar channel. In 1936, an international competition to design the new port was opened and the design submitted by Prof. A. Agatz of Bremen, Germany was selected.
Construction of the new port at Klong Toey sub-district where a large area was reserved for future expansion began in 1938. The construction was partly completed in 1940.
Since then, Klong Toey Port has been an important facility, housing the main wharves of Bangkok Port.
In 1951, the Port Authority of Thailand (PAT) was established as a public utilities state enterprise under the Ministry of Transport and Communications. PAT took over the administration of Klong Toey Port which had previously been in the hands of a government department.
In this year, a loan of U.S.$ 4.4million was obtained from the World Bank to proceed with the construction of the present west-quay which consisted of a 1,660m wharf, served by 9 transit sheds with an open storage area behind. The wharf was rail and road

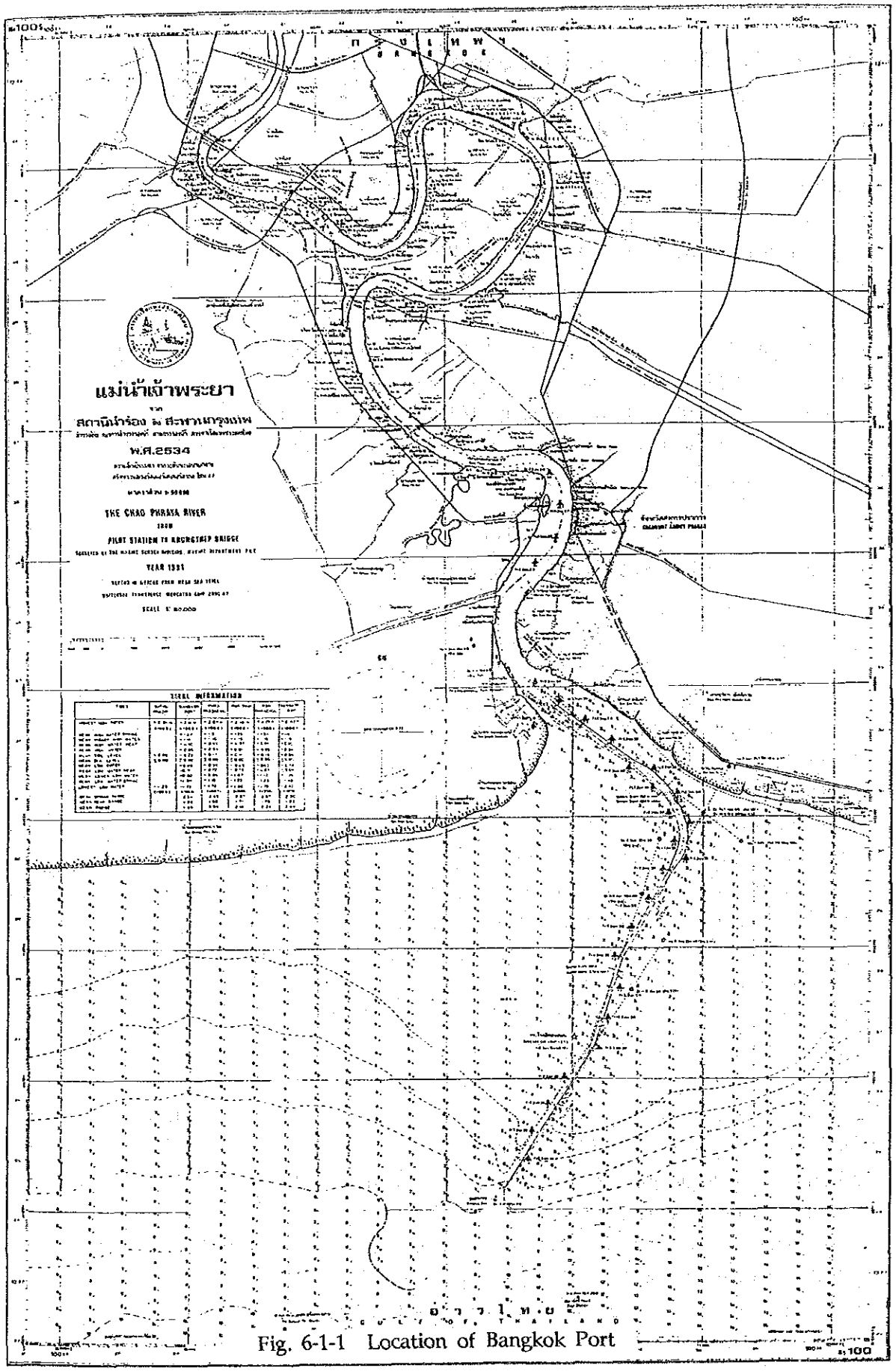


Fig. 6-1-1 Location of Bangkok Port

served.
In 1979, east-quay was constructed to handle increasing cargo in Klong Toey Port. The length of east-quay is 1,528m (8 berths, draught -8.2m for 1,230m).

As international trade has been booming together with the modernity of transportation methods and Thailand's gradual emergence as an industrialized country, the annual container handling volume of Klong Toey Port has increased in these 15 years from 73 thousand TEUs in 1977 to 1.3 million TEUs in 1992. The rapid increase of container cargo in the past years has resulted in severe congestion at Klong Toey Port, although PAT has been making efforts to smooth the situation.

At the beginning of 1993, the Government set up a policy to reduce the number of containers handled at Klong Toey Port to one million TEUs per year. Effective and swift handling of container cargo by modernizing management of the port is also required.

6.2 Land and Water Area Use within the Port

6.2.1 Land Area Use within the Port

As the Bangkok Metropolitan Area spreads, Klong Toey area where Klong Toei Port is situated has come to be surrounded by urban facilities and housings. The area owned by PAT is about 3.6 sq.km and is situated between the River Chao Phraya and At Narong Street. (See Fig.A-7-2 and Fig.A-7-3)

About 40% of the area including riverside is surrounded by a customs fence and is used mainly for port and harbour activities. Of the remaining 60%, yards used for port activities, customs office, PAT offices, private offices, housings, oil tanks and so on are randomly located.
A highway also crosses the area owned by PAT and the areas between the customs fence and the highway are squatters' areas.

At present, because of the lack of space behind east-quay, the area behind west-quay is also used for the handling of container cargo including stuffing and un-stuffing operations.

6.2.2 Water Area Use around the Port

The port of Bangkok is situated on the left bank of the Chao Phraya River between km.26 and km.29 of Klongtoey sub-district, Bangkok. The entrance to the River is marked by Bangkok bar light beacon situated at 13°26'N, 100°35'E.

The approach to the port is made through a 10 mile bar channel, whose width is 100m at the reaches and 250m at the bend. Following the bar channel, a 15 mile Chao Phraya river channel, whose width is 70m at the narrowest and 350m at the widest leads meanderingly to the core of the port. The depth of channel is maintained eight meters to eight and a half meters below MSL, and the river cannel is eight meters as well.

(1) Location of the Berths/Anchorages

* Bangkok Port, the core of Bangkok Port Complex, consisting of the west quay and the east quay lies 15miles above the estuary. east quay, the main container terminal, with seven berths for vessels up to 172m long drawing 8.2m is situated on the NE bank of the river, and the west quay, the main importing berths for general cargoes with supplementary use for container, which can accommodate 10 vessels up to 172m long drawing 8.2m is situated on the N side of the river close to the east quay.

* Klongtoey Dolphins, a row of 36 dolphins, which can accommodate seven vessels up to 172m long drawing 8.2m for the export cargoes loaded by lighters, are on the S side of the river opposite Klongtoey Wharf.

* Bang Hua Sua Dolphins, a row of 25 dolphins, that can accommodate eight vessels up to 172m long drawing 8.2m, are on the NE side of the river about seven to eight miles above the estuary.

* Sathupradit Mooring Buoys, a row of five mooring buoys, which can accomodate five vessels up to 137m long drawing 7.9m, are on the midstream about five miles above the west quay.

* 72 Private wharves lie scattered from the vicinity of the estuary to 41km upstream on both banks of the river.
The principal dimensions of those wharves, dolphins and buoys are listed in Table 6-2-1, and a sketch of their location is shown in Fig. 6-2-1.

Table 6-2-1 Principal Dimension of Berths

Port Authority of Thailand

Berth/Dolphin	Length (m)	Number of Berth	Limited L/D of Vessel	Capacity
Bangkok Port				
the west quay(22A-22J)	1,660	10	172.2/8.2	10
the east quay(20A-20F)	1,528	8	172.2/8.2	8
Klongtoey Dolphins	1,399	-	172.2/8.2	7
Bang Hua Sua Dolphins	1,561	-	172.2/8.2	8
Sathupradit M' Buoys	1,579	-	137.2/7.9	5

Private Berths

No. Private Berths Companies	Dist. (km)	Berth (No.)	Length (m)	Draft (m)
a. West Side				
1. Co-Operative Salt Wharf	3- 4	1	172.2	8.2
2. CRC Wharf Co.,Ltd.	9-10	1C	172.2	-
3. Thai Ruamthun Warehouse Co.,Ltd.	10. 2	1A	172.2	8.2
4. Pacific Plastic(Thailand) Co.,Ltd.	10. 1	1B	172.2	-
5. Mitraphol Warehouse Co.,Ltd.	10-11	3	172.2	8.2
6. Laemthong Sahakarn Co.,Ltd.	10. 7	5	172.2	8.2
7. Siam Chemical Co.,Ltd.	11. 8	5C	167.6	4.9
8. Thai Central Chemical Co.,Ltd.	12. 3	5A	172.2	8.2
9. Thai Asahi Caustic Soda Co.,Ltd.	12. 4	5D	118.9	6.9
10. Thai Silo & Drying Co.,Ltd.	13	5B	172.2	8.2
11. Bangkok Silo & Drying Co.,Ltd.	13. 5	7	172.2	8.2
12. Ruamthun Thai Co.,Ltd.	14	9	97.5	8.2
13. Bangkok Iron & Steel Works Co.,Ltd.	-	11A	144.8	8.2
14. Subsrithai Warehouse Co.,Ltd.	14. 5	11B	172.2	8.2
15. Mitsubishi(Thailand)Co.,Ltd.	14	11	172.2	8.2
16. Bangkok Molasses Partnership Co.,Ltd	16	13	137.2	8.2
17. Thonburi Warehouse Co.,Ltd.	15-16	15	131.1	7.3
18. Marubeni Co.,Ltd.	16	17	115.8	8.2
19. Asia Molasses Co.,Ltd.	16	19	140.2	6.7
20. Thai Far(2511) Co.,Ltd.	16-17	19A	172.2	8.2
21. Siam Tank Terminal Co.,Ltd.	33-34	21	95.7	8.2
22. Chemical terminal Co.,Ltd.	32	21C	121.9	8.2
23. Nanaphan Enterprise Co.,Ltd.	31-32	21A	152.4	7.9
24. Sapsathaporn Co.,Ltd.	33	21B	152.4	7.9
25. P.H. Development Co.,Ltd.	32. 4	21D	152.4	7.3
26. Laemthong Warehouse Co.,Ltd.	32.2	21E	152.4	7.9
27. Supanava partnership Co.,Ltd.	34-36	23A	129.0	6.7
28. Mobile Oil Thailand Co.,Ltd.	35-36	23B	137.1	7.9
29. Maenam Co.,Ltd.	34	23C	137.1	6.1
30. Hong Yiah Seng Co.,Ltd.	34	23	172.2	7.9
31. Kensen Co.,Ltd.	38.2	25	94.5	-
32. Krung Thai Bank Wharf(Prichasilpa)	38.4	27	121.9	7.6
33. Public Warehouse Organization	38.5	27A	112.8	7.3
34. Sangthong Rice Co.,Ltd.	39-40	29ABC	152.4	8.2

