2-3 Historical Background

Until the 1860's, Semarang was a small town built around a Dutch fort facing the Java Sea. The Semarang River was the only artery to carry goods by proa (small boat) between the town and oceangoing ships casting anchor offshore (Fig. 2-3-1).

Many warehouses and godowns developed along the river. As years passed by, the river became shallow on account of siltation. Furthermore, with the growth of the town, lack of sufficient storage, godown and warehouse sites became a serious problem.

To cope with the demand, a port plan was prepared in 1866. This is the port existing today as the Inner Harbour and Kali Baru.

Simultaneously, a new canal was also developed between the town and the port.

The first plan of the canal as shown in Fig. 2-3-2 was intended as a short cut to link trace line A-B, but later the route was changed to the place where the existing Kali Baru Canal is located. The depth of the canal was designed to be 2.5 m L.W.L. in order to carry goods between the port and the heart of the town by proa. After completion of the canal, warehouses and godowns were constructed one after another on both sides of the canal, and the East and West Breakwaters were also constructed.

As soon as the work of the first stage was finished, the depth at the entrance of the new port began to decrease on account of extraordinary siltation. Indeed, the siltation became a serious problem for port operations.

According to the report "DE PLANNEN VAN EEN ZEEHAVEN VOOR SEMARANG" by Ir. J.J. Baggelaas (Plan for a Sea Port for Semarang 1927), the speed of shoaling was up to 12 m annually.

To improve the port entrance, a special committee was established, and the committee decided to extend the breakwater. The work progress was reported three times until the end of 1890's.

With the endeavours of the committee, the trade of Semarang Port made a tremendous increase. According to the statistics during 1890 ~ 1925, the cargo volume and vessels calls increased as shown in Fig. 2-3-3. Until 1900, the calling of vessels at Semarang Port was rare, but after a slight stir in 1901 and 1902, the boom started in 1903. The city flourished with the new port.

The influence of World War I was seriously felt here, but a few years later (in 1925), the pre-war prosperity was recovered. Thus Semarang became the third among the eight Indonesian big ports, namely, Tg. Priok, Surabaya, Semarang, Cirebon, Makasar (Ujungpandang),Emmahaven (Padang), Belawan and Cilacap (Fig. 2-3-4).

Fig. 2-3-4 shows clearly that these ports could be classified into two groups, i.e. the big ports of Tg. Priok, Surabaya and Semarang, and the other small ports. Semarang Port had a large development. It can be said to have a potential similar to Tg. Priok and Surabaya. Today, however, Semarang has lost her position. This may be attributed to the port development policy taken after World War II. After the war, the Government chose to concentrate cargoes at the other two big ports.

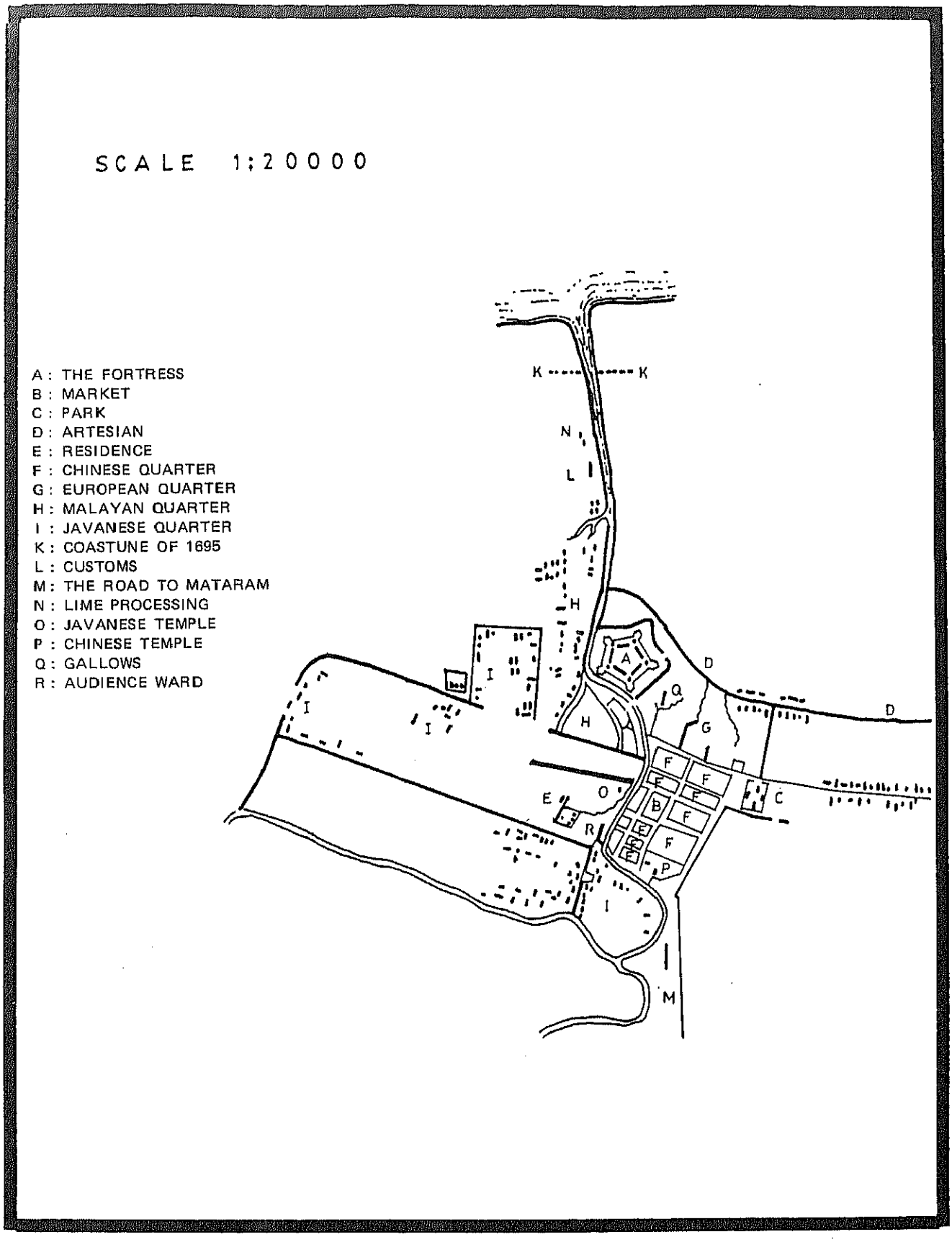
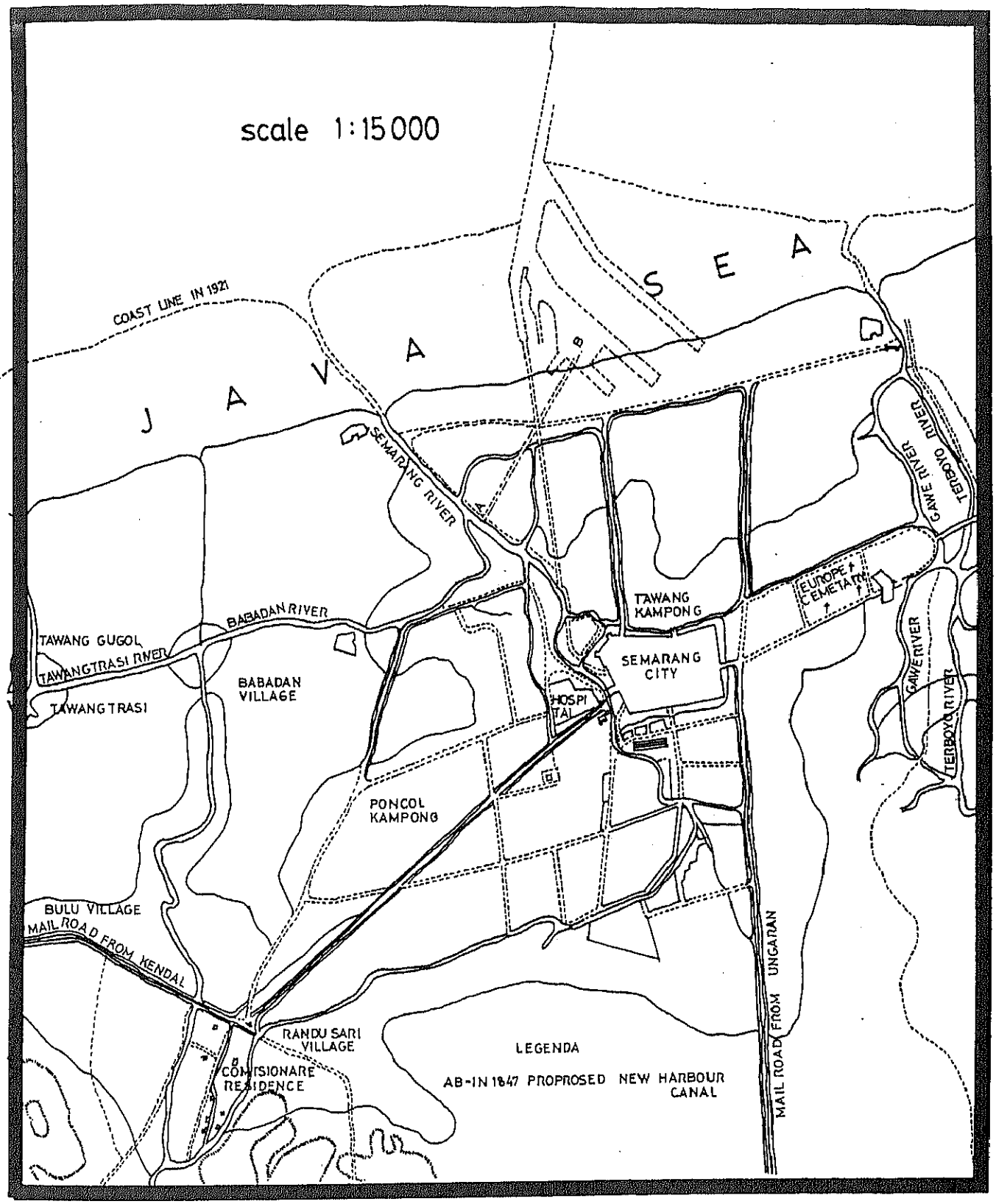


Fig. 2-3-1 Semarang in 1719



Source: RENCANA KOTA SEMARANG (BAPPEDA)

Fig. 2-3-2 Semarang in 1847

Geopolitically speaking, the big two have been enjoying benefits as the only deep seaports on Java Island because of their strategically important positions abutting on the Sunda and Lombok straits, respectively.

During the past three quarters of a century, practically no expansion has been executed at Semarang Port, except for some minor works in 1982.

In 1914, the Government actually agreed to carry out a study for a new deep seaport and a development plan was finalized in 1918 as shown in Fig. 2-3-5.

The new deep seaport plan was detailed as follows:

- to construct a 100 ha basin which could accommodate 21 big oceangoing vessels drawing water of −10 meters.
- to construct two breakwaters for the protection of the basin: a 1,175 m West Breakwater and a 2,035 m East Breakwater.
- to dredge an access channel (2,450 m long, 150 m wide, 10.0 m deep) with an entrance width of 280 m.
- to dredge a 350 m wide turning basin by the entrance of the port.

The capacity of the planned basin was:

	5 ships – 31 ft draft
	9 ships – 24 ft draft
	7 ships – 20 ft draft
Total	21 ships

Considering the future requirements that ships should be anchored directly at the quay, this was also provided for in the drawing.

Unfortunately, however, no development took place until 1982.

In 1976 the Government of Indonesia requested a JICA Study, for the development of Central Java, and the feasibility study was executed in 1978.

According to the feasibility study, the target year of the long term development plan is set at the year 2000 and the implementation of the urgent improvement program was recommended for completion by the year 1984.

Following the implementation of the program, the Government of Indonesia and OECF (the Overseas Economic Cooperation Fund of Japan) concluded a loan agreement in March 1979. Based on the agreement, a contract for the construction of the new deep seaport was signed in August 1982 and the works were completed in October 1985.

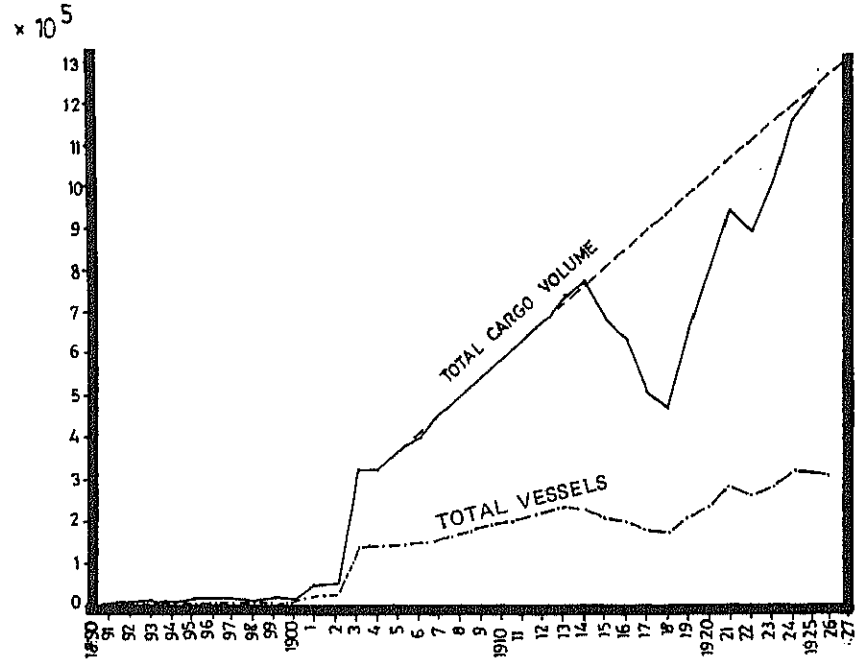


Fig. 2-3-3 Cargo Volume and Vessel Visit to Semarang from 1890 to 1925

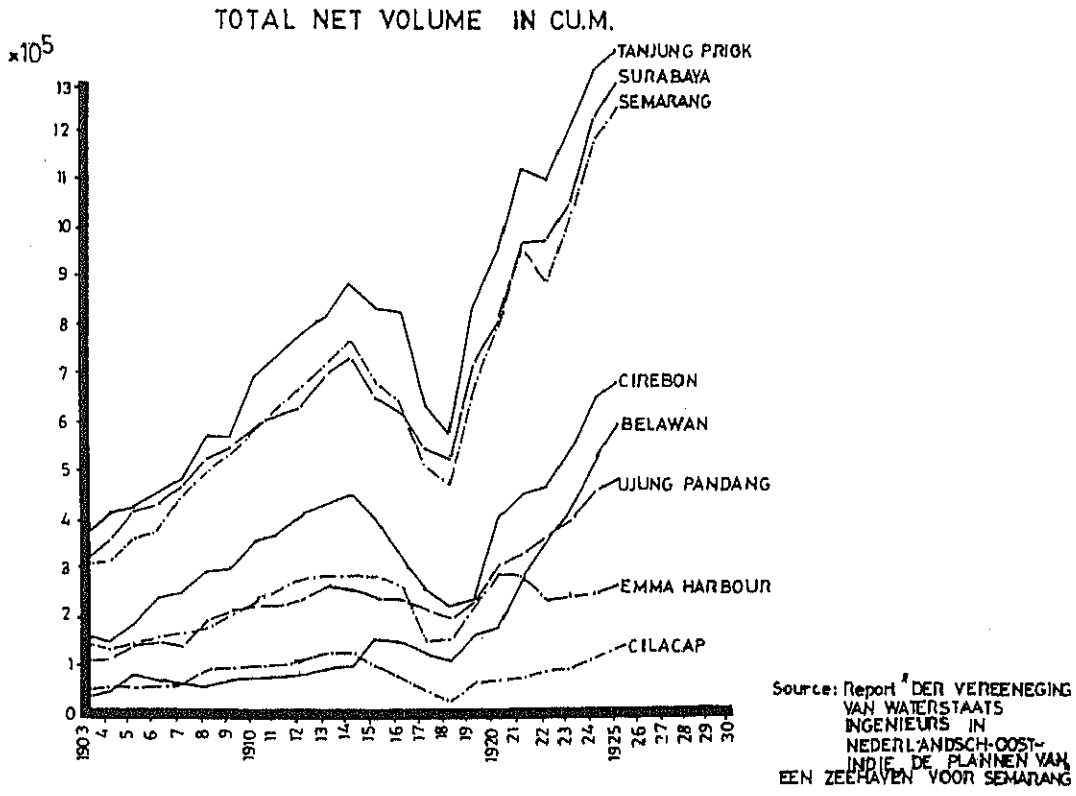


Fig. 2-3-4 Cargo Volume at the 8 Biggest Ports from 1903 ~ 1925

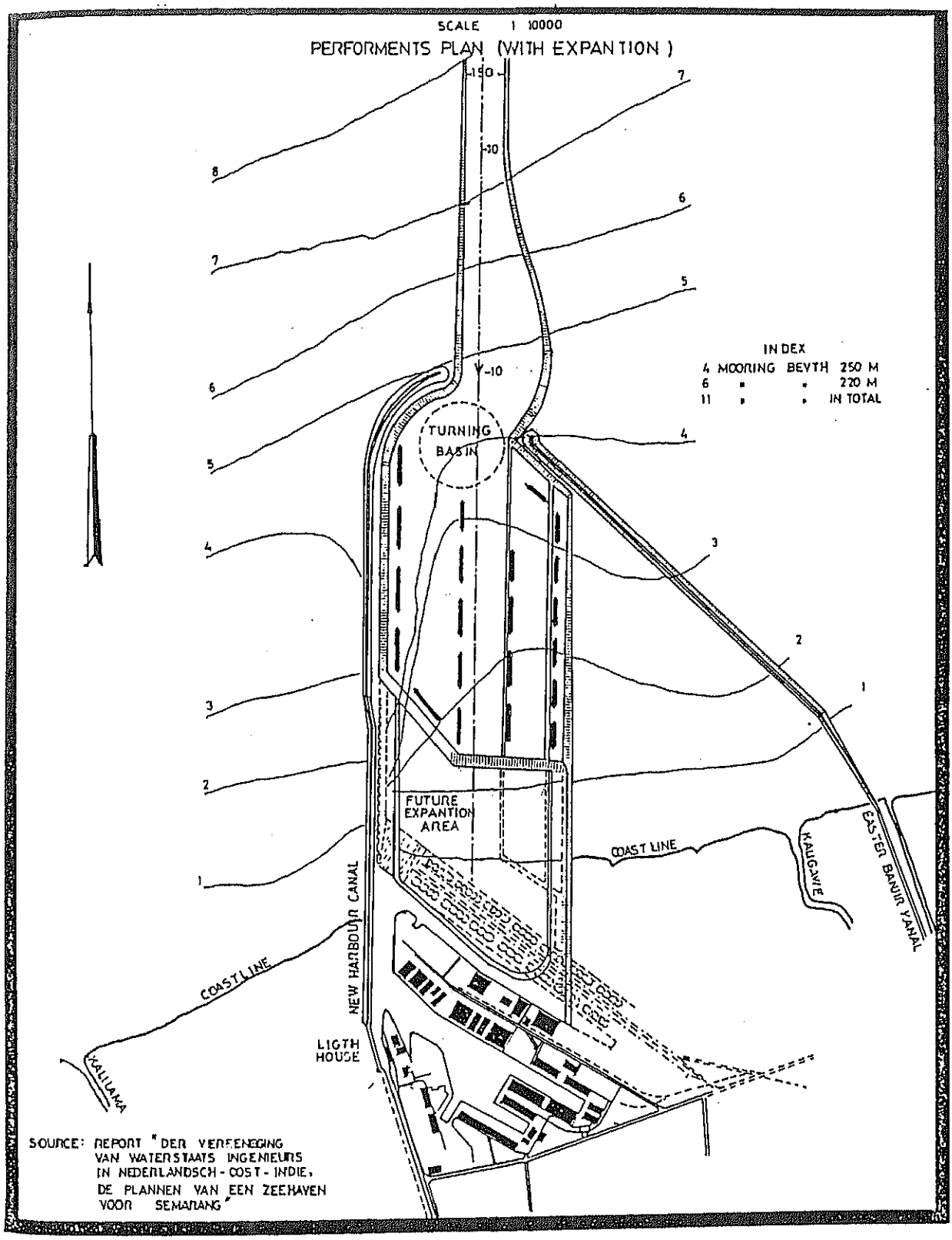


Fig. 2-3-5 A Revised Plan of Semarang Port in 1918

2-4 Cargo Throughput at Present

2-4-1 General

The port of Semarang is a typical Indonesian commercial port, located in the center of Java Island. The hinterland of the port is substantial: about 20 percent of the population of Indonesia live in the hinterland. The port is closely linked with other ports located on the large islands – Kalimantan, Sumatra and Sulawesi.

Semarang is now the eighth largest Indonesian port in terms of cargo handled excluding oil, as shown in Fig. 2-4-1. For reference, Figure 2-4-2 shows the volume of oil handled at major Indonesian ports.

Since World War II, for geopolitical reasons, the Indonesian Government has concentrated its development efforts at Tanjung Priok and Surabaya. Consequently, the relative standing of Semarang Port has declined. During the past 75 years, there has been no major expansion work at Semarang.

However, the potential for development at Semarang is great. In addition to serving a large hinterland, Semarang serves as the gateway to various international ports located in Singapore, Hong Kong, Japan, Europe, America and Australia, and domestic trade is conducted between Semarang and a variety of ports including Pontianak, Sampit, Banjarmasin, Balikpapan, Belawan and Palembang.

In 1983, overall dry cargo throughput totals 1.7 million tons. Imports, exports, domestic in and domestic out total 0.58, 0.18, 0.74 and 0.18 million tons, respectively. The statistics from 1970 through 1984 are presented in Table 2-4-1 and Figure 2-4-3.

The overall growth rates for foreign, domestic and total trade for the 14 year period are 5.7 percent, 19.0 percent and 10.0 percent, respectively. The shares of the major commodities in 1983 are presented in Table 2-4-2.

Petroleum products are also handled at Semarang Port. Most of these cargoes are handled at the offshore anchorage and carried to Pertamina's distribution center and PLTU's power plant directly via pipelines. Fuels handled include diesel fuel, gasoline, kerosine and heavy oil. Further, a small quantity of bunker oil is unloaded at Perutamina's jetties located at the mouth of the old port by small tankers (less than 3,000 DWT).

The total amount of petroleum products handled in 1984 was 1.26 million tons. This figure is equal to some 70 percent of the total dry cargo handled at the port. Nevertheless, as the petroleum products are separated as private cargo, they are outside the scope of this Study and will not be investigated in detail.

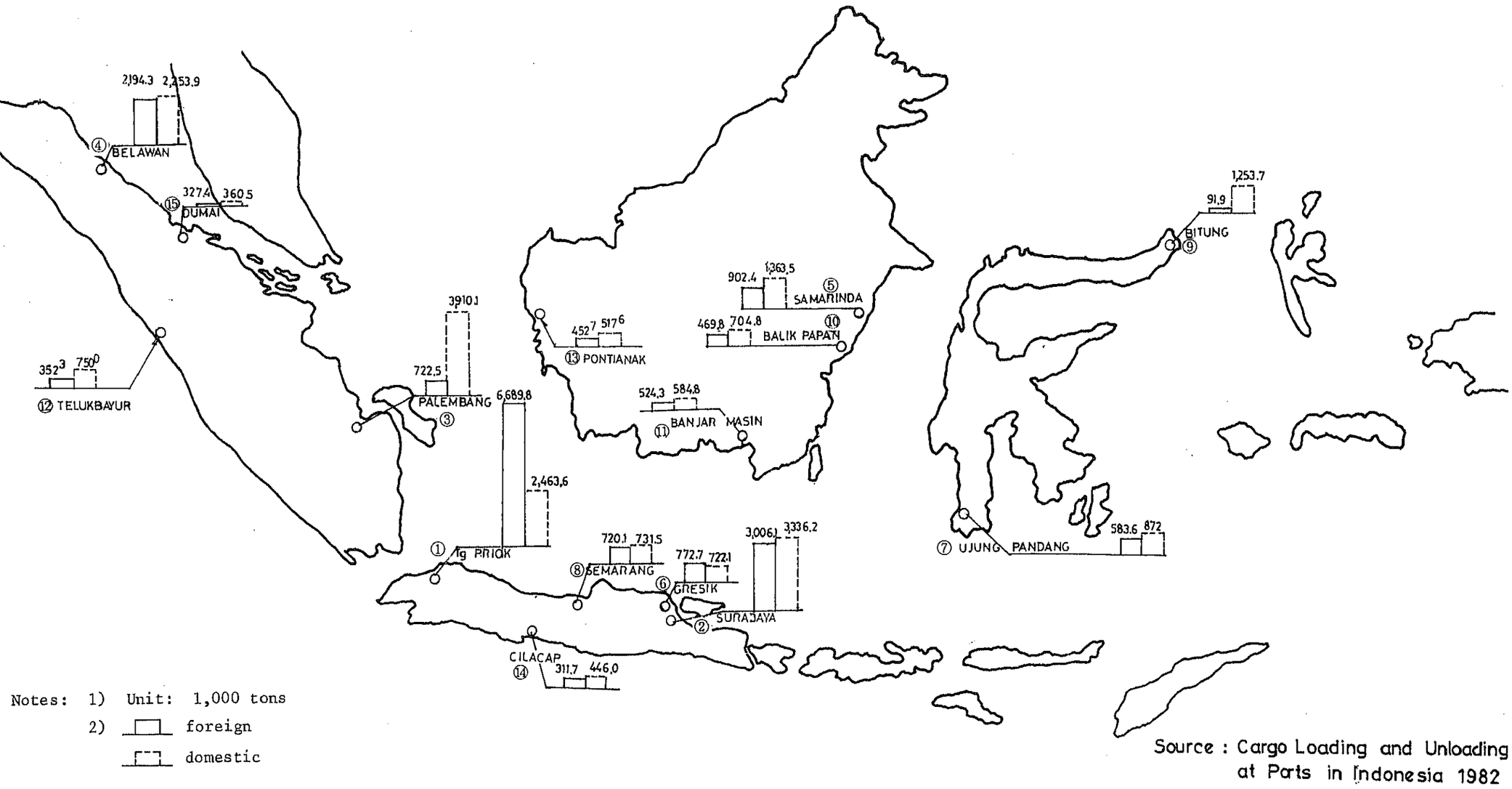


Fig. 2-4-1 Major Port Cargo Volume (Excluding Petroleum) in Indonesia 1982

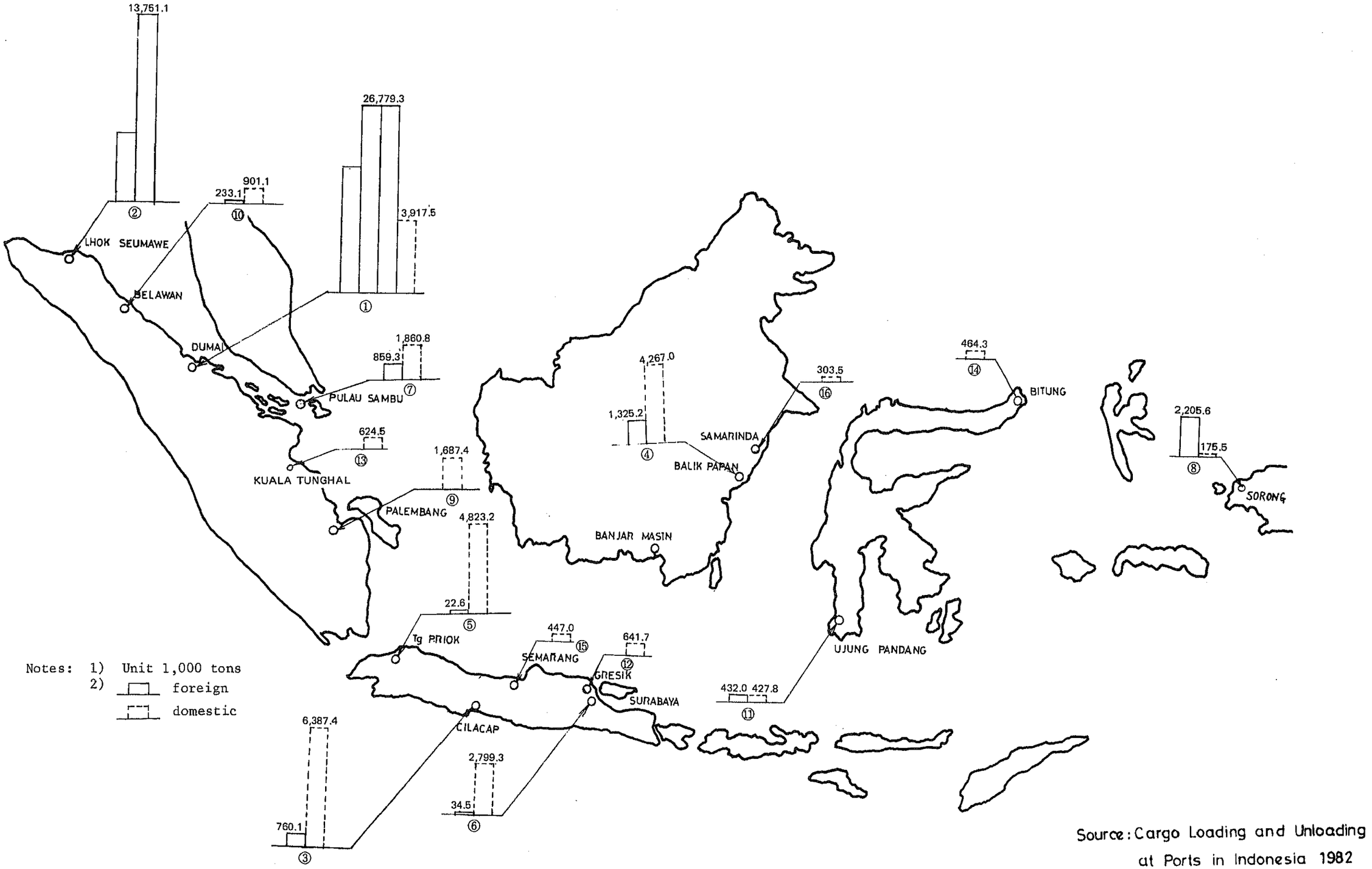


Fig. 2-4-2 Major Port Petroleum Volume in Indonesia 1982

Table 2-4-1 Cargo Statistics of Semarang Port

Unit: 1,000 tons

Year	Foreign Trade			Domestic Trade			Grand Total
	Export	Import	Total	Outward	Inward	Total	
1970	119	246	365	57	43	100	465
1971	140	253	393	71	45	116	509
1972	114	324	438	75	71	146	584
1973	89	422	511	80	93	173	684
1974	110	444	554	90	100	190	744
1975	69	622	691	87	112	199	890
1976	78	492	570	102	136	238	808
1977	73	531	604	104	137	241	845
1978	69	541	610	132	141	273	883
1979	104	594	698	152	130	282	980
1980	72	609	681	163	273	436	1,117
1981	88	622	710	200	503	703	1,413
1982	90	641	731	216	569	785	1,516
1983	176	585	761	183	738	921	1,682
1984	223	319	542	224	783	1,031	1,573
Annual Growth Rate (%)'70–'83	2.97	6.99	5.74	8.81	24.44	18.97	9.99

Source: ADPEL Semarang

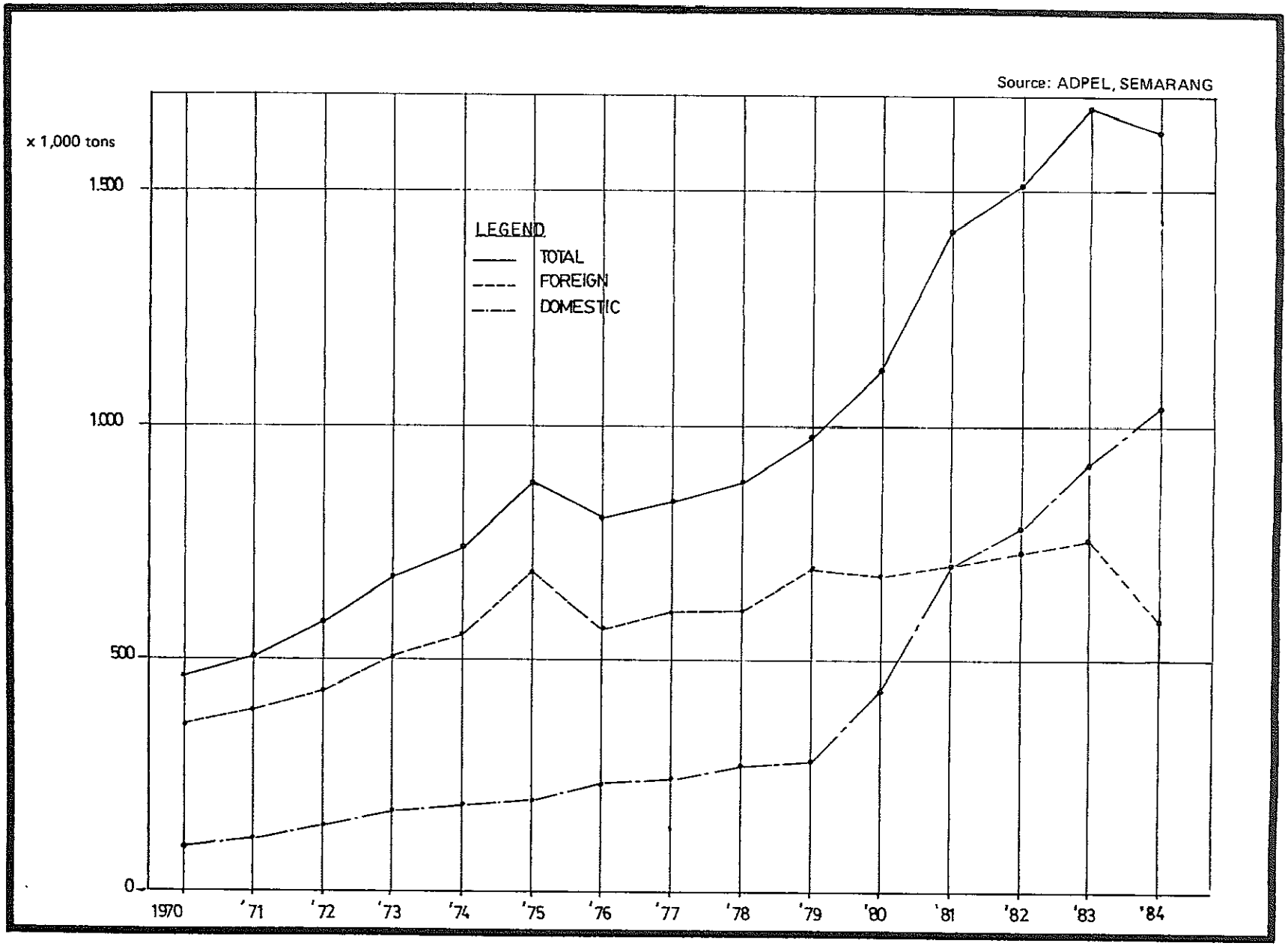


Fig. 2-4-3 Cargo Volume at Semarang Port (Excluding Oil)

Table 2-4-2 Share of Major Commodities at Semarang Port in 1983

Foreign				Domestic	
Import		Export		Inward	Outward
Total cargo (1,000 tons)	585	176		738	183
Steel/EWC	25.5%	Plywood	55.0%	Logs (67.0)	Sugar (23.5)
Project Equ.	12.5	Sawn Timber	10.2	Sawn Timber (17.8)	Rice (16.9)
Cotton	3.8	Rubber	9.2	Fertilizer (7.6)	N.Fertilizer (5.0)
Sugar	4.5	Fodder	3.1	Asphalt (1.4)	Salt (4.7)
Rice	13.3	Shrimp	3.0	Quartz Sand (1.2)	Capok (4.5)
Machines	3.2				
Total	62.3%		80.5%	95.0%	54.6%

2-4-2 Major Commodities

The major commodities handled at Semarang Port are considered below.