No. Private Berths Companies	Dist. (km)	Berth (No.)	Length (m)	Draft (m)
35. Thai Rice Co.,Ltd.	39	31	115.8	-
36. Thai Maritime Navigation	39.8	3A	134.1	7.3
37. Siam United service	40	35	86.9	7.6
38. Charoen Thai Co.,Ltd.	40	37	111.3	7.5
39. Pintong Rice Co.,Ltd.	40	39	111.3	-
40. Thai Far Warehouse Co.,Ltd.	40	41	111.3	7.6
41. Thai Sae Co.,Ltd.	41	43	114.3	6.7
42. Maha Samuth Rice Co.,Ltd.	40.8	45	106.7	-
b. West side				
1. Cholprathan Cement Co.,Ltd.	15-16	2	99.4	-
2. Electricity Generating Authority of Thailand		2A	172.2	4.6
3. Hartoil Siam Import/Export Co.,Ltd.	33	2B	68.6	-
4.Thai Plastic & Chemical Co.,Ltd.	15.4	4	100.6	4.0
5. Union Metal Co.,Ltd.	-	6	168.6	-
6. United Flour Mill Co.,Ltd.	-	8AB	172.2	8.2
7. United Silo & Service Co.,Ltd.	19. 3	8	172.2	7.0
8. Siam Cement Co.,Ltd.	19. 8	10	172.2	-
9. G.S. Steel Co.,Ltd.	19. 8	12	128.0	-
10. Poonpipat Co.,Ltd.	20. 5	14	172.2	8.2
11. Chaochorm Warehouse Co.,Ltd.	20.8	14A	119.0	6.7
12. The Thai Suger Terminal Corp.,Co.	21	16	172.2	8.2
13. Capital Silo & Drying Co.,Ltd.	21	16	172.2	8.2
14. Tanyakij Warehouse Co.,Ltd.	21-21.6	16	172.2	-
15. Nakorm Siam Wharf Co.,Ltd.	21. 8	16	172.2	8.2
16. Defence Energy Department	25	18ABCD	170.7	7.6
17. Fuel Organization	25	18B-G 22A-H 22A-B	172.2	7.6
18. Port Authority of Thailand	27-28	20A-G	172.2	8.2
19. Shell Co.,Ltd of Thailand	30	24ABC	172.2,	106.7-
20. Esso Co.,Ltd.	30	26AB	172.2,	106.7-
21. Caltex Oil Co.,Ltd.	30. 7	28	45.7	5.0
22. Caltex Oil Co.,Ltd.	31	30	172.2	-
23. Siam Cement Co.,Ltd.	30. 8	30A	70.1	-
24. Thai Dhamrong Pathana Co.,Ltd.	36. 4	32	121.9	7.0
25. Thai Ruang Commercial Co.,Ltd.	38	34	137.2	4.8
26. Siam Gas Industries Terminal Co.,Ltd.	36. 1	30	91.4	5.8

27.	Sukhothai Petroleum Co.,Ltd.	35. 9	30C	96.9	5.5
28.	Thep Nacornswan Co.Ltd.	37	36	121.9	-
29.	Asia Warehouse Co.,Ltd.	38	38	121.9	-
30.	Kiti Rice Co.,Ltd. Partnership	37	40	137.2	6.1

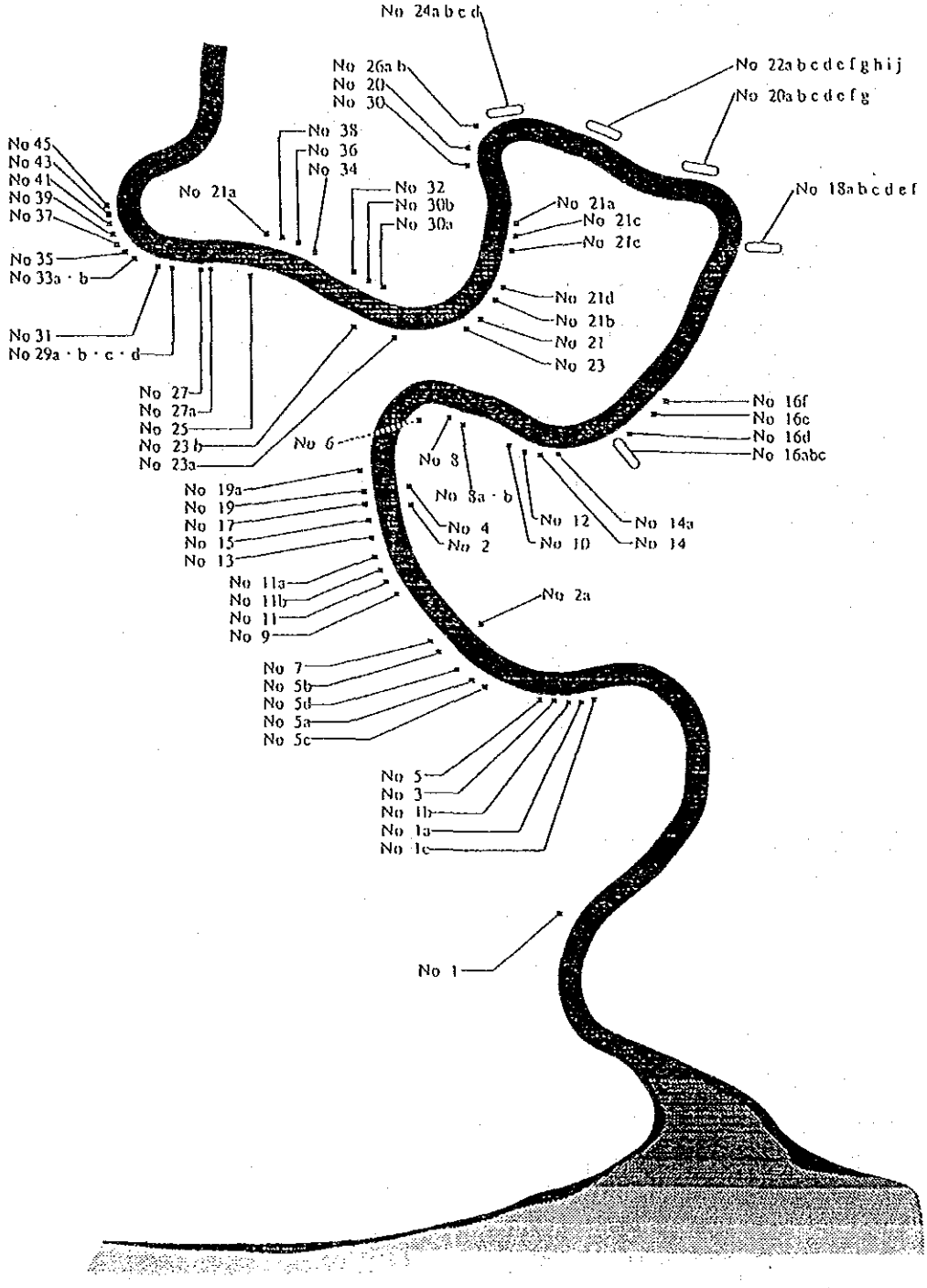


Fig. 6-2-1 Sketch of berths' Location

(2) Navigable Width/Depth of the River/Bar Channels

Navigable width of the waterway is rather narrow throughout the channels.
Assuming that the maneuvering depth of water for a loaded 10,000 DWT seagoing vessel is deeper than eight meters, the width of the river channels, according to THE CHAO PHRAYA RIVER CHART 1991 PAT, is almost less than 300m, further, the narrowest width of the bar channel according to chart datum is about 100m.
The detailed widths of the channels are listed in Table 6-2-3, in which the boldfaced widths, in particular, are narrower than 200m.

The bar extends eight miles S from the river entrance point. The river level is highest in February, and lowest in July and August. In the vicinity of the bar the difference is about half a meter. Water level is also affected by the wind, with S winds increasing the level. When a strong NE or E wind is blowing in the Gulf the water level will rise; with strong W winds and heavy NW or W squalls, the ingoing stream is retarded and the water level lowered.

A typhoon in the China Sea, in the neighborhood of Maui Jung Tao, Has been known to lower the water level at the bar by as much as 0.9m.
The width of a 10 mile long bar channel is 100m in the reaches and 250m on the bends. The depths in the bar channel, the river channel and the berths of sea-going vessel are maintained at -8m to -8.5m(MSL), -8m(LLW) and -9m(LLW), respectively.

Table 6-2-2 Width of the Channels
(-8m or more in depth, MSL)

Section		Course(°)	Width(m)		Landmark
from	to		widest	narrowest	
i) Chao Phraya river channel					
Estuary	km 1	307	150	70	
km 1	km 2	325	350	150	Naval Dockyard
km 2	km 3	348,360	340	320	Hydrographic Dept.
km 3	km 4	012,045	390	240	Khlong Sanphasamit
km 4	km 5	045	230	170	Khlong Taporn
km 5	km 6	047,026	260	160	
km 6	km 7	014,005	280	220	Pom Peesua Samut
km 7	km 8	005,333	290	170	Naval Academy
km 8	km 9	303,279	340	280	Khlong Bang Nang Kreng
km 9	km 10	260	350	260	Khlong Bang Duan
km 10	km 11	280	320	310	Mittraphol Warehouse
km 11	km 12	294	310	270	Siam Chemical Co.
km 12	km 13	307	280	250	Wat Bang Fai
km 13	km 14	320	320	290	Ruam Thum Thai Co.
km 14	km 15	329	300	260	Sub Sri Thai Co.
km 15	km 16	343	310	240	Thai Plastic Co.
km 16	km 17	357	270	260	Lepep Asylum Hospital
km 17	km 18	023,049	250	170	Car Ferry Terminal
km 18	km 19	090,116	250	200	Wharf No.6
km 19	km 20	120,087	290	250	Wharf No.8A,B,C & 10
km 20	km 21	087,077,062	250	210	Wharf No.12,14 & 14A
km 21	km 22	062,050	330	240	Wharf No.16A to 16F
km 22	km 23	039	330	250	Naval Ships Mooring Area
km 23	km 24	039	280	210	Naval ships Mooring Area
km 24	km 25	039,025,008	240	210	Wharf No.18A to 18F
km 25	km 26	355,335,322	240	210	East Quay
km 26	km 27	322,305	270	240	East Quay
km 27	km 28	290	270	250	West Quay
km 28	km 29	290,277	250	220	West Quay
km 29	km 30	277,255,230	220	180	Shell Oil Co.
km 30	km 31	197,180,175	270	210	Caltex Oil Co.

ii) Bar channel: It is 100m wide in the reaches and 250m wide on the bends.
The sounding survey of the bar channel is being carried out every two weeks by Marine Survey Division, PAT, and dredging works is maintained by PAT.

(3) Bends of the channels

In addition to the very narrow width, a 25 mile approaching channel to the core of Bangkok Port winds its way through the bar and the Chao Phraya River. While vessels are proceeding on a meandering narrow passage, they continuously steer to maintain a position in a fairway with enough room for maneuver. The frequency at which course points are altered on the approaches to Bangkok amounts to at least four times and 43 times on the bar channel and the river channel, respectively.

The sharp bends which call for prudent maneuvers are listed in Table 6-2-4, in which the boldfaced turning points, in particular, represent critical sharp bends of more than 40 degrees:

Table 6-2-3 Major Critical Turning Points

Turning P't between			Turning Angle(°)
km. 3	and	km. 4	33
km. 5		km. 6	21
km. 7		km. 8	32
km. 8		**km. 9**	**54**
km.16		Km.17	26
km.17		**km.18**	**67**
km.18		km.19	30
km.19		km.20	33
km.20		km.21	25
km.21		km.22	23
km.24		**km.25**	**44**
km.25		km.26	33
km.29		**km.30**	**80**
km.30		km.31	22

(4) Obstacles in the Channels

1) Floating debris

According to 'China Sea PILOT'(U.K.)', floating debris is plentiful in the channels during the rainy season, in particular. Thus, it likely can be assumed that the situation similar beneath the river surface. Muddy conditions provide zero visibility, so these 'hidden' materials have been impeding small vessel traffic, in particular.

2) Fish stakes

Several fish stakes, which reduce the narrow passage even further, are found, according to US chart No.93243, in the midstream and/or close off both banks of the river.

3) Wrecks

A sunken wreck indicated by lighted W cardinal buoy, lies close off km.23E, according to the same chart as above.

(5) Tidal streams

1) Off harbour

Tidal streams outside the bar and near the anchorage set NW on the rising tide and SE on the falling tide, attaining a rate of 1/4 to one knot. During the NE Monsoon, the current occasionally sets W along the edge of the bank with considerable strength.

2) Bar channel

Tidal streams in the channel over the bar run in the direction of the channel. Maximum rates in normal conditions at distances inward from Bangkok Bar Light-beacon are as follows:

Distance (mile)	Rate (knot)
$^1/_2$	$^1/_2$ to 1
4	1 to 2
$5^3/_4$	1 to 2
$6^1/_2$	1 to 3

3) River channel

The flow is the resultant of the tidal setting in and out of the river and of the current down the river; sets in the direction of the channel. Maximum rates in normal conditions are as follows:

Position	Rate (knot)
Samut Prakan	1 to 2
13°40''8N,100°31'4E	1 to $2^1/_2$
13°42'on,100°29'8E	2 to $2^1/_2$
13°42'7N,100°30'8E	2 to $2^1/_2$
13°44'ON,100°30'8E	2 to $3^1/_2$
Grand Palace	$1^1/_2$ to 2
13°46'ON,100°30'OE	$1^1/_2$ to $2^1/_2$

At Bangkok the tidal stream is usually weaker than the river current from September to December; during this period the flow is almost continuously towards the sea. Occasionally during the rainy season it may reach a rate of four to five knots, when a quantity of floating debris is brought down river.

(6) present Situation of Vessel Traffic within Port Area

The team conducted a fact-finding survey on vessel traffic off the west quay for 24 hours on 21-22 May '93; the results were as follows.

1) Traffic Volume by Type of Vessel

Total volume of passing vessels(more than 20m in length) along the river was 214, of which 116 were upstream and 98 were downstream, in addition to this, 557 crossing and 961 passing along the river by small boats(less than 20m in length) were observed.
Upon classifying the passing vessels(excluding small boats movements) into nine typical types(Cargo, Tanker, Passenger, LPG/LNG, pleasure, Fishing, Gravel, Tug and Other), it was observed that towing vessel with towed lighters(38%) was predominant, followed by tanker(24%) and other vessel(15%).
The fact that the predominant type is a vessel engaged in towing operation, thereby restricted in her ability to manoeuvre, and followed by a tanker loading dangerous cargo, should be minded as the feature characteristics of this area.

2) Traffic Volume by Size of Vessel

Upon Classifying the above vessels into seven sizes(GRT. 0-20, 21-100, 101-500, 501-1,000, 1,001-3,000, 3,001-10,000, 10,001-20,000), the majority fell in the 101-500GRT range(32%) and 1,001-3,000GRT(31%), followed by 3,001-10,000GRT(27%) and 501-1,000GRT(7%). However, small boats movements of crossing/passing the river stream were the overwhelming.

3) Traffic Volume by Time Zone

Since there are no restrictions on time of entry in the port of Bangkok incessant vessel

traffic along the river was observed by day and by night; the traffic volume during daylight hours(0800-2000) was 144(67%) while nighttime(2000-0800) was 70(33%), and the busiest time zones were 0800-1000 and 1300-1600. In addition, small boat crossing movements were marked between 0700-0800 and 1600-1700, while passing movements along the river were extremely in early morning(0600-0800) and early night(2100-2400).

4) Traffic Density of each Section of the Site

Upon dividing the water area fronting klongtoei wharf into 675 sections, the number of passing vessels in each section was integrated to take a general view of traffic density by shading; in the process of integration the report adapted three indexes to present each phases of traffic density as follows.

* Simple density chart: Counted a vessel as a vessel regardless her size
* L density chart: Combined each vessel's L according proportional value for a standard vessel's L
* L2 density chart: Combined each vessel's L2 which represents her occupying water area

5) Table and Figures

Table and Figures related to the above 1) to 4) are shown in Appendix as follows:

* Number of upstream vessel by type/size & time zone
* Number of downstream vessel by type /size & time zone
* Number of total passing vessel by type/time zone
* Number of river crossing boat by time Zone
* Number of passing boat along the river by time Zone
* Track of upstream/downstream/crossing vessel
* Track of every vessel by type
* traffic density by section on the basis of passing vessel
* Traffic density by section on the basis of L of passing vessel
* Traffic density by section on the basis of L2 passing vessel

6.3 Cargo Volume handled in the Port

Table 6-3-1 summarizes the volumes of cargo handled at Bangkok Port within PAT port limits. These figures suggest that about 19.5 million tones of imports in 1991 (representing an average annual growth rate of 12.6% between 1981 and 1991) and 22.4 million tons of exports in 1990 (representing an average annual growth rate of 5.5% between 1981 and 1990) were handled in this area. Of these totals, PAT handled 54.0% of imports and Klong Toei Wharf (excluding the dolphins and anchorage) handled 26.7% of exports.

At Klong Toei Wharf, the most significant increase in traffic has been in the handling of containers. In 1981 imports and exports were about 1.0 million tons each, however, by 1991 imports had increased to 4.4 million tons and exports to 7.2 million tons representing an average annual growth rate 14.8% and 21.8% respectively. Table 6-3-2 shows the annual container handling volume at Klong Toei Wharf in 16 recent years. Both exports and imports have been increasing rapidly. The total handling volume in 1992 is about 1.3 million TEUs, 674 thousand TEUs for exports and 612 thousand TEUs for imports. The rapid increase of container cargo in the past years has caused severe congestion at Klong Toei Wharf.

General cargo imports at Klong Toei Wharf increased only slightly over the period from 1981 to 1989, however between 1989 and 1990 they increased by over 1.0 million tons, while exports have shown relatively minor movement.

Import cargo handled at PAT's dolphins and anchorages ranged from 1.0 million to 2.4 million tons between 1987 and 1991.

Table 6-3-3 shows cargo handling volume at Klong Toei Wharf in 1992 fiscal year by commodities.

Table 6-3-1 Summary of Cargo Handling Volume at Bangkok Port

UNIT: Thousand tons

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
IMPORT CARGO											
Klong Toei Wharf	3,800	3,300	4,079	4,353	4,118	3,772	4,684	5,858	6,253	7,837	8,185
Containerised Cargo	1,100	1,100	1,396	1,565	1,591	1,585	2,182	2,813	3,340	3,917	4,373
General Cargo	2,700	2,200	2,683	2,788	2,527	2,187	2,502	3,045	2,913	3,920	3,812
Klong Toei Dolphins			904	618	487	469	595	835	656	854	995
Bang Hua Sua Dolphin			-	-	-	150	180	281	391	699	925
Sathupradit Anchorage	2,120	2,730	409	215	222	168	252	364	286	414	414
TMN Wharves				133	104	100	111				
Private Wharves			1,447	1,796	1,906	1,714	2,792	3,928	5,706	7,664	8,978
Total Bangkok Port	5,920	6,030	6,839	7,115	6,837	6,373	8,614	11,266	13,292	17,468	19,497
EXPORT CARGO											
Klong Toei Wharf	1,100	1,400	1,538	1,851	2,223	2,909	3,664	4,589	5,732	5,997	7,186
Containerised Cargo	1,000	1,100	1,291	1,637	2,219	2,903	3,662	4,587	5,398	5,795	7,166
General Cargo	100	300	247	214	4	6	2	2	334	202	20
Mid-stream Dolphins and Private Wharves	12,800	17,750	13,410	16,560	17,120	18,150	15,960	16,400	19,803	16,430	na
Total Bangkok Port	13,900	19,150	14,948	18,411	19,343	21,059	19,624	20,989	26,535	22,427	na

Source: Annual Reports, Port of Thailand

Notes : 1. Private Wharves include Thai Maritime Navigation Wharves but exclude oil jetty.
2. The extent of 'transshipment' and hence 'double counting' on the Chao Phraya is unknown
3. In addition to cargo handled at the port, there is a considerable volume of export barge traffic passing through the port area, loaded upstream of the port limits destined for the Ko Sichang Anchorage.