(1) Imports

Steel/Zinc (149,300 tons)

Most of the cargoes handled are raw materials for the GI and the electric furnace mills (coil, zinc, plate, scrap, etc.) Cargo is at present handled offshore – transshipped to barges. Cargo is often damaged from poor handling and from carriage over muddy roads around the port.

Project Materials (73,400 tons)

These cargoes are construction materials, machines and equipments for the development project of Semarang Port. After the project is finished, no cargoes will be imported.

Cotton (19,100 tons)

These are raw materials for producing the traditional textile, batik. Most of the yarn for the local industries is carried through Tg. Priok. Only a small amount of the cotton for the local factories is shipped through Semarang. Consignees complain that the cargo at Semarang is often damaged by rain or sea water due to obsolete transit sheds and handling equipment. The new international terminal will solve this problem.

Sugar (26,100 tons)

Although most of the locally consumed sugar is produced in Central Java, high quality refined sugar is sometimes imported for use in hotels and restaurants.

Rice (77,700 tons)	Recenty, with the introduction of chemical fertilizers, Central Java is becoming self-sufficient in the production of rice. No rice is being imported for the time being.
Machines & Electric Equipment (18,800 tons)	At present, whenever shippers use Semarang Port they make it a rule to prepare special small size containers to prevent cargo damage. Containerization would solve this problem.

(2) Exports

Plywood (96,500 tons)	All cargoes are loaded at the private wharf belonging to Kayu Lapis onto barges and then transshipped at the anchorage. The volume of cargo handled will increase in the future.
Lumber (17,800 tons)	This is high quality sawn timber. A new transit shed has already been constructed to cope with the increased cargo volume.
Rubber (16,200 tons)	Large foreign consignees are beginning to object to the traditional method of shipment. They want cargoes to be containerized. Rubber is presently shipped in the traditional way – unconvered. Unfortunately, this often causes cargo damage and contamination. Again, containerization would solve this problem.
Fodder (5,500 tons)	Fodder is presently bagged. At Cilacap, a cutting bag style loading system has been introduced for large vessels. Introducing this system of Semarang might create new demand.
Frozen Shrimp (5,200 tons)	Frozen packed shrimp are currently carried by small refrigerator ships. If containerization is introduced frozen shrimp will be the primary cargo. Facilities for reefer containers will have to be prepared.

(3) Domestic Inward

Logs (494,500 tons)	All logs are currently carried by Khusus to the private facility of Kayu Lapis.
Lumber (131,600 tons)	Most of this sawn timber is carried from Kalimantan by local vessels and sailing boats for domestic use.
Fertilizer (56,300 tons)	All fertilizer is shipped bagged from Palembang.

Others — Empty containers, grain (wheat), asphalt and glass comprise the majority of "other" domestic inward cargo.

(4) Domestic Outward

Sugar, Rice & Salt (82,700 tons) — These cargoes are all bagged. Most are shipped to Kalimantan.

The volumes of foreign and domestic cargoes at Semarang Port from 1979 through 1983 (or 1984) are presented in the following tables and figures. Import cargoes are shown in Table 2-4-3 and Figure 2-4-4; exports are presented in Table 2-4-4 and Figure 2-4-5. Domestic inward cargo is shown in Table 2-4-5 and Figure 2-4-6, and domestic outward cargo is shown in Table 2-4-6 and Figure 2-4-7.

Table 2-4-3 Import Cargo Volume by Commodity

(Tons)

Year / Commodity	1979	1980	1981	1982	1983	1984
Steel/Zinc	47,996	137,606	151,873	180,909	149,336	143,831
Rice	161,392	114,968	-	16,297	77,690	-
Sugar	50,766	76,482	89,388	42,620	26,132	-
Glass	40,669	38,026	46,140	67,930	12,864	5,550
Paper	13,763	11,583	-	-	9,228	4,223
Cotton	29,536	38,060	20,970	39,814	19,132	12,411
Spare Parts	8,526	16,365	33,058	24,700	8,962	6,883
Project Equipment	-	18,482	20,490	16,314	73,398	3,922
Textiles	9,130	17,669	28,368	-	5,912	466
Fertilizer	-	-	24,065	-	90	4,627
Machine Electric Equip.	12,676	-	38,522	31,180	18,764	11,524
Medicine	24,255	22,908	25,899	-	2,394	-
Asphalt	-	-	-	12,310	9,800	872
Others	195,058	117,194	142,963	209,252	173,134	114,989
Total	593,767	609,343	621,736	641,353	585,047	319,298

Source: ADPEL Semarang

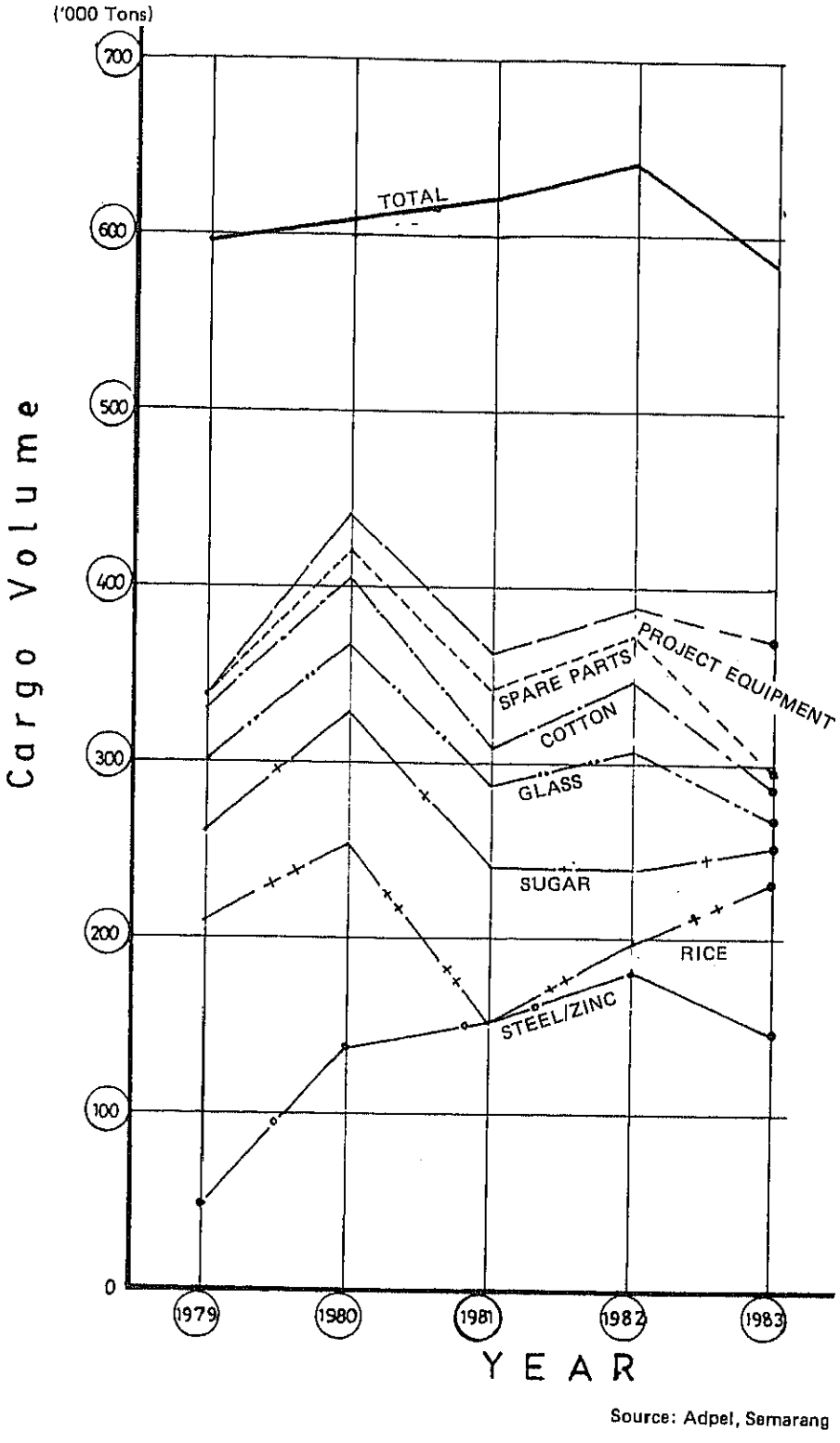


Fig. 2-4-4 Import Cargo Trend at Semarang Port

Table 2-4-4 Export Cargo Volume by Commodity

(Tons)

Year / Commodity	1979	1980	1981	1982	1983	1984
Plywood	-	604	13,599	20,935	96,543	448,127
Fodder	41,807	19,086	8,604	1,600	5,512	8,518
Rubber	14,262	15,073	13,711	12,300	16,177	16,712
Lumber	16,400	9,418	10,674	14,143	17,842	24,234
Frozen Shrimp	5,690	5,204	4,514	6,363	5,221	7,100
Tobacco	3,813	3,439	3,436	1,779	1,712	1,951
Handicrafts	1,056	1,056	1,367	1,048	168	283
Coffee	801	982	1,404	468	1,635	2,047
Astiri oil	699	293	1,789	538	-	-
Leather	3,537	-	-	-	1,464	-
Tea	660	201	134	193	764	239
Others	15,732	16,931	28,443	30,138	28,652	13,546
Total	104,457	72,287	87,638	89,512	175,691	222,757

Source: ADPEL Semarang

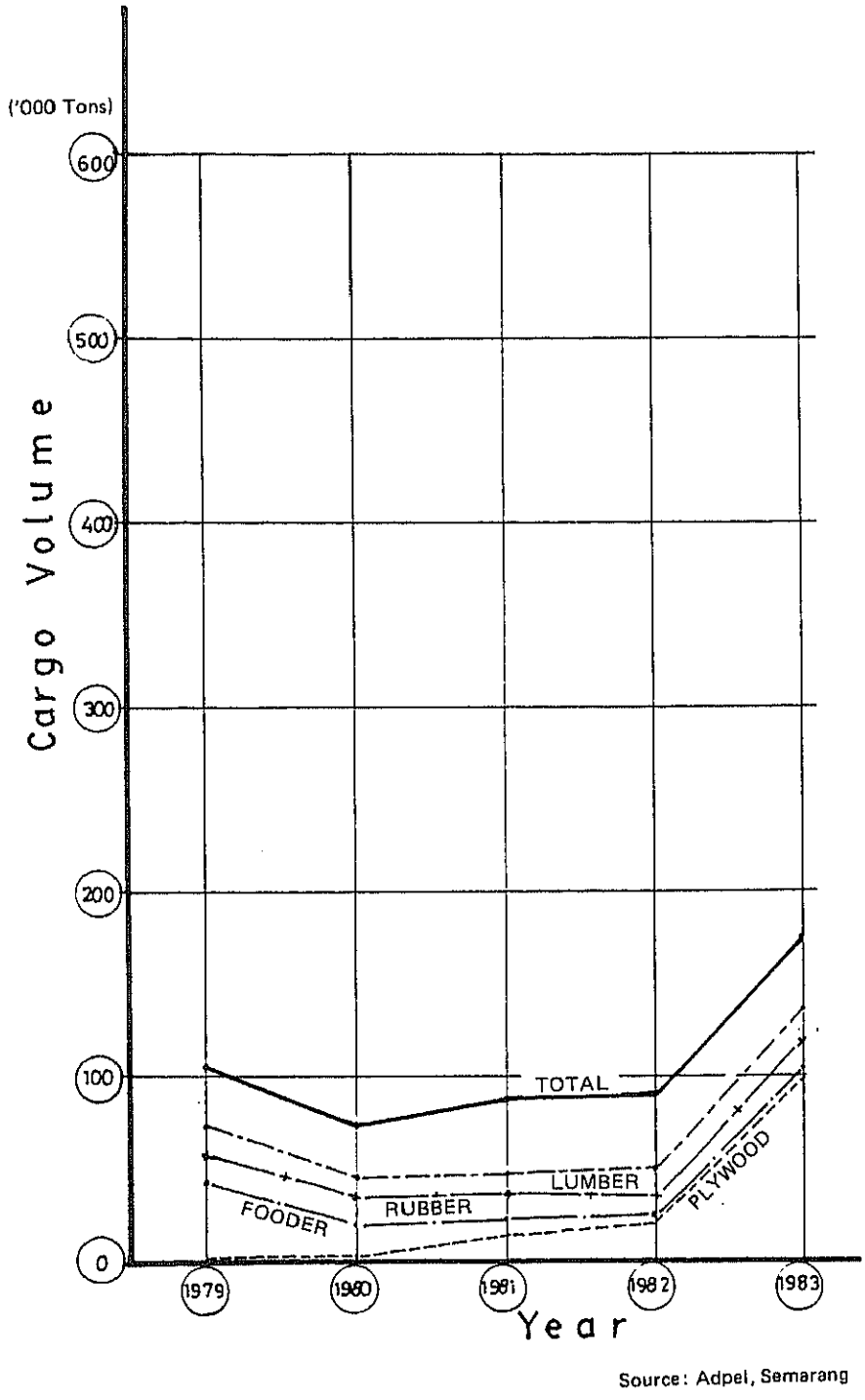


Fig. 2-4-5 Export Cargo Trend at Semarang Port

Table 2-4-5 Inward Cargo Volume by Commodity

(Tons)

Commodity \ Year	1979	1980	1981	1982	1983	1984
Logs	17,232	143,536	257,944	313,500	494,513	509,047
Sawn Timber	78,828	96,423	124,112	108,215	131,576	196,834
Fertilizer	11,831	-	81,366	66,073	56,283	8,546
Asphalt	-	7,400	7,100	45,502	10,000	17,950
Copra	5,807	4,263	6,493	2,052	2,008	748
Dry Fish	3,008	5,458	5,436	2,022	1,584	1,447
Kaolin	3,713	5,530	3,328	2,134	1,391	3,839
Quartz Sand	-	-	4,530	3,677	9,202	9,150
Palm Oil	2,600	2,000	3,148	1,500	-	-
Rattan	548	683	880	1,112	1,618	2,618
Clove Tree	155	-	-	-	-	-
Salt	-	544	-	-	-	7,680
Steel	-	-	-	-	-	1,828
Others	6,341	9,157	8,392	23,292	30,086	27,326
Total	130,063	272,914	502,729	569,079	738,083	787,013

Source: ADPEL Semarang

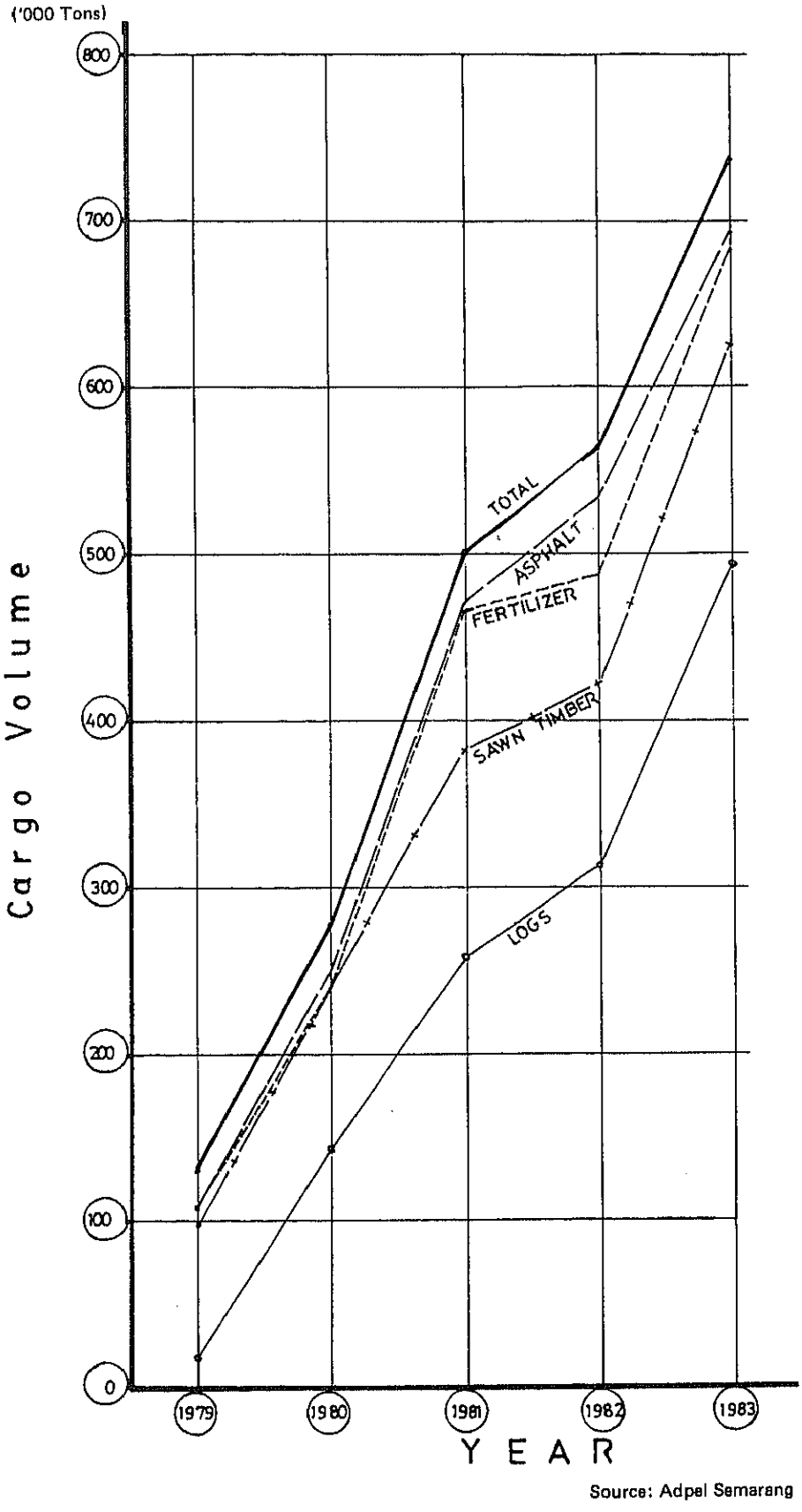


Fig. 2-4-6 Inward Cargo Trend at Semarang Port

Table 2-4-6 Outward Cargo Volume by Commodity

(Tons)

Year / Commodity	1979	1980	1981	1982	1983	1984
Rice	26,316	28,433	14,424	92,828	30,939	91,817
Sugar	69,184	57,544	147,591	51,758	43,141	51,600
Maize	2,331	4,869	7,598	4,614	6,813	9,509
Salt	4,764	5,569	5,583	24,287	8,653	7,888
Capok	-	1,227	590	1,041	8,334	6,662
Peanuts	604	2,066	-	2,112	2,847	4,421
Wheat	1,492	1,492	-	1,288	637	892
Cement	7,661	11,157	11,518	2,476	-	24
Natural fertilizer	1,393	-	2,459	1,876	9,258	2,134
Onions	-	905	554	876	4,087	4,216
Bulgur	583	1,250	817	-	497	1,038
Tobacco	530	-	-	-	-	2,693
Others	36,837	48,681	9,301	33,268	68,177	61,412
Total	151,695	163,193	200,434	216,421	183,383	244,306

Source: ADPEL Semarang

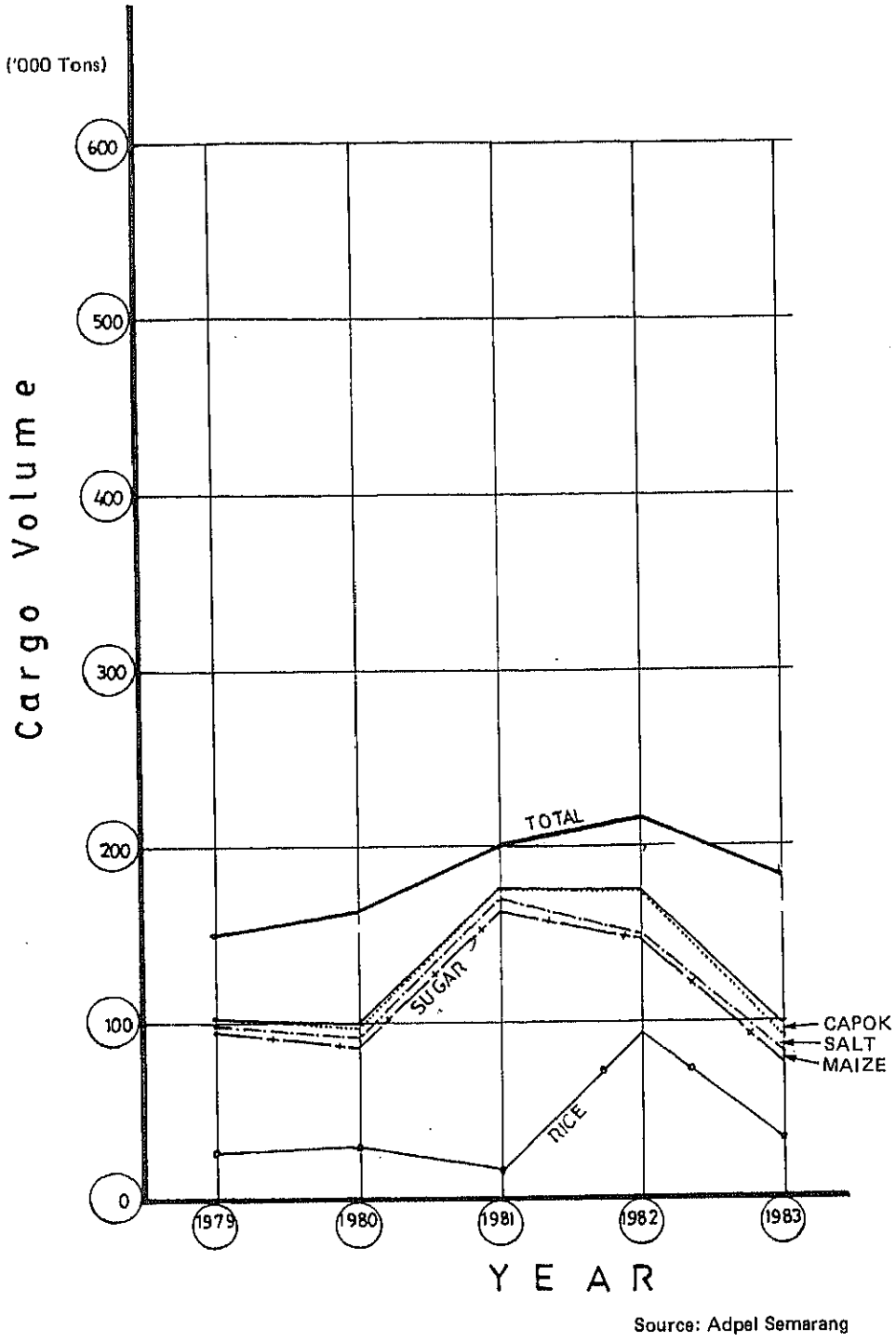


Fig. 2-4-7 Outward Cargo Trend at Semarang Port

The average cargo volume per vessel handled at Semarang Port by vessel is shown in Table 2-4-7.

Table 2-4-7 Average Cargo Handling Volume by Vessel in 1983

Commodity	Vessel	Average DWT	Average Cargo Volume (Tons)	Average Days of Stay for Cargo Handlings	Handling Tons/day
General Cargo	International	8,428	943	3.0	317.8
	Nusantara	1,474	484	3.6	133.7
	Local	142	113	4.0	28.8
	Sailing	167	40	3.8	10.8
Containterized Cargo	International	13,058	1,756	2.1	839.0
Iron/Steel Zinc	International	7,529	3,130	4.6	677
Lumber, Logs and Plywood	International	12,857	1,647	3.28	502.4
	Nusantara	581	144	5.8	24.8
	Local	147	90	2.3	38.9
	Sailing	230	90	7.2	12.4
Rice	Nusantra	547	399	4.2	94.0
	Local	172	168	4.5	37.5
	Sailing	199	99	4.1	24.4
Rubber, Tobacco, Coffee and Tea	International	10,839	800	2.6	306
Sugar	Nusantara	1,873	856	4.6	186.1
	Local	167	155	4.2	36.5
	Sailing	170	101	4.0	25.2
Bulk	Nusantra	1,101	902	6.1	148.2

2-4-3 Containerization

Because there are no deep berths at Semarang, neither full nor partial container vessels call at the port. Thus, the volume of container cargoes is very small. The number of containers loaded and unloaded at Semarang Port in 1983 and 1984 are presented in Table 2-2-8.

Table 2-4-8 Containers Handled at Semarang Port

Unit: TEU

	1983			1984		
	Loaded	Unloaded	Total	Loaded	Unloaded	Total
Full Containers	22	887	909	237	886	1,120
Empty Containers	916	1	917	946	133	1,079

Source: ADPEL Semarang

As the cargo tonnage per TEU is about 10 ~ 12 tons in average, Semarang Port already seems to handle about 9,000 to 13,000 tons of containerized cargo per year.

However, if Semarang Port were equipped with the proper facilities and were capable of accommodating full container ships, the volume of container cargoes in 1983 might have been as presented in Table 2-4-9.

Table 2-4-9 Hypothetical Volume of Container Cargoes at Semarang

		Cargo Volume (1,000 tons)	Container Cargo (%)	(1,000 tons)
Imports	Sugar	26	50%	13
	Glass	13	100	13
	Paper	9	100	9
	Cotton	19	50	10
	Spare parts	9	100	9
	Textiles	6	100	6
	Medicine	2	100	2
	Chemicals	10	100	10
	General cargo	97	75	73
	Total			145
Exports	Plywood	97	25	24
	Fodder	6	50	3
	Rubber	16	100	8
	Lumber	18	25	3
	Frozen Shrimp	5	100	5
	Tobacco, Coffee	4	100	4
	Leather	1	50	1
	Others*	29	75	22
	Total			70

* Others: Seeds, beans, ginger, chemicals, medicines, palm oil and dry tapioca

From the above figures, it seems that 4 percent to 5 percent of potential container cargoes are already being shipped by containers. Regular container service began after completion of the deep seaport in 1985.

2-5 Shipping Activities

2-5-1 Types of Vessels

Vessels calling at Semarang Port can be classified into five categories: samudra, nusantara, local, rakyat and khusus. Each of these categories is defined below.

(1) Samudra (Oceangoing Vessels)

The samudra ply international trading routes between Indonesia and various foreign countries. The Indonesian vessels have an average size of 12,700 DWT. Container and break-bulk vessels are typical.

(2) Nusantara (Large Domestic Vessels)

Nusantara are inter-island vessels operated by Indonesians. Services include regular liner service (RLS) and non-regular liner service (NRLS). These vessels range from about 300 to 5,000 DWT. The nusantara connect the various regions of Indonesia. There are no restrictions on the size of nusantara and they are employed on all the main routes specified by the Indonesian Government. These inter-island vessels are occasionally used for trade to and from Singapore.

(3) Local

The maximum size of the gross capacity of local boats is limited to 500 m^3, and the local boats operate within a radius of 500 miles from their base port. The routes of these boats are subject to governmental approval.

(4) Rakyat (Sailing Boats)

Rakyat are traditional Indonesian sailing boats. Many of these vessels are gradually being motorized, utilizing government subsidies.

(5) Khusus

Khusus are special non-liner industrial vessels which are licensed for the transport of special bulk cargoes. These include both domestic and foreign trade vessels. As for international trade, khusus are mainly used to carry logs to Japan, Taiwan and Korea. Most of the ships are in the 5,000 ~ 8,000 DWT range. For domestic trade, individual khusus usually convey only one cargo. Domestic cargo comprises logs, bagged cement, fertilizer and rice. Kayu Lapis's logs are carried by khusus.

2-5-2 Shipping Activities

(1) Oceangoing Vessels

The activities of oceangoing vessels calling at Semarang Port by route in 1983 are presented in Table 2-5-1. As for the number of calling vessels, 37.9 percent are on the Japanese route, 17.6 percent are on the European route, 15.9 percent on the Hong Kong route and 7.9 percent on the

Singapore route; about 80 percent of the vessels travel these four routes.

Of all the oceangoing vessels calling at the port, the average size is about 9,200 DWT. Compared with the previous study conducted in 1978, this figure has increased by about 2,200 DWT. As for the average size of the vessels by route, those vessels travelling to Europe, America, the USSR and "other" destinations are generally greater than 10,000 DWT whereas those vessels travelling to Japan, Singapore and Taiwan are generally less than 10,000 DWT.

The origins and destinations of major foreign trade cargoes handled at Semarang Port are shown in Table 2-5-2. The main foreign trading partners are Hong Kong, Singapore, Japan, Europe and Taiwan.

Referring again to Table 2-5-1, we see that overall the average stay per vessel is 4.3 days. This is an increase of 1.3 days since the study conducted in 1978. As for the average stay by route, vessels travelling to the USSR, Singapore and Taiwan generally stay more than 5 days, and vessels travelling to all other destinations less than 5 days.

The highest average cargo handling volume per vessel by route is about 2,720 tons for the American route. The lowest figure is about 1,190 tons for the USSR route.

Table 2-5-1 Oceangoing Vessels by Route in 1983

Route / Item	Japan	Europe	Hong Kong	Singapore	Taiwan	America	U.S.S.R	Others	Total / Average
Share of the number of calling vessels (%)	37.9	17.6	15.9	7.9	6.4	3.6	3.3	7.4	100%
Share of D.W.T. (%)	32.6	29.4	7.3	2.0	4.5	10.0	4.2	10.0	100%
Average D.W.T.	7,850	15,380	4,280	2,290	6,340	25,370	12,570	12,320	9,700
Average days of stay (days)	3.8	4.1	4.5	5.9	5.5	4.4	6.2	4.2	4.3
Share in cargo handling volume (%)	40.7	15.0	11.3	5.7	8.9	5.2	2.0	11.2	100%
Average cargo handling volume (tons)	2,020	1,640	1,350	1,340	2,600	2,720	1,190	2,810	1,890

Source: ADPEL Semarang

Table 2-5-2 Origins and Destinations of Major Foreign Trade Cargoes in 1983

	Country / Commodity	Singapore	Hong Kong	Japan	Europe	America	Australia	Others	Thousand tons
Exports	Plywood	5.8 %	37.9 %	11.8 %	12.9 %	29.4 %	-	2.2 %	148.2
	Wood	12.4	28.1	2.5	38.0	19.0	-	-	24.2
	Rubber	38.3	3.6	7.2	40.1	-	-	10.8	16.7
	Fodder	10.5	2.4	-	87.1	-	-	-	8.5
Imports	Steel	5.1	11.8	65.8	3.2	3.0	3.1	8.5	130.6
	Cotton	22.6	29.8	3.2	32.3	-	-	12.1	12.4
	Machines	10.4	8.7	37.4	27.8	-	-	15.7	11.5
	Glass	28.6	5.4	19.6	-	1.8	-	44.6	5.6

Source: ADPEL Semarang

The average stay per vessel by month and the average cargo handling volume per vessel by month are presented in Table 2-5-3. From the table, we note that the average stay per month in the monsoon season (Oct. ~ March) is rather long, about 5.0 days, while the average stay in the dry season (April ~ Sept.) is 1.2 days less, about 3.8 days.

As most of the cargo is transhipped offshore, the extended stays during the monsoon season may be due to a reduced cargo handling rate at transshipment due to the inclement weather. According to the SPJV Weather Observation Report, blue flags were only flown six times (an average of 2.7 hours per time) during 1983. Thus the delay may not only be caused by periodic cancellations of cargo handling, but also by reduced handling speed.

Table 2-5-4 shows the number of port calls of foreign trade vessels, the average DWT and LOA, and the average cargo handling volume and number of days per port call classified by DWT group.

Among these vessels, all ships over 3,000 DWT are obliged to anchor offshore for cargo handling. The share of cargo handled offshore is 83 percent by the number of calls and 93 percent by cargo volume. All of these cargoes are transshipped to barges. Assuming that the unit cost of barge transportation is 2,000 Rp per ton, the annual economic loss due to lack of appropriate berthing facilities totals 1,360 million Rp/year as of 1983.

Table 2-5-3 Average Stay per Vessel by Month and Average Cargo Handling Volume per Vessel by Month in 1983

Item \ Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
Average stay per vessel (days)	5.4	5.0	5.5	3.4	3.5	3.5	4.2	4.0	4.3	4.9	4.4	4.6	4.3
Average cargo handling volume per vessel (tons)	1,860	2,430	2,300	1,890	1,500	1,710	1,910	1,610	1,950	2,410	1,820	2,159	-

Source: ADPEL Semarang

Table 2-5-4 Size of Foreign Trade Vessels in 1983

DWT Class	No. of Calls	Average DWT and LOA (m)	Average Cargo Handling Volume	Average days of Stay
∿ 1000	27	678 (46)	219	4.7
1001 ∿ 2000	11	1,500 (63)	727	5.3
2001 ∿ 3000	24	2,325 (74)	1,626	5.7
3001 ∿ 4000	53	3,538 (87)	1,998	4.7
4001 ∿ 5000	5	4,597 (96)	2,966	5.8
5001 ∿ 10000	115	7,157(113)	2,282	4.5
10001 ∿ 15000	77	12,283(140)	1,771	3.7
15001 ∿ 20000	54	16,848(158)	1,679	2.9
20000 ∿	21	28,078(191)	3,456	5.1
Total	387	9,232(125)	1,902	4.3

(2) Domestic Vessels

The cargoes handled vary greatly by type of vessel and by trade route. As inward cargo, lumber from West and Central Kalimantan ports such as Pontianak, Ketapang and Samprit are mainly carried by rakyat (sailing boats). Fertilizer from Palembang is also carried by rakyat and by local vessels.

On the other hand, lumber from Balikpapan and Banjarmasin, and cement and asphalt are generally carried by local vessels and kyusus. Since nusantara, most of which are under 3,000 DWT, are able to call at the Coastal Harbour, they are sometimes utilized to carry export and import cargo to and from Singapore.

Logs are generally carried by khusus, special log carriers.

A. Nusantara and Kyusus

Table 2-5-5 shows the number of port calls of nusantara and khusus, the average DWT and LOA, and the average cargo handling volume and number of days per port call classified by DWT group.

Table 2-5-5 Size of Nusantara and Khusus in 1983

DWT	No. of calls	Average DWT and LOA (m)	Average Cargo Handling Volume	Average Days of Stay
∿ 500	140	321 (35)	220	10.7
∿ 1000	81	777 (49)	393	8.4
∿ 2000	135	1,413 (61)	619	7.8
∿ 3000	61	2,506 (76)	705	6.0
∿ 4000	22	3,428 (86)	2,430	8.1
∿ 5000	2	4,752 (97)	3,760	9.0
∿10000	2	6,077 (107)	2,500	10.5
∿15000	1	10,059 (130)	5,022	20.00
Average	444	1,259 (59)	586	8.6

The share of cargo handled offshore seems to be 6.1 percent by the number of port calls and 27.3 percent by cargo volume.

B. Local Vessels and Rakyat

Table 2-5-6 shows the number of port calls of local vessels in 1983, the average DWT and LOA, and the average cargo handling volume and number of days per port call classified by DWT group. Table 2-3-7 presents these same figures for rakyat for three months, January, May and September 1983.

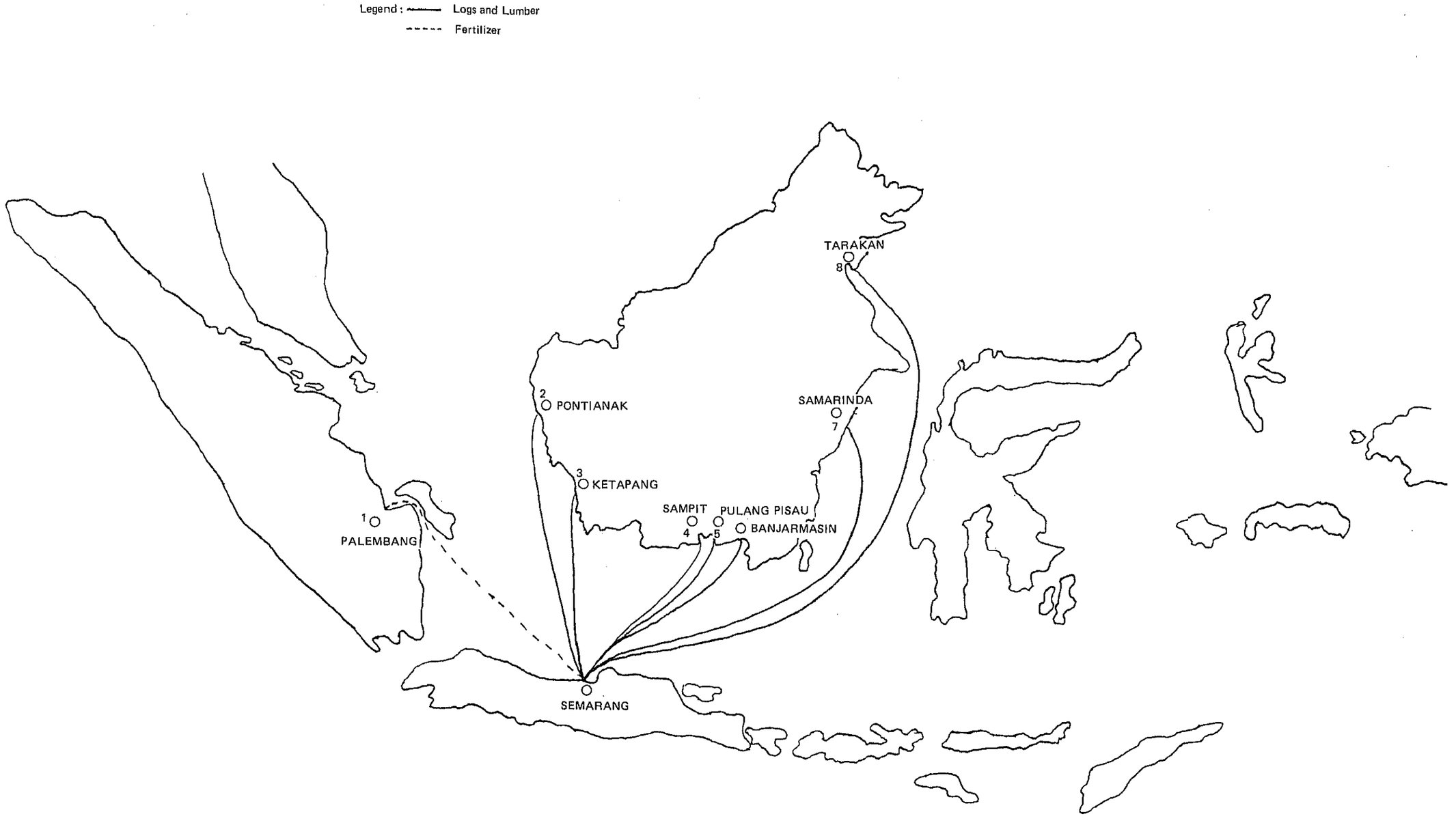
Table 2-5-6 Size of Local Vessels in 1983

DWT	No. of Calls	Average DWT and LOA (m)	Average Cargo Handling Volume	Average Days of Stay
0 ∿ 100	188	97 (22)	137	5.4
101 ∿ 150	159	150 (26)	198	6.3
151 ∿ 200	117	200 (29)	287	6.7
201 ∿ 250	29	250 (32)	343	7.7
251 ∿ 300	21	300 (34)	286	4.7
301 ∿ 400	15	389 (38)	358	5.4
401 ∿	4	660 (42)	576	10.8
Total	534	165 (27)	215	6.1

Table 2-5-7 Size of Rakyat for 3 Months in 1983

DWT	No. of Calls	Average DWT and LOA (m)	Average Cargo Handling Volgme	Average Day of Stay
0 ∿ 50	11	38 (16)	40	4.8
51 ∿ 100	89	82 (21)	71	6.0
101 ∿ 150	35	128 (25)	118	18.4
151 ∿ 200	19	178 (28)	117	7.0
201 ∿ 250	35	223 (30)	120	6.0
251 ∿ 300	8	278 (33)	168	8.9
301 ∿ 400	38	360 (36)	152	7.6
401 ∿	50	441 (40)	237	9.2
Total	285	215 (30)	127	8.4

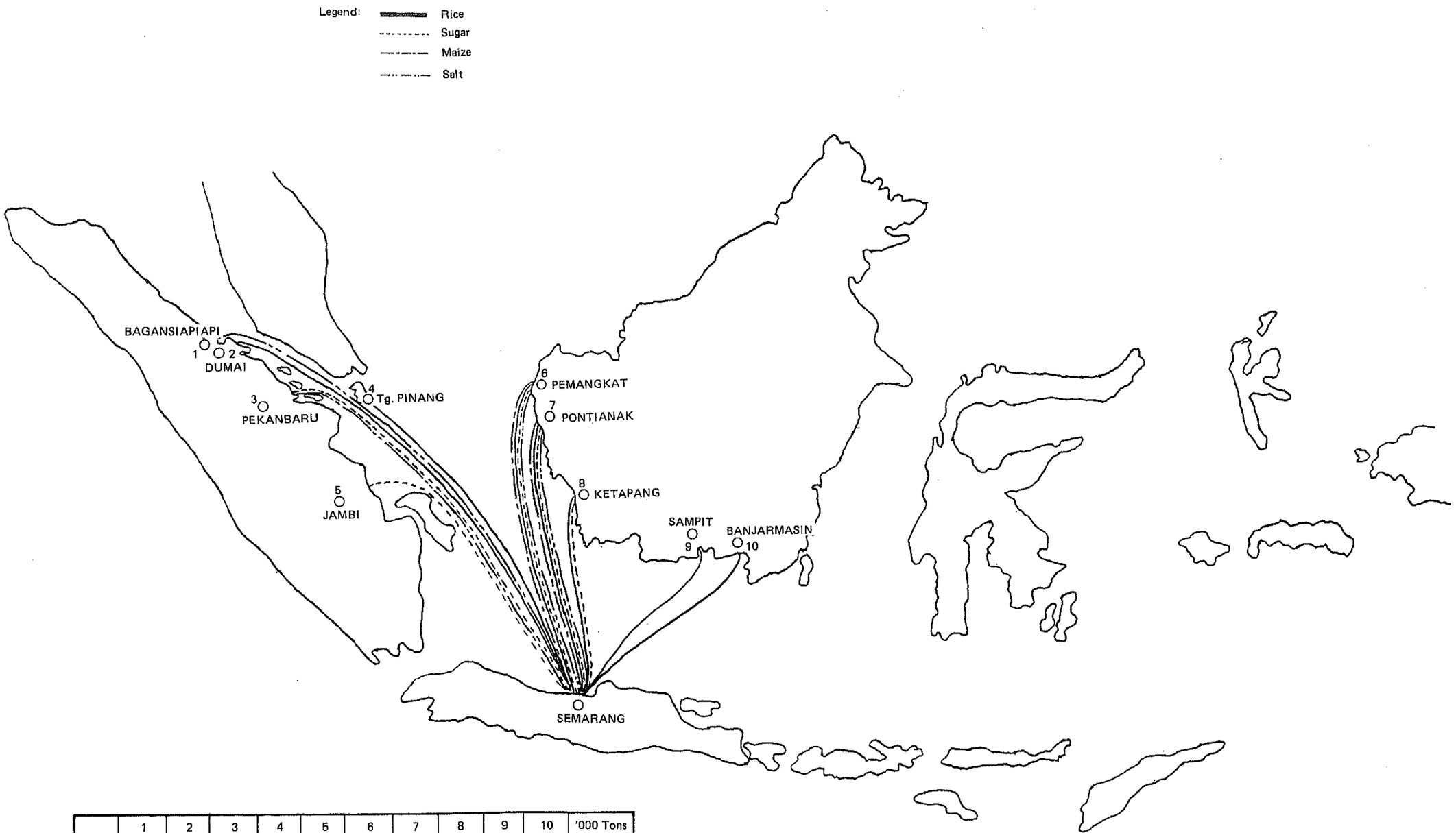
Figure 2-5-1 shows the distribution routes of major domestic inward commodities, and Figure 2-5-2 shows the distribution routes of major domestic outward commodities.



	1	2	3	4	5	6	7	8	'000 Tons
LOGS and LUMBER	–	9.3%	7.4%	15.2%	8.2%	13.2%	22.6%	15.4%	666.1
FERTILIZER	95.2%	–	–	–	–	–	–	–	63.3

Source: ADPEL SEMARANG 1984.

Fig. 2-5-1 Major Routes of Domestic Inward



	1	2	3	4	5	6	7	8	9	10	'000 Tons
Rice	–	3.9%	–	9.0%	–	5.3%	29.6%	14.2%	6.7%	13.8%	87.4
Sugar	–	–	9.6%	–	3.5%	10.4%	56.3%	6.3%	–	–	48.0
Maize	–	–	–	–	–	37.8%	31.1%	–	–	–	4.5
Salt	12.9%	–	46.8%	–	–	10.1%	10.1%	–	–	–	13.9

Source: ADPEL SEMARANG 1984.

Fig. 2-5-2 Major Route of Domestic-Outward

2-6 Existing Port Facilities

2-6-1 General

Most of the facilities at the old port of Semarang are obsolete, except for parts of the Coastal Harbour and the new International Harbour. The facilities are timeworn, and the channels are also in somewhat bad shape.

The conditions of the existing facilities and various problems are considered below.

2-6-2 Conditions

Existing port facilities are shown in Figure 2-6-1. Several of these facilities are no longer used. The status of the facilities is presented in Figure 2-6-2.

Unused facilities consist of warehouses and berths located along the southern part of the Coastal Harbour, some storehouses along Kali Baru, and most of the railway tracks.

Furthermore, there are several facilities in the area which are not related with commercial port activities. These include the army base, the navy base, a private school and a laboratory of the Ministry of Fishery.

Mooring facilities of the old harbour are located in the Coastal Harbour, Inner Harbour, Naval Harbour and Kali Baru. Table 2-6-1 (1 ~ 5) show the present conditions of the mooring facilities, and Table 2-6-2 lists the transit sheds and open storage facilities which belong to the public.

1) Coastal Harbour

The Coastal Harbour has a total basin of about 38 ha.

However, the southern part of the basin is not used because the water is too shallow and the mooring facilities are no longer functional.

The principal mooring facilities in the Coastal Harbour are a 320 m coastal wharf and two oil jetties owned by Pertamina. As the wharf is the biggest and newest facility in the old harbour, it is used for inter-island and oceangoing vessels. The wharf has 3 transit sheds and one large open storage area behind the apron. Unfortunately, the coastal wharf if only 4.5 to 5.0 meters deep due to siltation. The two oil jetties are used for small bunker oil tankers between 300 and 2,000 DWT.

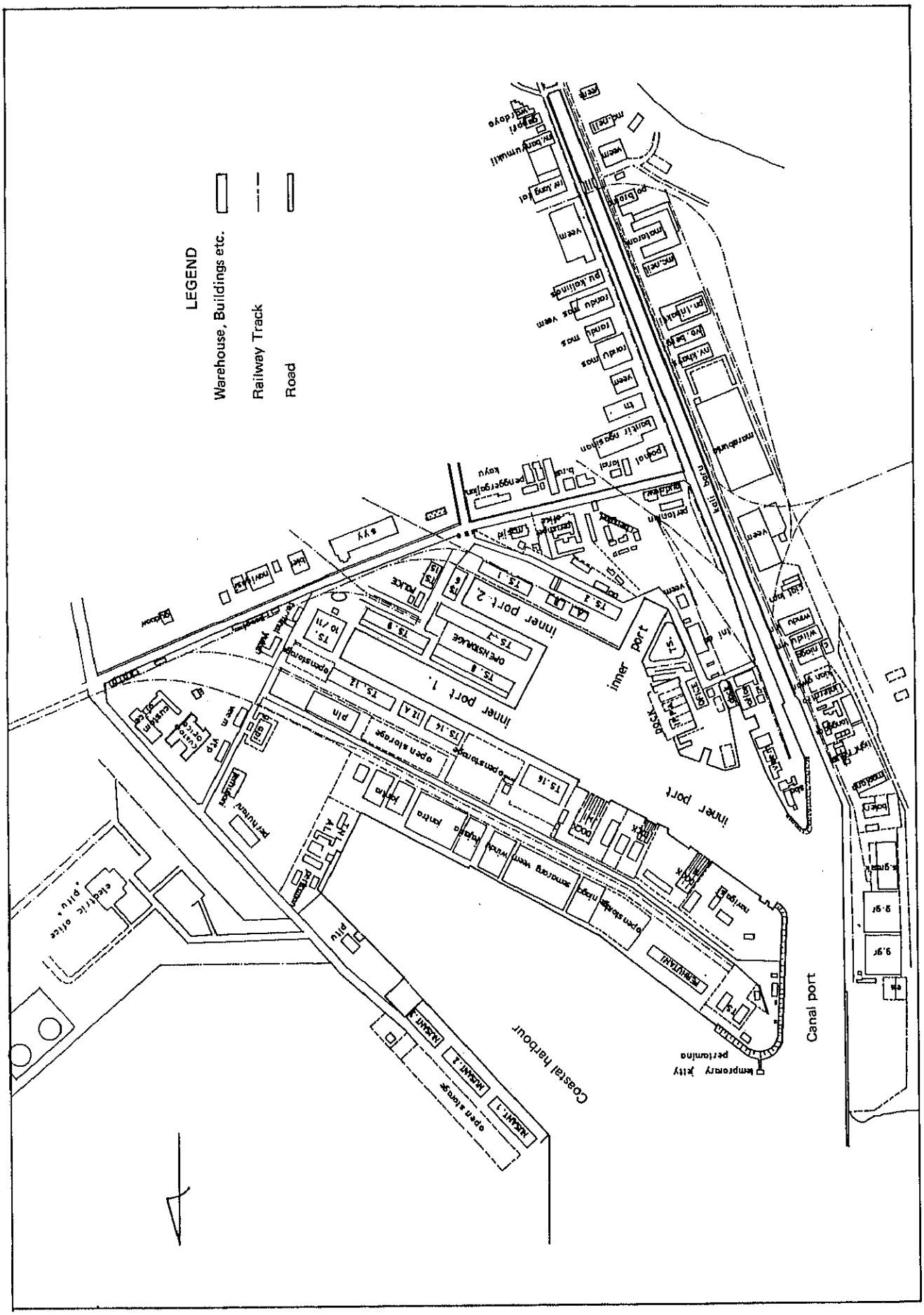


Fig. 2-6-1 Existing Port Facilities

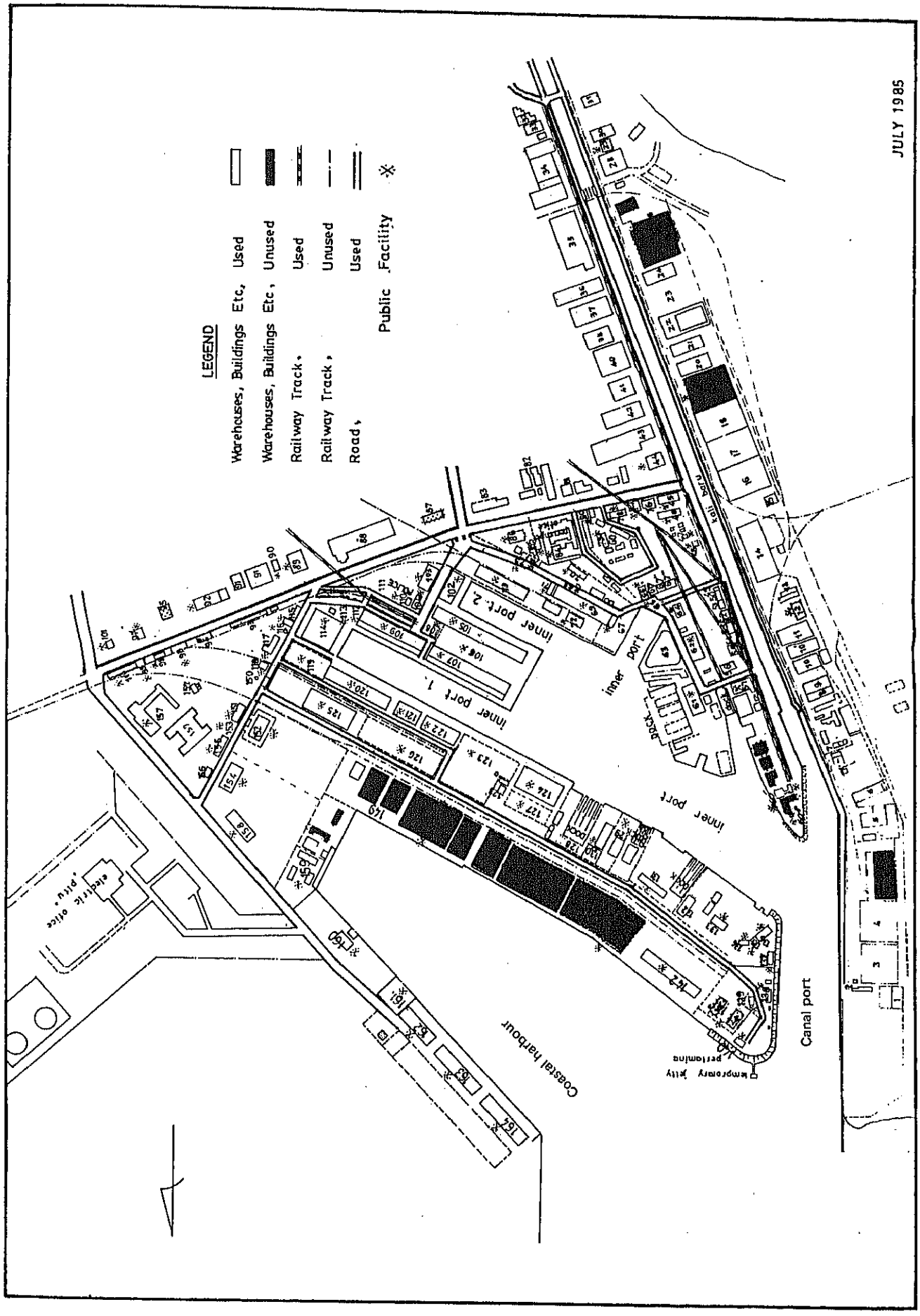
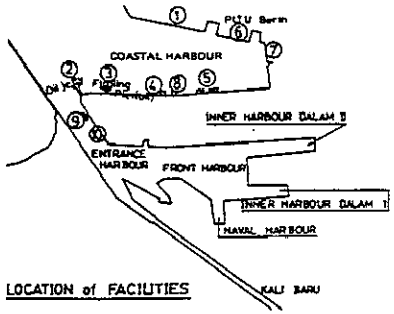


Fig. 2-6-2 Status of Existing Port Facilities

Table 2-6-1 (1) Mooring Facilities at Semarang Port in 1985



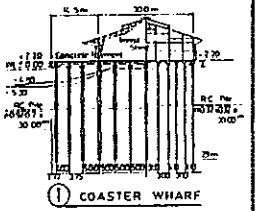
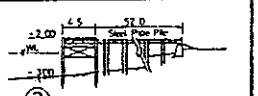
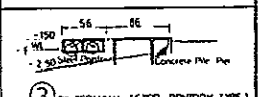
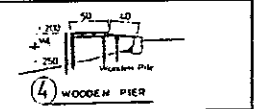
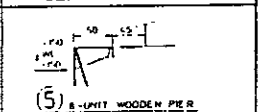
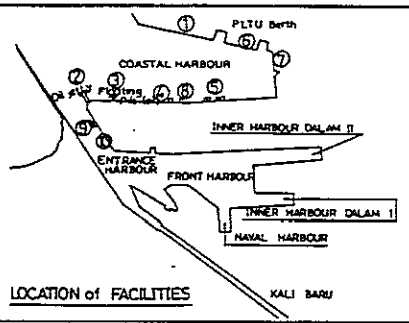
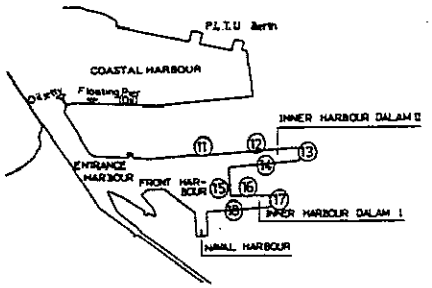
	Name	Water Depth (M)	Apron Width (M)	Berth Length (M)	Condition of Facilities	Use	Type of Structure	Ground Height of Apron	
1	2	3	4	5	6	7	8	9	
Coastal Harbour	Coastal Wharf	-4.5 ~ -5.5	14.5 - 15.0	320	Almost good High siltation	Small oceangoing vessels, inter-island vessels.	Relieving platform - type wharf.	+2.2	 ① COASTER WHARF
	Oil Jetty	-5.5		30 (Dolphin)	Fairly good Slight silta-tion.	Oil tankers (2,000 DWT class), tugboats, oil barges.	Dolphin-type and fixed jetty with access bridge (steel)	+2.0	 ② OIL JETTY (T FIGURE TYPE)
	Oil Pontoon	-2.5 ~ -3.0	-	10	Not so good	Oil tankers (less than 1,000 DWT), tugboats.	Steel pontoon with two steel dolpins.	+1.5	 ③ OIL TERMINAL (STEEL PONTOON TYPE)
	Small Pier	-1.5 -2.0	10.0	10	Bad	Deck barges only	Wooden deck concrete pier.	+2.0	 ④ WOODEN PIER
	ditto	±0.0 -1.0	5.0	-	Unusable	No use	Old wooden pier.	+2.0	 ⑤ 8-UNIT WOODEN PIER

Table 2-6-1 (2) Mooring Facilities at Semarang Port in 1985



1	2	3	4	5	6	7	8	9	
Coastal Harbour	PLTU Berth	-3.5	15.0	100	Fairly good, slight siltation.	Heavy cargo (less than 1,000 tons)	Relieving platform type. (concrete piles).	+1.8	⑥
	M.O.F. Berth	-2.5 -3.0	7.0	62	Fairly good	Fisheries investigation ships	Concrete pile pier.	+1.9	⑦
	Temporary Jetty	-1.0 -1.5	15.0	10x2 nos	Fairly good	No use at present	Steel deck type (H - shaped steel).	+2.0	⑧
	Customs (office pier)	-1.5	3.0	15	Not so good	Small customs boats	Wood piles, deck and fender piles.	+1.2	⑨ CUSTOM OFFICES PIER
	Revetment	+0.00	-	-	Bad settlement		Concrete wall.	+0.7 ~ +1.3	⑩ REVETMENT

Table 2-6-1 (3) Mooring Facilities at Semarang Port in 1985



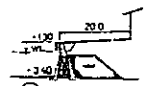
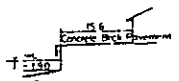
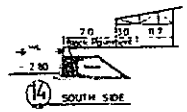
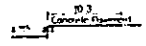
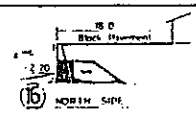
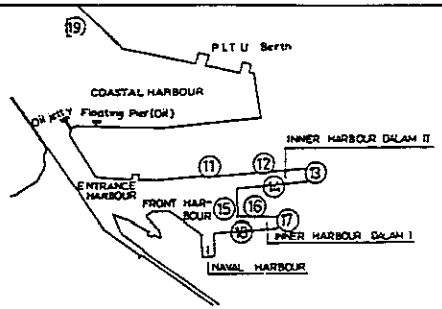
1	2	3	4	5	6	7	8	9	
Inner Harbour (Dalam I & II)	North side (1)	-3.0	15.5	95	Fairly good.	Local boats, lighters and sailing ships.	Pier type wharf (concrete pile)	+2.3	⑪ NORTH SIDE (1)
	North side (2)	-3.0	14.0	380	Fairly good, slightly settled.	Lighters, local boats and sailing vessels.	Gravity quay wall by caisson	+1.5	 ⑫ NORTH SIDE (2)
	East side	-1.5 -2.0	15.5	65	Almost good but front is buried.	Lighters	Gravity type quay wall	+1.5	 ⑬ EAST SIDE
	South side	-2.5 -3.0	10.0	310	Almost good but settled.	Lighters and local boats.	Gravity type quay wall by caisson	+1.5	 ⑭ SOUTH SIDE
	Front wharf	-0.5	20	120	Not so good- wheel stopper has dropped, siltation and settlement	Unusable except the side.	Gravity type quay wall by caisson	+1.2 ~ +1.4	 ⑮ FRONT WHARF
	North side	-1.5 -2.0	16.0	170	Almost good - some settlement	Lighters, local boats and sailing boats.	Gravity type quay wall by caisson	+1.2 ~ +1.4	 ⑯ NORTH SIDE

Table 2-6-1 (4) Mooring Facilities at Semarang Port in 1985



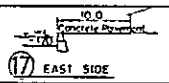
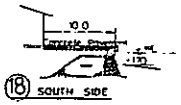
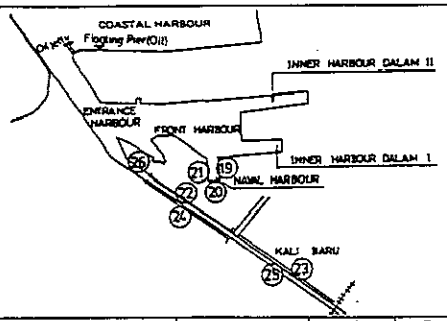
1	2	3	4	5	6	7	8	9	
	East side	-1.5	10.0	55	Almost good.	Lighters, local boats and sailing boats.	Gravity type quay wall by concrete blocks.	+1.1 ~ +1.3	 ⑰ EAST SIDE
	South side	-1.5	10.0	285	Good.	- ditto -	Gravity type quay wall by caisson.	+1.4 ~ +1.6	 ⑱ SOUTH SIDE
International Port	International	-9.0	25	605	Very Good	Oceangoing Vessels	Relieving Platform Type	+2.20	⑲

Table 2-6-1 (5) Mooring Facilities at Semarang Port in 1985



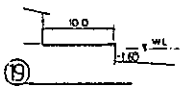
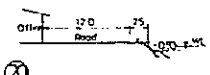
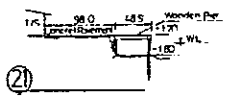
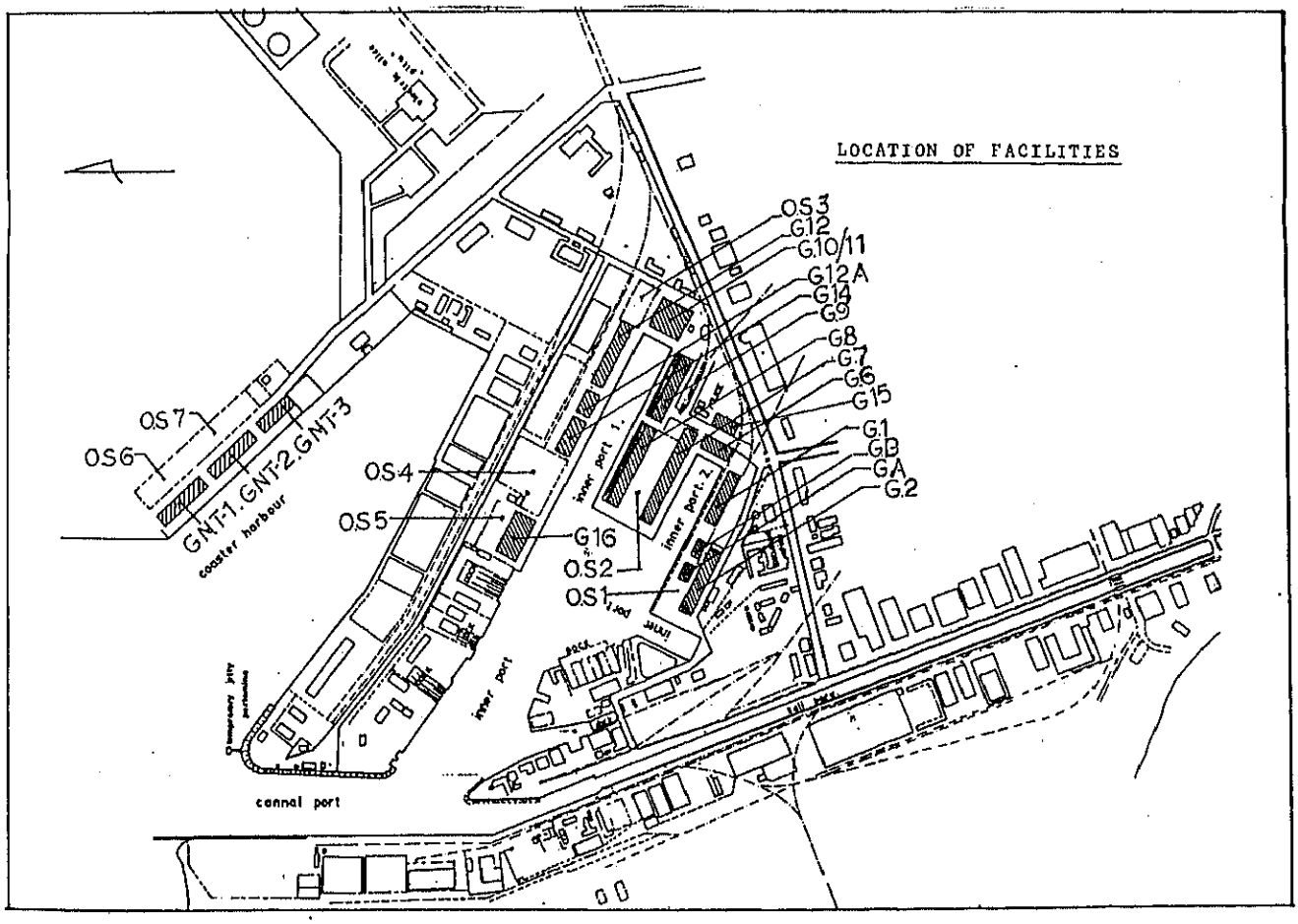
1	2	3	4	5	6	7	8	9	
Naval Harbour	East side	-0.5 -2.4	10.0	100	Fairly good, slight siltation	Military ships and patrol boats	Sheet pile type quay wall (concrete)		 ⑲
	South side	-0.5	-	45	Bad; completely broken	Unusable	Wooden jetty		 ⑳
	West side	-1.5	10	100	Bad: Wooden jetty almost broken	Tugboats, some lighters.	Concrete block type revetment, partly wooden jetty		 ㉑
Kali Baru	East side (1)	-1.5	-	450	Not so good, siltation and settlement	Sailing vessels and local boats	Concrete block type		㉒
	East side (2)	-0.5	-	550	- ditto -	Small boats, fishing boats	Concrete block type		㉓
	West side (1)	-1.5	-	450	- ditto -	Sailing vessels and local boats	- ditto -		㉔
	West side (2)	-0.5	-	750	- ditto -	Small boats only	- ditto -		㉕
	Official use berth	-1.5	-	100	- ditto -	Official use only- small boats	Concrete block type, partly wooden jetty		㉖
	New International Berth	-9.0	25	605	very good	Ocean going vessels	Relieving Platform type	+2.20	㉗

Table 2-6-2 List of Public Transit Sheds and Open Storage Facilities in the Old Port

CODE OF SHED	LOCATION	LENGTH	WIDTH	AREA	STOCKING CAPACITY	BUILT IN	CURRENT CONDITION	REMARKS
TRANSIT SHED								
G 1	DALAM 1	100 (m)	24 (m)	2400 (m^2)	2.5 (T/m^2)	1946	FAIRLY GOOD ATTACHED ROAD SETTLED	GENERAL CARGO
G 2	- ditto -	125	24	3000	2.5	1917	- ditto -	- ditto -
G B	- ditto -	45	24	1080	2.5	1921	FAIRLY GOOD	- ditto -
G A	- ditto -	40	17	680	2.5	1921	- ditto -	- ditto -
G 6	- ditto -	55	24	1320	2.5	1918	- ditto -	- ditto -
G 7	- ditto -	180	24	4320	2.5	1947	NOT SO GOOD APPRON SETTLED	GENERAL CARGO
G 8	DALAM 2	155	24	3720	2.5	1976	- ditto -	OPEN STORAGE INCLUDING
G 9	- ditto -	125	24	3000	2.5	1919	- ditto -	GENERAL CARGO
G 10/11	- ditto -	60	55	3300	2.0	1949	FAIRLY GOOD	- ditto -
G 12	- ditto -	125	24	3000	2.5	1954	- ditto -	- ditto -
G 12 A	- ditto -	45	28	1260	2.5	1956	- ditto -	- ditto -
G 14	- ditto -	70	28	1960	2.5	1963	- ditto -	- ditto -
G 15	DALAM 1	55	20	1100	2.0	1919	- ditto -	ARMY USE
G 16	DALAM 2	80	30	2400	2.5	1978	- ditto -	GENERAL CARGO
G.N.T 1	COASTER	100	30	3000	3.0	1969	GOOD	- ditto -
2	- ditto	100	30	3000	3.0	1970	GOOD	- ditto -
3	- ditto -	65	30	1950	3,0	1982	GOOD	- ditto -
PERHUTANI P.N	- ditto -	130	25	3250	-	-	BAD, SETTLED AND FLOODED	TIMBER
OPEN STORAGE								
O.S 1	DALAM 1	60	30	1800	2.5	1981	ALMOST GOOD	CONTAINER OIL
O.S 2	DALAM 1,2	160	20	3200	2.5	1982	- ditto - A LITTLE SETTLED	CONTAINER
O.S 3	DALAM 2	70	35	2450	2.5	1971	FAIRLY GOOD	OIL
O.S 4	- ditto -	110	90	9900	2.5	1982	- ditto -	GENERAL CARGO
O.S 5	- ditto -	110	50	5500	2.5	1978	- ditto -	-
O.S 6	- ditto -	215	35	7525	2.0	1975	UNDER CONSTRUCTION	-
O.S 7	- ditto -	66	24	1580	2.5	1971	- ditto -	-

Source: Yearly Report 1984 of Semarang Port



2) Inner Harbour

The Inner Harbour includes Dalam 1 (1.5 ha.), Dalam 2 (2.5 ha.) and the Naval Harbour.