Table 6-3-2 Container Number Throughput at Klong Toei Wharf
(1977-1992 Fiscal Year)

Year	Inward								Outward							
	Unloaded						EMPTY	TOTAl	Loaded						EMPTY	TOTAl
	20'	'35	'40	'45	BOX	TEU	TEU	TEU	20'	'35	'40	'45	BOX	TEU	TEU	TEU
1977	12,673	5,230	6,689	0	24,592	35,204	291	35,495	7,885	4,827	5,914	0	18,626	28,160	5,114	33,274
1978	22,397	5,960	8,901	0	37,258	50,630	3,172	53,802	16,098	5,845	8,012	0	29,955	42,353	6,589	48,942
1979	30,290	8,718	13,750	0	52,758	73,047	5,952	78,999	25,997	7,784	13,157	0	46,938	65,930	10,749	76,679
1980	35,014	8,122	15,577	0	58,713	80,383	12,852	93,235	35,059	7,523	15,414	0	57,996	79,052	10,101	89,153
1981	48,333	6,521	21,499	0	76,353	102,743	12,352	115,095	48,561	5,276	20,979	0	74,816	99,752	16,769	116,521
1982	53,761	3,294	20,347	0	77,402	100,219	28,364	128,583	63,108	4,374	23,381	0	90,863	117,525	8,476	126,001
1983	66,592	3,928	26,120	0	96,640	125,706	20,236	145,942	72,121	3,967	26,296	0	102,348	131,655	13,609	145,264
1984	75,113	3,837	30,106	0	109,056	142,040	23,971	166,011	83,941	3,582	31,296	0	118,819	152,801	13,657	166,458
1985	75,180	1,574	30,315	0	107,069	138,565	52,942	191,507	99,928	1,798	39,633	0	141,359	182,341	8,388	190,729
1986	72,677	380	31,515	0	104,572	136,372	105,938	242,310	129,169	519	53,857	0	183,545	237,791	3,063	240,854
1987	99,088	49	45,888	49	145,074	191,060	113,900	304,960	160,853	187	68,907	15	229,962	299,028	4,676	303,704
1988	123,125	4	67,055	276	190,460	257,863	120,906	378,769	190,150	0	87,876	308	278,334	366,595	7,339	373,934
1989	147,102	0	82,578	750	230,430	313,946	132,027	445,973	215,201	0	113,657	1,481	330,339	445,847	12,961	458,808
1990	161,606	0	99,125	717	261,448	361,470	119,127	480,597	224,356	0	122,935	1,559	348,850	473,734	27,658	501,392
1991	176,144	0	111,983	946	289,073	402,239	128,321	530,560	265,261	0	149,671	1,465	416,397	567,899	25,384	593,283
1992	182,057	0	121,489	998	304,544	427,281	183,545	610,826	291,168	0	177,906	2,247	471,321	652,036	22,147	674,183

Source: Statistical Sec. Technical Department PAT

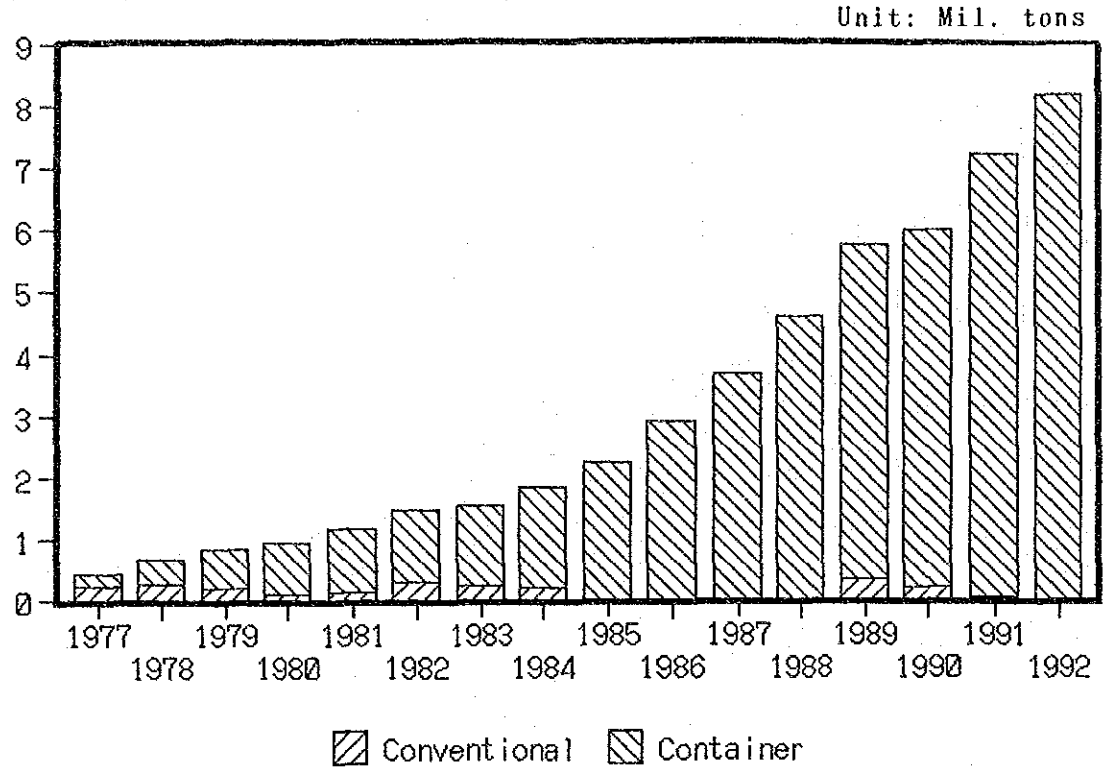


Fig. 6-3-1 Export Cargo Volume at Klong Toei Wharf

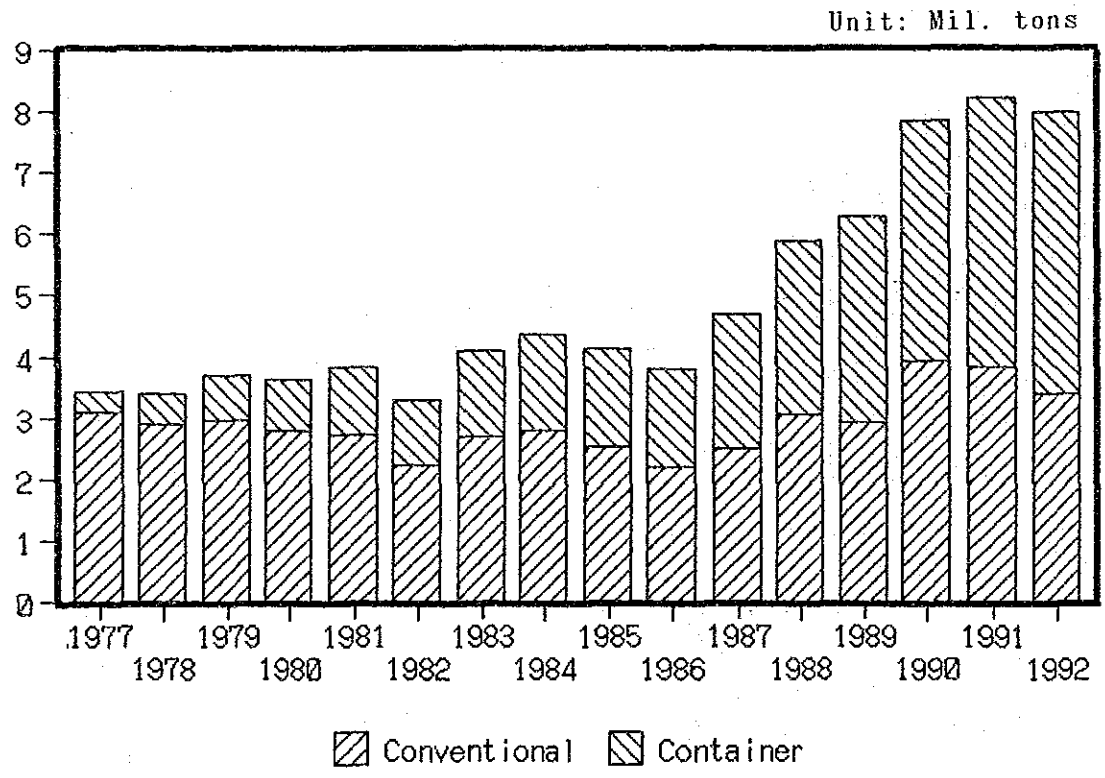


Fig. 6-3-2 Import Cargo Volume at Klong Toei Wharf

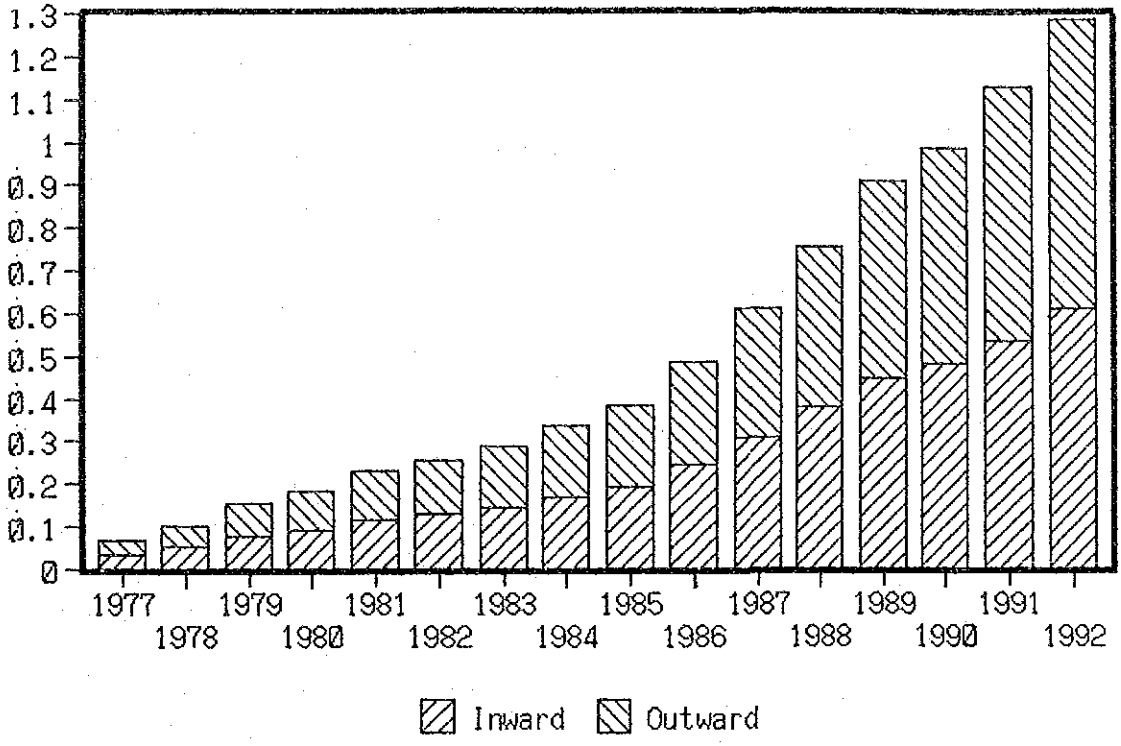


Fig. 6-3-3 Container Number Throughput at Klong Toei Wharf

Table 6-3-3 Cargo handling volume at Klong Toei Wharf in 1992 Fiscal year by Commodities

Unit: tons

Commodities	Import	Export
1. Live Animals	0	90
2. Fresh & Frozen Food	74,337	38,902
3. Animal Product	103,908	8,856
4. Vegitable Products	128,493	258,439
5. Rice	9,931	54,773
6. Tea & Coffee	1,559	15,022
7. Animal-Vegetable fat/Oil	51,291	3,013
8. Prepared Foodstuff/Canned food	64,565	129,878
9. Beverage, Spirit, Vinegar	22,278	3,829
10. Prepared Animal Fodder	121,035	28,551
11. Tobacco	9,922	3,302
12. Mineral Products	70,806	3,198
13. Chemical Products	783,190	5,149
14. Pharmaceutical Products	17,501	1,868
15. Fertilizers	57,554	0
16. Cosmetics	4,806	415
17. Lubricating Oil-Soap-Wax	72,568	8,317
18. Dangerous Chemical Products	273,674	893
19. Plastic & Rubber Products	330,317	48,404
20. Rubber	19,322	92,056
21. Hide-Skins-Leathers	41,235	3,271
22. Wood & Wickerware	44,927	7,489
23. Paper	546,513	8,345
24. Textile, Filament, Clothing	177,769	42,090
25. Jute-Cotton-Kapok	235,575	31,786
26. Stone, Plaster, Cemment, etc	138,631	30,559
27. Glass & Glassware	33,002	4,298
28. Metal & Steel	2,377,712	19,138
29. Tools	127,184	16,104
30. Machinery & Used Engines	352,519	1,284
31. Electrical Equipment	187,747	14,192
32. Vehicle	85,205	7
33. Transport Equipment, CKD. & Parts	284,603	7,122
34. Optical-Photo-Medical equipment	8,487	314
35. Musical Instrument	3,245	25
36. Arm & Ammunition/Cartridgs	3,672	0
37. Furniture	3,680	3,256
38. Toy-Games & Sport Requisites	14,028	1,975
39. Others	1,098,365	7,267,198
Total	7,981,156	8,163,408

Source: Statistical Section

6.4 Calling Vessels

6.4.1 Vessels Calling at the East Quay

(1) General

The records of 714 container vessels which called at the east quay from October, 1991 to March, 1992 were analyzed, and the results are summarized in the following sections (2)-(8).