Dalam 1 is approximately 3.0 meters deep, but the depth alongside the wharf is only 1.5 m to 2.0 m. The overall length of the mooring facility is 510 m, and 7 transit sheds are located behind the wharf. Although both the wharf and the transit sheds are in fairly good condition, the north side of the wharf is flooded during high tides to some extent. In addition, some of the transit sheds which were constructed more than 50 years ago are slightly damaged, and the apron width is not sufficient for trucks or machinery.

Almost all the cargo is at present moved by hand except for containers. Vessels which utilize this harbour are sailing boats with engines, lighters and local boats.

The water depth of the Dalam 2 basin is 3 to 4 meters, and the depth alongside the wharf is 2 to 3 meters. Total wharf length is about 950 m, and there are also 7 transit sheds located behind this wharf. Both the wharf and the transit sheds are in fairly good condition, but the open storage area and the apron just in front of transit shed No. G-8 is usually flooded during high tide.

The mooring facilities and aprons are generally not flooded during high tide except for the southwest side of the wharf. The apron in this part of the wharf is also too small for trucks and machines. However, the apron on the north side is wide enough to accomodate trucks and cargo handling equipment.

Vessels which use Dalam 2 consist of sailing vessels with engines, small boats and lighters.

3) Kali Baru Canal

The harbour basin of Kali Baru is about 1,200 m long and 40 m wide, but at present only about 500 m of the east side is used by sailing vessels without engines, small boats and customs patrol boats. The water depth is about 0.5 to 1.5 m alongside the berth.

The condition of the mooring facilities and apron is not very good, and the apron is mostly flooded during high tide.

4) New International Terminal

This terminal consists of three berths which were completed in 1985 as part of the Phase I Project.

The total length of the berths is 605 m (including the transition area), and two transit sheds and one open storage area are located behind the wharf.

The water depth alongside the wharf is –9.0 m. All of the facilities are in good condition; details are shown in Table 2-6-3.

Table 2-6-3 Facilities at the New International Terminal

Item	Unit	Quantity	Structural Type
Reclamation of Port Terminal Area	m^2	240,000	Retaining Wall, Bulkhead } Rubble Mound
Demolition of Existing East Breakwater	m	845	Rubble Mound with Concrete Coping
Dredging	m^2	284,600 351,900	Mooring Basin Access Channel
West Breakwater	m	1,950	Coupled Pile Type with Steel Sheet Piling
North Breakwater	m	1,700	Coupled Pile Type with Steel Sheet Piling
East Groin Sec. A	m	500	Coupled Pile Type with Steel Sheet Piling
Sec. B	m	400	Cantilever PC Sheet Pile
Sec. C	m	420	Earth Bags Mound Covered with Armor Stones
Piled Wharf	m	605	Steel Pipe Pile Width of Deck 23m
Foundation for Transit Sheds	m^2	9,138	Prestressed Concrete Pile (Octagonal 0.6m x 0.6m)
Foundation for Open Storage Area	m^2	7,833	Ditto
Navigation Aids	No. " " "	2 5	Light Beacon Light Staff Light Buoy Buoy
Road and Drainage	m^2	47,500	Branch Road 20.0m Wharf Road 25.0m
Pavement for Open Storage Area	m^2	21,060	90m x 234m
Transit Shed	m^2	2x40mx100m 8,000	One-story Steel Frame Structure
Warehouse	m^2	40x150m 6,000	One-story Steel Frame Structure
Wharf Administration Bldg.			Two-story Concrete Structure

2-6-3 Problems

There are several serious problems with the existing facilities, as shown below.

(1) Superannuated Facilities

Many transit sheds and warehouses are no longer used. Some of the wharves are too shallow and have become obsolete. Most of the unused facilities such as wharves and warehouses are located on the south side of the Coastal Harbour, in the harbour master area and in the west part of Kali Baru. It is necessary to demolish or to rehabilitate these superannuated facilities.

(2) Flooded Area

There are several areas which are regularly flooded by seawater during high tide. The flooded areas and the flooding time of the Inner Harbour are presented in Figure 2-6-3 and Table 2-6-4, respectively. The areas which are regularly flooded during high tide must be improved so that they can be used at all times.

For reference, Table 2-6-5 presents data related to the use of the shoreline in the Inner Harbour.

(3) Shallow Water Depth

The partially submerged broken breakwater is not capable of protecting the channel and basins from siltaton. Consequently, important water areas have become too shallow.

Figure 2-6-4 indicates the water depth of the Inner Port at Present. The water depth in front of some of the berths, particularly in the southwest part of the Coastal Harbour, seems too shallow for safe passage of vessels.

(4) Facilities Not Related with Commercial Port Activities

There are several facilities located in the area which are not related with commercial port activities. These facilities should be relocated or rearranged during the port development to promote the effective use of the port area.

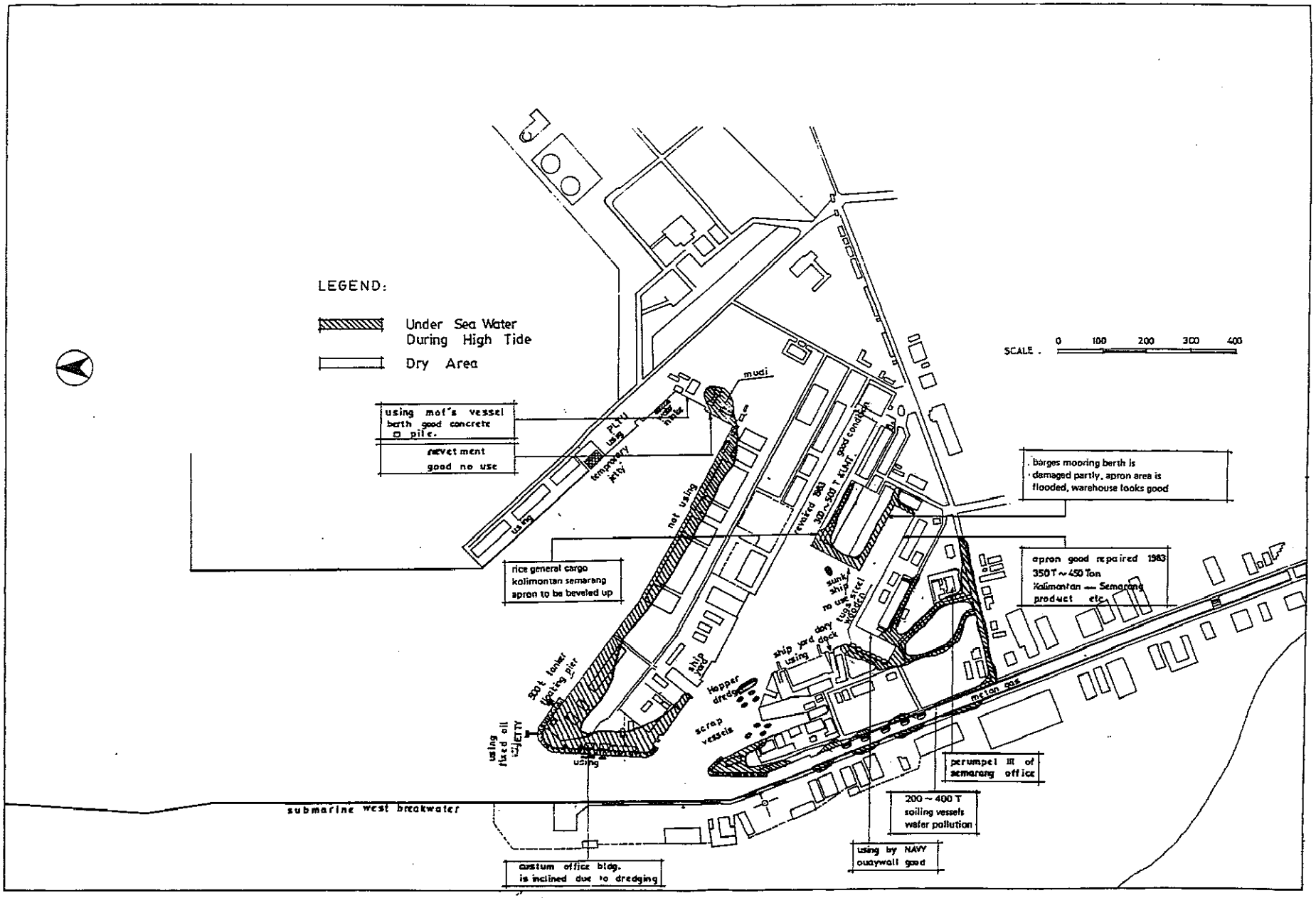


Fig. 2-6-3 Flooded Areas in Semarang Port

Table 2-6-4 Flooding Time of the Inner Harbour

YEAR/MONTH / DESCRIPTION		JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.	AVG.
OBSERVATION DATES		(day) 27	28	31	30	31	30	31	30	30	31	18	26	
Observation (hr)	6:00-17:00	(hr) 324	336	372	360	372	360	372	360	360	372	216	312	
	18:00- 5:00	(hr) 324	336	372	360	372	360	372	360	360	372	216	312	
	0:00-24:00	(hr) 648	672	744	720	744	720	744	720	720	744	432	624	
Flooding Time (hr)	6:00-17:00	(hr) 0	0	10	31	80	104	32	0	19	4	7	0	
	18:00- 5:00	(hr) 50	9	16	28	22	0	0	0	8	2	37	67	
	0:00-24:00	(hr) 50	9	26	59	102	110	32	0	27	6	44	67	
Flooding Time Rate (%)	6:00-17:00	0	0	2.7	8.6	21.5	28.9	8.6	0	5.3	1.1	3.2	0	7%
	18:00- 5:00	15.4	2.7	4.3	7.8	6.0	1.7	0	0	2.2	0.5	17.1	21.5	7%
	0:00-24:00	7.7	1.3	3.5	8.2	13.7	15.3	4.3	0	3.8	0.8	10.2	10.7	7%
		Flooding Height of Tide: C.D.L + 1.18M												

Table 2-6-5 Use of the Shoreline in the Inner Harbour

DESCRIPTION / AREA	WHOLE SHORE LINE (M)	WHOLE BERTH LINE (M)	USED BERTH LINE (M)	ALWAYS USABLE ① (M)	SOMETIMES USABLE ② (M)	① + ② x α (M)	REMARKS
COASTAL HARBOUR	1,600	690 (905)	340 (555)	320 (520)	20 (35)	338 (552)	
ENTRANCE	640	-	-	-	-		
INNER-2	970	970 (970)	905 (905)	735 (735)	170 (170)	893 (893)	
INNER-1	510	510 (510)	510 (510)	285 (285)	225 (225)	494 (494)	P.L.T.U: 100M M.O.P. : 60M
NAVAL-ENT	755	455 (555)	100 (200)	- (100)	100 (100)	93 (193)	OIL : 40M PILOT: 15M
KALI BARU	1,900	1,100 (1,200)	450 (550)	-	450 (550)	418 (512)	NAVAL: 100M CUSTOM: 100M
TOTAL	6,370	3,725 (4,140)	2,305 (2,720)	1,340 (1,640)	965 (1,080)	2,236 (2,644)	

Note: 1) Figures in parentheses are berth length including unrelated port activities.
2) α denotes the possible rate of use for ②, i.e. 0.93.

Fig. 2-6-4 Water Depth in Semarang Port

2-7 Wharf Productivity at Present

2-7-1 Present Berth Occupancy by Terminal

Statistics on the throughput by wharf are not available for Semarang Port. However, the berth occupancy by wharf as of 1983 can be calculated based on the following assumptions.

As the −9 m new international trade berth was not operating at that time, cargoes carried by oceangoing vessels and nusantara over 3,000 DWT were transshipped by barges, and barge cargoes other than logs and plywood were mainly handled in the Inner Harbour.

Cargoes carried by nusantara less than 3,000 DWT were handled at the Coastal Harbour; cargoes carried by local ships were handled in the Inner Harbour, and cargoes carried by rakyat were handled at Kali Baru. Based on the available statistics, Table 2-7-1 shows the apparent throughput by facility.

These figures are then used to calculate the apparent berth occupancy ratio as shown in the following fomulae.

Table 2-7-1 Overall Cargo Flow in Semarang Port in 1983

	Place of Loading and Type of Ship	Berth* Length (m)	Cargo Handling Volume (10,000 tons)	Average Size of Vessel DWT (tons)	Average Size of Vessel LOA (m)	Average Handled Cargo (tons)	No. of Call (times)	Days of Stay (days)	Handling per day (tons/day)
Foreign Trade	Offshore Anchorage	-	68	10,700	110	2,090	325	4.2	498
	Foreign Vessels (excluding Kayu Lapis)		58	10,300	110	2,150	270	4.4	489
	Kayu Lapis Cargo		10	12,900	140	1,760	55	3.3	533
	Coastal Wharf	320	11						
	Foreign Vessels		5	1,470	60	850	61	5.2	163
	Nusantara		6	1,870	70	780	78	4.1	190
	Inner Harbour	1,390							
	Barge Cargo		(58)	(170)**	(20)**	(150)**	(3,867)**	(1.0)**	(150)
	Sub Total		79	-	-	-	789	-	-
Domestic Trade	Offshore Anchorage	-	56						
	Nusantara		7	3,970	90	2,630	27	8.7	302
	Kayu Lapis Cargo		(49)	-	-	-	-	-	-
	Coastal Wharf	320							
	Nasantara		13	910	50	370	339	9.6	39
	Inner Harbour	1,390	18						
	Local		11	160**	30**	220**	530**	6.1**	36
	Barge Cargo		(7)	150**	20**	(150)**	(466)**	1.0**	(150)
	Kali Baru	420							
	Rakyat		10	210	30	127	790	8.3	15
	Sub Total	2,150	90	-	-	-	-	-	-
	Total	2,150	169	-	-	-	-	-	-

* Berth Length = Usable Always + 0.93 x sometimes usable.

** Barges are assumed as 170 DWT with 20m Length in average.

$$B_o = \frac{\sum_{i=1}^{m} (Loa + a) \times Di \times Ncj}{\sum_{i=1}^{n} Lbi \times 365}$$

B_o : Berth Occupancy (%)

L_b : Length of Berth (m) (Always usable + sometimes usable x 0.93)

a : Allowance a = 3 m

D : Days of Stay (days)

Nc : Number of calls (times)

Berth occupancy by terminal is obtained as follows:

Coastal Wharf (–4.5 m)

$$B_o = \frac{[(60+3) \times 5.2 \times 61 + (70+3) \times 4.1 \times 78 + (50+3) \times 9.6 \times 399]}{320 \times 365} = 1.85$$

Inner Harbour

$$B_o = \frac{[(20+3) \times 1.0 \times 3867 + (30+3) \times 6.1 \times 530 + (20+3) \times 1.0 \times 466]}{1387 \times 365} = 0.41$$

Kali Baru

$$B_o = \frac{(30+3) \times 8.3 \times 790}{365 \times 418} = 1.41$$

Total (Average)

$$B_o = \frac{215812 + 206348 + 216381}{116800 + 506255 + 152510} = 0.82$$

Berth Occupancy

Coastal	Inner	Kali Baru	Total
1.85	0.41	1.41	0.82

These berth occupancies which are based on the statistical data and information from the branch offices are extraordinary; theoretically occupancies over 100 percent are impossible.

These results may come from various reasons:

- Double mooring may be practiced.
- The statistical data for small vessels may include vessels which call at the dock yard for repairs.
- Barges may deliver cargo inside the water areas (not at the berths), or may be utilizing private berths.

Although the calculated occupancy ratios are questionable, it is clear that the port of Semarang is exceptionally congested as shown by the figure of 82 percent. In general, it is very difficult to operate ports with berth occupancy ratios above 80 percent.

2-7-2 Preferable Wharf Productivity

(1) At Semarang Port

Based on the on-site survey conducted at Semarang Port over 3 months in 1985, the outstanding factor is that the stay of vessels is far too long, especially for local vessels and rakyat.

The average actual cargo handling productivity by commodity is presented in Table 2-7-2.

Table 2-7-2 Observed Cargo Handling Productivity in Semarang Port in 1985

tons/gang/hour (ships/hour)

	Quay Loading/Unloading	Offshore Transhipment
General Cargo	7.5 (23.0)	9.2 (29.7)
Containers	1.0 Box (1.7 Box)	2.9 Box (2.9 Box)
Fertilizer	11.3 (31.2)	7.8 (10.6)
Asphalt (Bulk)	14.9 (29.8)	-
Grain (Bags)	14.7 (26.9)	-
Liquid	21.4 (44.6)	-
Palm Oil	20.8 (41.7)	-
Timber and Plywood	-	7.2 (27.1)
Tobacco	-	4.8 (20.28)

Working hours at Semarang Port are as follows:

First Shift	8:00 ~ 16:00
Second Shift	16:00 ~ 24:00
Third Shift	0:00 ~ 8:00

Each Shift includes a one hour break.

Cargoes from most vessels are handled in two shifts. Cargoes from a few vessels are handled in three shifts. Cargoes from rakyat are handled in one shift.

(2) Throughout Indonesia

In general, cargo handling rates vary by port and by commodity. Sample cargo handling rates at various Indonesian ports are presented below.

Table 2-7-3 Cargo Handling Productivity in Indonesian Major Ports

Port of Cilacap	tons/gang/hour
General Cargo	12
Dolog Cargo (Rice, Sugar)	9
Bulk (Gypum by derrick)	14
General Cargo	12
Frozen Cargo (Palletized)	37
Drums (Chemicals)	33
Fertilizer (Bulk by Conveyor Belt)	150
Bagged Cargo (Cattle Fodder 60 ~70 kg)	15 ~ 16
" (" -Cutting Bag)	25

Source: Master Plan and Feasibility Study for Port of Cilacap 1984

Port of Belawan	tons/hour
Bagged Cargo	18
General Cargo	7

Source: Indonesian Ports Study

Port of Banjarmasin	tons/hour
Bagged Bulk	10 ~ 13
General Cargo (Manual)	11
" (Gear)	12
Lumber	16 ~ 17
Logs (loading)	46 ~ 48

Source: Review Master Plan, Feasibility Study and Engineering Design 1985

The productivity also depends on the size of ships. For the conventional style of break bulk carriers over 500 DWT with 2 or more hatches, one cycle of loading and unloaidng takes from 3 to 5 minutes, and the lifting unit is 0.5 ~ 1.5 tons.

In the case of small ships for domestic trade, the cycle time is fast, but the lifting unit is smaller due to the lack of gear capacity. The average producitivity is said to be as follows:

Small Coastal Ships (17 ~ 20 cycles/hr: one sling 0.5 ~ 0.6 tons)
11 ~ 12 tons/hr

Large Oceangoing Ships (10 ~ 12 cycles/hr: one sling 1.0 ~ 1.2 tons)
12 ~ 14 tons/hr

(3) Preferable Productivity

Thus, the standard cargo handling productivity per ship is assumed as follows:

Kind of Vessel	Tons/hour/vessel	Working hours/day	Vessel/day
International (Large Vessel)	50	14	700
International (Small Vessel)	37.5	14	525
Nusantara	25	14	350
Rakyat and Local	12.5	10	125

(4) Working Days and Working Ratio at Semarang

In the monsoon season from October to March, cargo handling work is sometimes interrupted due to rain and wind.

According to cargo handling statistics, the average staying days during the monsoon season (5.0 days) is 1.2 days longer than during the dry season.

So the number of non working days due to inclement weather equals

$$365 \times \frac{1}{2} \times \frac{1.2}{5} = 43.8 \text{ days/year} \qquad \text{Working Day rate } \frac{365 - 44}{365} \times 100 = 88\%$$

(5) Effective Berth Lengths at Semarang Port

As shown before in Table 2-6-4, 7 percent of the total quay length in the Inner Harbour and along Kali Baru cannot be used due to flooding. Thus this length must be considered separately when calculating the cargo handling rate.

The effective berth lengths are as follows:

Table 2-7-4 Effective Berth Length at Semarang Port

	Always Usable	Sometimes Usable	Total
Coastal Harbour	320 m +	—	320 m
Inner Harbour	1,020 m +	395 m x 0.93	1,387 m
Kali Baru		450 m x 0.93	418 m

(6) Optimum Occupancy Ratios at Semarang

From these premises, the optimum occupancy ratios taking into consideration of the new −9 m wharf are obtained as follows.

A. Oceangoing vessels (using the new −9 m wharf instead of barge transshipment) (excluding Kayu Lapis's cargo)

$$B_o = \frac{(130+3) \times (\frac{2150}{48 \times 14}) \times 270}{495 \times 365 \times 0.88} = 0.722$$

This means that if the cargo throughput of foreign trade in 1983 had been handled with good conditions at the new international wharf completed in 1985, the berth occupancy cargo would have been 70 percent.

So, in this case, the number of berths is assumed as 3.7.

This means that the port is seriously congested, and even as the new port facilities begin to operate, the number of berths for oceangoing vessels is still insufficient.

B. Coastal Harbour (for Nusantara)

$$B_o = \frac{(60+3) \times \frac{850}{36 \times 14} \times 61 + (70+3) \times \frac{780}{24 \times 14} \times 78 + (50+3) \times \frac{370}{24 \times 14} \times 339}{320 \times 365 \times 0.88}$$

$$= \frac{39485}{102784} = 0.384$$

As the number of berths is 5.4, no vessels are waiting. For coastal vessels, the congestion is not so serious.

C. Inner Harbour (Local vessels and barge cargo without the new international harbour)

$$B_o = \frac{(20+3) \times 1.0 \times 3867 + (30+3) \times \frac{220}{12 \times 10} \times 530 + (20+3) \times 10 \times 466}{1{,}387 \times 365 \times 0.88}$$

$$= \frac{131724}{445504} = 0.296$$

The Inner Harbour is not so seriously congested.

D. Kali Baru

$$B_o = \frac{(30+3) \times \frac{127}{12 \times 10} \times 790}{418 \times 0.88 \times 365} = 0.206$$

Here again, the congestion is not serious.

The results of these calculations suggest the following points.

- Although Semarang Port has a relatively long quay line of over 4 km there is no deep sea wharf. Most of the quays are small obsolete facilities. A deep sea wharf is badly needed.
- The 600 m international wharf which was completed in 1985 is not sufficient the cope with the current demand. In fact, it is not even sufficient to accommodate demand as of 1983.
- On the other hand, the facilities for small vessels are more than sufficient as no barge transport will be required from now on.

CHAPTER 3
CARGO FORECAST

CHAPTER 3 CARGO FORECAST

3-1 Basic Concept

The volume of cargo handled at a given port is closely connected with the social and economic activities in the port's hinterland. Future volume is generally forecast based on extrapolation from past data, or based on correlation with major indices and future forecasts of these indices.

These forecasting methods are based on the premise that future change either in cargo volume or in economic indices will continue at the same rate as past change. In many cases this may be an accurate assumption. If for example, the cargo volume of a given port has increased at a steady rate for some years, it is likely that the growth of that port's volume will continue at about the same rate, ceteris paribus.

However, for certain port development projects, especially for big projects, the relation between a port and its hinterland's activities is dynamic; it is influenced by the economic policy of the whole nation, the conditions of international trade and the economic circumstances in neighbouring countries.

In this chapter, first of all, we must analyze what the economic framework will be in the future. Since as many factors as possible should be taken into consideration, we conduct the analysis in three steps; as the first step, the relationship between the national economy and the economic situation of neighboring countries is analyzed; as the second step, the relation between the national economy and Central Java including Yogyakarta is considered, and finally, as the third step, the relationship between the development of Semarang Port and of the entire economy of Central Java and Yogyakarta is studied.

After that, the future cargo projection by commodity is conducted for several economic frameworks.

Historically, time and again, we have seen that development of major infrastructures stimulates the economy. New port facilities tend to create new demand, especially if they are developed as a part of regional economic development plans which include the development of roads, railways, water and electricity supply, and various incentives to stimulate business.

Such comprehensive development plans, if properly executed, will increase regional economic activity, but it is difficult to forecast their effects precisely.

None the less, considering the experience of the studies of other ports which have a hinterland with a large population like Semarang Port, the cargo forecast should be based on the past cargo volume and regional activities, and new demand, or increased economic activity which will come about as a result of the port development project itself, should also be taken into consideration.

3-2 Future Economic Framework

3-2-1 Framework of Indonesia

Despite the sluggish growth of the world economy in the past decade, the economy of the Pacific countries has been growing at a relatively fast pace. These countries are highly dependent on international trade and investment.

As is widely known, the transpacific trading volume has at last surpassed that of the transatlantic in 1980's. That is to say, Europe and the US have lost their position as the centers of trade, a position they had held since the 16th century.

The economic growth of the Asian countries has been supported not only by Japan but also NICs, namely Singapore, Hong Kong, Korea and Malaysia. However, the economic growth of this Asian region is heavily influenced by the economies of the US, Japan and Europe.

Although the economic growth of the NICs has become sluggish recently, it seems that we are in short term stagnation similar to that experienced by Japan's economy after the oil crisis. The Indonesian economy is also hitting bottom at present; however, the future will be not so bad.

According to the "Economic Development and Issues among Pacific Region Countries toward 2000" issued by the Economic Planning Agency of Japan, the ASEAN Countries, especially Thailand, the Philippines and Indonesia will approach the present economic level of Korea or Malaysia by the end of this century.

The future economic development of each of these countries will be unique as each will be influenced by local economic policies and natural conditions. But on the whole, the overall economic development will most likely follow a pattern similar to the recent development in the NICs.

Furthermore, China, by participating in international trade and maintaining its new open economic policy, can be expected to reach its economic goal of a 400% increase in GNP from 1981 to 2000. Along with its enormous economic potential, Chian's full participation in the international market will undoubtedly have a huge impact on the world market and inject tremendous vitality into the growth of the Pacific region.

As the Pacific region countries develop, their international competitiveness in the industrial sector will increase. There may be a development of industrial specialization country by country. Various accords, both inside and outside of the region, will have to be reached to avoid trade friction.

According to the aforesaid study, from 1985 to 1990 the GNP per capita of Indonesia will grow at an annual rate of 5 percent and the population will grow at 2 percent per year (the GNP will grow at an annual rate of 7 percent). The study also predicts that from 1990 to 2000 the GNP growth rate will increase to 9.6 percent/year while the population growth will slow down somewhat to 1.96 percent per annum.

These projected growth rates seem to be rather optimistic.

Considering the projection based on Repelita IV (from 1994 to 1998 5%), the Study Team assumes the growth rates presented in Table 3-2-1.

Table 3-2-1 Assumed GDP Growth of Indonesia

% per year

Year	GDP Growth	GDP/Capita Growth
1985 - 1990	5.0	2.8
1990 - 2000	7.5	5.4

3-2-2 Future Framework of the Central Java Area

(1) General

Compared with other Indonesian provinces, Central Java and Yogyakarta are economically undeveloped. The economic situation of the area is the worst among the major provinces in Indonesia.

This result may come from inadequate and insufficient infrastructures such as ports, roads, and railways in spite of its huge population, creating an environment where it is difficult to industrialize.

The Indonesian Government is stressing the necessity of improving the economic situation of these provinces in the Repelita IV plan. However, under the current economic plans, Central Java and Yogyakarta will remain dependent on the agricultural and transport sectors. In other words, manufactured goods will continue to be brought in from the neighboring provinces of East and West Java.

The Government has a responsibility to get out from this desperate situation, that is to say, it will have to make a leap towards industrialization through the development of infrastructures.

Of course there are many possible scenarios for the future development of this region. For the cargo forecast, two scenarios are considered.

Under the first scenario, without the development of either the port or other major infrastructures, it would be difficult for the economy of Central Java to catch up with the national average level by the end of this century.

Most manufactured consumer goods and raw materials would have to be transported overland from West or East Java as at present as Repelita IV has predicted, only the transportation sector would enjoy the benefits. It would be difficult to industrialize the area.

The limitation of port capacity would hamper economic growth.

Under the second scenario, the Team expects the economy of Central Java to catch up with the Indonesian average.

Not only the port but also the other major infrastructures would be provided, and appropriate industrialization planning would be carried out.

(2) "Without" Development Case

In order to consider the impact of the port development on economic growth, we can examine the correlation between overall cargo throughput and GRP as shown in Table 3-2-2.

Table 3-2-2 Correlation Between Overall Cargo Throughput and GRP

	Cargo (Y) ('000 tons)	GRP (X) (10^9 Rp.)
1971	509	909
1972	584	991
1973	684	1,093
1974	744	1,156
1975	890	1,331
1976	808	1,378
1977	845	1,464
1978	883	1,628
1979	980	1,671
1980	1,117	1,906
1981	1,413	2,232
1982	1,516	2,338
1983	1,682	2,533
1985	1,820	2,850

The correlation equation is: $Y = 0.675\ X - 98.0$

$R = 0.986$

Under the "without case", no development would occur following the Phase I Project.

Based on the analysis in Chapter 2, the capacity of the port under normal or optimum operation based on berth occupancy is assumed as shown in Table 3-2-3.

Table 3-2-3 Capacity of Existing Facilities

(Unit: '000 tons)

	Present Situation (1983)				Future*			
Berth Occupancy	60	70	80	88	60	70	80	88
New Deep-sea Wharf					442	515	589	648
Coastal Harbour	383	446	510	561	383	446	510	561
Inner Harbour	1,041	1,215	1,389	1,527	1,041	1,215	1,389	1,527
Kali Baru	314	366	418	460	314	366	418	460
Total	1,738	2,027	2,317	2,548	2,180	2,542	2,906	3,196

The relationship between the capacity of the port facilities and total cargo volume based on different economic growth rates is shown in Fig. 3-2-1.

According to these results, we can predict that if the GRP grows at a rate of 6 percent as predicted in the Repelita IV, the cargo volume will reach 2.4 million tons and the berth occupancy will be 70 percent by the end of 1980's, which shows the port will be somewhat congested.

As this figure includes all commodities like Kayu Lapis inward log and all facilities. The relationship between the international trade volume and the existing international terminal including the new deep sea wharf opened in 1985 should also be analyzed.

As shown in Fig.3-2-2, the Volume of foreign trade exceeded the capacity of the cargo handling facilities from 1975 on, and the overflow cargo was loaded and unloaded at the Inner Harbour using barge transshipment. With the construction of the Phase I facilities in 1985, the cargo demand and the capacity balanced, but if the economic growth is as predicted, the cargo will again overflow by the beginning of the 1990's.

The scenario is as follows: the balance between the capacity and the demand for oceangoing vessels will be kept in balance for the time being, but by the middle of the 1990's, congestion from waiting will again be a serious problem, and considerable cargoes will again have to be carried to the Inner Harbour by barge. However, it is not certain that the Inner Harbour will still have sufficient capacity to accommodate the barges at that time.

Whether the economic growth rate is high or low, the port will not have sufficient capacity to handle foreign cargoes at berth by the middle of 1990's.

In other words, it is impossible to sustain normal economic growth under the "Without" development scenario.

Major commodities would have to be carried overland from Surabaya or Jakarta.

Of course, no industrial cargoes as such as coal, cement or grain would be able to be handled at the port due to a lack of facilities. The socio-economic conditions under the "Without" case are presented in Fig. 3-2-3.

Under this scenario, the economic growth in the area might be assumed as follows:

1985 ~ 1990	6.0%
1990 ~ 1995	3.0 ~ 4.0%
1995 ~ 2005	0 ~ 2.0%

This scenario is inconsistent with the philosophy of the economic scenario presented in Repelita IV.

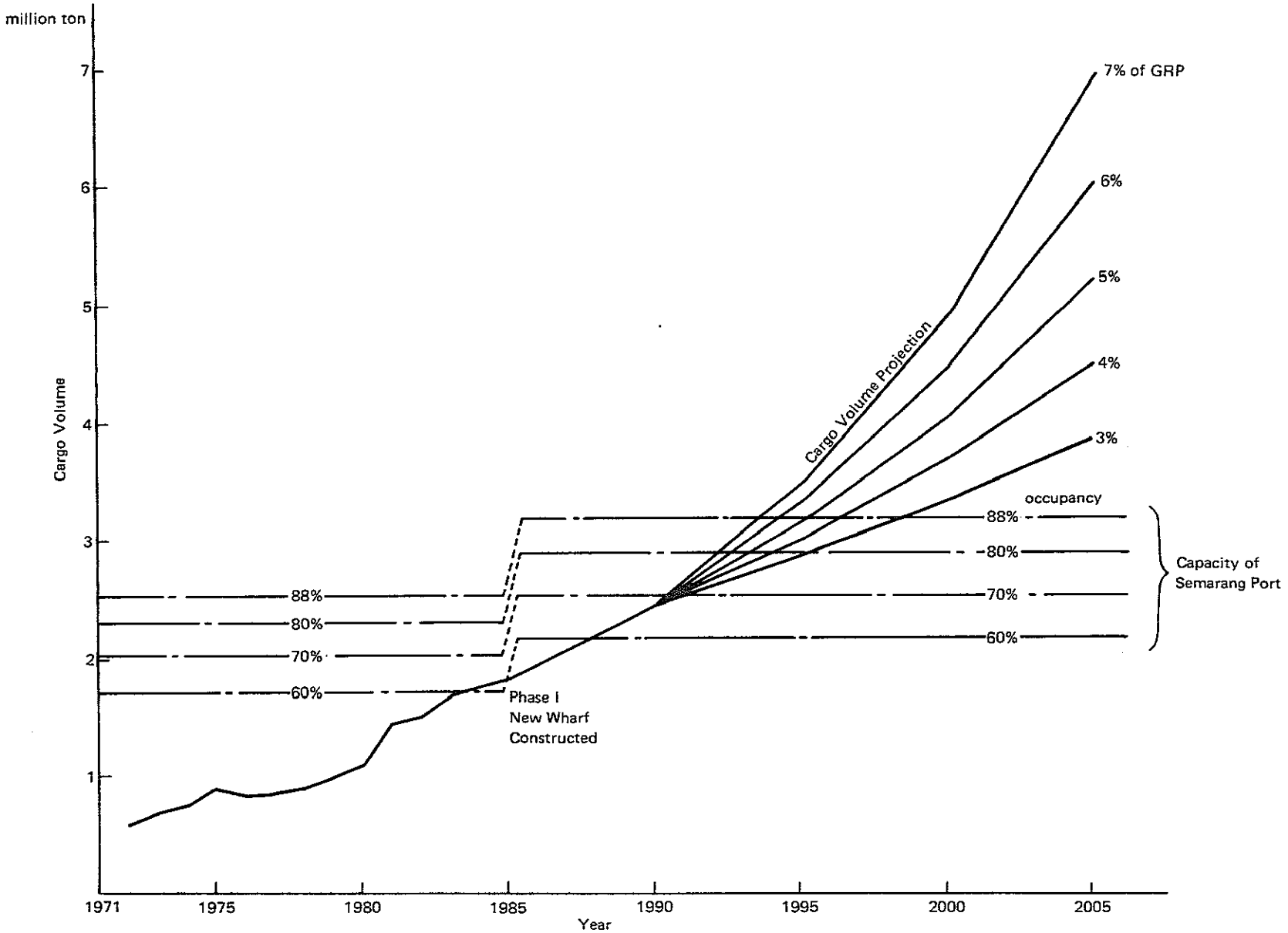


Fig. 3-2-1 Relation between Cargo Forecast and Capacity of Semarang Port

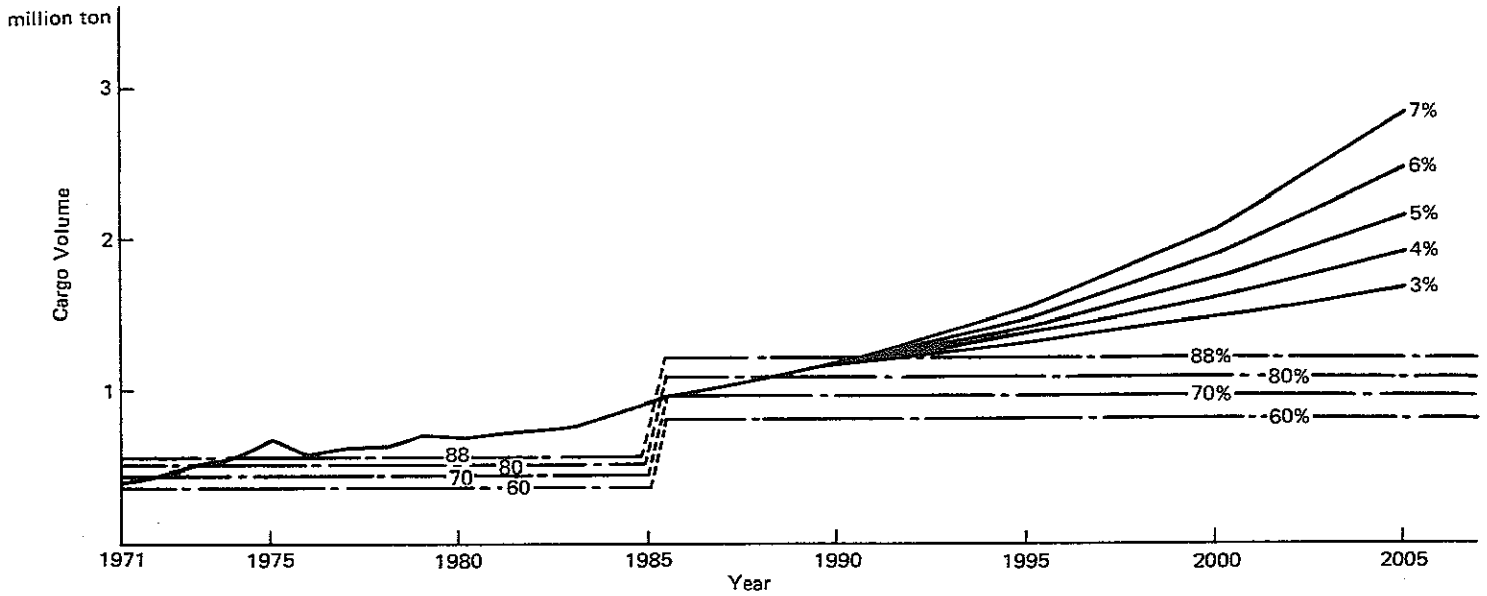


Fig. 3-2-2 Relation between Cargo Forecast and Capacity for Foreign Trade of Semarang Port

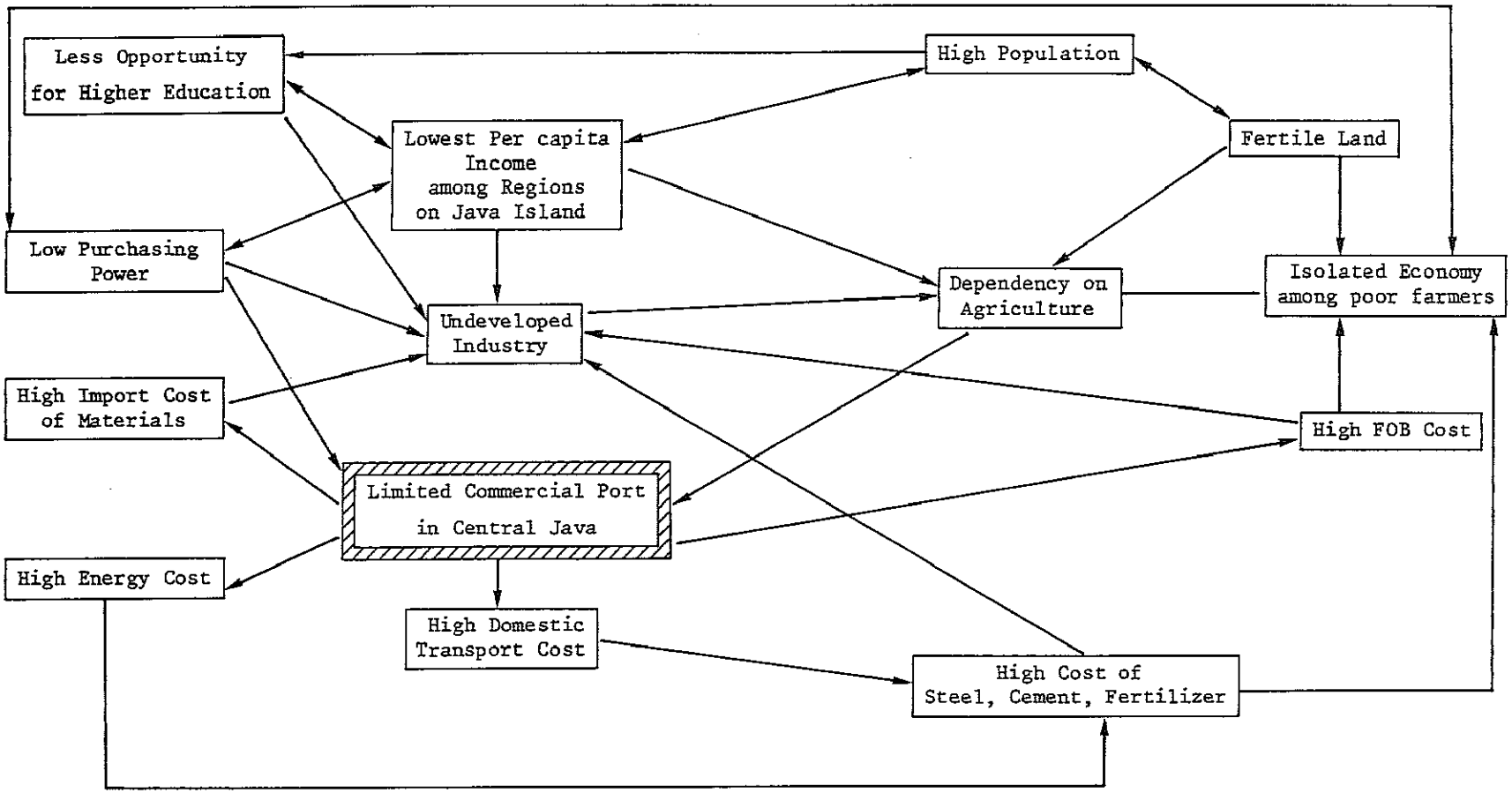


Fig. 3-2-3 Socio-economic Conditions in Central Java – "Without" Case

(3) "With" Development Case

With the development of a deep seaport and other infrastructures, both agricultural and industrial production in the region will be accelerated.

The isolated economic structure of the area will gradually change.

The future socio-economic structure of the area under the "With" scenario is presented in Fig. 3-2-4.

The forecast growth rate of the GRP with additional port facilities is based on the following assumptions:

- o The Government will endeavour to make the economic situation of the area catch up with the national average by the end of this century.
- o The growth rate for agricultural production may decline slightly in the future. The high 6.7% growth rate from '79/80 to 82/83 is based on improved irrigation and the widespread use of fertilizers. As these major changes in agricultural production have already been introduced and the arable land is limited, it is not likely that the growth rate will remain the same as in recent years.
- o The transport and communications sector is likely to decline somewhat after the opening of the new port in 1985.
- o Overall, under the "With" development case, the 6% growth rate of GRP predicted in Repelita IV toward 1990 seems to be somewhat conservative, because:
  - o Repelita IV does not take into consideration the boom of the construction period of Phase II, other infrastructures, new investments for the littoral and manufacturing industry, etc.,
  - o If we followed the figures of Repelita IV to 1990, it would be impossible for the economic level of the Central Java area to catch up with the national average of Indonesia by the turn of the century.

So the Study Team assumed the growth rate of GRP of the area under the "With" case as follows.

1985 ~ 1990	7.5%
1990 ~ 2005	9.0%

If this growth rate is achieved, the GRP/capita of the region will, indeed, catch up with the national average by the year 2000.

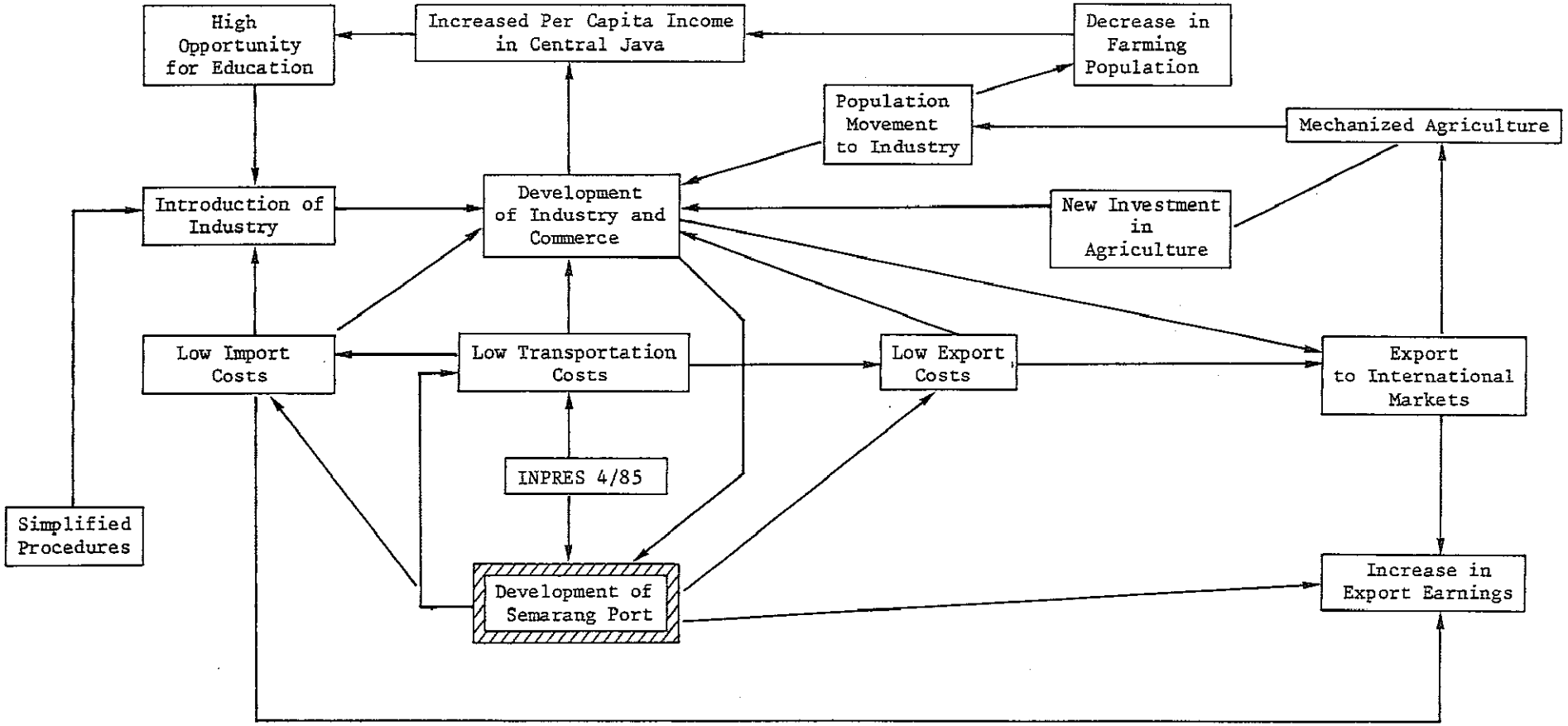


Fig. 3-2-4 Socioeconomic Conditions in Central Java – "With" Case

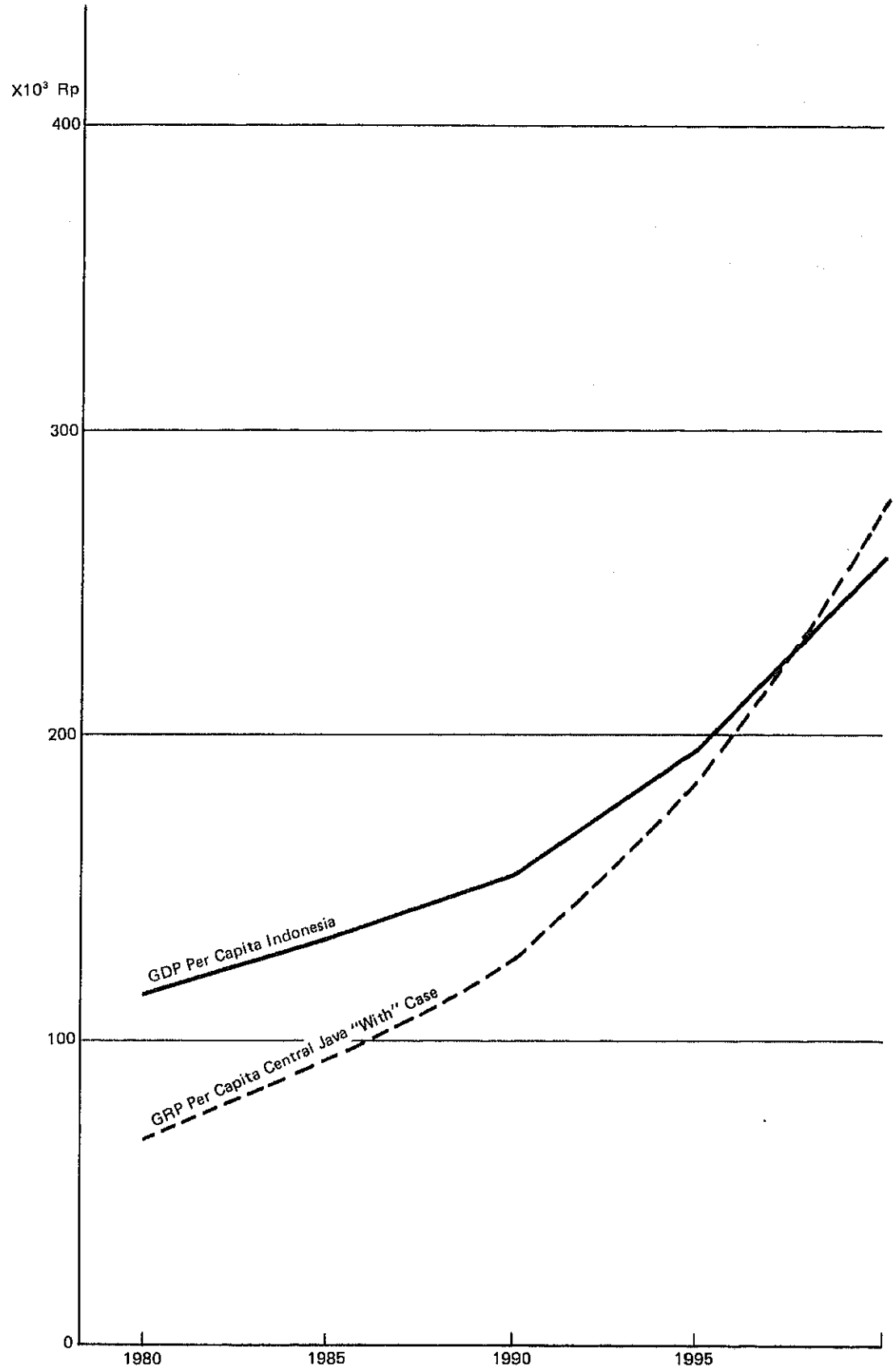


Fig. 3-2-5 Relation between GDP and GRP per Capita by Framework

3-3 Cargo Forecast "Without" Development Case

3-3-1 Premises

This forecast assumes that there will be no major changes in the commodities which have been handled in the past. The cargoes to be handled are plywood, rice, G/C and agricultural products for export; iron/steel products and G/C for import; G/C and rice for outward; and logs and lumber inward.

The economic growth in the scenario is assumed as follows.

1985 ~ 1990	6.0%
1990 ~ 1995	4.0%
1995 ~ 2005	2.0%

In general, an analysis by commodity is necessary because demand on handling facilities is different due to the difference of efficiency of the cargo handling system. However, in this case all the commodities are handled at the existing facilities which have not been specialized and an analysis by commodity is not necessary.

Accordingly, the Study Team only devided the forecast into two sectors: foreign trade and domestic trade. The former is for the International Wharves and Coastal Harbour, and the latter is for the Inner Harbour and Kali Baru.

3-3-2 Foreign Trade

The forecast is made based on the past correlation between the cargo throughput of foreign trade and the GRP of the area as shown in Table 3-3-1.

Table 3-3-1 Correlation Between Foreign Cargo Throughput and GRP

Unit: '000 tons, 10^9 Rp

	Cargo (Y)	GRP (X)
1971	393	909
1972	438	991
1973	511	1,093
1974	544	1,156
1975	691	1,331
1976	570	1,378
1977	604	1,464
1978	610	1,628
1979	698	1,671
1980	681	1,906
1981	710	2,232
1982	731	2,338
1983	761	2,533
	$Y = 0.191X + 309.3$	
	$R = 0.878$	
1985	822	2,685
1986	853	2,846
1987	886	3,017
1988	920	3,198
1989	957	3,390
1990	996	3,593
1991	1,023	3,737
1992	1,051	3,886
1993	1,081	4,042
1994	1,112	4,203
1995	1,144	4,372
1996	1,161	4,459
1997	1,178	4,548
1998	1,195	4,639
1999	1,213	4,732
2000	1,231	4,827
2001	1,250	4,923
2002	1,268	5,022
2003	1,288	5,122
2004	1,307	5,224
2005	1,327	5,329

3-3-3 Domestic Trade

The forecast is made based on the past correlation between the cargo volume of domestic trade and the GRP of the area as shown in Table 3-3-2.

Table 3-3-2 Correlation Between Domestic Cargo Volume and GRP

Unit: '000 tons, 10^9 Rp

	Cargo (X)	GRP (Y)
1971	116	909
1972	146	991
1973	173	1,093
1974	190	1,156
1975	199	1,331
1976	238	1,378
1977	241	1,464
1978	273	1,628
1979	265	1,671
1980	292	1,906
1981	445	2,232
1982	471	2,338
1983	426	2,533
	Y = 0.211X - 67.4	
	R = 0.973	
1985	499	2,685
1986	533	2,846
1987	569	3,017
1988	607	3,198
1989	648	3,390
1990	691	3,593
1991	721	3,737
1992	753	3,886
1993	786	4,042
1994	819	4,203
1995	855	4,372
1996	874	4,459
1997	892	4,548
1998	911	4,639
1999	931	4,732
2000	951	4,827
2001	971	4,923
2002	992	5,022
2003	1,013	5,122
2004	1,035	5,224
2005	1,057	5,329

In this case, as shown in Fig. 3-3-1, the capacity of the International Terminal will not be sufficient to handle the projected foreign trade volume.

Again 20 ~ 40 percent of foreign trade cargoes will have to be handled at the old port areas like the Inner Harbour.

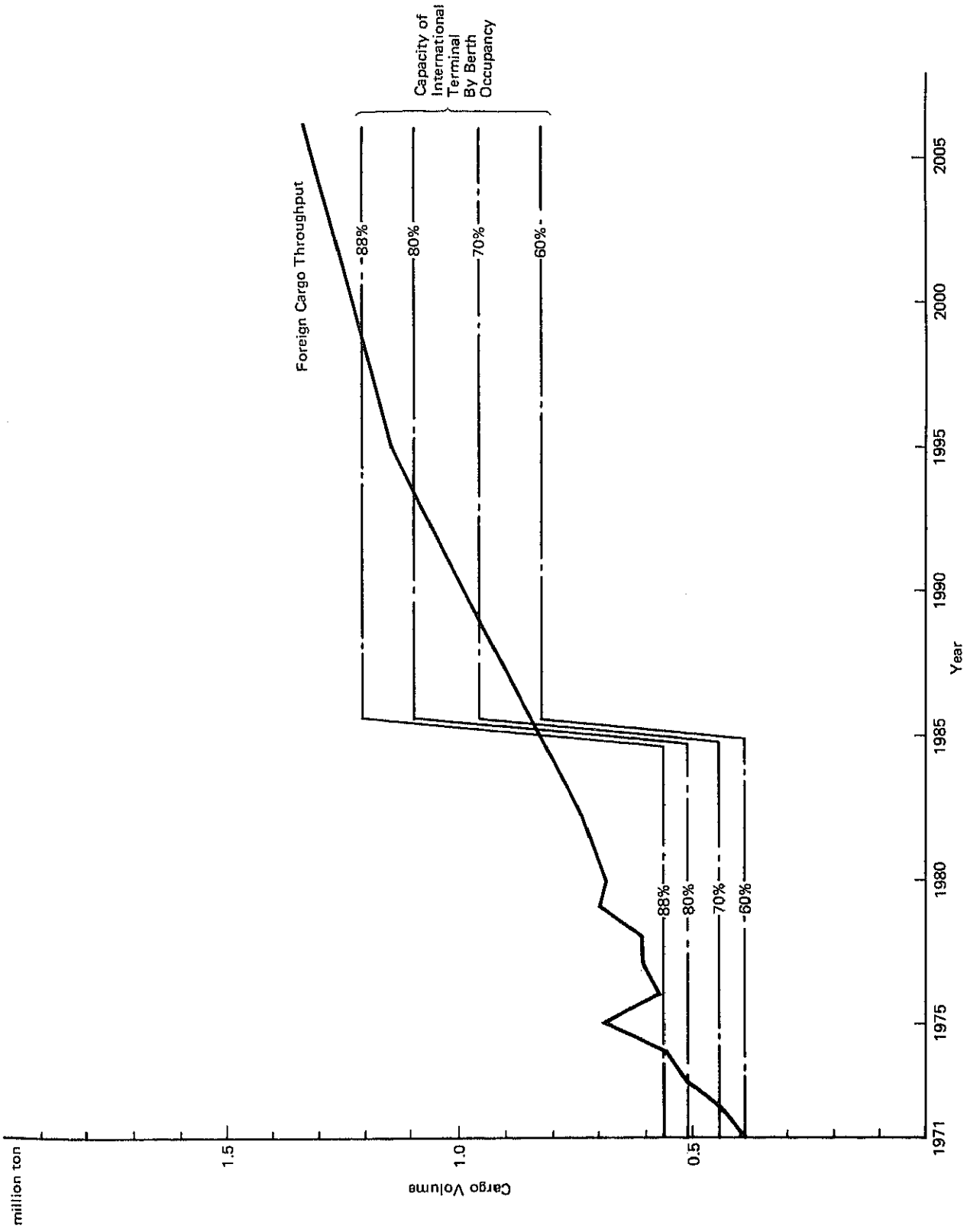


Fig. 3-3-1 Relation between Port Capacity and Foreign Cargo in "Without" Case

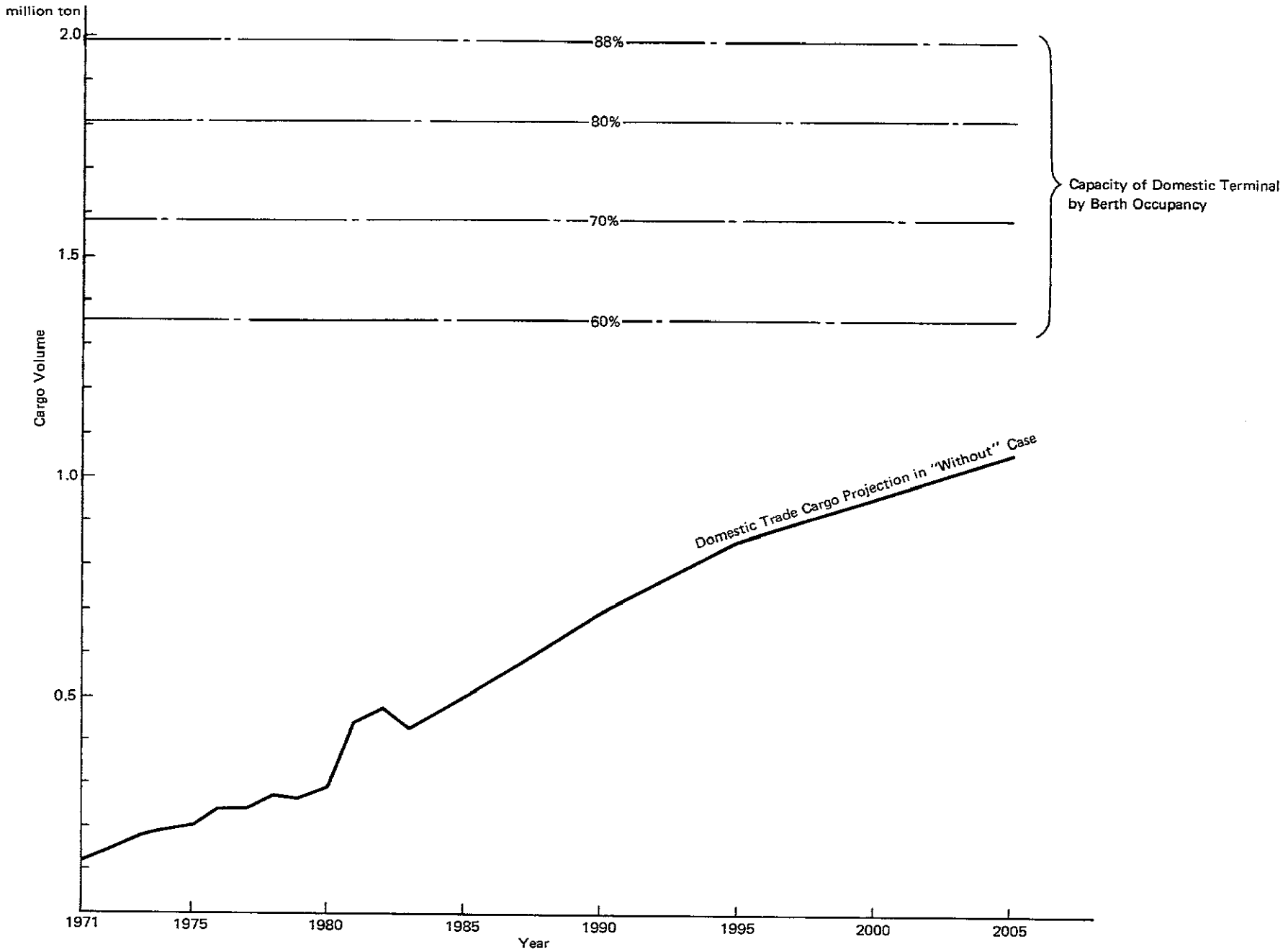


Fig. 3-3-2 Relation between Port Capacity and Domestic Cargo in "Without" Case

3-4 Cargo Forecast under the "With" Development Case

3-4-1 General

In this scenario, the Study Team would like to consider new demands, such as coal, steel, fertilizer and cement.

Furthermore, future demand for containerization should be taken into consideration.

The Volumes of major commodities have been forecast considering the demand in the hinterland as well as the international balance of supply and demand. Hereafter we use this forecast.

3-4-2 Cargo Forecast by Commodity

1. Wood Products

(1) General

The export of wood products has closely tied Indonesia to the world economy.

As Thailand and Malaysia, which had been major wood exporters, have become net importers of wood products, Indonesia has become the largest supplier in the world.

Since the export of logs from Indonesia was prohibited in 1980, exports of lumber and plywood have increased tremendously. The overall flow of wood products in Central Java centering on Semarang Port is presented in Fig. 3-4-1.

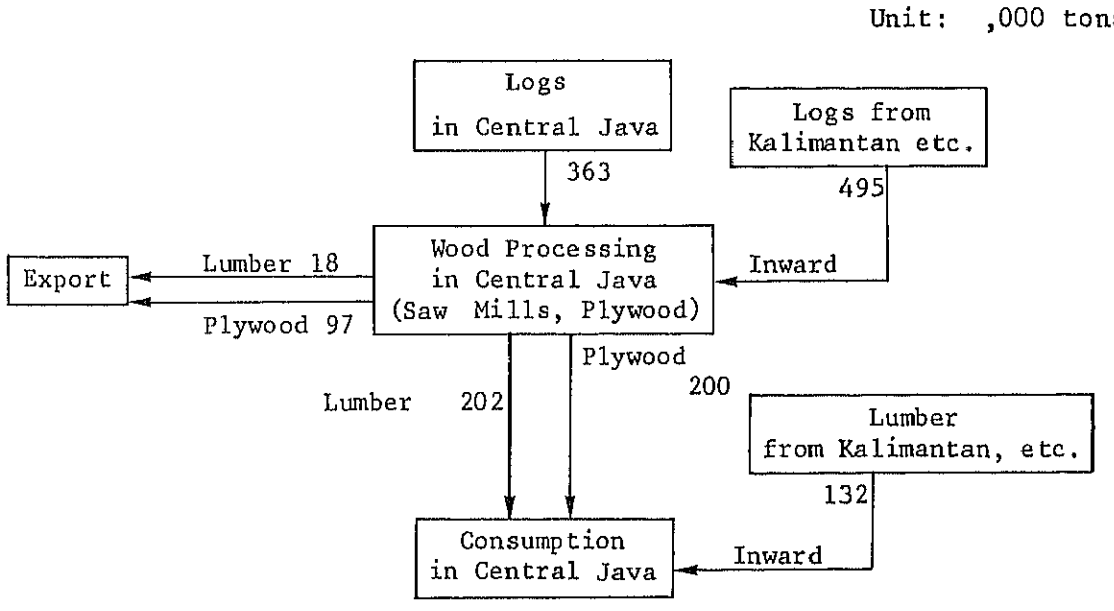


Fig. 3-4-1 Overall Flow of Wood Products in Central Java in 1983

(2) Logs Inward/Plywood Export

As mentioned above, a major plywood factory, Kayu Lapis, is located near Semarang Port. This factory opened in 1979 and the flow of raw materials and finished products at the plant are presented in Figure 3-4-2.

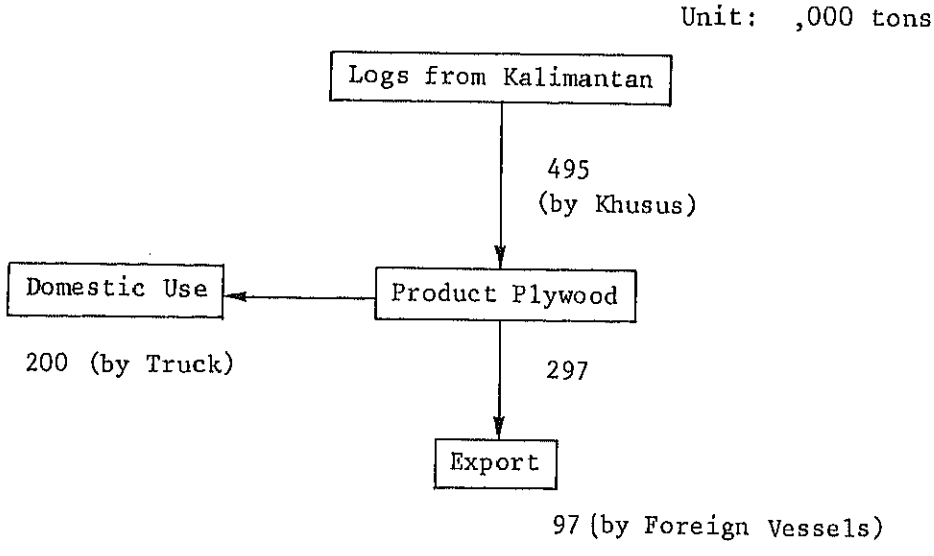


Fig. 3-4-2 Flow of Raw Materials and Finished Products at Kayu Lapis in 1983

The volume of logs brought into the plant from 1979 through 1984 are presented in Table 3-4-1.

Table 3-4-1 Historical Inward Volume of Logs at Kayu Lapis

Unit: ,000 tons

Year	1979	1980	1981	1982	1983	1984
Inward Volume	17	144	258	314	495	509

The production at this factory has grown rapidly since it opened. However, the future plans for expanding production capacity are not yet clear. Considering the world market and the past growth at the facility, the production will most likely continue to increase at a fast pace. Low priced raw materials and inexpensive labour make the products of the Kayu Lapis plant highly competitive.

For forecasting purposes, the Study Team assumes that production capacity at Kayu Lapis will double by 1995 and will grow at a 3 percent annual rate from 1996 to 2005 as shown in Table 3-4-2.

Table 3-4-2 Historical and Estimated Plywood Production at Kayu Lapis

Unit: ,000 tons

Year	1979	1980	1981	1982	1983	1984	1985	1990	1995	2000	2005
Production Volume	10	86	155	188	297	305	332	466	600	696	806

It is difficult to predict the percentage of these plywood products that will be exported in the future. Assuming a slight growth in this ratio and based on the 1984 export ratio of 48.5 percent, future plywood exports are estimated as shown in Table 3-4-3.

Table 3-4-3 Historical and Estimated Plywood Exports at Kayu Lapis

Unit: ,000 tons

Year	1979	1980	1981	1982	1983	1984	1985	1990	1995	2000	2005
Exports		1	14	21	97	148	166	233	300	348	403

Based on the estimated production of plywood (Table 3-4-2) and the ratio of raw material to finished product, the volume of logs which will be brought into the plant in the future is estimated as shown in Table 3-4-4.

Table 3-4-4 Forecast Inward Volume of Logs at Kayu Lapis

Unit: ,000 tons

Year	1985	1990	1995	2000	2005
Volume	553	773	1,000	1,160	1,340

(3) Imports and Exports of Lumber

The flow of lumber in and out of Central Java is somewhat complex. This is because the quality and type of lumber exported is generally better than the lumber consumed domestically. Some of the lumber is processed from logs cut in Central Java at local saw mills. Other lumber already sawn is brought into Central Java from Kalimantan and other areas.