(2) Container-handling Productivity at the Dockside

Containers are discharged or loaded by container gantry cranes installed on the apron. The monthly averages of gross container-handling productivity per vessel in the six months are shown as follows (see Table 6-4-1 and Fig. 6-4-1):

	Average gross container-handling productivity (Boxes/hr/vessel)
October,1991	17
November	19
December	18
January,1992	16
February	18
March	19

Table 6-4-1 Container-Handling Productivity at the Dockside of the East Quay

Cargo-Handling Productivity (Box/Hr/Vessel)	1991						1992						Total	
	October		November		December		January		February		March			
	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)
70-60	1	0.8%	2	1.6%			1	0.8%	2	1.9%	1	0.8%	7	1.0%
60-50	1	0.8%	2	1.6%	2	1.7%			2	1.9%	2	1.7%	9	1.3%
50-40	3	2.3%	2	1.6%	3	2.6%	2	1.7%	2	1.9%	2	1.7%	14	2.0%
40-30	12	9.4%	15	12.3%	10	8.6%	8	6.7%	10	9.3%	8	6.6%	63	8.8%
30-20	34	26.6%	38	31.1%	36	31.0%	32	26.9%	40	37.0%	40	33.1%	220	30.8%
20-10	61	47.7%	52	42.6%	52	44.8%	48	40.3%	35	32.4%	55	45.5%	303	42.4%
10- 0	16	12.5%	11	9.0%	13	11.2%	28	23.5%	17	15.7%	13	10.7%	98	13.7%
Total	128	100.0%	122	100.0%	116	100.0%	119	100.0%	108	100.0%	121	100.0%	714	100.0%

Source: PAT

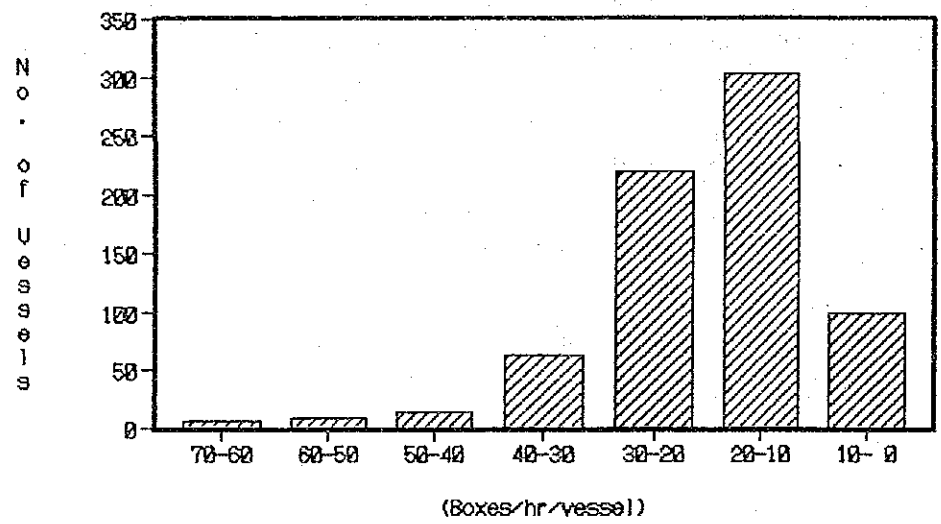


Fig. 6-4-1 Cargo-Handling Productivity per Vessel (Oct.,'91-March,'92)

(3) Berthing Times of Container Vessels

The monthly averages of berthing times of container vessels are shown as follows (see Table 6-4-2 and Fig 6-4-2):

Berthing times of container vessels

	(hrs)
October,1991	33
November	32
December	33
January,1992	34
February	32
March	32

Table 6-4-2 Berthing Times of Container Vessels at the East Quay

Berthing Time (Hrs)	1991						1992						Total	
	October		November		December		January		February		March			
	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)
100-90									2	1.9%			2	0.3%
90-80									1	0.9%			1	0.1%
80-70			1	0.8%	3	2.6%	3	2.5%	3	2.8%	1	0.8%	11	1.5%
70-60	7	5.5%	5	4.1%	1	0.9%	2	1.7%	2	1.9%	2	1.7%	19	2.7%
60-50	5	3.9%	2	1.6%	6	5.2%	9	7.6%	2	1.9%	6	5.0%	30	4.2%
50-40	17	13.3%	23	18.9%	25	21.6%	25	21.0%	15	13.9%	29	24.0%	134	18.8%
40-30	36	28.1%	35	28.7%	22	19.0%	26	21.8%	22	20.4%	22	18.2%	163	22.8%
30-20	48	37.5%	42	34.4%	46	39.7%	41	34.5%	48	44.4%	43	35.5%	268	37.5%
20-10	11	8.6%	8	6.6%	12	10.3%	13	10.9%	10	9.3%	17	14.0%	71	9.9%
10- 0	4	3.1%	6	4.9%	1	0.9%		0.0%	3	2.8%	1	0.8%	15	2.1%
Total	128	100.0%	122	100.0%	116	100.0%	119	100.0%	108	100.0%	121	100.0%	714	100.0%

Source: PAT

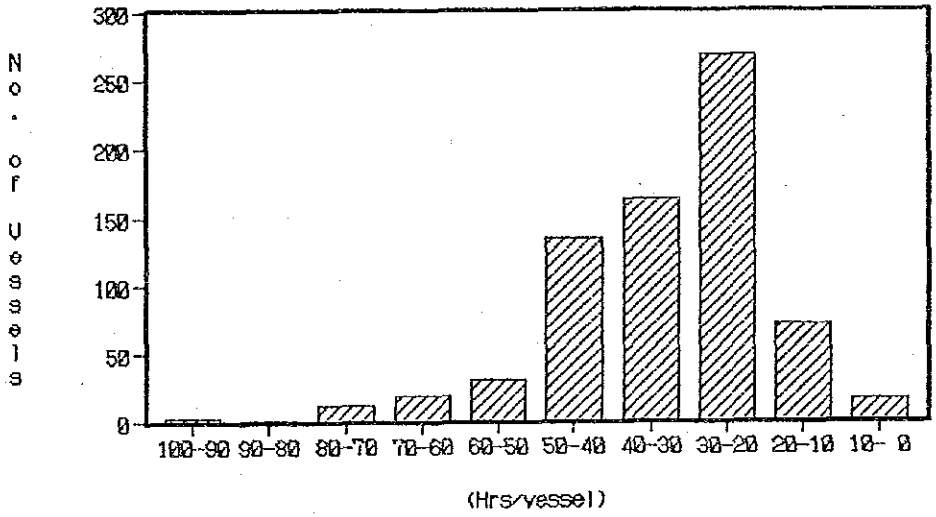


Fig. 6-4-2 Berthing Time Distribution (Oct.,'91-March,'92)

(4) Number of Containers Discharged and Loaded per Container Vessel

The monthly averages of the number of containers discharged and loaded per container vessel are shown as follows (see Table 6-4-3 and Fig 6-4-3):

Number of containers discharged and loaded	(Boxes/vessel)	(TEUs/vessel)
October,1991	575	784
November,1991	610	845
December,1991	594	815
January,1992	541	744
February,1992	586	817
March,1992	590	825

Table 6-4-3 Number of Containers Discharged and Loaded per Container Vessel at the East Quay

Number of Containers Discharged & Loaded (Boxes)	1991						1992						Total	
	October		November		December		January		February		March			
	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)
1700-1600									1	0.9%	1	0.8%	2	0.3%
1600-1500			1	0.8%									1	0.1%
1500-1400	1	0.8%	1	0.8%			2	1.7%	1	0.9%	1	0.8%	6	0.8%
1400-1300			1	0.8%	1	0.9%	1	0.8%	1	0.9%	2	1.7%	6	0.8%
1300-1200	4	3.1%		0.0%	1	0.9%	1	0.8%	2	1.9%	2	1.7%	10	1.4%
1200-1100	4	3.1%	3	2.5%	6	5.2%					2	1.7%	15	2.1%
1100-1000	4	3.1%	3	2.5%	3	2.6%	1	0.8%	4	3.7%	2	1.7%	17	2.4%
1000- 900	4	3.1%	4	3.3%	5	4.3%	1	0.8%	1	0.9%	4	3.3%	19	2.7%
900- 800	2	1.6%	8	6.6%	4	3.4%	4	3.4%	7	6.5%	6	5.0%	31	4.3%
800- 700	12	9.4%	15	12.3%	12	10.3%	13	10.9%	6	5.6%	10	8.3%	68	9.5%
700- 600	16	12.5%	15	12.3%	15	12.9%	22	18.5%	18	16.7%	21	17.4%	107	15.0%
600- 500	22	17.2%	28	23.0%	27	23.3%	24	20.2%	29	26.9%	28	23.1%	158	22.1%
500- 400	29	22.7%	26	21.3%	20	17.2%	18	15.1%	15	13.9%	11	9.1%	119	16.7%
400- 300	15	11.7%	11	9.0%	10	8.6%	14	11.8%	11	10.2%	16	13.2%	77	10.8%
300- 200	9	7.0%	3	2.5%	9	7.8%	10	8.4%	8	7.4%	7	5.8%	46	6.4%
200- 100	3	2.3%	2	1.6%			6	5.0%	3	2.8%	5	4.1%	19	2.7%
100- 0	3	2.3%	1	0.8%	3	2.6%	2	1.7%	1	0.9%	3	2.5%	13	1.8%
Total	128	100.0%	122	100.0%	116	100.0%	119	100.0%	108	100.0%	121	100.0%	714	100.0%

Source: PAT

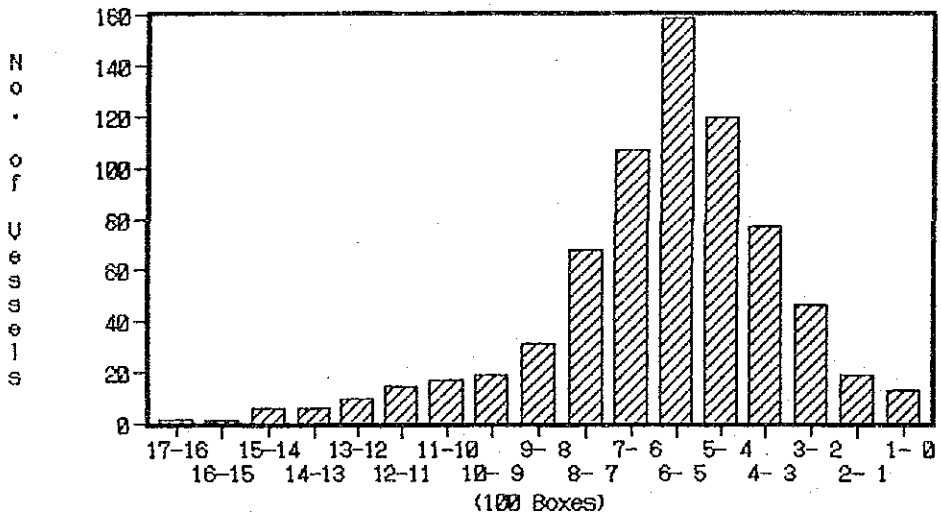


Fig. 6-4-3 Number of Container Boxes Unloaded & Loaded (Oct.,'91-March.'92)

(5) Lengths of Containers Vessels

Reflecting the restriction of the vessel length of 565 ft. (172.2 meters) within the limits of Bangkok Port, the maximum length (L.O.A.) of container vessels which actually called at the east quay in the record period does not exceed 555 ft. (169.2 meters). The distribution of the vessel lengths in the record period is shown in Table 6-4-4 and Fig 6-4-4.