According to Jawa Tengah Dalam Angka 1983, the total forest area in Central Java has remained constant at 579 hectares since 1979. Any increases in domestic lumber consumption and in exports will have to come from logs produced outside of Central Java.

The production of logs and lumber in Central Java is presented in Java from Kalimantan and other areas.

Table 3-4-5 Production of Logs and Lumber in Central Java and Lumber Brought into Central Java

Unit: ,000 tons

Year	1975	1976	1977	1978	1979	1980	1981	1982	1983
Logs	256	317	300	307	307	383	333	409	363
Lumber	115	142	135	138	138	172	150	184	163
Inward Lumber					79	96	124	108	132

Source: Jawa Tengah Dalam Angka 1983
ADPEL

Note: Lumber volume is assumed equal to volume of logs x 0.45

The volume of lumber exports from Central Java is presented in Table 3-4-6. Again, the quality of the lumber exported is generally higher than that used domestically.

Table 3-4-6 Lumber Exports from Central Java

Unit: ,000 tons

Year	1979	1980	1981	1982	1983	1984
Exports	16	9	11	14	18	24

Domestic consumption is calculated from domestic production, inward lumber and exported lumber. Table 3-4-7 presents the calculated consumption figures.

Table 3-4-7 Lumber Consumption in Central Java

Unit: ,000 tons

Year	1979	1980	1981	1982	1983
Consumption	201	259	263	278	277

The future consumption in Central Java is calculated based on the historical correlation between lumber consumption and the GRP of the construction sector in Central Java. The results are presented in Table 3-4-8.

Table 3-4-8 Future Lumber Consumption in Central Java

Unit: ,000 tons

Year	1985	1990	1995	2000	2005
Consumption	327	437	631	905	1,347

Future exports from Central Java are projected based on a time trend analysis. The correlation equation is Y = 2.00X + 8.33, R = 0.699.

Table 3-4-9 Future Lumber Exports from Central Java

Unit: ,000 tons

Year	1985	1990	1995	2000	2005
Exports	22	32	42	52	62

The future inward volume of lumber is calculated based on the future consumption plus the future exports minus the future local production. As the forested area in Central Java is limited and the production of lumber from Central Java logs has already reached its limit, we assume that the future local production will remain at 170 thousand tons per year, near the current level. The calculated future volume of lumber which will be brought into Central Java from Kalimantan and other areas is presented in Table 3-4-10.

Table 3-4-10 Future Volume of Inward Lumber

Unit: ,000 tons

Year	1985	1990	1995	2000	2005
Volume	179	299	503	787	1,239

2. Iron and Steel Products

(1) Consumption in Central Java

The consumption of iron and steel products in Central Java is calculated based on the national consumption of iron and steel products in Indonesia which, in turn, is calculated based on the future GDP per capita of Indonesia and the elasticity of GDP per capita for consumption of iron and steel products.

The per capita consumption of iron and steel products in Indonesia, Thailand, Malaysia and China (mainland) are currently 20, 40, 200 and 40 kilograms per person. Steel consumption per capita is an important measure of industrialization, and the per capita consumption in Indonesia is presently the lowest in the region.

The GDP of Indonesia and the total consumption of iron and steel products in the nation are presented in Table 3-4-11.

Table 3-4-11 Indonesian GDP and Consumption of Iron and Steel Products at Constant 1973 Prices

Unit: 10^9 Rp. and '000 tons

Year	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
GDP	6,753	7,269	7,631	8,156	8,871	9,480	10,165	11,169	12,054	12,325
Iron/Steel Consumption	1,114	1,298	1,334	1,265	1,607	1,829	2,485	2,727	3,261	2,731

The correlation equation is as follows:

X: GDP, Y: Consumption of Iron and Steel Products

$$Y = 0.371X - 1,517$$

$$R = 0.961$$

There is no data available for the actual consumption in Central Java. As the economy of Central Java accounts for roughly 10 percent of the economy of Indonesia, for forecasting purposes we assume that the consumption of iron and steel products in Central Java is equal to 10 percent of the national consumption. Thus the consumption in Central Java as of 1980 is approximately 250 thousand tons.

As stated above, the future consumption of iron and steel products in Indonesia is calculated based on the future Indonesian GDP per capita and the future elasticity of GDP per capita for consumption of iron and steel products.

Historically, from 1974 through 1983 the elasticity of GDP for consumption of iron and steel products decreases. The GNP per capita and the elasticity of the GNP per capita for consumption of iron and steel products for various developing countries is presented in Table 3-4-12. These same figures are presented graphically in Figure 3-4-3.

Table 3-4-12 GNP per Capita and Elasticity of GNP per Capita for Consumption of Iron and Steel Products in Various Developing Countries

	GNP per Capita ($)	Elasticity
Bangladesh	140	4.1
Sri Lanka	320	2.6
China	310	1.1
India	260	1.2
Pakistan	380	1.5
Indonesia	580	1.9
Thailand	790	0.5
Guatemala	1,130	0.8
Philippines	820	0.8
Korea	1,910	0.9
Mexico	2,270	0.7

Source: Nippon Steel Co and
World Development Report 1984

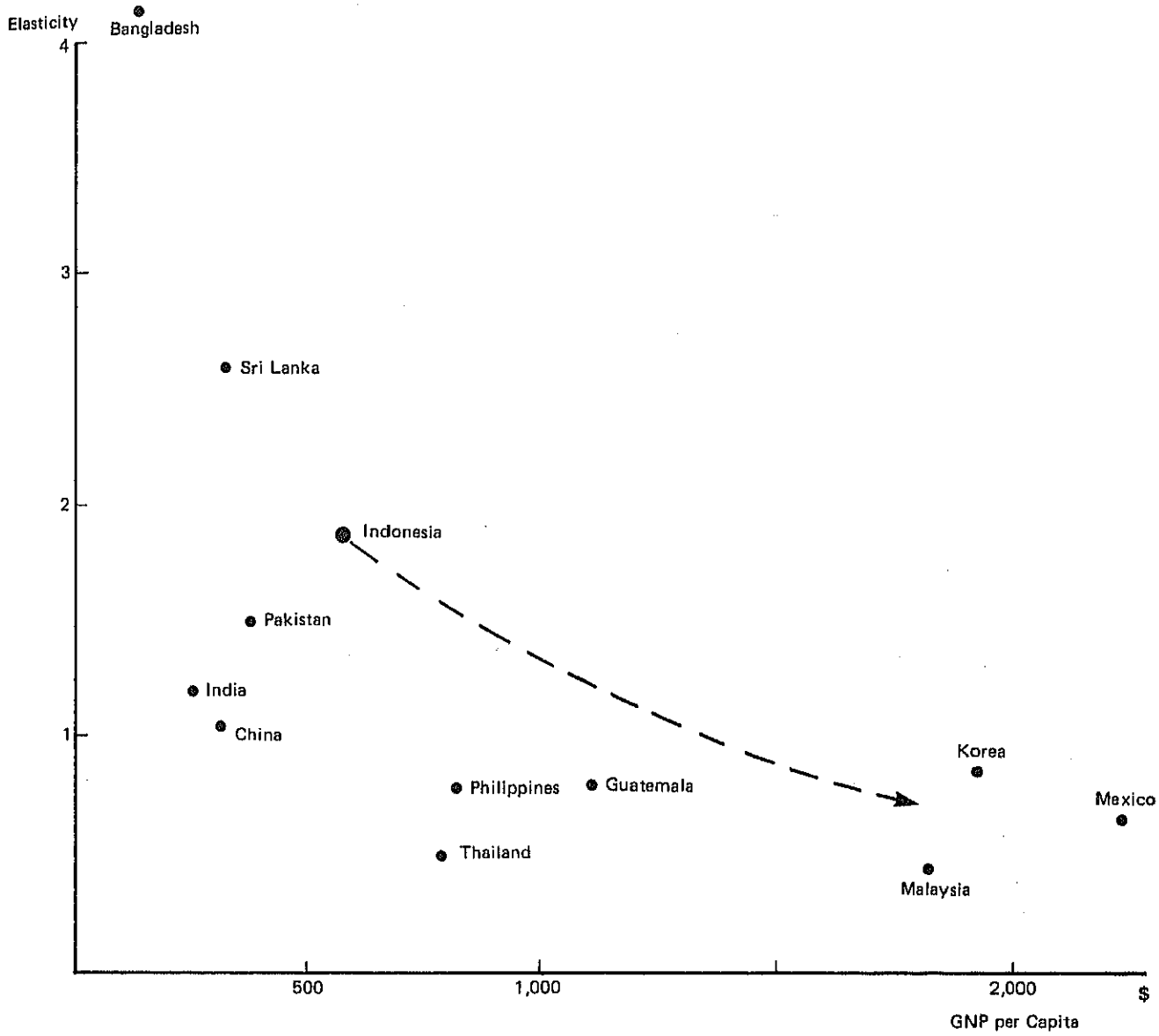


Fig. 3-4-3 GNP per Capita and Elasticity of GNP per Capita for Consumption of Iron and Steel Products in Various Developing Countries

As shown by the dotted line in the figure, we expect that in Indonesia the elasticity will drop as the GNP per capita increases. Similar development has occurred in the Philippines, Malaysia and Korea.

The Study Team assumes that the elasticity of GDP per capita for consumption of iron and steel products in Indonesia will decrease in the future as shown in Table 3-4-13.

Table 3-4-13 Estimated Future Elasticity of GDP per Capita for Consumption of Iron and Steel Products in Indonesia

Year	Elasticity
1980 - 1995	1.2
1995 - 2005	1.0

The growth rate of the GRP of Central Java and the growth rate of consumption of iron and steel products are estimated as shown in Table 3-4-14.

Table 3-4-14 Estimated Growth Rates of GRP of Central Java and Iron and Steel Consumption

Unit: %

	1980~1985	1986~1990	1991~1995	1996~2000	2000~2005
GRP Growth Rate	8.38	7.5	9.0	9.0	9.0
Consumption Growth Rate	10.1	9.0	10.8	9.0	9.0

In conclusion, the consumption of iron and steel products in Central Java is calculated as shown in Table 3-4-15.

Table 3-4-15 Estimated Consumption of Iron and Steel Products in Central Java

Unit: ,000 tons

Year	1980	1985	1990	1995	2000	2005
Consumption	250	400	680	1,040	1,600	2,530

(2) Domestic Supply

According to the budget of the Republic 1983/1984, the iron and steel production of Indonesia over the last few years is as shown in Table 3-4-16.

Table 3-4-16 Production of Iron and Steel Products in Indonesia

Unit: ,000 tons

	1976/77	77/78	78/79	79/80	80/81	81/82	Growth Rate
Production	890	830	1,160	1,240	1,780	1,620	12.7%

Table 3-4-17 shows the volume of domestic production and imports by product. Almost all of the steel plate and seamless pipe is imported. The other products are mainly produced domestically. Over 90 percent of the iron bar and angle is produced within Indonesia.

Table 3-4-17 Domestic Production and Imports of Iron and Steel Products

Unit: ,000 tons

	Domestic Production	Imports	Rate of Domestic Supply (%)	Exports	Domestic Consumption
Iron Bar	636	55	92.0	-	691
Angle	88	169	34.2	-	257
Wire	280	29	90.6	-	309
Steel plate	60	980	5.8	600	440
Zinc plate	323	135	70.5	-	458
Seemless pipe	-	114	0	-	114
Welded pipe	230	120	65.7	-	350
Total	1,617	1,602	61.5	600	2,619

Source: The Study Team

The present production capacity of Indonesian steel mills on a manufactured steel base is 390,000 tons per year. Based on current expansion plans, this capacity should expand to 510,000 tons per year by 1990. No long-range expansion plans are available. Based on forecast capacity and production, Indonesian mills will have some excess capacity until 1990, as shown in Table 3-4-18.

Table 3-4-18 Capacity and Production of Indonesian Steel Mills

Unit: ,000 tons

	1983	1985	1990	1995	2000	2005
Capacity	3,300	*	5,100	5,100	5,10	5,100
Production	1,800	2,290	4,160	5,100	5,100	5,100

* Data not available

As present, 61 percent of total Indonesian consumption is produced domestically. Assuming a local consumption of 330,000 tons in the Central Java area in 1983, the flow of iron and steel products in Central Java is presented in Figure 3-4-4.

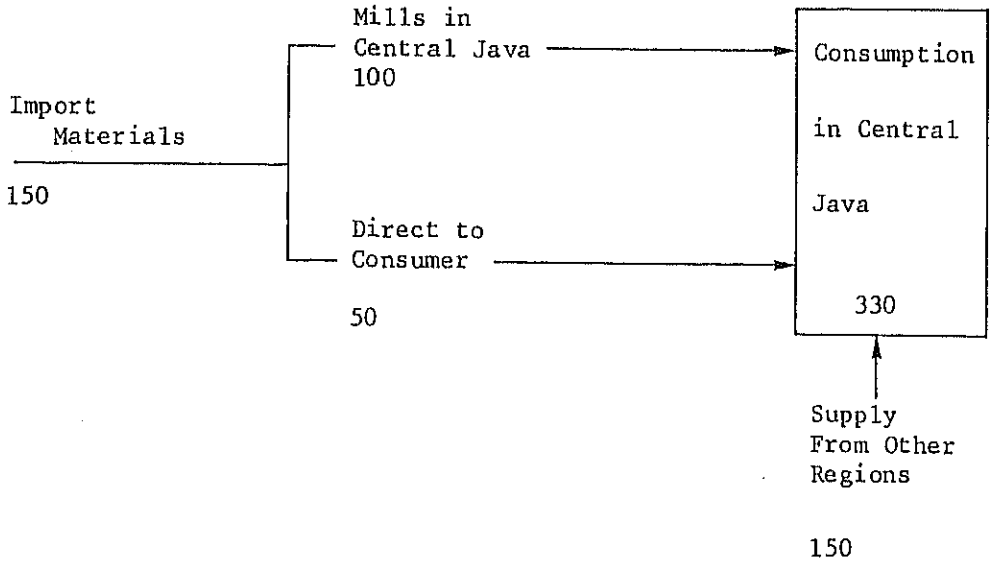


Fig. 3-4-4 Overall Flow of Iron and Steel Products in Central Java in 1983

Thus, as of 1983, 150,000 tons of iron and steel products are brought into Central Java from outside the region. This is equal to 45 percent of the local consumption.

These products are carried overland from East and West Java or via Cilacap. Assuming that this volume will remain the same in the future and all products not carried overland are brought in via Semarang Port, the future flow of iron and steel products into Central Java is as presented in Table 3-4-19.

Table 3-4-19 Future Trend of Iron and Steel Products in Central Java

Unit: ,000 tons

		1983	1985	1990	1995	2000	2005
Consumption in Central Java		330	400	680	1,040	1,600	2,530
Overland		180	190	200	200	200	200
Via Semarang Port	Inward	-	-	110	270	520	980
	Import	149	210	370	570	880	1,350

In conclusion, we not the following main points:

- o The local industry will be operating at full capacity by 1995.
- o The volume of iron and steel products handled at Semarang Port will increase slightly during the 1980's.
- o From the early 1990's, the volume handled at the port will increase drastically.
- o To minimize transportation costs and imports, new production facilities such as GI mills and electric furnaces will be required in the 1990's.
- o The area just behind Semarang Port is an ideal location for such new facilities.

3. Wheat

(1) Flow of Wheat to Central Java

All of the wheat consumed in Indonesia is imported and handled by Bogasari, a national organization. The wheat is first imported to Tg. Priok and Surabaya.

Some of this wheat is carried overland as bulk cargo by trucks to Bogasari's branch warehouses (Dolog), and then distributed to local manufacturers. There are 5 Dolog wheat warehouses in Central Java. The rest of the wheat is processed into food products such as noodles and biscuits at factories located behind the two ports and then transported to the Central Java area. The flow of wheat to Central Java is shown schematically in Figure 3-4-5.

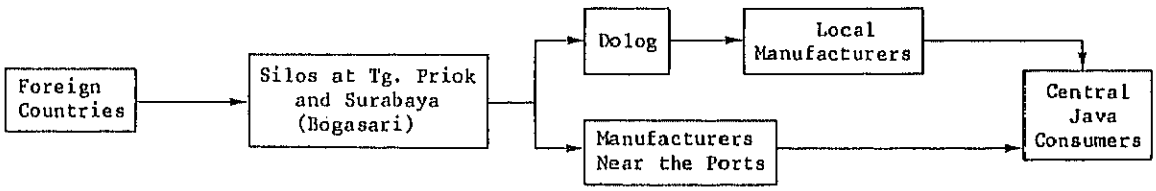


Fig. 3-4-5 Flow of Wheat to Central Java

(2) Volume of Import Cargo and Cargo Distributed by Dolog in Central Java

Until 1979, the volume of wheat imported into Indonesia was relatively stable, roughly 0.7 to 1.0 million tons per year. Since 1980, however, the import volume has increased rapidly to 1.4 to 1.7 million tons per year. As of 1983, per capita wheat consumption is 11 kg/year as shown in Table 3-4-20.

Table 3-4-20 Import Volume & Per Capita Consumption of Wheat in Indonesia, and Volume of Wheat Distributed by Dolog in Central Java

Year	Indonesia		Central Java	Share	Share of Population in Central Java
	Ⓐ Import Volume ('000 tons)	Per Capita Consumption (kg/person)	Ⓑ Distributed Volume by DOLOG ('000 tons)	Ⓑ/Ⓐx 100 (%)	(%)
1975	716.6	5.57			
1976	965.1	7.35			
1977	752.9	5.62	56.0	7.4	
1978	792.4	5.80	59.8	7.5	
1979	771.9	5.54	63.9	8.3	
1980	1,482.2	10.01	67.9	4.6	17.2
1981	1,416.6	9.36	51.5	3.6	17.1
1982	1,486.3	9.61	56.9	3.8	17.0
1983	1,739.3	11.00	62.9	3.6	16.8

Source: Statistical Book of Indonesia
Jawa Tengah Dalam Angka

According to the table, the volume of wheat distributed by Dolog in Central Java grew from 56 thousand tons in 1977 to 62.9 thousand tons in 1983. This is equal to approximately 4 percent of the entire wheat consumption of Indonesia. As the population of Central Java is roughly 17 percent of the national population, clearly a significant portion of the wheat products consumed in Central Java are processed at the factories located behind the ports and are distributed to Central Java consumers directly, without being handled by Dolog.

(3) Future Cargo Volume of Wheat at Semarang Port

The volume of wheat which will be handled at Semarang Port is calculated as shown in Figure 3-4-6.

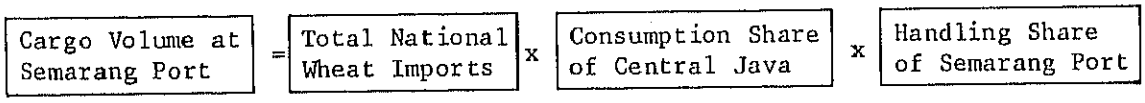


Fig. 3-4-6 Volume of Wheat to be Handled at Semarang Port

A. Total National Wheat Imports

The total wheat imports into Indonesia are calculated using two methods, as follows:

1) Based on Per Capita Consumption

The per capita consumption of wheat in Indonesia is growing rapidly. The 1983 per capita consumption is almost double the 1975 figure. Based on a time trend analysis, the consumption in 1995 will be 18 kg per person, and the consumption in the year 2005 will reach 25 kg per person. Multiplying this forecast per capita consumption by the forecast population, total wheat consumption in Indonesia will be 3.75 and 6.16 million tons per year in 1995 and 2005, respectively. These total consumption figures are roughly 2.0 and 3.5 times the total consumption in 1983. The growth of per capita consumption based on time trend analysis is shown graphically in Figure 3-4-7.

2) Based on GDP

Total national wheat imports are calculated based on the correlation between past imports and GDP and the estimated future GDP. The correlation equation is:

$$Y = 0.1202\ X - 802.6$$
$$R = 0.786$$

where X = GDP in billion Rp. at 1973 prices and Y = past imports (tons/year).

The future GDP of Indonesia is estimated assuming that the 5 percent annual growth rate presented in Repelita IV until 1988 will be realized and that the growth rate from 1989 to 2005 will be 7.5 percent per annum.

Based on these premises, total Indonesian wheat imports will be 4.05 million tons in 1995 and 9.20 million tons in 2005. These figures are somewhat higher than those predicted based on per capita consumption. For this study, the Study Team would like to use these higher figures as the wheat forecast. These figures take into account the relation between income and consumption, and the income per capita in Indonesia will continue to grow.

B. Consumption Share of Central Java

The percent of national wheat imports which are consumed in Central Java including Yogyakarta is presumed equal to the share of GDP in these provinces, that is GRP/GDP. This share over the last several years and the projected share in the future are presented in Table 3-4-21.

C. Handling Share of Semarang Port

As mentioned above, the flow of wheat to the Central Java area is somewhat complex. Some of the wheat is brought into the area and distributed through Dolog. The rest of the wheat is brought in the form of noodles and other processed foods. None of the wheat is currently imported via Semarang.

In the future Dolog will continue to distribute some of the wheat. It is difficult to estimate the handling share of Semarang Port precisely. However, as it is preferable to minimize the distance between the landing port and the consumption area to minimize transportation costs, we assume that 50 percent of the wheat consumed in the Central Java area in the future will be landed at Semarang. In other words, the handling share will be 50 percent.

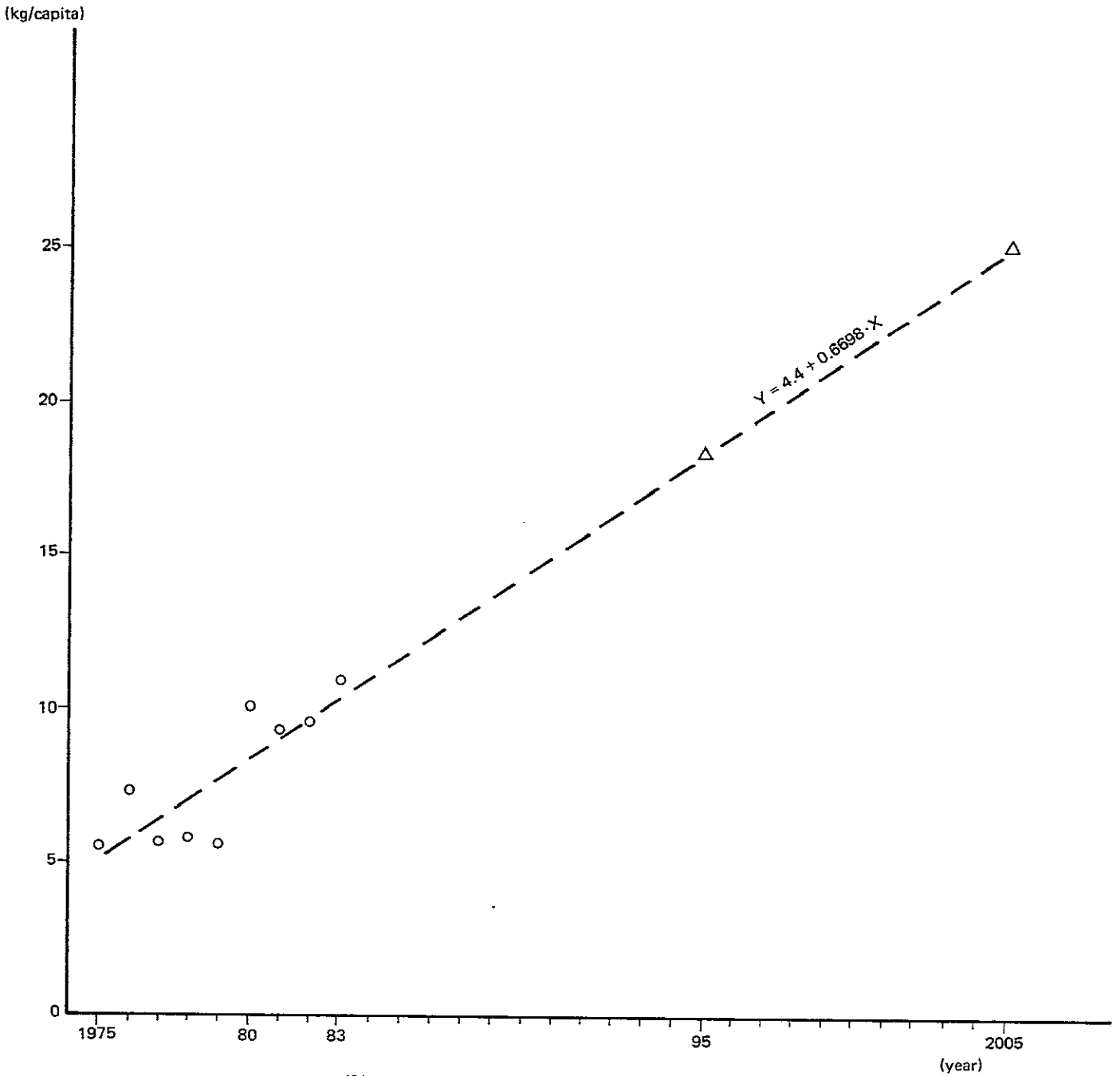


Fig. 3-4-7 Per Capita Wheat Consumption in Indonesia

D. Volume of Wheat via Semarang

So, according to the equation presented in Figure 3-4-7, the volume of wheat which will be handled at Semarang is estimated as shown in Table 3-4-21.

Table 3-4-21 Wheat via Semarang Port

Unit: ,000 tons

	1983	1990	1995	2000	2005
Total National Imports	1,739	2,575	4,050	6,169	9,199
Consumption Share of Central Java and Yogyakarta (%)	12.7	14.6	15.6	16.7	17.9
Consumption in Central Java & Yogyakarta	221	375	632	1,030	1,647
Imports Via Semarang	--	188	316	515	824

In conclusion, the volume of wheat which will be handled at Semarang Port is approximately 315 thousand tons in 1995 and 825 thousand tons in 2005.

4. Fertilizer

(1) Consumption at Present

(A) General

At present, almost one million tons of fertilizer are consumed per year in the Central Java area. The types and quantities of fertilizer consumed in Central Java are presented in Table 3-4-22.

Table 3-4-22 Consumption of Fertilizer in Central Java in 1985

Unit: ,000 tons

Urea	650.0
Sulfur Phosphate	198.6
Ammonium Sulfate	90.0
Kalium Chloride	15.8
Total	954.4

Source: PUSRI Cabang Semarang

Most of the fertilizer (about 70 percent) is urea produced from natural gas at Palembang and Aceh in Sumatra. Roughly 90 percent of the urea consumed in Central Java and Yogyakarta is carried by regularly scheduled 8,500 ~ 10,000 DWT special bulk carriers which ply between Sumatra and Cilacap 7 or 8 times a month. The Urea is bagged at a plant near Cilacap Port and later transported overland to Central Java. Only 10 percent of the urea is carried directly to Semarang by local vessels and rakyats.

The other types of fertilizer (sulfur phosphate, ammonium sulfate and kalium chloride) are carried overland from Gresik by truck. The flow of fertilizer to Central Java is summarized in Table 3-4-23.

Table 3-4-23 Flow of Fertilizer to Central Java

Unit: ,000 tons

Via	Type		Percent
Cilacap	Urea	590	62
Semarang	Urea	60	6
Gresik	Others	304	32
Total		954	100

B. Application Rate by Crop

For the fertilizer forecast we consider the three major crops: rice, sugar cane and vegetables. The standard application rates in Indonesia are shown in Table 3-4-24.

Table 3-4-24 Standard Fertilizer Application Rate in Indonesia by Crop (kg/ha)

	Rice	Sugar	Vegetables
Urea	1,300	600	150
Sulfur Phosphate	200 - 300	-	-
Ammonium Sulfate	50	-	-
Kalium Chloride	50		
Total	1,600 - 1,700	600	150

Source: PUSRI Cabang Semarang

Considering the cultivated area of these crops in Central Java and the standard application rate, the consumption of fertilizer in Central Java would equal the figures presented in Table 3-4-25 if the local application rates were equal to the national standard.

Table 3-4-25 Fertilizer Consumption by Crop

	Rice	Sugar	Vegetables	Total
Cultivated Area (10,000 Ha)	136 (150)	7 (7)	12 (13)	155 (160)
Application Rate (Kg/Ha)	1,600 - 1,700	600	150	-
Theoretical Consumption (Million Kg)	2,180 - 2,310 (2,400 - 2,550)	42 (42)	18 (18)	2,240 - 2,370 (2,460 - 2,610)

Note: Figures in parentheses include Yogyakarta.

The table shows that if the local application rates were equal to the national standards, total fertilizer consumption in Central Java would total 2,240 ~ 2,370 million kg per year. The actual consumption in the region is about 950 million kg. Thus, the local application rate for Central Java equals 40 percentto 43 percent of the national average, and if we include Yogyakarta the local application rate is 36 percent ~ 39 percent of the standard.

(2) Future Cultivated Area by Crop

A. Rice

As of 1983, the cultivated area of rice in Central Java is 1,300 thousand hectares. The area under rice cultivation has been growing very slowly. Recent increases in rice production are primarily due to increased use of fertilizer. According to Repelita IV, the growth rate of the cultivated area is 0.74 percent per year through 1988.

The Study Team assumes that the cultivated area of rice will increase at an average rate of 0.7 percent per year up to 2005.

B. Sugar Cane

The area of cultivated land planted with sugar cane totalled 70 thousand hectares in 1983. This figure had been increasing up to 1983. However, considering the Repelita plan and the depressed world sugar market, the Study Team assumes the cultivated area of sugar cane will remain at 70 thousand hectares through 2005.

C. Vegetables

In 1983, approximately 120 thousand hectares in Central Java were planted with vegetables. According to Repelita IV, the demand for vegetables will continue to increase and the cultivated area of vegetables will increase accordingly. Under the plan, the area will increase at 4.32 percent per annum up to 1988. The Study Team assumes that the area will then continue to grow at a rate of 4.0 percent per year up to 2005.

(3) Future Consumption of Fertilizer in Central Java

The consumption of fertilizer in Central Java and Yogyakarta is calculated using the following formula:

$$Q = A \times F \times \alpha$$

where, Q: Consumption (Tons)
A: Cultivated Area (Hectares)
F: Standard Application Rate (Tons/Hectare)
α: Ratio of the Local Application Rate to the Standard Application Rate (%)

The values of F are:

Rice –	1.65 tons/ha
Sugar –	0.60 tons/ha
Vegetables –	0.15 tons/ha

As of 1985, for Central Java and Yogyakarta, α = 37 percent. Assuming that the local application rate will reach 60 percent of the standard in 1990, 75 percent of the standard in 1995 and 80 percent in 2000, the consumption of fertilizer in the Central Java area is calculated as shown in Table 3-4-26.

Table 3-4-26 Consumption of Fertilizer in Central Java and Yogyakarta

Year	Rice			Sugar			Vegetable			Total
	A (10^3 ha)	α (%)	Q (10^3 tons)	A (ha)	α (%)	Q (10^3 tons)	A (10^3 ha)	α (%)	Q (10^3 tons)	(10^3 tons)
1985	1,500	37	920	70	37	20	130	37	10	950
1990	1,550	60	1,530	70	60	30	180	60	20	1,580
1995	1,610	75	1,990	70	75	30	220	75	30	2,050
2000	1,660	80	2,190	70	80	30	270	80	30	2,250
2005	1,720	80	2,270	70	80	30	330	80	40	2,340

(4) Future Cargo Volume of Fertilizer at Semarang Port

Most of the fertilizer consumed in Central Java and Yogyakarta is currently distributed via Gresik and Cilacap. There is a chemical fertilizer plant at Gresik and a urea bagging plant at Cilacap. The plant at Cilacap is already operating at full capacity.

Again, a major problem of this distribution system is the high overland transportation costs which significantly affect the price for end users in Central Java. From Cilacap, about 60 percent of the fertilizer is carried by truck and 40 percent by rail. The share which is carried by rail has been decreasing recently. This is partially because the rail transport capacity is limited to 200 ~ 250 thousand tons per year. There is not much excess capacity for additional shipments by rail. Moreover, the distributors tend to prefer trucks for their convenience and punctuality.

Considering that the bagging plant at Cilacap is already operating at full capacity and that the transportation costs from Cilacap and Gresik are high, the Study Team would like to recommend that all the additional fertilizer that will be handled in the future (the increased volume) should be transported via Semarang Port. This will minimize transportation costs for consumers of fertilizer in Central Java. Furthermore, some of the fertilizer could be distributed from the port via the national railway from Semarang Station. There is still considerable unused capacity on the trains departing from Semarang.

We recommend that appropriate facilities and handling equipment be introduced, and that the additional fertilizer be handled at Semarang Port using the same handling and distribution system now used at Cilacap. Based on this recommendation, the future volume of fertilizer that will be handled at Semarang Port is presented in Table 3-4-27.

Table 3-4-27 Future Cargo Volume of Fertilizer

Unit: ,000 tons

	1985	1990	1995	2000	2005
Demand in Central Java & Yogyakarta	950	1,580	2,050	2,250	2,340
Via Cilacap	590	600	600	600	600
Via Gresik & Cirebon	300	300	500	500	500
Via Semarang	60	680	950	1,150	1,240

5. Cement

(1) General

There are 9 cement factories in Indonesia which produce almost 10.5 million tons of cement per year. Recently domestic production has been increasing more rapidly than domestic demand: in 1984 the production increased by 20 percent while the consumption increased by only 2 percent over the previous year.

Table 3-4-28 shows the capacity and the production of these cement plants in 1984.

Table 3-4-28 Capacity and Production of 9 Cement Plants in 1984

Name of Cement Plant	Abbreviation	Plant Location	Status	Start of Production	Capacity (1,000 tons)	Production (1,000 tons)
PT. DICE	Indo * Cement Group	Citeuraup, Cibinong (West Java)	Private Company	1974	4,500	3,500
PT. Semen Padang	PTSP	Padang (West Sumatra)	State owned enterprise	1913	2,130	1,350
PT. Semen Gresik	PTSG	Gresik (East Java)	State owned enterprise	1957	1,500	1,500
PT. Semen Tonasa	PTST	Tonasa, Pangkep (South Sulawesi)	State owned enterprise	1968	1,210	
PT. Semen Cibinong	PTSC	Narogong (West Java)	Public company	1974	1,200	
PT. Semen Andalas Indonesia	PTSAI	Belawan/ Aceh (North Sumatra)	Private Company	1983	1,000	
PT. Semen Nusantara	PTSN	Cilacap (Central Java)	Private Company	1976	750	
PT. Semen Baturaja	PTSB	Baturaja, Palembang (South Sumatra Panjang/ Lampung (Lampung)	State owned	1980	500	
PT. Semen Kupang	PTSK	Osmo, Kupang, Timor (East Nusa Tenggara)	Indirectly State owned enterprise	1984	120	
T O T A L					12,910	10,477

Notes: 1. Source - Indonesia Cement Association

2. * Indo Cement Group consist of
   a. PT. Distinct Indonesia Cement Enterprise
   b. PT. Perkasa Indonesia Cement Enterprise
   c. PT. Perkasa Indah Indonesia Cement Putih Enterprise
   d. PT. Perkasa Agung Utama Indonesia Cement Enterprise.

Table 3-4-29 shows the supply and demand balance of cement in 1984 and 1985.

Table 3-4-29 Supply and Demand Balance of Cement in 1984 and 1985

Unit: '000 tons

Year	Capacity	Production	Domestic supply	Domestic consump-tion	Target export	Actual export	Domestic Stockpile
1984	12,910	10,477	10,084.85	9,600	1,100	393	541.7
1985		13,000 ~ 14,500)	(12,000 ~ 13,500)	9,500	1,300		3,000 ~ 4,000

Notes: 1. Source - "Business News", 24-9-1984.
2. Figures in parentheses are estimates.

Production has exceeded consumption since 1979. During the middle 1970's, six new plants began operations which caused excess supply. Figure 3-4-8 is a graphic representation of the supply and demand of cement in Indonesia. Cement producers intend to continue to increase production. The cement production plans in Indonesia for the period from 1984 to 1990 are shown in Table 3-4-30.

Table 3-4-30 Cement Production Plans (1984 ~ 1990)

Unit: '000 tons

	1984	1985	1986	1987	1988	1989	1990	Growth Rate (1984-1990)
Production	12,310	17,410	17,410	18,910	20,910	26,010	28,510	15.02%

Sources: Directorate General of Basic Chemical Industry
Directorate of Inorganic Chemical Industry

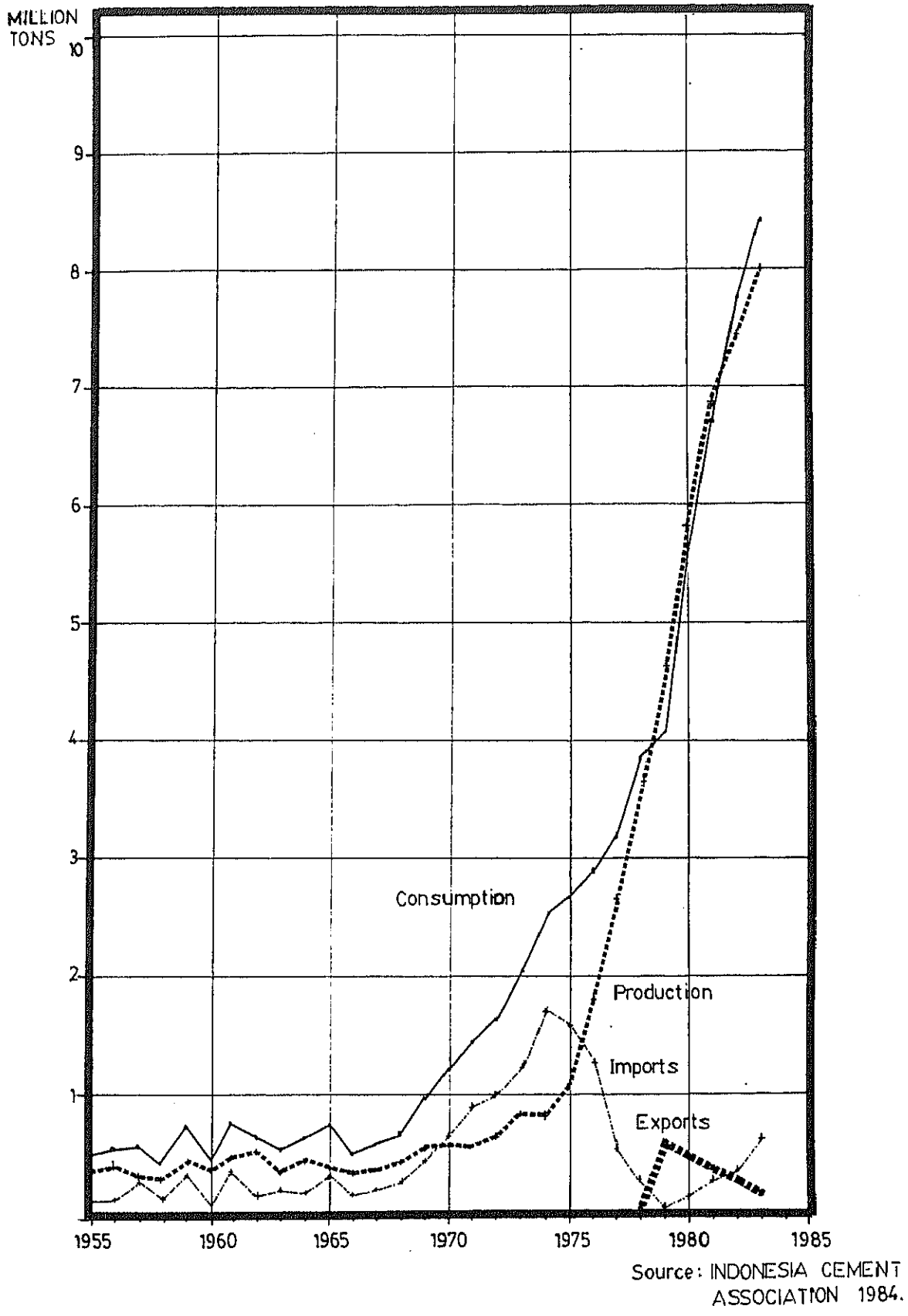


Fig. 3-4-8 Cement Supply and Consumption in Indonesia

The relation between GDP and cement consumption in Indonesia is shown in Table 3-4-31.

Table 3-4-31 Cement Consumption in Indonesia

		GDP (10^9 Rp.)	Cement Consumption ('000 Tons)
Actual	1975	11,876	2,592
	1976	12,693	3,023
	1977	13,806	3,188
	1978	14,753	3,831
	1979	15,819	4,107
	1980	17,382	5,605
	1981	18,761	6,723
	1982	19,181	7,780
	1983	19,986	8,455
	1984	20,985	8,592
	1985	22,035	9,347
	1986	23,136	10,139
	1987	24,293	10,971
Projected	1988	25,507	11,844
	1989	26,783	12,761
	1990	28,122	13,724
	1991	30,091	15,139
	1992	32,197	16,654
	1993	34,451	18,274
	1995	40,400	22,552
	2000	58,000	35,206
	2005	83,200	53,324

$Y = 0.719 X - 6496$

$R = 0.974$

R which is the correlation coefficient between cement consumption and GDP is higher than that between cement consumption and the construction sector of GDP. Thus future consumption is estimated in relation to total GDP.

The future demand and supply of cement in Indonesia is estimated as shown in Table 3-4-32.

Table 3-4-32 Future Demand and Supply of Cement in Indonesia

Unit: ,000 tons

	Official Production Capacity	Actual Supply Capacity (70% of official)	Demand (Domestic Consumption)	Difference
1984	12,310	8,617	8,592	25
1985	17,410	12,187	9,347	2,840
1986	17,410	12,187	10,139	2,048
1987	18,910	13,237	10,971	2,266
1988	20,910	14,637	11,844	2,793
1989	26,010	18,207	12,761	5,446
1990	28,510	19,957	13,724	6,233
1991	28,510	19,957	15,139	4,818
1992	28,510	19,957	16,654	3,303
1993	28,510	19,957	18,274	1,683
1994	28,510	19,957	20,008	Δ51
1995	28,510	19,957	22,552	Δ 2,595
2000	28,510	19,957	35,206	Δ15,249
2005	28,510	19,957	53,324	Δ33,367

Based on the table, there will be excess capacity until 1993. From 1995, however, capacity will be less than demand. Thus new cement factories should begin production in the mid-1990's.

(2) Central Java at Present

As noted in Chapter 1, there is currently only one factory in Central Java, Semen Nusantara which is located in Cilacap. Most of the cement used in Central Java is supplied by Semen Nusantara, especially in the southern part of the province.

(3) Central Java in the Future

The relation between the GRP and the cement consumption in Central Java is shown in Table 3-4-33.

Table 3-4-33 Cement Consumption in Central Java

		GRP Total 10^9 Rp	Consumption '000 ton
Actual	1975	1,331	242
	1976	1,403	328
	1977	1,487	340
	1978	1,644	427
	1979	1,691	540
	1980	1,904	669
	1981	2,233	811
	1982	2,338	928
	1983	2,425	929
	1984	2,629	1,087
	1985	2,849	1,226
	1986	3,062	1,361
Projected	1987	3,292	1,507
	1988	3,539	1,664
	1989	3,805	1,832
	1990	4,090	2,013
	1991	4,458	2,246
	1992	4,859	2,500
	1993	5,297	2,778
	1994	5,773	3,080
	1995	6,295	3,411
	2000	9,685	5,560
	2005	14,903	8,869

$Y = 0.634\ X - 580$

$R = 0.992$

As mentioned in Chapter 1, there are plans to construct two new plants about 40 km east of Semarang. Although the operation plans of these factories are shown in Table 1-4-1, these are tentative plans, and are subject to change. Based on the projected supply/demand situation, the Study Team assumes that new suppliers would begin operations in 1990 at a rate of 500,000 tons per year and increase production over time as shown in Table 3-4-34.

Table 3-4-34 Demand and Supply of Cement in Central Java

Unit: ,000 tons

		Consumption	Existing Supply	Supply by New Suppliers	Inward
Actual	1975	242	-		242
	1976	328	750		Δ422
	1977	340	750		Δ410
	1978	427	750		Δ323
	1979	540	750		Δ210
	1980	669	750		Δ81
	1981	811	750		61
	1982	928	750		178
	1983	929	750		179
	1984	1,087	750		337
	1985	1,226	750		476
	1986	1,361	750		611
Projected	1987	1,507	750		757
	1988	1,664	750		914
	1989	1,832	750		1,082
	1990	2,013	750	1,000	263
	1991	2,246	750	1,000	496
	1992	2,500	750	1,500	250
	1993	2,778	750	2,000	28
	1994	3,080	750	2,000	330
	1995	3,411	750	2,000	661
	2000	5,560	750	4,000	810
	2005	8,869	750	7,000	1,119

From the table, we note that within Central Java, demand exceeds supply from 1981. Although supply will continue to be greater than demand on a national basis until 1994 (Table 3-4-32), we recommend that local production should be expanded beginning in 1990. Even with expanded local production as shown in Table 3-4-34, a substantial percentage of local consumption will continue to be supplied from outside the province (the inward volume shown in the table).

(4) Cement Transport

The transport of cement is very expensive. No cement will be carried by truck from East or West Java: all of the overland cement will be carried by rail. As the railway is a single line, its capacity is limited.

The Study Team assumes that 300 thousand tons of the inward cement can be carried by rail. The remainder will have to be carried by ship to Semarang Port. Thus, the inward volume of cement via Semarang Port will be as shown in Table 3-4-35. A bagging plant may be requried behind the port.

Table 3-4-35 Inward Volume of Cement at Semarang Port

Unit: ,000 tons

Year	1990	1995	2000	2005
Volume	0	360	510	820

(5) Coal Transport

The new cement factories which will begin operations near Semarang in 1990 will use a substantial quantity of coal. The coal required is listed in Table 3-4-36. The cement production figures are also presented for reference. All of this coal will be handled via Semarang Port.

Table 3-4-36 Coal Required for Cement Production

Unit: ,000 tons

	Cement Production	Coal Required
1990	1,000	150
1991	1,000	150
1992	1,500	230
1993	2,000	300
1994	2,000	300
1995	2,000	300
2000	4,000	600
2005	7,000	1,050

6. Rice

In spite of the high growth in production during past years, the demand for rice has been undergoing a large increase to a high growth in population and the rise of per capita consumption, and the Government has been obliged to import a tremendous volume of rice from neighbouring countries.

During the 1970's 2 million tons of rice was imported per year. Especially in 1977 ~ 78 and 1979 ~ 80, 2.3 and 2.6 million tons of rice were imported, respectively. The shortage of rice has put pressure on Indonesia's international balance of payments due to the flowing out of foreign currency.

The production of rice after 1980, however, increased at a faster rate than the population. Although an average of one million tons of rice per year was imported at the beginning of the 1980's, the import volume has been decreasing year by year.

In 1984 ~ 1985 it was recorded that one hundred thousand tons of rice was exported and four hundred thousand tons of rice was imported. Thus, Indonesia has almost become self sufficient in the production of rice.

However, considering regional distribution, only eight of the twenty-seven provinces have become basically self-sufficient in rice production. By island, Java and Sulawasi have an excess supply, and Sumatra, Kalimantan and other islands have a shortage.

Central Java currently has an excess production. However, the arable land in the region is limited, and it will not be possible to greatly increase the regional production of rice in the future.

(1) Production in Central Java

The future forecast of rice production is assumed as follows:

(Premises)

Production = Cultivated Area x Yield Rate

Cultivated area will increase slightly at a rate of 0.74 percent/year.

Yield rates per ha

1984	5.02	tons/ha	Actual
1995	5.80	tons/ha	Estimated
2005	6.15	tons/ha	

(Future Yield)

$$\log_{10} Y = 0.85163 - \frac{2.2076}{x+4}$$

Y : Yield rate

x : 1 = 1975

2 = 1976

11 = 1985

r = 0.909

(Yield Rate)

1990	Y = 5.51	2000	Y = 6.00
1995	Y = 5.80	2005	Y = 6.15

The Rice Production is estimated as shown in Table 3-4-37.

Table 3-4-37 Production of Rice in Central Java

	Year	Cultivated Area (1,000 ha)	Average Yield (tons/ha)	Production ('000 tons)
	1975	1,322.1	2.79	3,690
	1976	1,177.2	3.21	3,775
	1977	1,225.3	3.33	4,077
	1978	1,358.9	3.42	4,641
	1979	1,286.1	3.33	4,278
Actual	1980	1,330.5	4.22	5,615
↑	1981	1,405.4	4.54	6.382
	1982	1,315.1	4.85	6,384
	1983	1,307.9	5.10	6,667
	1984	1,347.0	5.02	6,766
↓	1985	1,356.0	5.13	6,977
	1986	1,371.3	5.25	7,200
Projected	1987	1,386.0	5.36	7,433
	1988	1,387.0	5.51	7,643
	1990	1,407	5.51	7,753
	1995	1,460	5.80	8,468
	2000	1,515	6.00	9.090
	2005	1,572	6.15	9,668

Source: 1975 - 1978 STATISTICA BOOK
1979 - 1988 REPELITA IV

(2) Rice Outward

Shipments of rice from Central Java to Kalimantan and Sumatra will continue. The volume of outward rice varies from year to year. In 1984 outward shipments totaled over 90 thousand tons. In 1981 the figure was only 14 thousand tons.

Even though demand will sometimes exceed supply within Central Java, rice will continue to be shipped to other provinces because of the existing distribution network and for other reasons. In Sumatra, the relatively high average income makes it possible for the local inhabitants to continue to bring in rice from other areas. Rice will continue to be shipped from Central

Java to Kalimantan even when there is a rice surplus in Kalimantan. This is because this rice is provided to public servants and to the military, and is also stocked as emergency stores in border areas. Thus the demand in Kalimantan is political and should be forecast based on the growth of the military and government service sector there.

The growth rate of total outward rice from Central Java is estimated as 3 percent per annum. Currently the volumes shipped to Kalimantan and to Sumatra are approximately equal. We expect that the demand in Sumatra will grow at about 2 percent per year, equal to the growth of the population, and that the demand of the military and government service sector in Kalimantan will grow at about 4 percent per year. So, the growth rate of the total outward rice from Central Java is estimated as 3 percent per annum. The projected volumes are presented in Table 3-4-38.

Table 3-4-38 Rice Outward

Unit: ,000 tons

Year	1983	1990	1995	2000	2005
Outward Volume	31	38	44	51	59

(3 percent/Year Growth)

(3) Consumption of Rice and Wheat in Central Java and Imports and Exports

The consumption of rice and wheat in Central Java is currently about 6,950 thousand tons per year. The consumption of total grain is estimated to be growing at a rate of about 2.5 percent per year.

Table 3-4-39 shows the demand and supply balance of rice and wheat in Central Java. The table presents imports and exports, shipments to other parts of Indonesia, and net consumption. It seems that rice will be exported from 1990 through the mid-1990's, but will be imported or shipped inward from the late 1990's through the year 2005.

The Study Team assumes that rice will be imported.

Table 3-4-39 Demand and Supply of Rice and Wheat in Central Java

Unit: ,000 tons

Year	Production	Outward	Export Rice	Import Rice	Consumption Wheat	Net Consumption
1979	4,278	26	-	161	64	
1980	5,615	28	-	115	68	
1981	6,382	14	-	-	52	
1982	6,384	93	-	16	56	
1983	6,667	31	-	78	221	6,935
1984	6,766	92	-	-	274	6,948
1990	7,753	38	33	-	375	8,057
1995	8,468	44	-	60	632	9,116
2000	9,090	51	-	245	1,030	10,314
2005	9,668	59	-	413	1,647	11,669

7. Major Agricultural Products

It is difficult to forecast the volume of major agricultural products such as rubber, coffee and tobacco that will be exported via Semarang Port. Some of the agricultural products produced in Central Java are currently exported via Tg. Priok and Surabaya because the facilities at Semarang are inadequate. Thus the historical trend of the handling volume of these commodities at Semarang cannot be used to forecast the future throughput after the construction of a deep seaport and proper handling facilities. The Study Team assumes that the throughput of major agricultural products will increase at least at the same rate as the national average. The historical trend of exports of agricultural products from Indonesia is presented in Table 3-4-40.

Table 3-4-40 Export of Major Agricultural Products from Indonesia

Unit: ,000 tons

Year	1977	1978	1979	1980	1981	1982	1983
Rubber	806	865	981	813	803	801	941
Frozen Shrimp	47	52	57	69	30	45	34
Tapioca	1	4	6	3	7	3	4
Tobacco	26	26	24	29	25	20	24
Coffee	160	215	220	239	211	227	242
Astere Oil	48	17	29	110	52	19	42
Tea	51	56	54	74	71	64	69
Total	1,139	1,236	1,371	1,337	1,199	1,179	1,356

Source: Statistic Year Book

From 1977 through 1983 the growth rate of the exports of agricultural products averaged about 3 percent/year. We estimate that this rate will increase to 5.0 percent/year from 1983. As stated above, we expect that exports of agricultural products from Central Java will increase at the same rate as the national totals. So, the future export volume of major agricultural products from Central Java is calculated as shown in Table 3-4-41.

Table 3-4-41 Future Export of Major Agricultural Products from Central Java

Unit: ,000 tons

Year	1983	1985	1990	1995	2000	2005
Export Volume	33	36	46	59	75	96

*Note: Major agricultural products are fodder, rubber, frozen shrimp, Handicrafts, coffee, asteri oil, leather and tea.

8. General Cargo (Others)

(1) Import Cargo

According to ADPEL statistics, the import commodities classified as general cargo are glass, paper, cotton, spare parts, textiles, machines, medicine and others.

The historical trend of these imports is shown in Table 3-4-42.

Table 3-4-42 General Cargo Imported at Semarang Port

Unit: ,000 tons

Year	1979	1980	1981	1982	1983
Glass	41	38	46	68	13
Sugar	51	76	89	43	26
Paper	14	12	-	-	9
Cotton	30	38	21	40	19
Spare Parts	9	16	33	25	9
Textiles	9	18	28	-	6
Machines	13	-	39	31	18
Medicines	24	23	26		3
Project Equipment	—	18	20	16	73
Others	195	117	143	221	183
Total	386	356	445	444	359

Source: ADPEL SEMARANG

As far as general cargo is concerned, the handling volume has not increased due to insufficient equipment. A large quantity of the general cargo destined for Central Java is currently being carried via Tg. Priok and Surabaya.

Past general cargo statistics at Semarang cannot be used to accurately forecast the volume of general cargo that will be handled at the port after the new facilities are constructed. Here, future general cargo throughput is estimated based on the elasticity of the GDP of Indonesia for the total national imports of general cargo. The historical data are presented in Table 3-4-43.

Table 3-4-43 Imports of General Cargo in Indonesia

Unit: ,000 tons

Year	1977	1978	1979	1980	1981	1982	1983
Glass	62	58	61	56	96	118	51
Paper	216	237	237	272	265	291	270
Cotton	66	91	151	117	99	113	116
Textiles	50	34	46	31	27	28	16
Machines	47	50	64	78	102	144	162
Total	441	470	559	554	589	694	615

Source: STATISTIC YEAR BOOK

Thus, the imports of general cargo grew at an annual rate of 5.69 percent from 1977 through 1983. During the same period, the GDP grew at an annual rate of 6.36 percent, so the elasticity of GDP for imports of general cargo is 0.894. The future imports of general cargo at Semarang are estimated based on the projected growth rate of the GRP multiplied by this elasticity, as shown in Table 3-4-44.

Table 3-4-44 Future Imports of General Cargo at Semarang Port

Unit: ,000 tons

Year	1983	1985	1990	1995	2000	2005
GRP Growth Rate (%)	-	8.38	7.5	9.0	9.0	9.0
Production Growth Rate (GRP rate x elasticity) (%)		7.5	6.7	8.0	8.0	8.0
Imported General Cargo Volume*	286	331	457	672	987	1,450

*Excluding Project Equipment

(2) Export Cargo

General export cargoes are a variety of miscellaneous items, and the throughput of these items may increase as industries are developed near the port and in the hinterland. The growth rate of these items is assumed equal to the growth rate of the industrial sector of the GRP assuming the deep seaport is constructed. The estimated volume is presented in Table 3-4-45.

Table 3-4-45 Future Exports of General Cargo at Semarang Port

Year	1983	1985	1990	1995	2000	2005
Growth Rate (%)	-	10.1	10.0	13.0	12.0	11.0
Export Volume ('000 Tons)	29	35	56	103	182	306

(3) Inward Cargo

General inward cargoes are mainly agricultural products and raw materials other than logs, lumber and fertilizer. General agricultural products including dry fish, copra, and rattan total 35 thousand tons in 1983. We assume that these cargoes will grow at the same rate as the wholesale/retail sector of GRP assuming the deep seaport is constructed. Raw materials including asphalt, kaolin and quartz sand total 20 thousand tons in 1983, and we assume these cargoes will grow at the same rate as the construction sector of the GRP assuming the deep seaport is constructed. The estimated volume of these items is presented in Table 3-4-46.

Table 3-4-46 Future Inward General Cargo at Semarang Port

Year	1983	1985	1990	1995	2000	2005
Agricultural Products						
Growth Rate (%)	-	8.2	9.0	10.0	10.0	10.0
Volume ('000 Tons)	35	41	63	102	164	264
Raw materials						
Growth Rate (%)	-	10.1	10.0	13.0	12.0	11.0
Volume ('000 Tons)	20	24	45	82	145	244
Total	55	65	108	184	309	508

(4) Outward Cargo

General outward cargo other than rice is primarily composed of sugar, maize, salt, capok and natural fertilizer. We assume that the throughput of these items will grow at the same rate as the throughput of inwards agricultural products. Other general outward cargo items include various miscellaneous items. The throughput of these items is assumed to grow at the same rate as the throughput of the wholesale/retail sector of the GRP. The estimated throughput is presented in Table 3-4-47.

Table 3-4-47 Future Outward General Cargo at Semarang Port

	1983	1985	1990	1995	2000	2005
Agricultural Products						
Growth Rate (%)	-	2.8	3.0	3.0	3.0	3.0
Volume ('000 Tons)	83	88	102	118	137	158
Miscellaneous Items						
Growth Rate (%)	-	8.2	9.0	10.0	10.0	10.0
Volume ('000 Tons)	68	80	122	197	317	510
Total ('000 Tons)	151	168	224	315	454	668

9. Container Cargo

Container throughput at Semarang Port in 1983 and 1984 is shown in Table 3-4-48.

Table 3-4-48 Container Throughput at Semarang Port

Unit: TEU

	1983			1984		
	Unloading	Loading	Total	Unloading	Loading	Total
Full	887	22	909	883	237	1,120
Empty	1	916	917	133	946	1,079
Total	888	938	1,826	1,016	1,183	2,199

Source: Cabang Pelabuhan Semarang

Assuming that one TEU is equal to 11.0 tons, the Study Team estimates that 10,000 tons of container cargo were handled at the port in 1983. This is equal to only 3.0 percent of the estimated containerizable cargo volume, and only 1.3 percent of total import and export cargo volume.

Due to the lack of a deep seaport and appropriate handling equipment and facilities for containers, the percentage of container cargo at Semarang Port is currently extremely low. According to the statistics of Surabaya Port, the containerized ratio is about 30 percent for imports and 20 ~ 25 percent for exports as of 1980. The containerized ratio by commodity is shown in Table 3-4-49.

Table 3-4-49 Containerized Ratio at Surabaya Port by Commodity (1980)

Imports	
Paper, Plastic & Textiles	100%
Chemical Goods, Miscellaneous	75%
Lubricating Oil	50%
Project Equipment	25%
Steel & Iron	25%
Soybeans	25%
Exports	
Coffee, Rubber	100%
Other Goods	75%
Wood	50%

At Tg. Priok Port, 43 percent of the import cargo and 55 percent of the export cargo is containerized as of 1982 (other than bulk cargo). These figures may have already reached about 60 percent.

Thus, after the introduction of proper container facilities at Semarang Port, the containerization ratio at the port will increase dramatically, following the growth at Surabaya and Tg. Priok.

The future volume of container cargoes at Semarang are estimated as shown in Table 3-4-50. The Study Team assumed that all import and export cargoes are containerizable and that the containerized ratio at Semarang will equal the current level at Surabaya Port, around 45 percent, by 1995 and the current level at Tg. Priok, around 60 percent, by 2005.

Table 3-4-50 Future Volume of Container Cargo at Semarang Port

Unit: ,000 tons

	1983	1990	1995	2000	2005
Containerized Rate for Imports and Exports (%)	3	20	47	55	62
Containerizable Cargo					
Exports					
Major Agricultural Products	33	46	59	75	96
General Cargo	29	56	103	182	293
Imports					
General Cargo	286	457	672	987	1,450
Total Containerizable Cargo	348	559	834	1,244	1,839
Total Container Volume	10	112	394	684	1,149

3-4-3 Conclusion

In conclusion, the future cargo throughput by commodity is presented in Table 3-4-51. These same figures are presented graphically in Figs. 3-4-9 ~ 3-4-12.

Table 3-4-51 Future Cargo Throughput by Commodity

Unit: ,000 tons

	1983	1990	1995	2000	2005
Foreign Trade					
Export					
Rice	-	34	-	-	-
Plywood	97	233	300	348	403
Lumber	18	32	42	52	62
Agro-products	33	46	59	75	96
General Cargo	29	56	103	182	306
Sub-Total	177	401	504	657	867
Import					
Rice	78	-	60	245	413
Iron and Steel	149	370	570	880	1,350
Grain	-	188	316	515	824
General Cargo	359	457	672	987	1,450
Sub-Total	586	1,015	1,618	2,627	4,037
Foreign Total	763	1,416	2,122	3,284	4,904
Domestic					
Outward					
Rice	31	38	44	51	59
G/C & Agro-pro.	151	224	315	454	668
Sub-Total	182	262	359	505	727
Inward					
Logs	495	773	1,000	1,160	1,340
Steel	-	110	270	520	980
Lumber	132	299	503	787	1,239
Fertilizer	56	680	950	1,150	1,240
Cement	-		360	510	820
Coal	-	150	300	600	1,050
G/C & Agro. Product	55	108	184	309	508
Sub-total	738	2,120	3,567	5,036	7,177
Domestic Total	920	2,382	3,926	5,541	7,904
Total	1,683	3,798	6,048	8,825	12,808

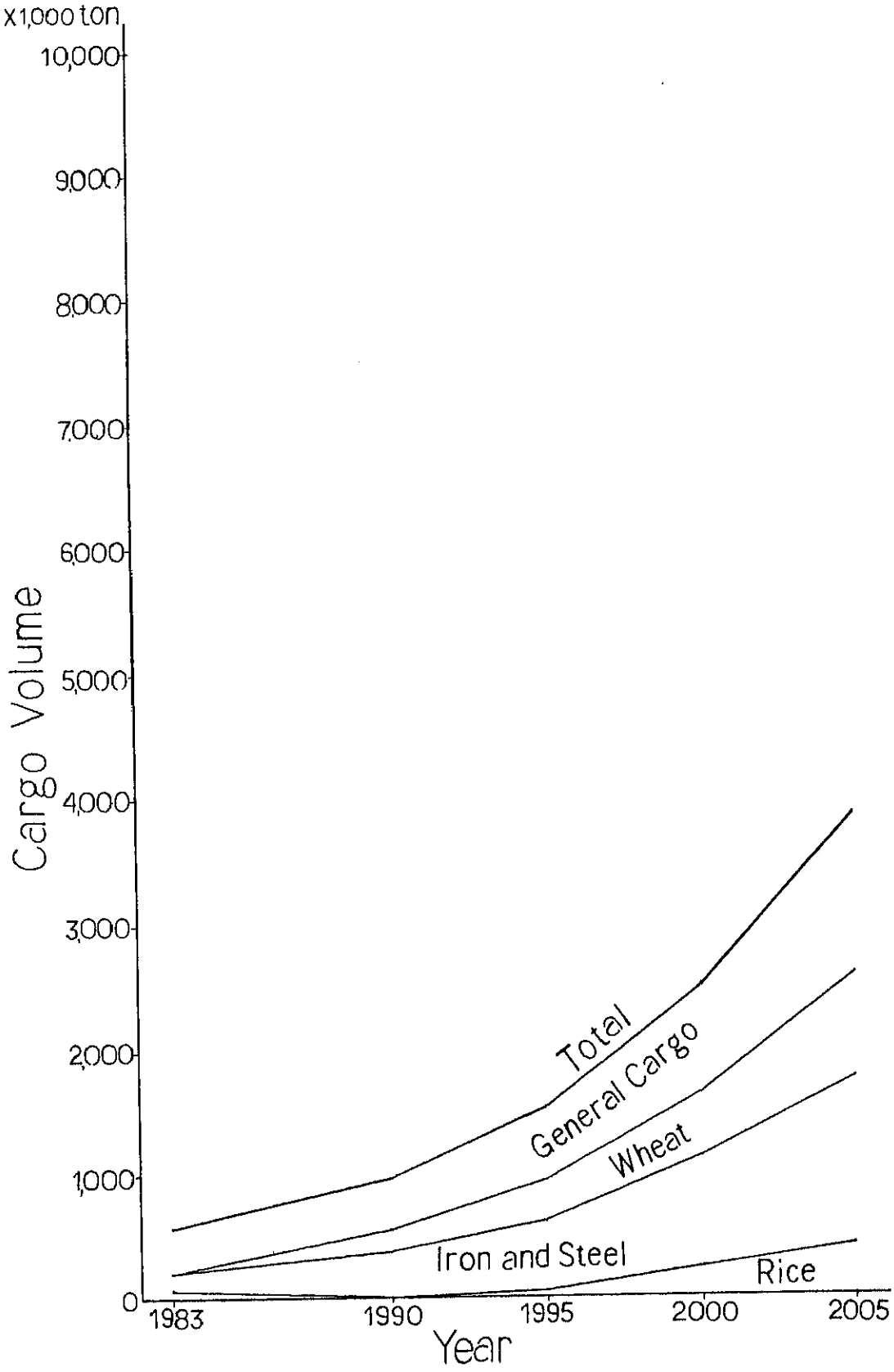


Fig. 3-4-9 Future Cargo Throughput by Commodity Foreign-Import

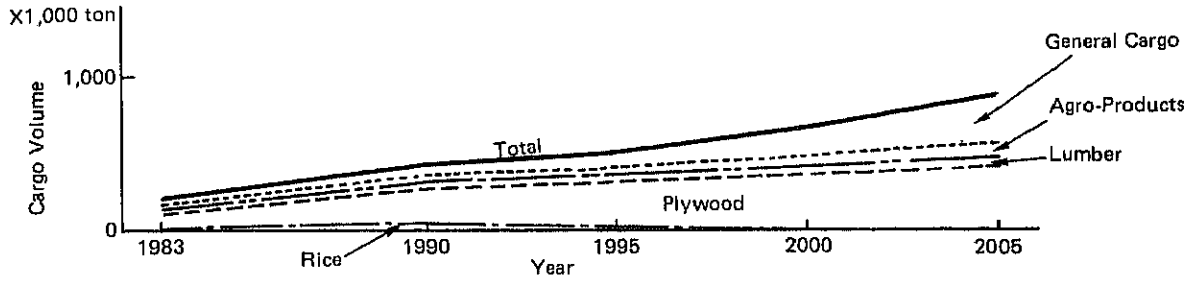


Fig. 3-4-10 Future Cargo Throughput by Commodity Foreign-Export

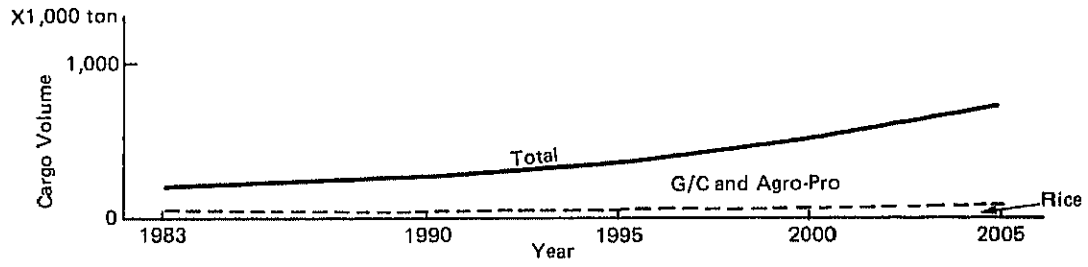


Fig. 3-4-11 Future Cargo Throughput by Commodity Domestic-Outward

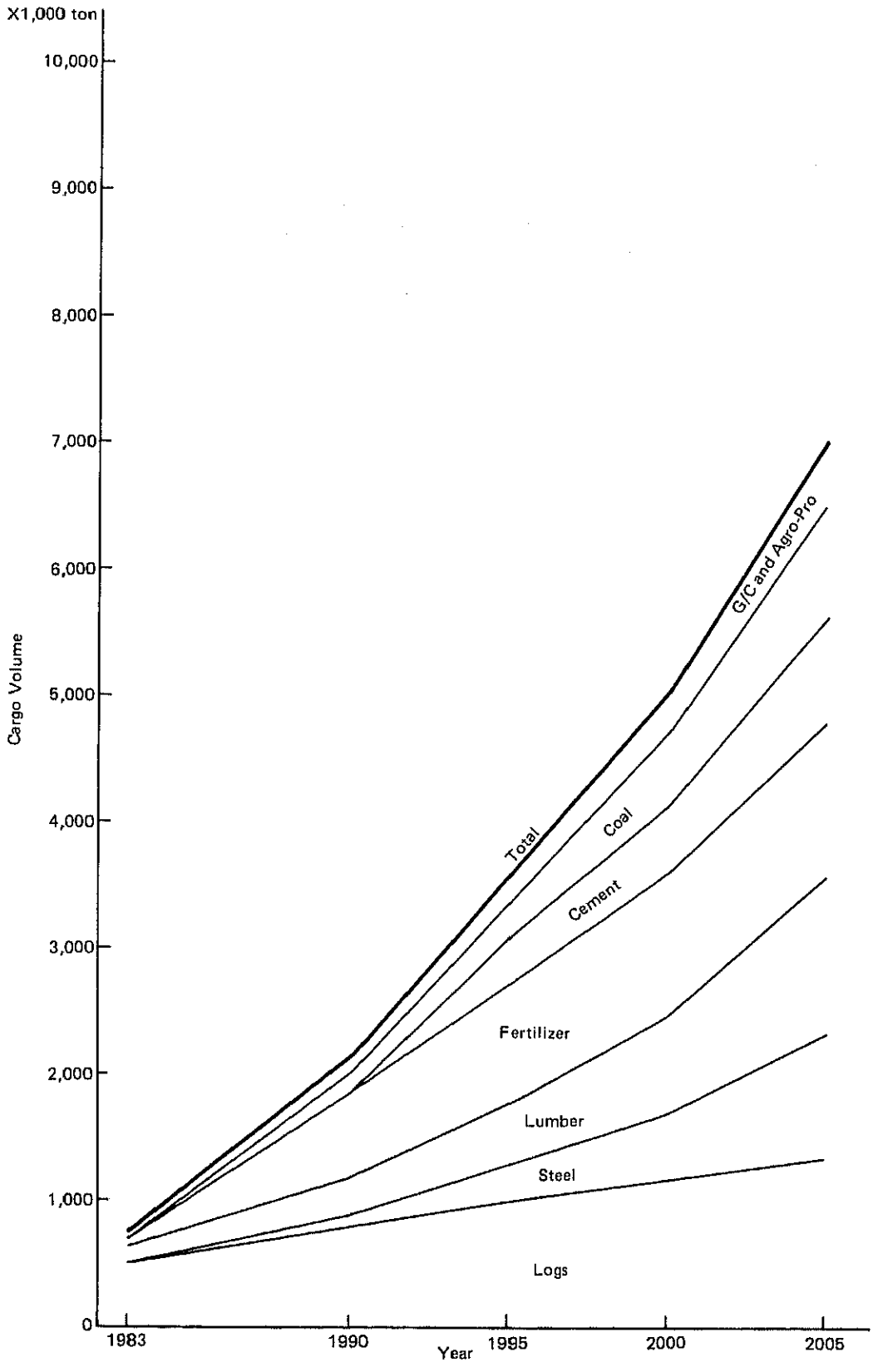


Fig. 3-4-12 Future Cargo Throughput by Commodity Domestic-Inward

Having been requested to update the master plan of the Phase I study executed in 1978, the Study Team would like to compare the results of the forecasts in this chapter with the forecasts from the 1978 study.