Table 6-4-4 Lengh Over All (L.O.A) of Container Vessels Calling at the East Quay

L.O.A. (ft.)	1991						1992						Total	
	October		November		December		January		Februay		March			
	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)
Max 555	3	2.3%	3	2.5%	3	2.6%	3	2.5%	1	0.9%	3	2.5%	16	2.2%
550-500	31	24.2%	27	22.1%	32	27.6%	37	31.1%	31	28.7%	32	26.4%	190	26.6%
500-450	25	19.5%	32	26.2%	23	19.8%	20	16.8%	25	23.1%	24	19.8%	149	20.9%
450-400	25	19.5%	24	19.7%	24	20.7%	22	18.5%	16	14.8%	30	24.8%	141	19.7%
400-350	40	31.3%	32	26.2%	31	26.7%	33	27.7%	32	29.6%	30	24.8%	198	27.7%
350-300	3	2.3%	2	1.6%	3	2.6%	4	3.4%	3	2.8%	1	0.8%	16	2.2%
300-250	1	0.8%											1	0.1%
250-200			2	1.6%							1	0.8%	3	0.4%
Total	128	100.0%	122	100.0%	116	100.0%	119	100.0%	108	100.0%	121	100.0%	714	100.0%

Source: PAT

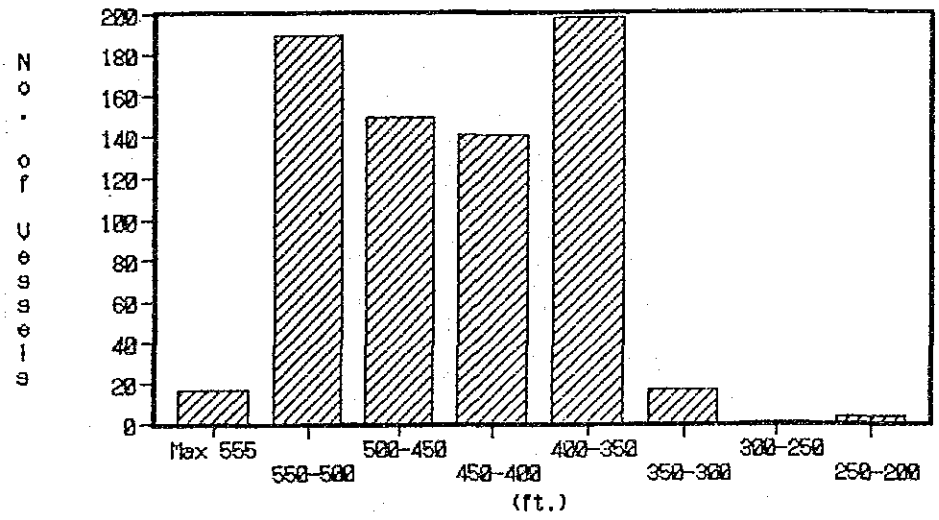


Fig. 6-4-4 L.O.A. Distribution (Oct.,'91-March,'92)

(6) Drafts of Containers Vessels

Reflecting the restriction of the vessel drafts of 27 ft. (8.2 meters) within the limits of Bangkok Port, the maximum draft of container vessels which actually called at the east quay in the record period does not exceed 26 ft. (7.9 meters). The distribution of the vessel drafts in the record period is shown in Table 6-4-5 and Fig 6-4-5.

Table 6-4-5 Drafts of Container Vessels Calling at the East Quay

Draft (ft.)	1991						1992						Total	
	October		November		December		January		February		March			
	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)
Max 26	1	0.8%	4	3.3%			2	1.7%	1	0.9%			8	1.1%
26-24	11	8.6%	11	9.0%	6	5.2%	10	8.4%	12	11.1%	17	14.0%	67	9.4%
24-22	31	24.2%	33	27.0%	19	16.4%	33	27.7%	32	29.6%	41	33.9%	189	26.5%
22-20	42	32.8%	30	24.6%	42	36.2%	34	28.6%	31	28.7%	26	21.5%	205	28.7%
20-18	21	16.4%	29	23.8%	29	25.0%	21	17.6%	18	16.7%	20	16.5%	138	19.3%
18-16	15	11.7%	11	9.0%	18	15.5%	11	9.2%	9	8.3%	9	7.4%	73	10.2%
16-14	6	4.7%	1	0.8%	1	0.9%	3	2.5%	4	3.7%	3	2.5%	18	2.5%
14-12	1	0.8%	2	1.6%	1	0.9%	5	4.2%	1		4	3.3%	14	2.0%
12-10			1	0.8%							1	0.8%	2	0.3%
Total	128	100.0%	122	100.0%	116	100.0%	119	100.0%	108	99.1%	121	100.0%	714	100.0%

Source: PAT

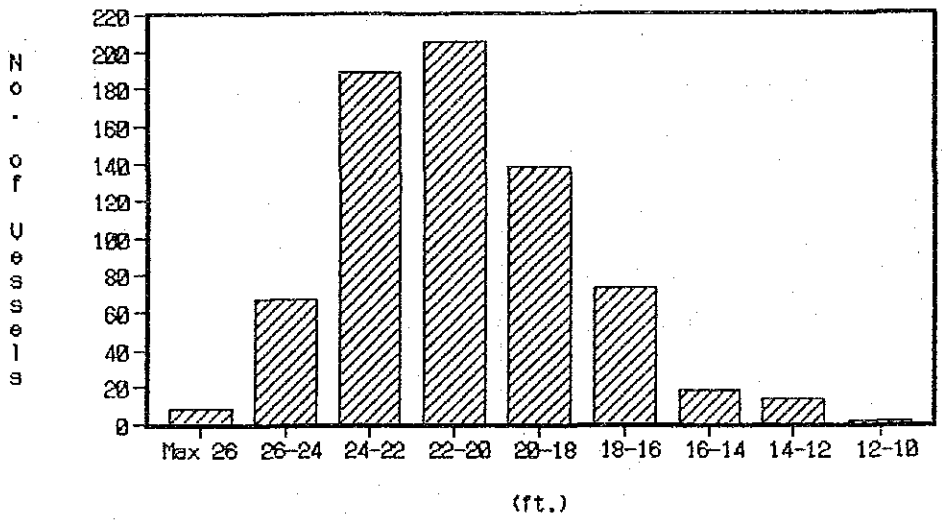


Fig. 6-4-5 Drafts Distribution (Oct.,'92-March,'92)

(7) Number of Discharged and Loaded Containers by Shipping Route

The monthly averages of the number of discharged and loaded containers by shipping routes are shown in Table 6-4-6 and Fig 6-4-6. The Singapore route takes the largest percentage of 62.5%, followed by the Japan route (18.8%) and Hong Kong route (16.9%) in the record period of October, 1991-March, 1992. The portion of the other routes is negligibly small (see Table 6-4-6 and Fig. 6-4-6).

Table 6-4-6 No. of Unloaded & Loaded Containers by Origin Country of Container Vessels Calling at the East Quay

Origin Countrys	1991						1992						Total	
	October		November		December		January		February		March			
	(TEUs)	(%)	(TEUs)	(%)	(TEUs)	(%)	(TEUs)	(%)	(TEUs)	(%)	(TEUs)	(%)	(TEUs)	(%)
Singapore	67142	66.9%	64034	62.1%	60177	63.7%	58564	66.2%	53098	60.2%	55943	56.1%	358958	62.5%
Japan	19921	19.8%	18828	18.3%	15911	16.8%	14421	16.3%	13665	15.5%	25067	25.1%	107813	18.8%
Hong Kong	12943	12.9%	19325	18.8%	17460	18.5%	13469	15.2%	17811	20.2%	15955	16.0%	96963	16.9%
Vietnum			858	0.8%			594	0.7%	2933	3.3%	2660	2.7%	7045	1.2%
Others	406		0		957		1443		743		152		3701	0.6%
Total	100412	99.6%	103045	100.0%	94505	99.0%	88491	98.4%	88250	99.2%	99777	99.8%	574480	100.0%

Source: PAT

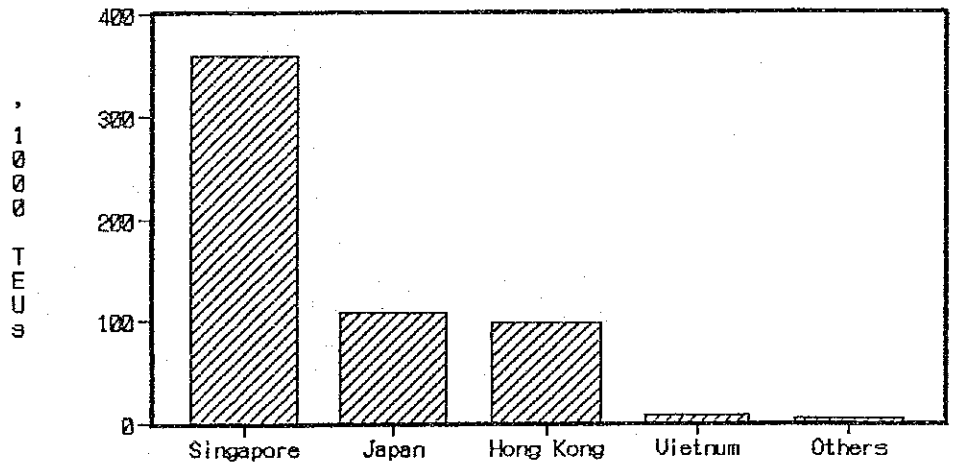


Fig. 6-4-6 Origin Countries of Container (Oct.,'92-March,'92)

(8) Berth Occupancy Ratios of the Berths at the East Quay

Berth occupancy ratios of the berths at the east quay in the record period are shown in Table 6-4-7 and Fig 6-4-7. Judging from the high value of the average berth occupancy ratio of 75.5% in the record period, the east quay seems to have been saturated.