Table 3-4-52 shows the Phase I and Phase II projections. From this table, it is clear that the total cargo throughput in 2000 estimated in this chapter (Phase II estimate) is about 2.5 million tons greater than the estimate presented in the Phase I study.

The difference in estimates results from the different development policies of the two studies. The Phase I study emphasized only the development of the commercial port, whereas the current (Phase II) study considers the development of both the commercial and the industrial ports, in accordance with the wishes of the Indonesian Government.

If cargoes such as coal, fertilizer, cement and logs whch have become a priority under the new policy were not included, the estimated total cargo throughput of the instant study would actually be 0.8 million tons less than the estimated throughput of the Phase I study.

Thus, the new projections are not overly optimistic. Especially, the volume of foreign trade projected in this chapter (excluding wood products which was not taken into consideration in the Phase I Study) is almost same as that of the Phase I projection.

Overall, the total throughput estimated in this chapter is greater than the Phase I estimate, but this is only because the new governmental policy will result in additional cargoes being handled at the port.

Table 3-4-52 Phase I and Phase II Projections of Cargo Throughput in 2000

(Unit: '000 Tons)

Phase I (High Projection)	Foreign:	Export	330
		Import	2,670
		Total	3,000
	Domestic:	Out	1,180
		In	2,180
		Total	3,360
	Grand Total		6,360
Phase II ("With" case)	Foreign:	Export	657 (309)*
		Import	2,627 (2,627)
		Total	3,284 (2,936)
	Domestic:	Out	505 (505)
		In	5,036 (2,121)
		Total	5,541 (2,626)
	Grand Total		8,825 (5,562)

*( ) Excluding logs, wood products, coal, fertilizer and cement.

3-5 Passenger Traffic

(1) General

Table 3-5-1 shows the past trend of passenger traffic at the port. Three types of passengers are considered in the table. The first is ordinary passengers travelling to and from Semarang for business or other purposes. An average of 20 ~ 30 such passengers travel per week.

The second group of passengers are transmigration passengers. The number of people transmigrating has been increasing rapidly in accordance with the government policy. Thus transmigration passengers have come to account for 90% of the total passenger traffic through the port.

Table 3-5-1 Passenger Traffic through Semarang Port

Unit: Persons

		Out	In	Total
1980	Ordinary	789	508	1,297
	Transmigration	6,623	-	6,623
	Tourist	24	24	48
	Total	7,436	632	7,968
1981	Ordinary	2,332	2,763	5,095
	Transmigration	2,852	-	2,852
	Tourist	107	107	214
	Total	5,291	2,870	8,161
1982	Ordinary	2,282	607	2,889
	Transmigration	9,134	-	9,134
	Tourist	-	-	-
	Total	11,416	607	12,023
1983	Ordinary	817	479	1,296
	Transmigration	12,847	-	12,847
	Tourist	-	-	-
	Total	13,664	479	14,143
1984	Ordinary	1,004	242	1,246
	Transmigration	12,116	-	12,116
	Tourist	-	-	-
	Total	13,120	242	13,362

Source: ADPEL Semarang

The third group are tourists. As the passenger facilities at the port are substandard, few excursion vessels call at the port and the number of tourists has remained very small.

To date, all of the passengers passing through the port have experienced some inconvenience due to the lack of proper facilities. As there is no passenger terminal, the passengers are obliged to wait in an open storage yard. Further, until recently, as the large vessels which carry passengers were unable to dock at the port due to a lack of deep berths, the passengers were obliged to board small vessels and be carried to the larger vessels waiting offshore.

Since the completion of the new deep seaport in 1985, however, the situation has changed. Large passenger boats are now able to dock at the port. As part of the port development, a passenger terminal should be built. The future demand for the terminal should be estimated by passenger type.

(2) Ordinary Passengers

Ordinary passengers generally travel between Semarang and small port towns on other islands including Pontianak, Ketapang, Sampit, Banjarmasin and Samarinda. The vessels which travel to and from these ports moor at the existing old port area. After the passenger terminal is completed, most of these vessels will continue to moor at their present locations.

The future passenger demand for ordinary passengers will grow in proportion to the growth of domestic cargo carried by small vessels. The Study Team projects that the number of ordinary passengers will grow at a rate of 5% per annum as shown in Table 3-5-2.

Table 3-5-2 Ordinary Passengers

Unit: '000 passengers

1983	1985	1990	1995	2000	2005	Growth Rate
1	1	2	2	3	4	5%/annum

(3) Transmigration

From 1980 through 1984, the growth rate of transmigration passengers from Central Java averaged 17.6% per annum. Under Repelita IV the number of transmigration passengers will continue to grow. However, the rate of increase may decline. To reach the Government's target for transmigration, the growth rate in the number of passengers during Repelita IV will have to average about 8.4%.

The transmigration passengers from Semarang Port from 1980 through 1984 (presented in Table 3-5-1) show an average growth rate of 16.3%. To date, two types of vessels have been calling at Semarang to carry passengers for transmigration: 700 DWT vessels (capacity of 250 passengers, length 60 m, draft 3 m) and 300 DWT vessels (capacity of 100 passengers, length 40 ~ 50 m, draft 1 m). Both the 300 DWT vessels and the 700 DWT vessels carry both passengers and cargo.

Four large passenger boats currently carry transmigration passengers from major ports such as Tg. Priok and Surabaya. These are 13,900 GRT vessels capable of carrying 1,700 passengers. The large vessels are 144 m long, 25.4 m wide and have a draft of 5.9 m.

As Semarang Port is now capable of accommodating these large passenger boats, the number of transmigration passengers at Semarang may increase dramatically. Based on the historical data from Tg. Priok, it seems that new facilities and vessels tend to create new demand, especially for the first few years. However, the rate of increase of demand tends to decrease somewhat thereafter. Thus, the Study Team projects that the growth rate in the number of transmigration passengers at Semarang will average 20 percent per annum from the beginning of the operation of the larger vessels through 1990, and 8 percent from 1990 through 2005.

Table 3-5-3 shows the estimated number of transmigration passengers passing through Semarang Port in the future.

Table 3-5-3 Transmigration Passenger

Unit: '000 passengers

1983	1985	1990	1995	2000	2005
12	17	43	64	94	138

(4) Pilgrims and Tourists

As the construction of the new deep seaport has been completed, Semarang Port can now accommodate large passenger vessels. Thus, the passenger traffic demand for pilgrims and tourists is expected to increase. Once, in 1972, an international excursion vessel of the Holland American Lines did call at Semarang Port. However, except for this one port call, large passenger vessels have avoided Semarang Port. Excursions have shunned Semarang due to the lack of appropriate facilities.

In Central Java, excursions have generally cast anchor at Cilacap in order to visit Borobudur via Yogyakarta. In the future, the Tourism Office in Central Java intends to invite excursion vessels to call at Semarang Port. Fig. 3-5-1 shows the present and planned routes of international excursion vessels.

Furthermore, if a passenger terminal is constructed at Semarang, passengers will use the facility to visit various domestic ports as part of package tours. Passenger boats will connect Semarang with Pontianak, Banjarmasin, Tarakan, Ujung Pandang and Bali.

The number of pilgrims travelling to and from Mecca will also increase. Until now the pilgrims from this area have had to transship to large passenger boats anchoring offshore.

The Study Team estimates that each year 4 ~ 6 large passenger boats will call at Semarang Port to carry pilgrims and tourists, and 5 ~ 6 small passenger boats will call to carry passengers to various domestic ports.

Table 3-5-4 shows the estimated number of pilgrims and tourists who will pass through Semarang Port.

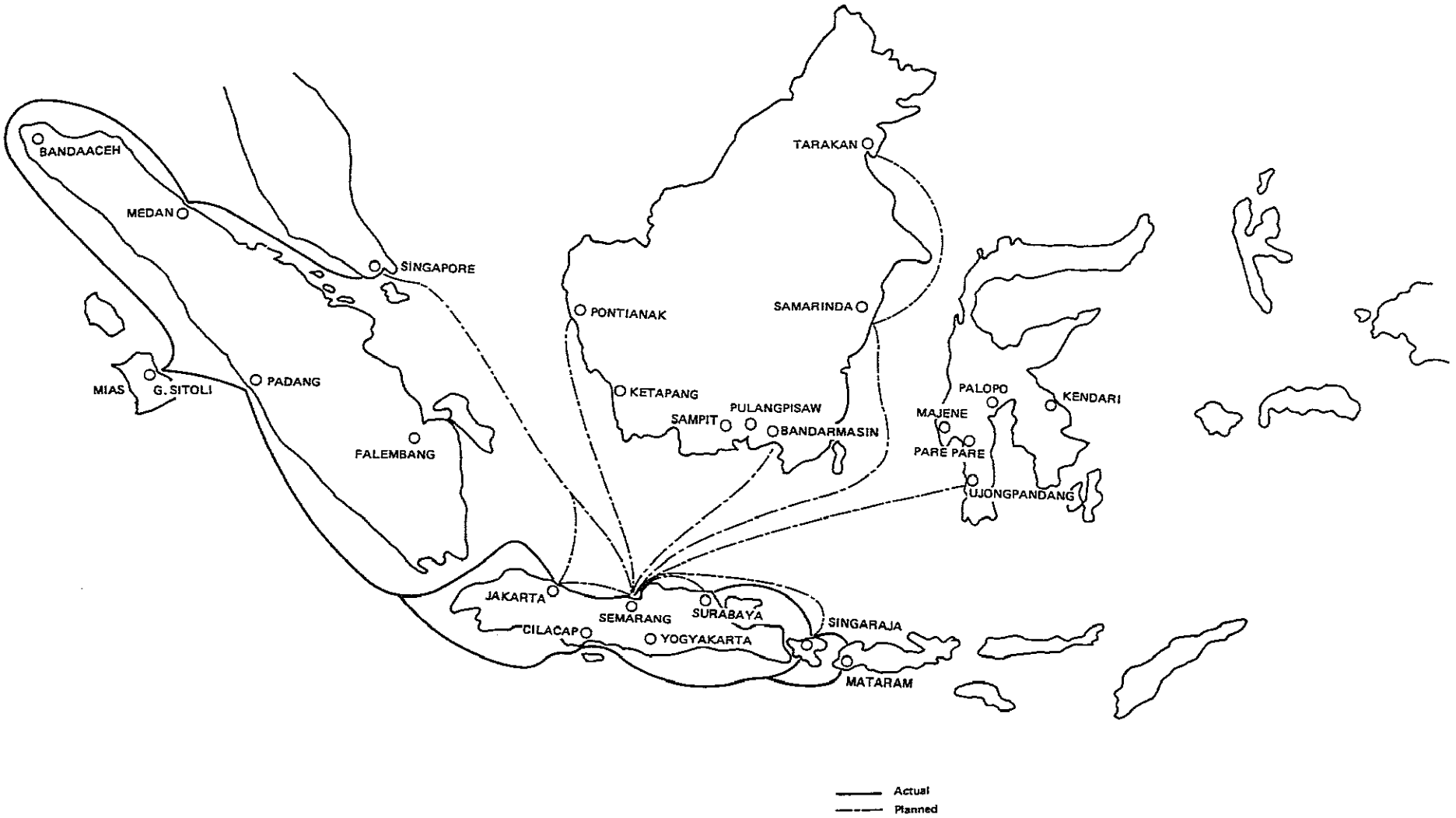


Fig. 3-5-1 Routes of International Excursion Vessels

Table 3-5-4 Pilgrims and Tourists

Unit: '000 passengers

	1983	1985	1990	1995	2000	2005
Pilgrims	0	1	2	2	2	2
Tourists	0	1	3	3	3	3
Total	0	2	5	5	5	5

(5) Conclusion

The estimated total number of passengers which will pass through Semarang Port in the future is presented in Table 3-5-5.

Table 3-5-5 Estimated Total Number of Passengers at Semarang Port

Unit: '000 Passengers

	1983	1985	1990	1995	2000	2005
Ordinary Passengers	1	1	2	2	3	4
Transmigration Passengers	12	17	43	64	94	138
Pilgrims & Tourists	0	2	5	5	5	5
Total	13	20	50	71	102	147

CHAPTER 4
PORT PLANNING

CHAPTER 4 PORT PLANNING

4-1 Basic Policy

The port development project is designed to achieve certain goals. Specifically, the port development will promote regional economic development, promote regional industries, and enhance the regional transportation system. The port plan will have to consider the new demand for marine transport that will be caused by the new facilities. Furthermore, the port development plan should include a land use plan for the port area and a rehabilitation plan for timeworn facilities. Each of these aspects of the overall plan are explained below.

1. To Promote Regional Economic Development

Considering the rapid economic development in other Asian countries, the economy of Indonesia is also expected to progress steadily in the near future. Indonesia may very well catch up with the other countries in the region.

Although the economy in Central Java and Yogyakarta is underdeveloped in comparison with the other Indonesian provinces, we assume that as the Government is making special efforts to promote economic growth in this region, the local economy will reach the average national level by the beginning of the 21st century.

The development project at Semarang is certainly one of the main measures to promote local economic growth. In fact, the development project may well be the biggest development project in Central Java during the next few decades. This project is essential to realize the Government's goal of promoting the development of the economy in the Central Java Area.

The port should not be considered as only a profit making entity, but rather as an infrastructure which is essential for the development of the regional and national economy. In the case of Semarang, the port development project should function as the nucleus of regional economic development.

Current port development projects in developing countries are often carried out on a piecemeal basis, and cover only certain facilities at a given port, or only one port at a time. This sort of partial planning results in lopsided growth: only certain profitable port facilities are improved at the expense of others. Such limited development may not necessarily be in the public interest. Proper development should be planned on the national level and measured from the economic point of view.

In accordance with this philosophy, the development project at Semarang Port will consider the entire port as an organic whole. Moreover, the development of the port as a major infrastructure to promote the economic growth of the entire region will be emphasized. In addition to financial projections, the entire project will be analyzed from the economic viewpoint in an effort to estimate the overall benefit of the overall project to the nation.

2. To Promote Regional Industries

The port development should be part of a comprehensive regional industrial development plan as described below.

(1) Stage Plan

Hasty industrialization efforts in developing countries sometimes cause social and economic problems due to the lack of appropriate infrastructures or for other reasons. In the case of Semarang Port, a comprehensive stage plan for industrialization should be prepared by the Government in line with the development of the port.

The industries which should be developed under the phase plan are listed in Table 4-1-1. Those industries categorized as littoral industries in the table should be located at the port. Some of the manufacturing and food processing industries may also be located at the port.

Table 4-1-1 Proposed Industries

Stage (Year)	Littoral Industries and Distribution	Manufacturing Industries	Food Processing Industries
(1985)	Iron, Coal Fertilizer, Saw Mills	Furniture, Glass, Textiles, Machinery	Rubber, Tobacco, Shrimp
↕	Metals, Machinery		
(1995)	Chemicals, Cement		Fruit, Grains Vegetables, Mushrooms
↕		Electronics, Knockdown Automobiles	
(2005)	Shipbuilding		

(2) Self-sufficiency in Basic Materials

It is essential for the development of this area to reduce the costs of basic materials such as iron and steel, cement and fertilizer. For this purpose, the Study Team would recommend the introduction of iron and steel factory (electric furnace) and a fertilizer bagging plant in the port industrial zone as part of the first stage development. Food processing, chemical, iron and steel, cement, coal and wood processing factories should also be introduced behind the port at this stage. Especially, a coal and iron/steel terminal is essential.

(3) Local Technology

In general, developing countries show an inclination to introduce high technology industries as soon as possible, in an effort to earn foreign currency. However, such industries often cannot operate smoothly due to lack of experience and supporting technology, and the small scale of the domestic market.

In the long run, it may be better to first introduce middle level technology which is suited to the local situation. Local technology must first be developed. Afterwards, high technology industries may be successfully introduced after the local infrastructure and highly educated workers are developed. This may be the royal road to technological development and promotion of export-oriented industries.

Fortunately, at Semarang, there are a few sectors where such middle level technology can be introduced. Factories which produce cultivators, textiles, steel plate, pottery and furniture could all benefit from improved technology, and Semarang Port could help to promote this technological progress. Thus, we recommend that these industries, as well as the peripheral industries which are related to them, should be promoted during the first stage of the development project.

(4) Processing Industry for Agricultural Products

After completion of the deep seaport, the export of agricultural products will be greatly improved. There are already many processing plants in the area which produce rubber, tobacco, shrimp and sugar. Improved facilities at the port will greatly assist the export of these products, and will also facilitate introduction of high value added processing plants which could produce such products as canned and frozen fruit, vegetables, fish, chicken and beef.

(5) Decentralization of Industries

After the completion of the new port facilities, many factories will want to locate nearby. Of course the port must help to promote all the local industries. However, if all the factories were to locate near the port, there would be serious problems such as traffic congestion, a shortage of waterfront sites, and excessive pollution.

Therefore, most of the factories should be located on the outskirts of Semarang City or in various satellite towns as shown in Figure 4-1-1. Some sort of criteria must be established to determine which industries will locate in the immediate vicinity of the port. Naturally, this will have to be limited to those industries which are closely related to port activities and perhaps to certain manufacturers of export goods. The port branch office will have to be responsible for determining the exact criteria and for granting permission to certain industries to locate in the littoral area, that is for executing the coastal area development plan.

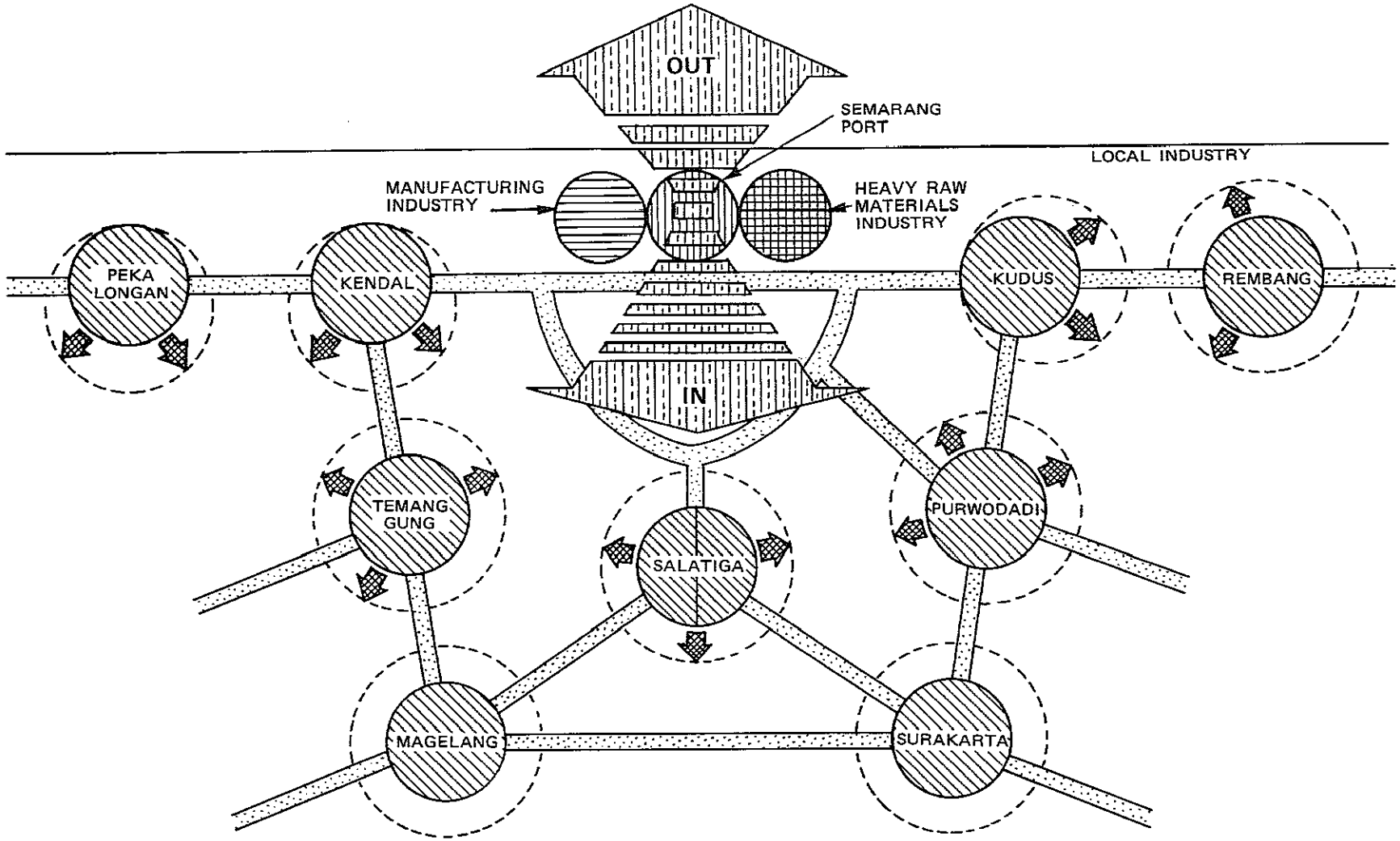


Fig. 4-1-1 Semarang Port and Industrial Development

3. To Enhance Regional Transportation Systems

As mentioned in Chapter 1, the present conditions of the road network and the railway system are poor. No comprehensive port development can take place without the simultaneous development of roads and railway service.

As a result of the port development project, the volume of cargo which will be carried by truck and by rail will also increase substantially. Basically, general cargoes, wood products, bagged cargoes and containers should be carried by truck. Cement, coal and fertilizer should be carried by rail.

According to the Public Work's estimation, the arterial roads connecting Semarang with Jakarta, Surabaya and Yogyakarta will be filled to capacity. Considering the long term traffic demand centering on Semarang City, the entire road network inside Pekalongan, Yogyakarta and Kudus will have to be improved. This may be impossible in the near future; however, the road which is currently under construction will cover the demand around Semarang for the near future.

As for the rail system, the railway which is connected with Semarang Port has been of almost no use. As noted before, the railway currently carries only 0.02 percent of the port cargoes. The key issues concerning development of the rail service are how to maximize the capacity on the single line, and how to make the operations more practical New tracks will have to be laid within the port area and proper facilities must be provided to carry bulk cargoes.

The detailed demand for both roads and railways can be estimated from the projected cargo throughput at the port. It will be necessary to estimate not only the volume of traffic but also the quality of traffic, that is, both the number and types of vehicles that will be necessary to carry the overland cargo generated by the port.

Thus the port development plan includes estimates of the number and type of roads and trains that will be necessary. It also includes a layout of the roads, rails and related facilities that will be constructed within the port area.

4. To Cope with the New Maritime Transport Demand

The port of Semarang is by far the largest port in Central Java, and the cargo throughput at the port will grow rapidly along with the development project. However, Semarang Port is relatively small when compared with Tg. Priok and Surabaya, and for certain cargoes Semarang Port will be competing directly with these two giants. The entire development project is based on the concept of taking advantage of the relative economy of maritime transport and having Semarang carry most of the cargo for Central Java. Nonetheless, modern port facilities and efficient operating systems will have to be developed at Semarang. If the quality and efficiency of service at the port is not improved, a large volume of cargoes will continue to flow to Central Java overland from Tg. Priok and Surabaya.

As the tariffs at all three ports are standardized by government regulation, Semarang will have to provide excellent port service in order to attract cargo. The first important point is to diminish the waiting time for berths. The second main point is to provide high quality facilities to accommodate container vessels and specialized carriers. Of course the quality of the cargo

handling equipment and of the labour will also be crucial factors.

Thus, in order to cope with the projected demand, the port will need appropriate facilities for handling containers, grain (wheat), coal, cement, chemicals, fertilizer and iron and steel products. As long as the volume of each type of cargo remains small, multiple use of cargo terminals will be necessary. khusus will be serviced at a multiple use wharf. Container cargo will also be handled at a multipurpose wharf, together with general cargo or lumber.

During the short term development project (1986 ~ 1995), the main facility to be constructed is a multipurpose general cargo wharf. During the next phase of the project (1995 ~ 2005), a container terminal will become an exclusive facility only for the use of container cargoes in response to the increased demand for container shipments.

The special industrial terminal will handle a wide variety of cargoes. As cargo volume increase, particularly for such cargoes as coal, grain, and chemicals, the private sector will have to build exclusive private berths. ADPEL will provide the private sector with land sites in the port's industrial zone and with water sites for certain specialized berths. ADPEL will also provide roads and electricity and water supply. By initially handling the cargoes at the multipurpose berth and by providing appropriate sites, ADPEL will promote the private development of port facilities.

As the size of the industrial park and the land facing the waterfront are limited, a detailed land use plan is essential to ensure the best possible development of the port area.

5. To Establish a Land Use Plan

The present situation of land use in the port area is disorderly, and shows the lack of a consistent and comprehensive land use policy. It is of the utmost importance to make the best possible use of the limited land around the port.

The proposed land use plan presented by the Study Team should act as a guideline to help the Government in making a final land use plan and in determining appropriate criteria for judging which enterprises should be allowed to locate near the port. The port area should include the following facilities:

—— For the Purpose of Cargo Movement

(1) International Terminal
Container terminal, general cargo terminal, bulk cargo terminal, passenger terminal.

(2) Domestic Terminal
Nusantara, local vessels and rakyat.

(3) Private Terminals

(4) Distribution Area

—— For the Purpose of Industrial Activities

(5) Littoral Industry Zone
Coal terminal, chemical plant, cement distribution terminal, steel mill, fertilizer plant, glass factory, etc.

(6) Manufacturing Industry Zone (Export Processing Zone)
Food processing, furniture production, electrics, lumber, automobiles, machinery, ship-building, etc.

—— For Business and Government Offices

(7) Business Area
Shipping agents, trucking companies, warehouse companies, representatives of traders and banks.

(8) Government Office Area

The proposed land use plan is presented in Figure 4-1-2.

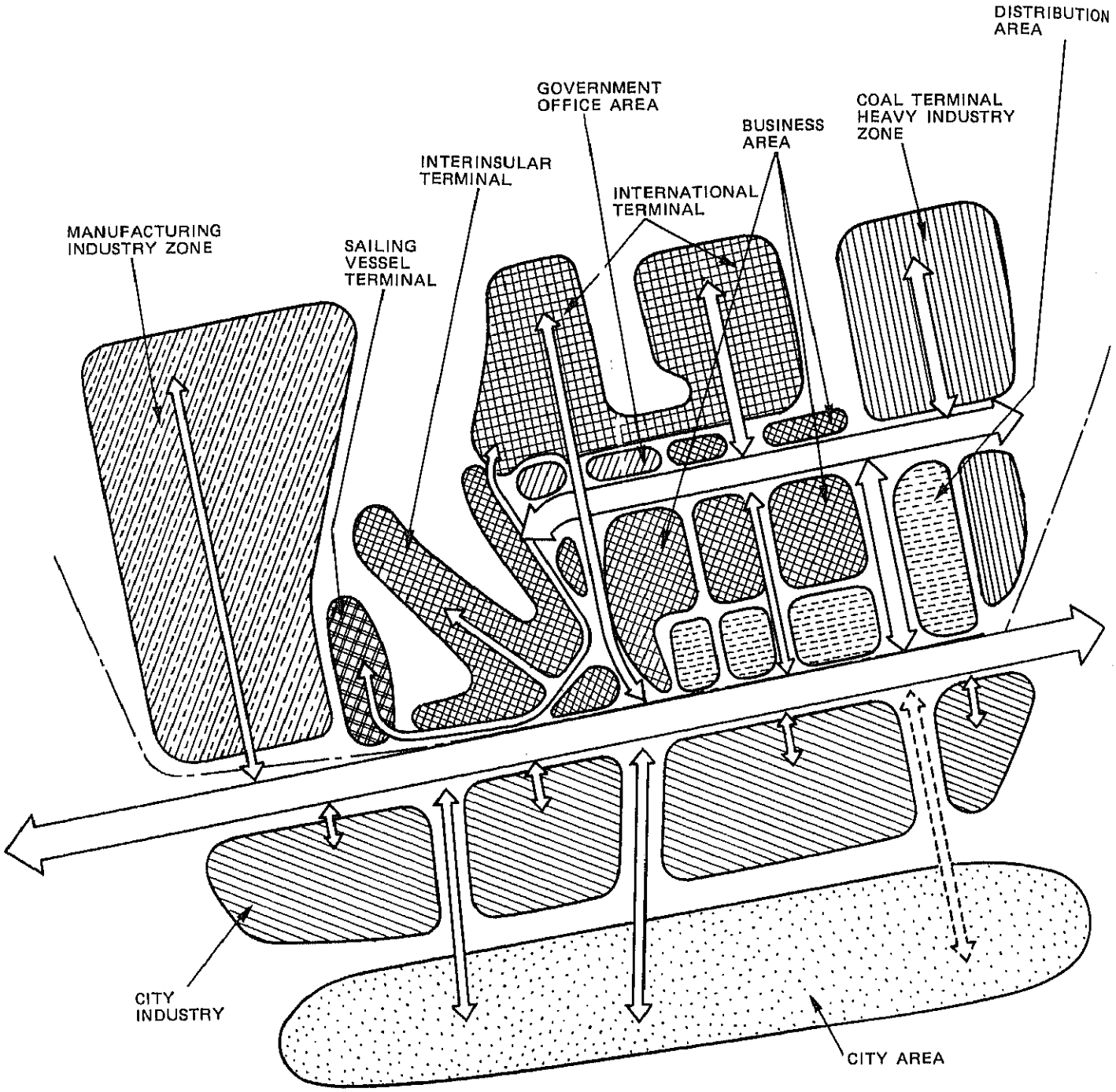


Fig. 4-1-2 Proposed Land Use Plan

6. To Establish a Rehabilitation Plan

There are many superannuated, obsolete facilities in the port area which are no longer used for port activities. These unused facilities include roads and railways which are presently flooded every day during high tide.

The basic concept of the rehabilitation plan is as follows:

(1) Reconstruct the roads in the old port area.
(2) Demolish the unused railway in the old port area.
(3) Reroute all the canals which currently pass through the port: fill in the old canals and locate the new canals outside of the port area.
(4) Remove all the old godowns, factories and other structures which are no longer used.
(5) Construct a new domestic and sailing boat terminal.
(6) Demolish and reconstruct the old West Breakwater.

(1) Reconstruct the roads in the old port area

The roads along Kali Baru Canal and around the Inner Harbour should be improved as early as possible; because of unrepaired pavement, there are currently many difficulties in transporting cargoes.

Especially, the roads behind Kali Baru mooring place are being used for loading and unloading, so the pavement damage is very serious.

The Study Team would like to recommend that the roads and the apron for cargo handling for rakyat should be functionally separate.

The detailed layout is presented in Fig. 4-6-5.

(2) Demolish the unused railway in the old port area

The railroad network in the old port area contributed to cargo movement before the road transportation system of the hinterland was developed.

According to recent statistical data, general cargo is no longer conveyed by the network, and this situation will never change.

Only bulk cargoes such as coal, cement and grains will be transported by rail, and these cargoes will total some hundreds of thousands of tons, so the railroad branch office in Semarang Port should devise a new railroad plan to cope with the new demand.

According to our experts' view, new railroads should be constructed into the heavy industry zone and manufacturing industry zone in order to convey coal, fertilizer and other bulk cargoes. The rail in the old port should be removed and reused for the new lines to minimize construction cost. Furthermore, removing the unused lines will open new space for new port activities.

(3) Reroute and fill in the old canal in the port area

As the East Banjir Canal was rerouted for the expansion of the port area in the Phase I development, the West Banjir Canal should be rerouted as a part of Phase II project. The canal should be rerouted into the drain of PLTU's power plant or into the New East Banjir Canal.

Details are presented in 4-7-4.

As for Kali Baru, the upper parts of the canal which are not used for port activities should

be filled in for the construction of a new road connecting the port to the city area.

(4) Remove all the old timeworn or unused godowns and warehouses

The old timeworn or unused godowns and warehouses located along Kali Baru, in the finger facing the Coastal Harbour and at the south side of the Inner Harbour Darum II should be demolished as early as possible. Especially, the transit sheds at Darum II are obstacles to the ordinary cargo handling of local ships due to the narrowness of the apron and there will be sufficient space for cargo handling and cargo movement after these unused facilities are removed.

Details are shown in 4-6-3.

(5) Construct a new domestic and sailing boat terminal

After demolishing unused railways, transit sheds and warehouses, the space obtained should be used for aprons, storage yards and parking in order to expedite the cargo handling of these vessels.

(6) Demolish and reconstruct the old West Breakwater

The existing old breakwater no longer functions to break waves and prevent siltation, so it must be reinforced or relocated.

Considering the future development of the port, the relocation program mentioned in Fig. 4-6-15 is better than reinforcement, because the cost is not so different.