Table 6-4-7 Berth Occupancy Ratio at the East Quay

Berth	1991			1992			Average
	October	November	December	January	February	March	
	(%)	(%)	(%)	(%)	(%)	(%)	(%)
A	83.4	66.6	73.8	99.0	77.1	57.5	76.2
AB	77.9	83.4	75.6	85.7	68.3	74.6	77.6
B	68.0	59.4	56.4	71.4	69.8	74.1	66.5
C	62.8	75.1	76.2	64.2	64.2	59.2	67.0
D	72.3	76.4	76.7	76.0	63.1	76.3	73.5
E	83.5	67.1	73.9	62.0	88.2	78.8	75.6
EF	17.2	31.2	26.2	21.2	7.9	14.3	19.7
F	80.1	77.8	66.3	58.0	79.4	73.3	72.5
Average	77.9	76.7	74.9	76.8	74.0	72.6	75.5

Source: PAT

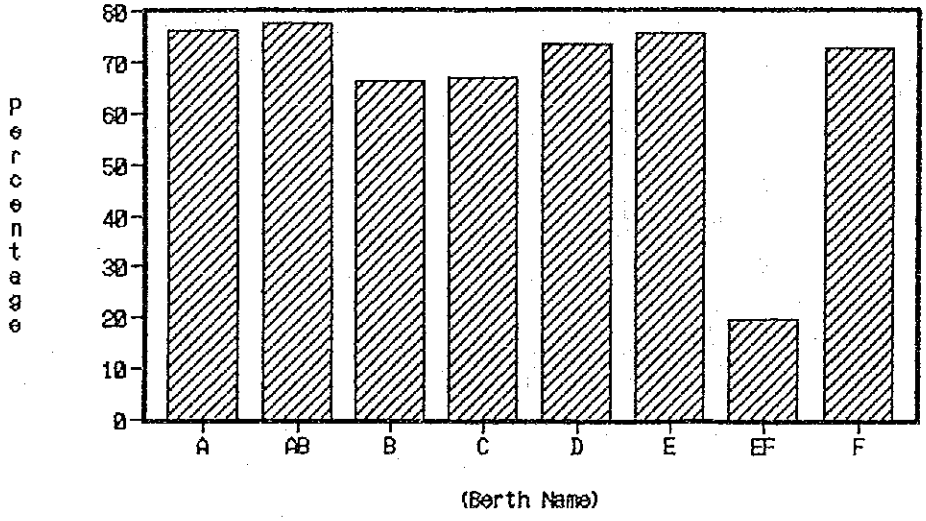


Fig. 6-4-7 Berth Occupancy Ratios (Oct.,'92-March,'92)

6.4.2 Vessels Calling at the West Quay

(1) General

A record of 445 vessels from/onto which cargoes were discharged/loaded at the west quay from October, 1991 to March, 1992 was analyzed. Out of the 445 vessels, 385 vessels are conventional vessels and the remaining 60 vessels are container vessels with ship cranes for container-handling. Some of the conventional vessels, which called at the west quay in the record period, transported a small number of containers together with break-bulk cargoes. The results of the analyses are summarized in the following sections (2)-(6).

(2) Cargo-Handling Productivity at the Dockside

1) Conventional Vessels

Non-containerized general cargoes with various package conditions such as bagged and palletized are discharged from or loaded onto conventional vessels using their ship cranes/derrick cranes at the west quay. Bulky and heavy cargoes such as steel products and vehicles are also handled at the west quay. Almost all conventional cargoes are imports, and exports are few, except for a small number of exported containers transported on decks of the conventional vessels. The monthly averages of gross cargo-handling productivity of the conventional vessels in the six months are shown as follows (see Table 6-4-8 and Fig. 6-4-8):

	Average gross cargo-handling productivity (Tons/hr/vessel)
October,1991	45
November	48
December	57
January,1992	52
February	51
March	53

2) Container Vessels Calling at the West Quay

The monthly averages of gross container-handling productivity of the container vessels by using ship cranes in the six months are shown as follows:

Average gross container-handling productivity

(Boxes/hr/vessel)

October,1991	13
November	10
December	12
January,1992	15
February	9
March	15

Table 6-4-8 Cargo-Handling Productivity of Conventional Vessels at the Dockside of the West Quay

Cargo-Handling Productivity (Tons/Hr/Vessel)	1991						1992						Total	
	October		November		December		January		Februay		March			
	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)
Over 150	4	6.8%	2	3.1%	8		3	4.8%	2	3.0%	3	4.1%	22	5.7%
150-140														
140-130											2	2.7%	2	0.5%
130-120	2	3.4%	1	1.6%	2		1	1.6%	1	1.5%			7	1.8%
120-110			2	3.1%	1		1	1.6%	1	1.5%	2	2.7%	7	1.8%
110-100			2	3.1%	3		1	1.6%	1	1.5%			7	1.8%
100-90			5	7.8%	1		4	6.3%	1	1.5%	5	6.8%	16	4.2%
90-80	3	5.1%	3	4.7%	5		3	4.8%	7	10.6%	5	6.8%	26	6.8%
80-70	5	8.5%	1	1.6%	2		2	3.2%	5	7.6%	7	9.5%	22	5.7%
70-60	6	10.2%	7	10.9%	2		8	12.7%	8	12.1%	6	8.1%	37	9.6%
60-50	10	16.9%	4	6.3%	7	11.9%	4	6.3%	6	9.1%	6	8.1%	37	9.6%
50-40	4	6.8%	7	10.9%	5	8.5%	8	12.7%	5	7.6%	7	9.5%	36	9.4%
40-30	2	3.4%	5	7.8%	2	3.4%	12	19.0%	7	10.6%	8	10.8%	36	9.4%
30-20	11	18.6%	14	21.9%	8	13.6%	7	11.1%	10	15.2%	10	13.5%	60	15.6%
20-10	6	10.2%	8	12.5%	9	15.3%	7	11.1%	9	13.6%	10	13.5%	49	12.7%
10- 0	6	10.2%	3	4.7%	4	6.8%	2	3.2%	3	4.5%	3	4.1%	21	5.5%
Total	59	100.0%	64	100.0%	59	59.3%	63	100.0%	66	100.0%	74	100.0%	385	100.0%

Source: PAT

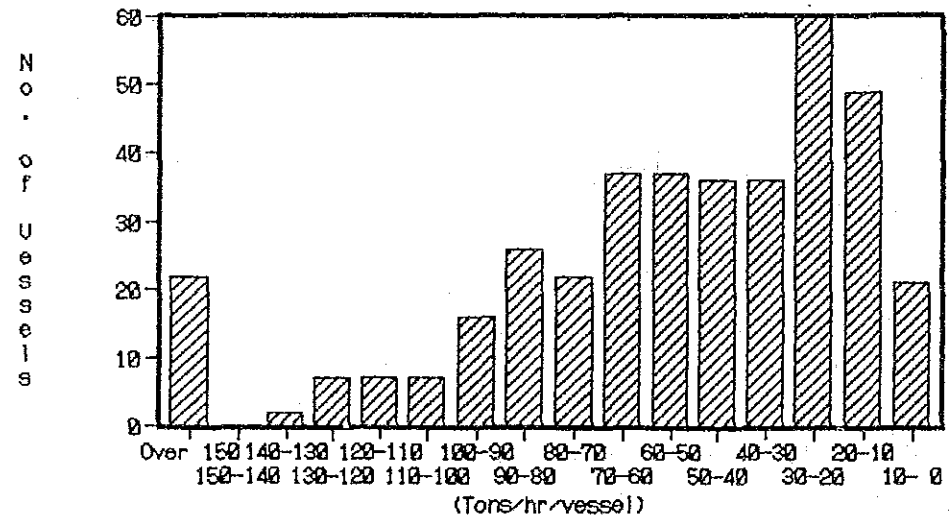


Fig. 6-4-8 Cargo-Handling Productivity per Vessel (Oct.,'92-March,'92)

(3) Berthing Times

1) Conventional Vessels

The monthly averages of berthing times of conventional vessels are shown as follows (see Table 6-4-9 and Fig 6-4-9):

Berthing times of conventional vessels

	(days)
October,1991	3.9
November	3.8
December	3.1
January,1992	3.3
February	3.5
March	3.2

2) Container Vessels

The monthly averages of berthing times of container vessels at the west quay are shown as follows:

Berthing times of container vessels

	(hrs)
October,1991	38
November	36
December	38
January,1992	40
February	44
March	37

Table 6-4-9 Berthing Times of Conventional Vessels at the West Quay

Berthing Time (Days)	1991						1992						Total	
	October		November		December		January		February		March			
	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)
15-14							1	1.6%					1	0.3%
14-13	1	1.7%											1	0.3%
13-12														
12-11			1	1.6%			1	1.6%					2	0.5%
11-10	1	1.7%											1	0.3%
10- 9			1	1.6%	1	1.7%					1	1.4%	3	0.8%
9- 8	2	3.4%	3	4.7%			3	4.8%			1	1.4%	9	2.3%
8- 7	4	6.8%	3	4.7%	3	5.1%			3	4.5%	1	1.4%	14	3.6%
7- 6	2	3.4%	4	6.3%	3	5.1%	3	4.8%	6	9.1%	4	5.4%	22	5.7%
6- 5	3	5.1%	6	9.4%	3	5.1%	1	1.6%	7	10.6%	6	8.1%	26	6.8%
5- 4	15	25.4%	5	7.8%	8	13.6%	6	9.5%	10	15.2%	7	9.5%	51	13.2%
4- 3	14	23.7%	16	25.0%	12	20.3%	15	23.8%	10	15.2%	14	18.9%	81	21.0%
3- 2	5	8.5%	12	18.8%	9	15.3%	15	23.8%	14	21.2%	21	28.4%	76	19.7%
2- 1	5	8.5%	8	12.5%	11	18.6%	9	14.3%	7	10.6%	12	16.2%	52	13.5%
1- 0	7	11.9%	5	7.8%	9	15.3%	9	14.3%	9	13.6%	7	9.5%	46	11.9%
Total	59	100.0%	64	100.0%	59	100.0%	63	100.0%	66	100.0%	74	100.0%	385	100.0%

Source: PAT

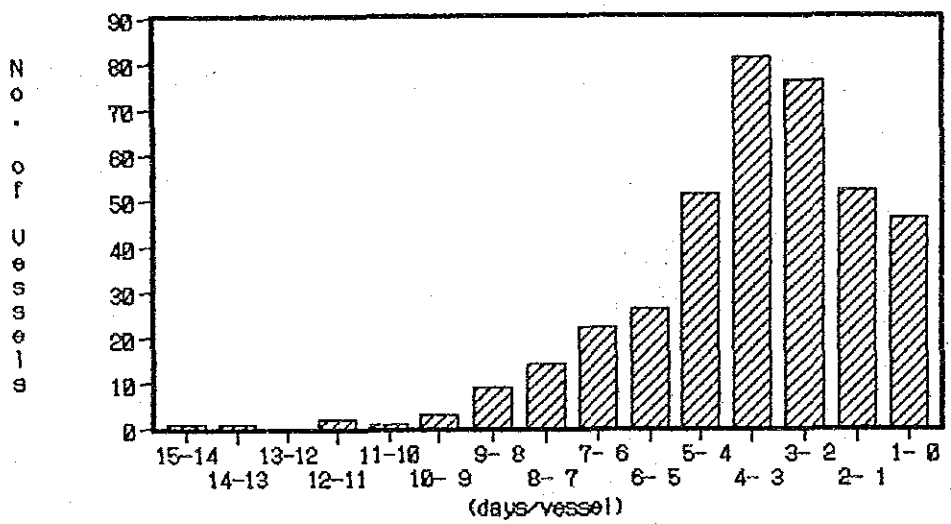


Fig. 6-4-9 Berthing Time Distribution (Oct.,'92-March,'92)

(4) Volume of Cargoes Discharged and Loaded per Vessel

1) Conventional Vessels

The monthly averages of the volume of cargoes discharged and loaded per conventional vessel are shown as follows (see Table 6-4-10 and Fig 6-4-10):

Volume of cargoes discharged and loaded

	(Tons/vessel)
October,1991	4244
November,1991	4433
December,1991	4279
January,1992	4103
February,1992	4238
March,1992	4059

2) Containers Vessels

The monthly averages of the number of container discharged and loaded per container vessel at the west quay are shown as follows:

Number of containers discharged and loaded

	(Boxes/vessel)	(TEUs/vessel)
October,1991	480	692
November,1991	364	471
December,1991	450	655
January,1992	622	887
February,1992	386	555
March,1992	537	729

Table 6-4-10 Volume of Cargoes Discharged and Loaded per Conventional Vessel at the West Quay

Number of Containers Discharged & Loaded (Tons)	1991						1992						Total	
	October		November		December		January		February		March			
	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)	No. of Vessels	(%)
15000-14000							1	1.6%			1	1.4%	2	0.5%
14000-13000	1	1.7%	1	1.6%									2	0.5%
13000-12000					2	3.4%			2	3.0%	1	1.4%	5	1.3%
12000-11000	1	1.7%			1	1.7%							2	0.5%
11000-10000		0.0%	1	1.6%			2		1	1.5%	2	2.7%	6	1.6%
10000- 9000	1	1.7%	1	1.6%	3	5.1%	1	1.6%			2	2.7%	8	2.1%
9000- 8000	2	3.4%	3	4.7%	5	8.5%	2	3.2%	6	9.1%	1	1.4%	19	4.9%
8000- 7000	4	6.8%	12	18.8%	1	1.7%	6	9.5%	4	6.1%	4	5.4%	31	8.1%
7000- 6000	4	6.8%	6	9.4%	3	5.1%	6	9.5%	10	15.2%	7	9.5%	36	9.4%
6000- 5000	11	18.6%	7	10.9%	8	13.6%	6	9.5%	4	6.1%	8	10.8%	44	11.4%
5000- 4000	6	10.2%	3	4.7%	5	8.5%	4	6.3%	6	9.1%	9	12.2%	33	8.6%
4000- 3000	8	13.6%	3	4.7%	7	11.9%	8	12.7%	5	7.6%	5	6.8%	36	9.4%
3000- 2000	4	6.8%	4	6.3%	3	5.1%	9	14.3%	5	7.6%	9	12.2%	34	8.8%
2000- 1000	8	13.6%	13	20.3%	10	16.9%	9	14.3%	11	16.7%	13	17.6%	64	16.6%
1000- 0	9	15.3%	10	15.6%	11	18.6%	9	14.3%	12	18.2%	12	16.2%	63	16.4%
Total	59	100.0%	64	100.0%	59	100.0%	63	96.8%	66	100.0%	74	100.0%	385	100.0%

Source: PAT

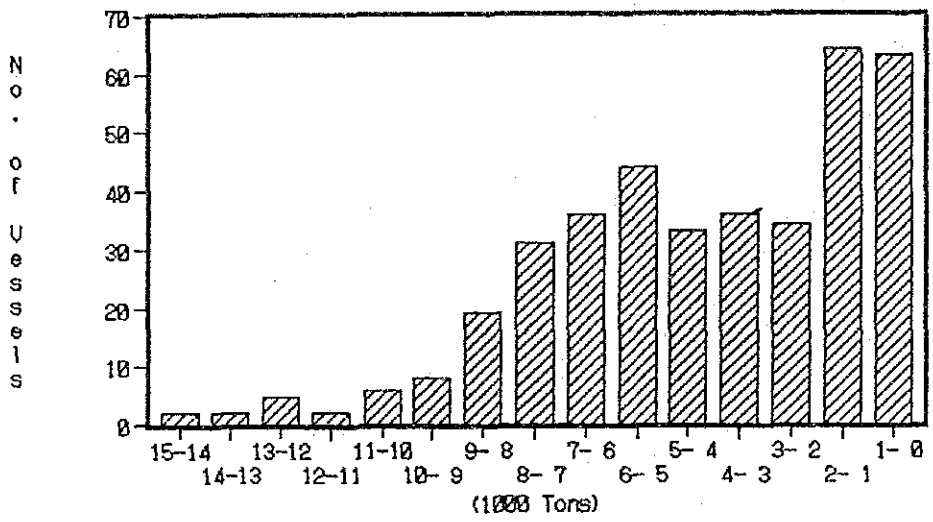


Fig. 6-4-10 Volume of Cargoes per Vessel Unloaded & Loaded (Oct.,'92-March,'92)

(5) Volume of Discharged and Loaded Cargoes by Shipping Route of Conventional Vessels

The monthly averages of the volume of discharged and loaded cargoes by shipping route of conventional vessels are shown in Table 6-4-11 and Fig 6-4-11. The Japan route takes the largest percentage of 53.3%, followed by the Chins route (17.0%), the Singapore route (6.9%), Hong Kong route (6.5%), the Europe route (4.1%) and the Korea route (3.3%) in the record period of October, 1991-March, 1992. The portion of the other routes is negligibly small (see Table 6-4-11 and Fig. 6-4-11).

Table 6-4-11 Volume of Unloaded & Loaded Cargoes by Origin Country of Conventional Vessels Calling at the West Quay

Origin Countrys	1991						1992						Total	
	October		November		December		January		Februay		March			
	('1000 tons)	(%)	('1000 tons)	(%)	('1000 tons)	(%)	('1000 tons)	(%)	('1000 tons)	(%)	('1000 tons)	(%)	('1000 tons)	(%)
Japan	152	60.7%	138	48.8%	142	59.2%	117	44.7%	168	60.0%	145	48.2%	862	53.3%
China	35	14.1%	80	28.2%	19	8.0%	49	18.8%	48	17.3%	42	14.1%	274	17.0%
Singapore	9	3.6%	17	6.2%	25	10.5%	33	12.4%	11	4.0%	15	5.1%	111	6.9%
Hong Kong	22	8.8%	21	7.5%	18	7.6%	16	6.2%	9	3.4%	19	6.2%	106	6.5%
Europe	1	0.2%	3	1.2%	3	1.1%	7	2.5%	20	7.3%	32	10.6%	65	4.1%
Korea	5	2.0%	2	0.9%			9	3.6%	13	4.7%	23	7.5%	53	3.3%
India			9	3.3%			8	3.2%			9	2.9%	26	1.6%
Taiwan					13	5.5%	6	2.4%	3	0.9%	4	1.5%	26	1.6%
Malaysia	8	3.3%	7	2.6%					2	0.6%			18	1.1%
Others	18	7.3%	4	1.4%	20	8.2%	16	6.0%	5	1.8%	12	4.0%	75	4.6%
Total	250	100.0%	283	100.0%	240	100.0%	263	100.0%	280	100.0%	300	100.0%	1616	100.0%

Source: PAT

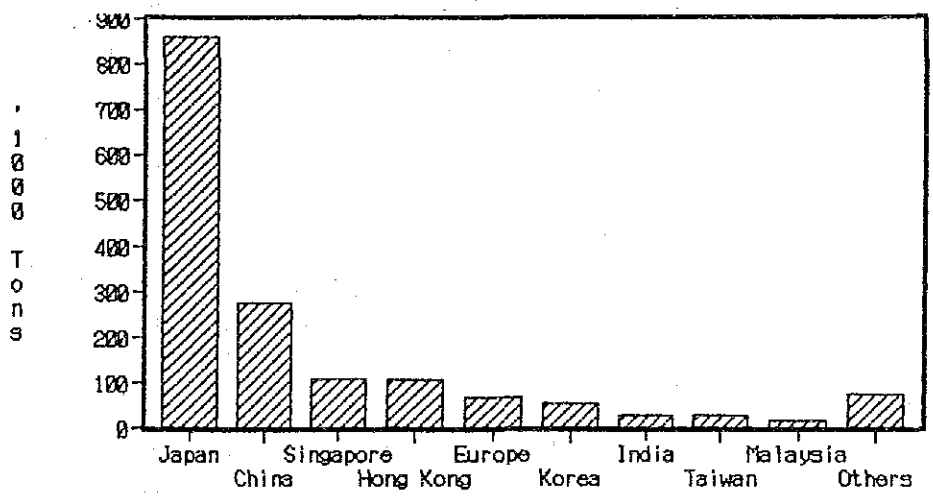


Fig. 6-4-11 Origins of Conventional Cargoes (Oct.,'92-March,'92)

(6) Berth Occupancy Ratios of the Berths at the West Quay

Berth occupancy ratios of the berths at the west quay in the record period are shown in Table 6-4-12 and Fig 6-4-12. As shown in the table, the berth No. 22A is used mainly for container vessels. Judging from the high value of the average berth occupancy ratio of 77.6% in the record period, the west quay seems to have been saturated.

Table 6-4-12 Berth Occupancy Ratio at the West Quay

Berth	1991			1992			Average
	October	November	December	January	February	March	
	(%)	(%)	(%)	(%)	(%)	(%)	(%)
22A	45.6	48.1	59.0	75.0	69.0	65.3	60.3
(Container Ships)	(41.7)	(20.2)	(47.2)	(56.2)	(44.9)	(50.5)	
(Conventional Ships)	(3.9)	(27.9)	(11.8)	(18.8)	(24.1)	(14.8)	
22B	99.7	77.0	60.2	45.2	76.7	82.9	73.6
22C	97.8	89.1	65.6	64.0	97.2	84.2	83.0
22D	75.6	81.1	61.4	62.0	80.9	69.6	71.8
22E	93.3	87.5	73.2	64.1	96.9	100.0	85.8
22F	78.2	100.0	83.6	77.3	68.5	47.2	75.8
22G	67.9	98.6	82.6	94.9	90.0	85.3	86.6
22H	81.0	81.3	80.6	100.0	70.2	100.0	85.5
22I	71.6	82.8	30.9	71.3	94.8	85.9	72.9
22J	82.6	71.6	55.5	91.9	100.0	84.2	81.0
Average	79.3	81.7	65.3	74.6	84.4	80.5	77.6

Source: PAT

6.4.3 Number of Containers Discharged and Loaded By Vessel Type

Percentage of containers discharged or loaded at the east or west quay in the above record period is shown as follows:

Unit: TEUs

Month, Year	Number of containers discharged or loaded					
	East Quay		West Quay			
	Container vessel (Mostly gearless)		Container vessel (With ship cranes)		Conventional vessel	
October,1991	100,412	92.7%	5,539	5.1%	2,384	2.2%
November	103,045	95.9%	1,855	1.8%	2,505	2.3%
December	94,505	91.1%	7,200	6.9%	2,087	2.0%
January,1992	88,491	86.8%	11,526	11.3%	1,926	1.9%
February	88,250	91.4%	5,552	5.8%	2,724	2.8%
March	99,777	91.2%	8,015	7.3%	1,644	1.5%
	574,480	91.6%	39,687	6.3%	13,270	2.1%